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BY: OKON, ABIGAIL EDEM Ph.D

INTRODUCTION TO PSYCHOLOGY

BY

OKON, ABIGAIL EDEM Ph.D

DEDICATION

I dedicate this book with profound gratitude to the Almighty God in whom I put my trust, and to my lovely husband H/H Engr. Celestine E. Okon Snr who made me to be what I am today, my children and to all my students who choose education as a priority in life.

FOREWORD

The scientific study of both the overt and covert of human and animal behavior is what psychology is all about. The knowledge of psychology helps in making the ideas of educational aims clearer, understand developmental characteristics and students problems, individual differences, curriculum planning etc.

Introduction to psychology is very important and essential for understating how human function.

The author, Dr. (Mrs.) Abigail Edem Okon has carefully prepared a detailed psychology text which begins with clear and concise definition and explanation of what psychology is, phases of psychology and origin are pinpointed while their progenitors are not left out in the first two chapters.

Chapter three of the book dealt with awareness i.e. sensation and perception, origin of knowledge which were carefully explained.

The fourth and fifth chapters presented details information on memory and cognition. Memory types, forgetting etc, while justice was done to the explanation of cognition.

The last two chapters; six and seven, painstakingly discussed language development, concepts and stages, intelligence; emotional, sound, practical etc are also, carefully, explained.

I therefore, recommend this clear, concise and comprehensive text introduction to psychology to all categories of readers, especially students who daily desire to know about human behaviour and study same to understand human behaviour and why they behave the way they do.

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INTRODUCTION TO PSYCHOLOGY

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PREFACE

In the last two decades psychologists has developed a rich partnership among various fields of psychology. In writing introduction to psychology textbook, I have sought to present some of the topics of psychology in all its diversity which convey the sense in which it is a coherent intellectual enterprise. In pursuit of this goal, I have designed this textbook for interesting readers, students, parent and stakeholders in the schools. For some students, this may be their course as such, this text provides an important opportunity for students to learn the core concepts of introduction to psychology and understand how these concepts apply to their lives. The textbook has been developed to meet the scope and sequence of most general introduction to psychology courses. At the same time, this book includes a number of innovative features designed to enhance students' learning. This book is therefore designed to be User- friendly. It is a book that not only introduces readers to the basic content and promise of introduction to psychology, but does so in a way that brings alive the excitement of the field. The author's hope is that initial exposure to the realm of introduction to psychology will forge an ongoing enthusiasm and passion for the discipline, one lasts a lifetime.

Abigail Edem Okon Ph.D
Calabar, April, 2019

ACKNOWLEDGEMENTS

There are many people to whom I am indebted for this useful suggestions and advice. I express my profound gratitude to everyone who made the production of this book a reality. Many individuals have been involved at different stages in the production of this book. Their helpful comments have enabled me to improve the quality of the materials and saved this work from a number of inaccuracies their criticisms have been stimulating and worthwhile.

My greatest indebtedness, however, is to the Head of Department, Prof. (Mrs.) Alice Asim, and other colleagues, Prof. A. J. Isangedighi, Prof. M. Joshua, Prof. (Mrs.) E. M. Ukpong, Prof. R. A. E. Iheanacho, Rev. Fr. Dr. Imo Obot, Dr Omori Anne in Institute of Education and all other staff of the Department of Educational Foundations, Faculty of Education, University of Calabar, Calabar for their advice, extensive comments and support.

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CHAPTER ONE

INTRODUCTION

What is psychology? Psychology is a field of inquiry that can be defined as the science of the mind or the science of behaviour. It concerns itself with how and why individual do what they do; why wolves howl at the moon and children rebel against their parents; why birds sing and moths fly into the flame; why we remember how to ride a bicycle many years after the first attempt; why humans speak, gesture, make love and fight wars. All of these are kinds of behaviour and psychology is the science in which all of these is studied.

According to Coleman (2004) psychology is the study of the functioning of organisms, and also the working of a particular organisms or one of its organs or parts. Sometimes it is correct to say that Botany is about plant, history is about the present and past event and psychology is about people and animals. You may know someone who is a psychologist, or you may have some knowledge about how psychology is put to use in the society, but what exactly is psychology? What will you learn about people, and of what use is it?

The term psyche, according to Aristotle is the study of life. Psychologists want to understand the nature of peoples' lives, that means that Psychology can also be defined as the science of behaviour and mental processes of life. This definitions contains three major key words; Science, Behaviour and Mental processes. Scientifically, psychologists considered the attempt to understand people by

studying them through a careful, controlled observation, think about people and learned about peoples' behaviour.

The term behaviour refers to all of a person's overt actions that others can directly observe. When you walk, speak, throw a Frisbee, or show a facial expression, you are behaving in the sense. While mental processes refers to the private thoughts, emotions, feelings and motives that others cannot directly observe. Mental processes – This refers to the private thoughts, emotions, feelings, and motives that others cannot directly observe. Your private thoughts and feeling about your dog catching a Frisbee in midair are mental processes.

BRANCHES OF PSYCHOLOGY

Behavioural Psychology: As the name implies, it is the study of behavioural science such as mental process and human behavioural patterns. Behavioural psychology is based on study of the functions of human cells.

Clinical Psychology: This is a treatment oriented branch of psychology which deals with scientific ways of handling psychological problems. It is also called counselling psychology. This includes prevention, understanding and cure of psychological issues by counselling and psychotherapy.

Educational Psychology: This is the field of study basically focuses on students' learning. It deals with shyness, learning disorders, adolescence, sex education in children etc. Educational Psychology is often taught in educational institutions like in schools and colleges, in due to

this studies and awareness, it comes in handy in the different forms of developmental stages of children.

Abnormal Psychology: This is a branch of psychology which deals with the abnormalities in a person's behaviour and psyche. This is a branch of study which is commonly found in Human Resources Management Programme and Criminal Law courses.

Developmental Psychology: This deals with the changes that occurs in a human being over course of time, it deals with early childhood developmental stages. This helps in identifying the causes, treatment and effects of any psychological disorders better.

Personality Psychology: This is a branch of psychology that studies personality and it's variation among individuals construction of a coherent picture of the individual and their major psychological processes investigation of individual psychological differences.

Evolutionary Psychology: This deals with the study of psychological stimuli in human beings. Psychological stimuli include ability for developing linguistic skills, identifying a person's state of mind, recognizing a kin from another.

Cognitive Psychology: This deals with the mental processes like thoughts, and problem-solving. It basically deals with the perception and problem-solving capability of the brain.

Legal Psychology: This is almost like cognitive and clinical psychology, but in the case of legal psychology, it include a legal point of view. The legal psychologist assists the crime

investigation by assisting the testimonies and statements of the witnesses and the victims.

Community Psychology: This is a study of psychological aspects of the individual in a community. This is based on characteristics like interdependence, adaptation, diplomacy etc.

IMPORTANT OF PSYCHOLOGY

Psychologist study people to know who they are and what they are, they look into why people act and think the way they do and how someone can improve his or herself.

Psychology allows people to understand more about how the body and mind work together.

The knowledge of psychology can be helpful in decision-making and avoiding stressful situations. It can help with time management, setting and achieving goals, and living effectively.

Through the study of psychology, individuals applied it on a daily basis, during talking with friends, arguing with a partner or disciplining their children.

Psychology helps to build relationships and make with others by understanding them more and working with their behaviour.

Psychologist improve a greater communication on understanding of how humans think, behave, and communicate better.

Psychologists helps to build self-confidence through understanding more about yourself and your personality, gain

more self-confidence, learn more about your weaknesses and build on them.

Through the help of psychology, people are able to understand their co-workers more and stand a better chance of building friendships, it helps to deal with their actions to enrich their career.

Through the help of psychology, it helps with managing times, set and achieve goals and become more effective with the way people live.

GOALS OF PSYCHOLOGY

What are the goals of the science of psychology? What are psychologists trying to accomplish? Psychologists study people by using scientific methods. The goals of this scientific enterprise are to: Describe, Predict, Understand and Influence behaviour.

Describe: The information gathered through scientific research help us to describe psychological phenomena more accurately and completely, for example, information gathered in a survey on the frequency of sexual behavior among college students without the protection of a condom would tell us if they are high risk for the spread of sexually transmitted diseases such as HIV/AIDS.

Predict: In some cases, psychologists are able to predict behaviour, such as predicting how much anxiety a group of students will experience during examination in which there have not prepared before going into the examination hall.

Understanding: This requires the addition of an explanation to our descriptive and predictive knowledge of facts and

relationships. We understand behaviour and mental processes when we can explain them. This means that we understand psychological phenomena when we know the truth about them.

Influence: What can psychologists do to help a teenage boy climb out of a period of severe depression? How can we help parents raise their rambunctious children better? What is the best way to guide students to select careers? These can be done psychologically if behaviour is being influenced.

CHAPTER TWO

FACES OF PSYCHOLOGY AND THEIR ORIGINS

Behavior is superbly complex and varied. A scientist could spend an entire career studying the causes of emotional disorders, or the way we recall facts, or methods of improving job satisfaction among employees or the role of the brain in emotions or the nature of racial prejudice, or any of a variety of topics within. When we consider the range of possibilities, its not surprising that the science of psychology is a very broad field with many divisions. In order to understand these terms, we need to look back to the history of its development. The following are some of the faces of psychology and their origins: Aristotle, Wundt, Titchener, William James, Pavlov, Watson Hermann and Sigmund Freud.

ARISTOTLE: He first defined subject matter in broad terms for the science to be called psychology. He laid the basic foundation for the methods that psychologists and other scientists would use in carrying out their studies. Aristotle received much of their training in philosophical methods from the famous philosopher Plato, but Aristotle disagreed with Plato's belief that one could achieve a full understanding of anything simply by thinking about it. He believed that one must observe the thing being studied, look at it, touch it. Aristotle studied life by observing it. Although he was not a scientist in the modern sense of the word, he emphasis on observation as the basis for the methods of contemporary science. Progress in scientific

methods from Aristotle to the present involved no basic changes in this idea; scientists have only developed more precise and efficient ways of observing things. Aristotle launched the study of life that evolved later into the modern science of psychology. During the time of Aristotle, there was no formal discipline of psychology and for 2,200 years after he lived. Like the other science, psychology was a part of philosophy. It was not until modern times that the sciences emerged from the general field of philosophy. In the seventeenth and eighteen countries, physics, biology, medicine, and other disciplines began to accumulate knowledge that set each somewhat apart from the others.

The formal launching of the separate field of psychology was usually credited to Wilhelm Wundt for establishing the first laboratory of psychology in Leipzing, Germany in 1879. However, some psychologists and historians felt that, William James deserves the honor for a less publicized laboratory at Harvard University which opened in 1875.

WILHELM WUNDT: He was a professor of biology, who was fascinated by human consciousness and culture. He was familiar with the methods used by the other sciences and applied them to the phenomena of human consciousness. This part of Wundt's work was taken over and expanded by one of his students' Edward Titchener. Titchener taught in the United States at Cornell University. He identified the basic elements of conscious experience just as physicists sought to discover the basic particles that make up physical matter. Wundt and Titchener studied consciousness using a

method of looking inward at once own experiences, called INTROSPECTION. They rigorously trained themselves to observe the contents of their own minds as accurately and unemotionally as possible in an attempt to isolate the basic elements of the mind. Since Wundt and Titchener were interested in the elements of the mind and how those elements are organized, they were the first proponents of school of thought called STRUCTURALISM, in which they sought to determine the structure of the mind through controlled introspection.

WILLIAM JAMES: He was a professor of biology and philosophy at Harvard University. He taught the first course on psychology and in 1890 he published an influential early textbook on psychology, where he borrowed concepts and scientific methods from biology to use in his study of consciousness. James took a different dimension of psychology from Wundt and Titcherner's view. James was also impressed with the work of Charles Darwin who was also a biologists that suggested in his theory of evolution that every physical characteristic evolved in a species because it serve some purpose. James observed that the same thing could be said about the human mind. His observation led to speculation that learning, remembering, thinking, feeling and other processes of human consciousness exist only because they help us survive as species. Since we can think, find food, avoid danger and care for our children, we can survive as human species. Because of its emphasis on the functions of consciousness, a school of thought known as functionalism emerged based on the work of William James.

James was interested in evolutionary important conscious awareness, decision making (free will), the learning of unconscious habits, and the emotions of range, fear, anxiety and depression. James scientific reasoning was in-line with his study of emotion which also influenced his life-long struggle with depression and incapacitating attacks of anxiety. Francher 1990 in Lahey (1995).

IVAN PAVLOV: Pavlov, a physiologist who implanted tubes in the cheeks of dogs to gather saliva during eating. He noticed that after several feedings, the dogs started salivating when they heard the food being brought to them rather than when it was placed in their mouths, and after sometime, the dogs learned to associate the sound of the food brought to them with the food itself.

Since the sound had immediately preceded the food on many occasions, the dogs came to respond to the sound of salivating. Pavlov demonstrated that this interpretation was correct by conducting careful experiments using a clicking metronome instead of the sound of food being brought and small quantities of powered meat. When the metronome and the meat powder were presented together, the dogs quickly learned to salivate to the metronome alone after the whole incident. Pavlov discovered new methods in the field of psychology. He identified a simple form of learning or conditioning to use his term and a precise scientific way to study it. By measuring the number of drops of saliva produced by a dog hearing the metronome, Pavlov was able to study many aspects of the learning process, such as the time interval between the sound and the food that produced

the most rapid conditioning. Pavlov believed that all human thought, emotion, and Language derived largely from this simple form of learning that we called the classical or Pavlovian conditioning.

SIGMUND FREUD

The pioneering work of Sigmund Freud (1856 – 1939), started from an Austrian physician who practiced neurology, the treatment of diseases of the nervous system. Sigmund Freud's view of psychology was different from his contemporaries, because he was responsible for the day-to-day care of a large number of patients, many of whom had psychological problems. This explains the enormous differences between his view of psychology and those of the founders. To Freud, his interest was on psychology of abnormal motivation because he saw it as the cause of psychological problems. Learning memory, thinking and other processes which were so important to the other founding psychologists were of little interest to Freud.

To Freud, the psychodynamic theory emphasizes the active dynamic process which strongly influences an individual's social and emotional development and experiences. Psychoanalysis according to Freud was primarily a method of treating disorderly behaviour. And develops an explanation of neurosis. He believed that neurosis has its inception in traumatic experiences during childhood.

Memory of such experiences are depressed and forgotten, but they still exist in the unconscious mind and

produce neurotic symptoms later in life. Freud's theory emphasizes developmental stage which are biological determined, but are also influenced by unconscious processes.

CHAPTER THREE

AWARENESS
SENSATION AND PERCEPTION

The world is known to us only indirectly because our brains are not in direct contact with the outside world. But sensory receptor cells have the ability to transduce physical energy into coded neural messages that are sent to the brain (sensation) where they are interpreted (perception). Not all forms of physical energy can become part of our perception of the world. Our perception of external reality is complicated because there is no simple and direct relationship between the properties of physical stimuli and our conscious sensations. Example, a small change in the intensity of a stereo is noticeable when the stereo is being played softly, but the same size change could go unnoticed if the stereo were at high volume. The complicated relationship between physical stimuli and conscious sensation is the subject matter of psychophysics.

How do our senses function? And how accurate and complete is the sensory information we receive from them? To what extent is our perception of the world objective, true to the sensory information we receive, with a minimum of interpretation? Conversely, to what extent is our perception influenced by our biases, expectations, and hopes?

THE ORIGINS OF KNOWLEDGE

Sensory processes grow out of questions about the origin of human knowledge, John Locke (1632-1704) and other adherents of empiricism argued that all knowledge comes through stimuli, that excite the senses. We can distinguish two kinds of stimuli. The distal stimulus, an object or event in the world outside. The other is the proximal stimulus, the pattern of physical stimulus energies that impinges on a given sensory surface.

The only way to get information about distal stimuli is through the proximal stimuli. This stimuli leads to theoretical problems, for we perceive many qualities, depth, constant size, and shape, that are not given in the proximal stimulus. Empiricists try to overcome such difficulties by asserting that much of perception is built up through learning by association, which has been challenged by Nativism, a view espoused by Immanuel Kant and others (1924-1804). He argued that knowledge cannot come from sensory input alone, but must also be certain preexisting categories according to which these sensory material is ordered and organized. The path to sensory experience or sensation begins with a proximal stimulus. This is transduced into a nervous impulse by specialized receptors. It is usually further modified by other parts of the nervous system, and finally leads to a sensation. Psychophysics which is a branch of sensory psychology tries to relate the characteristics of the physical stimulus to both the quality and intensity of the sensory experience. The founder of psychophysics, Gustav Fechner, studied sensory intensity by determining the ability

of subjects to discriminate between stimulus intensities. The difference threshold is the change in the intensity of a given stimulus that is just large enough to be detected producing a just noticeable difference.

According to Fechner's law, the strength of a sensation grows as a logarithm of stimulus intensity. A way of disentangling sensory sensitivity and response bias is provided by signal-detection theory. In a typical detection experiment, the stimulus is presented on some trails and absent on others. In this procedure, there can be two kinds of errors; a mere saying a stimulus is absent when it is present and a false alarm, saying it is present when it is absent. Their relative proportion is partially determined by expectation and by a payoff matrix. An individual's sensitivity to the stimulus is assessed by the proportion of hits and correct negatives relative to his number of misses and false alarms. His criterion for responding saying "yes" when in doubt or "no" is measured by the proportion of yes and no responses.

This general approach has applications to many other situations in which one has to decide between two alternatives but cannot be certain of the outcome, as in cases of juror decisions ("innocent" or guilty") or medical diagnosis (yes, there is a tumor, no, there is no tumor).

Sensory codes are the rules by which the nervous system translates the properties of the proximal stimulus into neural impulses. Some codes are for psychological intensity, such as changes in loudness and brightness. Such changes are usually coded by the rate of firing by the neurons, and

also by the sheer number of neurons triggered by the stimulus. Other codes are for sensory quality. According to the doctrine of specific nerve energies, such differences in sensory quality (e.g. the difference between seeing and hearing are not caused by differences in the stimuli themselves but by the different nervous structures that these stimuli excite. In some cases, qualitative differences within a sensory modality are best described by specificity theory, which holds that different sensory qualities (sweet versus sour, red versus green) are signaled by different neurons, just as the different sense modalities (vision versus pressure) are signaled by different nerves. While pattern theory holds that certain sensory qualities arise because of different patterns of activation across a whole set of neurons.

FUNCTION OF THE SENSES

Difference sense modalities have different functions and mechanisms. One group of senses provides information about the body's own movements and location. Skeletal motion is sensed through kinesthesis, bodily orientation by the vestibular organs located in the inner ears. Difference part of the skin senses inform the organism of what is directly adjacent to its own body. Hearing is one major function of the sense of audition. This informed us of pressure changes that occur at a distance. Vibration is a major problem that disturbed the air and propagated in the form of sound waves, these can vary in amplitude and frequency, and may be simple or complex.

Sound waves set up vibrations in the eardrum that are transmitted by the ossicles to the oval window, whose movements create waves in the cochlea of the inner ear. In between the cochlea is the basilar membrane, which contains the auditory receptors that are stimulated by the membrane deformation. Place theory observed that sensory experience of pitch is based on the place of the membrane that is most stimulated, each place being especially responsive to a particular have frequency and generating a particular pitch sensation.

In the same view, some theories also observed that the experience of pitch depends on the firing frequency of the auditory nerve. But since very low frequency waves deform the whole membrane just about equally, modern theorists believe that both the place of deformation and firing frequency of the auditory nerve are important. This turns out that the perception of higher frequencies depends on the place stimulated on the basilar membrane, while perception of lower frequencies depends on neural firing frequency.

VISION

Vision, is one of our primary distance senses, that has light as stimulus, which can vary in intensity and wavelength. Lens and the Iris, which are structures of the eyes, control the amount of light entering the eyes and fashion a proper proximal stimulus, the retinal image. Once an retina, the light stimulus is transduced into a neural impulse by the visual receptors, the rods and cones. Acuity

is greater in the fovea, where the density of the receptors (cones) is greatest.

According to Duplex theory of vision, rods and cones differ in function. The rods operate at low light intensities and are insensitive to differences in hue. The cones function at much higher illumination levels and are responsible for sensations of colour.

The first stage in the transformation of light into a neural impulse is a photochemical process that involves the breakdown of various visual pigments that are later resynthesized. Rhodopsin is the pigment in the rod, the cone contains three different pigments but the chemical composition of these pigments is still unknown.

The different areas of components of the visual system interact constantly with one another. The visual system actively shapes and transforms the stimulus input, such as the relationship between the signal receives a movement ago, example, sensory adaptation. Interaction occurs in space between neighboring regions on the retina. This is shown by brightness contracts which effect increases as the intensity difference between two contrasting regions. Brightness contrast tends to accentuate edges, as in the case of Mach bands.

The physiological mechanism that underlies the effects is lateral inhibition. When any visual receptor is stimulated, it transmits its excitation to other cells that eventually relay signal to the brain. But the receptors excitation also stimulates lateral neurons, which make contact with neighbouring cell and inhibit the activation of

these neighbors. Lateral visual system is refining the stimulus information from the very start emphasizing some aspects of the inputs and understanding others.

Visual sensation have a qualitative character in colour which can be ordered by reference to three dimensions. Hue, brightness and saturation. The colour circle embodies the perceptual relations among the different hues. This colour solid summarizes the perceptual relations among all three of the colour dimensions.

STATE OF CONSCIOUSNESS

State of consciousness, according to Lahey (1995) is a state of awareness, awareness of the outside world, of our own thought and feelings and sometimes it is seen as our own consciousness. Consciousness is not a single state rather, there are many different states of conscious awareness. Even during the course of a typical day, our wakefulness is composed of a variety of states of consciousness, focused consciousness, loosely drifting.

CONSCIOUSNESS AND DAYDREAMS

When the waking day ends, moreover, we do not cease to be aware, rather we experience other kinds of consciousness. As we drift off to sleep, we pass through a dreamlike "twilight" phase, and even amidst the shifting stages of sleep itself, we experience the strange reality of dreams. Apparently dreams are important to our well-being. It is known that sleep does not rest and restore us for the next day if we do not dream sufficiently. But we still have not

developed a widely accepted method of interpreting the meaning of dreams. Some states of altered awareness occur spontaneously such as hallucinations and other distorted perceptual experience. Other states of consciousness are achieved in part through deep concentration and relaxation, such as during meditation and hypnosis while others altered states are induced by taking certain kinds of drugs.

THE COMPLEXITY OF PERCEPTION

Perception is the interpretation of meaningless sensation. It's an active process in which impressions are created which often go beyond the minimal information provided by the senses. Many ways in which we organize and interpret sensations are inborn and common to all humans. Gestalt principles of perceptual organization, perceptual constancies, depth perception, and visual illusions provide examples of the active, creative nature of perception. Other factors that enter into the process of perception are more unique to the individual, such as motivational states and cultural learning experiences. These factors ensure that we will perceive the world in a way that is largely universal and common to all humans, but with a great deal of individuality due to differences in motivation, emotion, learning and other factors.

The fundamental problem of perception is how we come to apprehend the objects and events in the world around us. One problem lies in how we grasp the meaning of the visual input. Another question is why we see any object at all. How do we see past the continual variations in

the proximal stimulus to perceive the constant properties of the distal stimulus, the external object? Before this questions can be answered, we must consider the way in which we see depth, movement and form.

PERCEPTION OF DEPTH

According to Hochberg (1988), the visual world is seen in three dimensions even though only two of these are given in the image that falls upon the eye. This fact had led to an interest in depth cues. Among these are binocular disparity and monocular depth cues which sometimes called pictorial cues, such as interposition and linear perspective, relative size and texture gradients.

Another information source is provided by the motion of our heads and bodies which leads to motion parallax and various patterns in the optic flow, all of which provide information about how far objects are from each other and from us. Many of these depth cues are redundant. This redundancy is helpful, because different distance cues become important in different circumstances, example binocular disparity is only informative for objects relatively close by.

THE PERCEPTION OF MOVEMENT

It is one thing to see someone being attractive across a crowded room, it is quite another to see that person smile and walk towards you. Plainly, then, we want to know what an object is and where it is from and what it is doing. In another aspect, we want to perceive events as well as objects. And to do this, we must be able to perceive movement.

In Retinal Motion, according to Vaultin and Berkely, (1977). They observed that at times one might think that we see things move because they produce an image that moves across the retina, and some cells in the visual cortex do seem responsive to such movements on the retina. These cells are direction specific, firing if a stimulus moves across their receptive field from left to right but not if the stimulus moves from right to left. Other cells show the reverse pattern and the cells are well suited to act as motion detectors.

APPARENT MOVEMENT

Suppose we turn a light in one location in the visual field, then quickly turn it off, and after an appropriate interval between 30 and 200 milliseconds, turn on a second light in a different location. The result is apparent movement. The light appears to travel from one point to another, despite that there was no stimulation let alone movement, in the intervening region.

This phenomenon is perceptually overwhelming given the right intervals, it is indistinguishable from real movement (Wertheimer, 1912). This shows an effect that has numerous

technological applications and that is why some people and objects seen in movies seem to move.

This phenomenon underscores the fact that motion can be perceived even when there is no motion of an image across the retina. Instead, all we need is an appropriately timed change in positions. At a point it could be seen as if something is at a particular spot but afterward disappear at the next second. If the timing is right, the nervous system interprets this as evidence that things moved.

EYE MOVEMENTS

One hypothesis is that the perception of motion depends on the relative positions of the objects in our view. If our eyes move while observing an object like moon, the retina image of the moon is displaced, but so is the image of the lamp alongside the moon, the image of the floor beneath both moon and lamp, and so on. As a result, there is no movement of one object relative to the others, and perhaps this is what signals the world's stability.

As Herman Von Helmholtz obtained a century ago, that movement will be seen if the eyes are moved by muscles other than their own. To experience this, one needs to close one eye and jiggle the outside corner of the other eye gently with a finger. The entire world will seem to move around, even though all relationships within the image remain intact. This shows that the perceptual system can sense "motion" even when there was no changes in the spatial relationships on the retina. A different hypothesis is that the nervous system somehow compensates for the retinal displacements

that are produced by voluntary eye movements. The idea is that when the brain signals the eye muscles to move, it computes the retinal displacement that such a movement would produce in interpreting the visual input. Example, the brain order the eyes to move 5 degrees to the light. This anticipation is then used as a basis for cancelling out the image motion that really does occur as a result of the eye movement, leaving no motion signal overall. In this way, we perceive stationary objects as stationary, even though our eyes are moving (Bridgeman and Stark, 1991).

ILLUSIONS OF MOTION

Perception of motion depends on several factors; movement of an image across the retina stimulates motion detectors in the visual cortex and also in the brain and this certainly contributes to movement perception. However, the activity of these detectors by itself does not lead to a perception of movement, because the nervous system also needs to compensate for changes in eye or head position, in order to determine whether motion across the retina is produced by an object's movement in the environment or merely by a change in our viewing position. In addition, we can also perceive motion without any motion across the retina, that is the case of apparent motion.

The Barber-Pole Illusion: This pole actually rotates from left to right, but we perceive the stripes on the pole as moving upward. Similarly, a spinning spiral shape drawn on a flat surface appears to be moving toward us or away from us, depending on the direction of spin. These illusions derive from the way the perceptual system interprets the

relationship between the view in front of our eyes right now and the view we has just a movement ago. Specifically, the perceptual system must solve the correspondence problem, the problem of determining which elements our current view correspond with which elements in our view a movement before (Wallach, Weisz and Adam 1956; Wallach, 1976).

Induced Motion: A different sort of perceptual interpretation is illustrated by phenomenon of induce motion. Consider a ball rolling on a billiard table. We see the ball as moving and the table at rest. But we can also consider the other way round to be sure that we see the ball getting closer and closer to the table's edge, but, at the same time, we also see the table's edge getting closer and closer to the ball. Why, therefore do we perceive the movement as "belonging" entirely to the ball, while the table seems to be sitting still?

One might guess that we see this pattern as we do simply as a result of banning. Perhaps experience has taught us that ball generally move around while tables stay put in this view, it indicates that what matters is a more general perceptual relationship between the two stimuli; the object that encloses the other tends to act as a frame, which is seen as stationary. In the case of billard table, the table serves as a frame again which the ball is seen to move.

CHAPTER FOUR

MEMORY

WHAT IS MEMORY

Memory is the process by which we encode, store, and retrieve information. There are three basic kinds of memory storage.

SENSORY MEMORY, SHORT-TERM MEMORY, AND LONG TERM MEMORY

Sensory Memory: It is the first stage in memory, it is a very brief one and is designed to hold an exact image of each sensory experience in the sensory register long enough to locate and focus on relevant bits of information and transfer them into the next stage of memory. For visual information this "snapshot" fades very quickly, lasting about one-quarter of a second in most cases.

This phenomenon can be observe by waving your fingers back and forth in front of your eyes, causing one to see many fingers for a very brief time. For auditory information, a vivid image of what is heard is retained for about the same length of time, one-quarter of a second. Cowan (1987), but a weaker "echo" is retained for up to four seconds (Tarpy and Mayer, 1978).

Sperling (1960) observed that the information stored in the sensory register does not last long, but it is apparently a completed replica of the sensory experience.

Sperling presented subjects with an array of 12 letters arranged in three horizontal rows of four letters each. Example:

G	K	E	Q
R	Y	H	T
C	M	L	A

He showed the subjects these letters for 1/20 of a second and then asked some set of students to recall all of the letters in one of the three rows. He never disclosed which row he would ask them to recall. Instead, he signaled to them using a tone. A higher-pitched tone indicated the first row, a medium tone indicated the second row, and a low tone indicated the third row. If the tone was presented very soon after the presentation of the array of letters, the subjects could recalled most of the letters in the indicated row. But if the delay was more than one-quarter of a second, the subjects recalled an average of just over one letter per row, indicating how quickly information is lost in the sensory register.

Visual information in the sensory memory is lost and replaced so rapidly with new information that we seldom are aware we even have such a memory store. Sometimes the longer lasting echolike traces of auditory information can be noticed, though, most of us have had the experience of being absorbed in reading when a friend speaks. If we divert our attention from book quickly enough, we can "hear again" what was said to us by referring to the echo of the auditory sensation stored in the sensory register.

SHORT-TERM MEMORY

The information that is stored briefly in our sensory memory consists of representation of raw sensory stimuli, it is not necessarily meaningful to us. In order to make sense of it and to allow for the possibility of long-term retention, the information must be transferred to the next stage of memory, which is sometimes refers to as working memory. This memory material initially has meaning, although the maximum length of retention is relatively short.

The process of which sensory memories are transferred into short-term memories is yet to be justify, some theorists suggest that the information is first translated into graphical representations or images, and others hypothesize that the transfer occurs when the sensory stimuli are changed to words Baddeley (1986). What is clear, however, is that unlike sensory memory, which holds a relatively full and detailed, if short-lived, representation of the world, short-term memory has incomplete representational capabilities.

According to Milness (1966), the specific amount of information that can be held in short-term memory has been identified as seven items, or "chunks" of information, with variations up to plus or minus two chunks. A chunk can be defined as a meaningful grouping of stimuli that can be stored as a unit in short-term memory.

According to Milness (1966) chunks can be identified as the following:

CNQMWN

Each separate chunk qualifies a letter and as there are seven of them, they are easily held in short-term memory. A chuck can also consists of large categories such as words or other meaningful units. Example: T W A C I A A B CC B S M TV U S A A A A.

Consider the following list of twenty-one letters clearly, because the list exceeds seven chunks, it is difficult to recall the letter after one exposure. But if it was presented in this format.

TWA, CIA, ABC, CBS, MTU, USA, AAA despite the letters are twenty-one in numbers, it would be possible to store them in memory, since they represent only seven chunks.

Chunks can vary in size from single letters or numbers to categories that are far more complicated, and the specific nature of what constitutes a chunk varies according to one's past experience. Fisher et al (1977).

Long-Term Memory: Storehouse information that make its way from short-term memory to long-term memory enters a storehouse of almost unlimited capacity like a new book delivered to a library, the information in long-term memory is field and cataloged so that it can be retrieved when we need it.

According to Miller (1966), evidence of the existence of long-term memory, as distinct from short-term memory, comes from a number of sources especially with certain kinds of brain damage which have no lasting recall of new information following the damage, although people and events in memory prior to the injury remain. Because short-

term memory following the injury appears to be operative, new information can be recalled for a very brief period and because information from before the injury is recalled, we might infer that there are two distinct memories, one for short-term and one for long-term storage.

Researches from some laboratory experiment consistent of separate short-term and long-term memories asked a set of people to recall a relatively small amount of information such as a set of three letters, but to prevent practice of the initial information, they were required to recite some extraneous information aloud, such as counting backward by threes (Brown 1958; Peterson, 2000). By varying the amount of time between which the initial information was first presented and its recall was required, some researchers found that recall was quite good when the interval was very short, but it declined rapidly thereafter. After fifteen seconds has gone, recall hovered at around 10 percent of the information initially presented.

Apparently, the distraction of counting backward prevented almost all the initial information from reaching long-term memory. Previous recall was suitable since it was coming from short-term memory, but these memories were lost at a rapid rate. Eventually, all that could be recalled was the small amount of information that has made its way into long-term storage despite the distractions of counting backward.

WHEN MEMORY FAILS

Forgetting is employed whenever memory fails. But in truth, memory failure has many causes, and so I do not want to label them all with the same term. Some failures arise from faulty encoding while others arise at the moment of recall. There are three aspects of memory failure; passage of time, memory error and memory failure of a more extreme sort.

In the passage of time, why is it easier to remember the recent past than it is to remember events from long ago? The second concerns memory error-cases in which events are misremembered, so that the past as recalled differs from the past as it actually unfolded while the third aspect of memory failure considers what happens to memory in patients with certain kinds of brain damage.

FORGETTING

It is common to recall yesterday lecture easier than last week's and last week's better recall than last year's. however, the longer the time between learning and retrieval, that is, the longer the retention interval, the greater the chance of forgetting. Many studies have documented this simple fact. In addition, some researchers has shown that the passage of time erodes memory accuracy for things as diverse as past hospital stays, eating or smoking habit in past years, car accidents we experienced, sells and purchase of goods (Jobe, et al, 1993). The classic demonstration of this pattern, though was offered more than a century ago by Ebbinghaus (1850-1909) who systematically studied his own

memory in a series of careful experiments, examining his ability to retain lists of nonsense syllables such as zup and rif. Ebbinghaus was the first to plot a forgetting curve by testing himself at various intervals after learning, using different lists for each intervals. As expected, he found that memory did decline with the passage of time. However the decline was uneven, sharpest soon after the learning and then move gradual (Ebbinghaus, 1985).

DECAY

According to decay theory, memory traces simply decay as time passes, like mountains that are eroded by wind and water. The erosion of memories is presumably caused by normal metabolic processes that wear down memory traces until they fade and finally disintegrate.

Supports for the decay theory exploits the fact that, like most chemical reactions, many metabolic processes increase their rates with increasing temperature. If these metabolic reactions are responsible for memorial decay, then forgetting should increase if body temperature is elevated during the retention interval. The prediction is difficult to test with humans or any other mammal because internal mechanisms keep the temperature of the bodies relatively constant.

However, this prediction was tested with animals such as goldfish whose bodies tend to take on the temperature of their surroundings. This result was in line with the hypothesis, the higher the temperature of the tank in which

the fish were kept during the retention interval, the more forgetting took place (Gleitman, 1971).

Other findings, however, make it clear that decay cannot provide the entire explanation of forgetting. Example, several experiments compared recall after an interval spent awake with recall after an equal interval spent sleeping. If the passage of time were all that mattered for forgetting, then performance would be the same in these two cases. But it was not. The group that slept during the retention interval remembered more than the group that stayed awake (Jenking and Dallenbach, 1924). The group that stayed awake experienced interference, new ideas and events somehow interfered with their recall. According to this findings, event and activities are suggested and not the mere passage of time, which are crucial for forgetting. Reisberg (2001) can also be seen as evidence comparing the effects of time to the effects of interference.

INTERFERENCE

This is a process that memory can be seen as vulnerable to some sort of interference with the newly arriving information somehow interfering with the previously learned materials. But what produces this interference? Some researchers observed that the forgotten materials are neither damaged nor erases, but simply misplaced. Analogy consider someone who buys a newspaper each day and then stores it with others in a large piles in the basement, each newspaper is easy to find when it is still sitting on the breakfast table; it can still be located

without difficulty when it is on top of the basement stack. After some days though, finding the newspaper becomes difficult. It is somewhere in the pile but may not come into view without a great deal of searching. And, of course, the pile grows higher and higher every day, that is why the interference increase as the retention interval grows longer.

RECONSTRUCTION

This theory started in 1932 by Bartlett, who suggested that some memory traces became so distorted over time that they are unrecognizable. Memories changes with time in such a way as to become less complex, more consistent, and more congruent with what the individual already knows and believes. For example if a story is told about a person, whom you dislike, that is favourable to him on some points and slightly negative on other points, your recollection of the story might be somewhat different later when you retell it to a friend. It will become shorter and less detailed. But because your preconceived view of the person was negative, the most obvious changes would be a forgetting of positive facts, an exaggeration of negative facts, and may be even the addition of a few fictional facts move in line with your feelings about him.

The distortion of memories has been demonstrated in a classic experiments (Carmichael, et al, 1936). Several experiments make it clear that the distortions of memories hypothesized by Bartlett do not occur gradually over time, but occur during the process of retrieval itself (Reynolds and Flagg, 1983).

Reconstruction theory provides an interesting view of forgetting in LTM that is intuitively appealing. This theory has little impact on the research on memory, because Bartlett (1932) started it in rather vague terms in the first place. Recent versions of reconstruction theory use the distinction made by Tulving (1972) between episodic and semantic memory. For example, Branford et al (1972) suggested that human being tend to distort or reconstruct memories because in LTM, we store the meaning of events better than episodic details. If we try to recall an event later, we will be more likely to remember it meaning than the details. Thus, without being aware that we are doing so, we make up details that are consistent with the meaning we have remembered.

CHAPTER FIVE

COGNITION
WHAT IS COGNITION?

Cognition, according to Feldman (1993), is the higher mental processes by which we understand the world, process information, make judgements and decisions, and communicate knowledge to others.

Cognition can also be defined as those intellectual processes (such as perception, memory, thinking, and language) through which information is obtained, transformed, stored, retrieved, and used.

Cognition is involved in nearly every aspect of psychology, but is almost interchangeable with thinking, language and intelligence. The basic units of thinking are concepts, these categories of things allow us to reason in general rather than specific ways. In cognition, the most important form of thinking is productive thinking or problem solving.

The origin of cognition can be traced back to the experiments of Pavlov and Thorndike, on the one hand, and Weitheimer and his fellow cognitivists on the other. Thus, traditional theories of learning branch into two types – S – R theories and cognitive theories. Later theorists either joined the S – R school or the cognitive school while others, followed the eclectic stand and some belong to both theoretical perspectives.

The cognitive theorists are concerned with how organisms recognize or gain knowledge about their world,

and how they use that knowledge to guide decisions and perform effective actions. According to Bower and Hilgard (1986), the cognitivists try to understand the mind and its abilities or achievements in perception, learning, thinking and language use. Hence, they postulate theories about it inner workings. The cognitive theorists, therefore in contrast to the S – R theorists, see learning as a function of the combinatorial effect of an individual's perceptual processes, attitudes, and belief systems as well as other mental processes that are associated with an organism becoming aware of or coming to know the environmental setting in which it exists and interacts. They see man as an active information process or rather than a passive organism where associations are strengthened through training, and view learning as a function of the symbolic mental processes like thinking, reasoning abstraction, perception and memory searching.

According to Bower and Hilgard (1986) they observed the human brain as a kind of computer. Cognitive theories of learning according to Loftus (1993) observe learning as perception of new relationships, the organization or reorganization of what is known into a new pattern which enables the solution of a particular problem to be found.

The major proponents of the traditional cognitive school were principally Max Weigheimer (the father of Gestalt psychology) and his fellow festalters, Wolfang Kohler, Kurt Koffka and Kurt Lewin the "Berlin School" as they were called. Later cognitive theorists included Piaget, Bruner, Asubel and Bandura.

TRADITIONAL COGNITIVE THEORIES (GESTALT THEORY)

The main proponents of the cognitive theories of learning were the Gestalt psychologist pioneered by Max Weitheiner and later joined by his fellow German collaborators, Kohler, Koffka and Lewin.

Gestalt theory developed at about 1912 in Germany was influence on American psychologists however started about 1925 with the appearance in English of Kohler's book the mentality of the Ader and Cohen(1981) and Kohler's The Growth of the mind (1969) and the consequent visits of Kohler and Koffka to America at about the same time of the publication. Gestalt is a German word which means pattern, shape, form or configuration.

The Gestalt theorists were primarily interested in perception and problem solving processes. They regarded what was learnt to be product of and determined by the laws perceptual organization. Similarly, what was performed was seen by them as depending on how the mind, using its current problem solving processes, analyzed the structure of the present situations and made use of traces of past experience. To the Gestalt theorists therefore, we learn, not by associating bits of experiences, but by forming new Gestalts. That is by seeing new patterns and by organizing them into a meaningful whole. Thus, learning was seen as a function of an interrelated perception of a whole whose form, pattern, shape or configuration, would be disrupted and disorganized by breaking it into parts, since such breaking made the perceived object lose meaning. For example, in

word formation, the interrelationship of letters produces a word, but breaking up the word into mere letter units, makes the word lose its gestalt perception. Thus, the interrelationship of the three letters 'b', 'o' and 'y' produces a patterned word "boy". But by breaking these letters into isolated letter units, it will be seen that each letter per se does not convey the meaning which "boy" has given. The views of the Gestalt theorists relating to learning are derived mainly from Kohler's experiments on insight learning.

KOHLER'S THEORY OF INSIGHT LEARNING

The theory of learning by insight is associated with Kohler whose experiments with apes from 1913 to 1917 provided the basis for the theory of insight learning. In Kohler's first experiment, a chimpanzee name Sultan was confined in a cage. A stick was place inside the cage while outside the cage some bananas were put. On first seeing the bananas, the chimpanzee was agitated and tried its best to reach the bananas but it could not do so without the help of the stick. Suddenly, the chimpanzee perceived the stick and established a relationship between the stick and the bananas by using it to get the bananas.

In the second experiment, two sticks which could be fitted together like a joined fishing pole were placed inside the cage. The chimpanzee could only reach the bananas with the aid of both sticks fitted into each other. The chimpanzee tried to get the bananas with the aid of one stick but it failed. Agitated and restless, it withdrew finally to sit in one corner of the cage. Suddenly, as if it had thought of something, it

came back and took both sticks, fitted them and got the bananas.

In the third experiment, the bananas were attached to the ceiling of the cage and a box was put in the corner of the cage. The chimpanzee attempted to get the bananas but could not reach them. Suddenly, it established a relationship between the box and the bananas by putting the box under the bananas, climbed on it and got the bananas.

The fourth experiment introduced a second box and required that the second box be placed upon the first before the banana can be reached.

In all these experiments, insight occurs when the sticks or boxes came into play and the consequent relationship that is established between the sticks or boxes and the goal-bananas. Once the relationship has been established, the act is repeated over and over again. It is this repetition of the successful act following insight which was called insight learning.

Kohler's interpretation of the performances of the apes in these experiments was that there were intelligent attempts at problem solving; that confronted with a problem, the animal could survey the relevant conditions, perhaps think through the probable success of a given act, then test it out as a possible solution to the problem.

Thus, Church (1969) in Yerkes, maintains that insight learning has the following characteristics. Survey of problematic situation, hesitation, pause, attitude of concentrated attention to the problematic situation, trial mode of responses, trial of some other responses where the

initial response modes prove inadequate. The transition from one method to the other being, however, sharp and sudden, steady repetition of adaptive response, frequent recurrent attention to the goal and motivation.

GESTALT LAWS OF PERCEPTUAL ORGANIZATION

The Gestalt psychologists based on the series of experiments conducted by them developed certain laws of perceptual organization which could be sued to aid learning. These laws are as follows:

Figure-ground relationships: This principle states that everything we perceive stands against a background. Therefore, there is a close relationship between figure and ground. The figure is what one focuses attention on; it stands out and is more noticeable or salient than the background.

The law of proximity: This law states that objects or ideas which are close tend to form a gestalt. This means that the closer two elements are, the more likely they are to be grouped together.

Law of similarity: This law states that items similar in respect to some feature (shape, colour, texture, etc.) tends to be grouped together provided such grouping is not overridden by proximity factors.

Law of simplicity: This law says that, other things being equal, a person will see the perceptual field as organized into simple, regular fields.

The law of common direction: This law provides that a set of points will tend to be grouped together if some appear to continue or complete a lawful series.

TOLMAN'S SIGH-GESTALT THEORY OF LEARNING

Edward Tolman's theory was first called purposive behaviourism and later sign-gestalt or expectancy theory. These later terms emphasize the cognitive nature of the theory which, as Bower and Hilgard (1986) observe, distinguishes it in certain respects from the S – R theories.

Tolman's theory is concerned with how behaviour is influenced by such motion as knowledge, thinking, planning, inference, purpose and intention. His main beliefs were that behaviour was goal directed, or purposive and that behaviour was docile and varied according to environmental circumstances in pursuit of a given goal. Tolman argues that behaviour is organized and regulated by objectively determined goals such as learning. According to Lynn (1995), behaviour does not depend on reward or reinforcement but on "cognitive maps" or cognitive structure built upon experience. It is this experience that leads the learner to build up new "expectancies" through learning "what will lead to what". For example, if a child is exposed to an idea 'A' which leads to another idea 'B', the child will definitely develop an expectation that A will always lead to B and this expectation is integrated into the cognitive maps or structure of the idea being learnt. Therefore, what is

learned is expectancy or value of signs rather than S – R connections.

Tolman's theory formulated a large number of laws of learning and variables. Prominent among his laws were capacity laws, stimulus law and laws relative to the manner in which material is presented. On variable, he proposed three types – independent variables, dependent variables and intervening variables.

Generally, Tolman's theory concerned itself with certain cognitive processes such as, an organism's deliberate reflection about problems, it internal representations of the environment and how these representations can be used to solve problems.

PIAGETIAN THEORY OF COGNITIVE DEVELOPMENT

Piaget's theory maintains that an organism tries to establish a balance between itself and the environment in which it operates, and in trying to do so, the organism generates some relevant intelligent behaviour and learns consequently. Piaget argues that a learning organism directs it intelligent behaviour through assimilation and accommodation. Assimilation refers to a learning process by which an organism incorporates or absorbs a new learning material as part and parcel of the organism's experience while accommodation is the learning process by which an organism modifies its cognitive and structural mode of perception or thinking known as schema.

According to Piaget, these behaviours follow some meaningful pattern and stages which correspond to different psychological stages of development. These stages are as follows:

The sensori-motor stage (0-2 years of birth): During this stage, the organism is exposed to the environment and gains experience, which helps him/her to learn, as a result of the interaction with the environment.

The pre-operational stage (2-7 years of birth): This stage heralds the rudimentary development of language and positive thinking.

The concrete operation stage (7-12 years): During this stage, children are able to classify objects according to sizes, shapes, colour and group semblemances and also arrange things according to their serial order but are still handicapped in dealing with abstract concepts.

The formal operations stage (12 years onwards): During this stage, there is a gradual increase in ability to master formal operations through logical deduction and consideration of hypotheses and consequences. The child at this stage is able to think logically and deal with abstract concepts through abstract reasoning.

IMPLICATIONS OF PIAGETS THEORY

Piaget's psycho-developmental stages imply that the curriculum should be planned in such a way that learning experiences fall within the intellectual ranges of the learner. Therefore, in developing syllabus, the developmental stage at which each learner is functioning should be taken into

consideration. Consequently, what is to be learnt at the pre-primary, primary post-primary and tertiary levels must be carefully planned and structured to match the cognitive abilities of the learners at each stage.

Similarly, subject matter or material presented to the learner should be organized and arranged in an increasing order of complexity and relatedness so that the learner can bring into the pattern of solution experiences acquired from simpler ones.

Activity method of teaching where learners manipulate objects of widely different properties of texture, colour and shape, should be emphasized particularly at the primary school level. In addition, teaching aids should be used to strengthen learning. At the primary, junior and secondary schools, such aids should comprise mainly of concrete objects and visuals (pictures) rather than graphs and maps.

BANDURA'S OBSERVATIONAL LEARNING THEORY

Albert Bandura's theory of observational learning is described by Bower and Hilgard (1986) as one that tries to provide a more balanced synthesis of cognitive psychology with the principles of behaviour modification. Thus, this theory is a less extreme form of behaviourism which stresses the role of observation as a means of learning and considers learning to be mediated by cognitive factors. According to Bandura (1977) "the theory approaches the explanation of human behaviour in terms of continuous reciprocal

interaction between cognitive, behavioural and environmental determinants. Within the process of reciprocal determinism lies the opportunity for people to influence their destiny as well as the limit of self-direction. This conception of human functioning then neither casts people into the role of powerless objects controlled by environmental forces nor forces agents who can become whatever they choose. Both people and their environments are reciprocal determinants of each other."

Bandura's theory has it most distinctive aspects of observation and modeling as the basis for learning. Thus, learning, he argues, occurs through example either intentionally or accidentally. We learn before by observing other people and modeling our behaviours after theirs. The observational theory of learning according to Bandura and Walter (1963) is governed by four interrelated meditational mechanisms or processes. These are:

Attention processes by which the learner's attention is drawn to the model.

Retention processes by which what is being modeled undergoes the normal processes of retention associated with perception, encoding, short-term storage, consolidation and final storage in the long term memory.

Motor reproduction processes which implies ability of the learner to perform aspects of motor behaviour associated with observational learning. Thus, it is the doing or acting out process which is associated with the aspect of retrieval of what has been retained.

Incentive and motivational processes which implies the learner's level of anticipated reward and reinforcement associated with manifestation of observational behaviour.

IMPLICATIONS OF BANDURA'S THEORY

Bandura's observational learning implies for school curriculum development that learners should be made to make use of their minds in a creative and original manner. In addition, teachers should always try to model desirable behaviour at all times for children to observe and imitate. This is particularly so because many children have been known to model their teacher's behaviour so closely that they in a sense, become the teacher when interacting with younger brothers and sisters at home. The teacher should also draw favourable attention to children who are modeling the desired behaviour and by equally stressing in his instructions to the class and the desired rather than the undesired behaviour.

CHAPTER SIX
LANGUAGE DEVELOPMENT

Language is a symbolic code used to communicate meaning from one person to another. Language is one of the main features that mark out man from other species. Although birds, dolphins, bees and some other creatures communicate with their respective kinds, they do not possess the intricacies of human language. Language is at the centre of what it means to be human and is instrumental in all humanistic pursuits.

According to Trotter (1972) language development is innate and creative from the very beginning. The concept of language development is a process that begins early in infancy and depends crucially on skills on a variety of domains including perception, cognition, motor development and socialization. Environmentalists and nativist alike share the view that the human child never demonstrates the linguistic dexterity of the normal adult at birth. Linguists describe language as a code and form, as a code, language has various sets of elements which can harmoniously occur in an acceptable sequence and as a form, language has various sounds and letters that could under the acceptable convention combined to form words, the words combine to form sentences and so on. The essential things about the set of forms is that there would be expected to make meaning their validity lies in communication. The communication on the other hand is expected to occur only between individuals who share the same rules. Linguists see these rules embedded in syntax and semantics. It is syntax that governs

the rule for permitted combination of elements, while semantics relates to rules of meaning. Since communication can occur only between members who share the same syntax and semantics, language is a closed system which is internally consistent, closed and insulated from the environment.

Greenfield (1966) sees language from a human science perspective and also stated that, language is a set of culturally transmitted behaviour pattern shared by a group of individual's needs. It is seen as the main vehicle of the culture of the people. Viewed against the background of the perspective stated briefly above, our general understanding of what language is summarize to embrace all of its major functions and characteristics. Language is a structured and tacitly organized arbitrary system of sounds that have socially standardized meanings. It is essentially a spoken thing vital to all humans for communication. It is used for transmitting information, attitudes, ideas, concepts emotion, facilitates thought and thought processes and the projection of the past and projection into the future. It conveys in completeness the technology, science, beliefs,, folklores, drama, literature, tradition, taboos, and others for those who speak it.

From the above definitions, the "concepts of language development" means the idea or notion on how language begins. Otherwise, trying to answer the question on language development.

THEORIES OF LANGUAGE DEVELOPMENT

Theories of language development can be classified into two main groups, behaviourism or nativist. The learning theory of B. F. Skinner or Piaget's theory of language as intelligence rightly belongs to the behaviourist school. On the other hand, there is Chomsky's innateness theory. Although these theories differ in their explanation of language acquisition, each is a pointer to the way children learn language.

PIAGET'S THEORY OF LANGUAGE DEVELOPMENT

Piaget (1972) believes that the process that leads to language development are graded and depend on intellectual maturation level of the child. At the end of the turtous sensory motor period, the child masters the notion of objects. The object exists beyond his body in space and time. His emerging "decentred" nature teaches him to understand that objects in space and time are not part of his body movements. Objects are recognized by to be indexes and signals.

Later, the child gradually develops and acquires a symbolic function-the ability to use signs and symbols to represent objects not present. Through the imitation process, the child begin to make transition from indexes to symbols. The child's memory further develops to the stage in which he can image an object or event or act. This

becomes the stage providing the vital source of symbol and language.

LANGUAGE AS REINFORCEMENT

Language can be serve as reinforcement. Skinner as environmentalist states that the way language is acquired by the child follows the same process as other processes of learning or behaviour. Language is acquired through learning process. Children acquire language in three main ways that depend primarily on reinforcement by adults. These ways are termed a MAND responses. TACT (contact) and ECHOIC (imitation). The MAND responses are those which parents interpret and respond to satisfy children wants and needs. In so far as children make the MAND responses, parent reinforce by satisfying the need. In the TACT responses, children are deliberately rewarded for specific sounds that they repeated correctly. ECHOIC responses on the other hand, are purely imitation of adult speech by the child. Each time the infants imitates a sound correctly, he is appropriately rewarded to provide the necessary basis for encouragement. By this process, the child through directed trials and rewards, gradually learns the language of his environment as necessary behaviour and an inevitable skill.

THE INNATENESS THEORY

Nativists led by its chief proponent Chomsky, (1965, and 1968). He propounded a theory of language development different from the two theories discussed above. Chomsky believes that human beings are endowed with a biological capacity for languages to support and

advance. The logic of his theory holds that language of the world are different but they share certain similarities. This is what he terms "language universal".

Every human child, according to Chomsky (1965), inherits an inborn language generating mechanism - Language Acquisition Device (LAD). The important thing as evident from this theory is that every human child has his/her language structure-channelled for him genetically. What the child does is to merely learn peculiarities of his society's language and not the basic structure. This theory has also been termed by some authorities as the cognitive "Theory Model". This is because the theory simply attempts to describe what happens within the child. The theory also believes that the child behaves as a self-directed organizer who listens to adult speech, observes actions and formulates rules for tests at the appropriate time.

CONCEPTS AND STAGES OF LANGUAGE DEVELOPMENT

Man has shown incredible curiosity in his attempt to trace the concepts of language development. Adventure into how children learn how to talk were first recorded by Herodotus on the experimental attempts by the Egyptian King, Psammetchus in the 7th Century B. C. However, it was not until late 19th century that systematic research on how children acquire language began.

Today, linguists no longer believe that children merely speak an imperfect version of adult language, but that they speak their own language that develops only systematically

through indefinable stages. Five main stages spreading, through pre-linguistic or early vocalization, cooing and babbling, holophrasestic speech, two-word sentences and three-word sentences have been identified, Peretonode (1994).

Pre-vocalization: The main means of communication in this stage is through differentiated crying from birth to about one month of age, the only sound an infant makes is to cry. This helps the child to improve the lungs capacity and cardiovascular development and this signals to the care givers that the baby is in need. Infants seemed to have several different cries to signal several kinds of discomfort and many parents become quite skilled in reading these to diagnose the baby's particular need at the moment. But the sick or low birth/weight babies or those rated as having difficult temperament are likely to have more unpleasant crying sounds. So the quality of the child's cry may turn out to be a helpful diagnostic tool to the physicians or parents. Young infants also produce such other sounds as belches, coughs, signs and yawns. The infants advance from this sound to cooing and babbling.

Cooing and babbling: Around the third month of their lives infants make cooing sound by the sixth month babbles. These squealing-gurgling noise usually sustain for a few seconds are identified as cooes. The alternative of sequences of vowels and consonants like one syllable utterance for example, 'da, da, da, are termed as babbling (Lenneberg, 1967). The process of babbling is usually enjoyed by babies for its own sake.

Holophrastic speech: This stage is characterized by the beginning of a patterned speech. It is at this stage infants usually begin to produce their first recognizable words. Although opinions are divided among developmental psychologists as to when children speak their first words. Some put it at ten months and others thirteen months. Because of the anxiety of expecting the first words, parents tend to read meanings into the infants babbling. Holophrases are single words. The meaning attached to such words depend upon the context in which such words are used by children.

Two-word sentences: These are common features of a child who is between 18 to 22 months old. Most of these two-word sentences are usually said as one word. These words have to be interpreted according to context and intonation if we have to make meaning from the two-word sentences. It should be noted that two-word sentences may not fit into adult grammar or parental speech as such.

Three-word sentences: Children advance systematically from two-word sentences to three-word sentences. The three-word in one phrase are usually telegraphic-example, 'mummy water' in two-word sentences may become 'mummy drink water', etc. The child has constraints of length of sentences. He employs mainly nouns, verbs, few adjectives and adverbs. Children's speech lack use of articles, conjunctions and prepositions. With passage of time, however, they develop better grammatically constructions and more complex sentences. 30 month old child makes rapid gains in learning new words but his

sentences are typical child's grammar. At 36 months, he/she has a vocabulary of some one thousand words and about 80% of speech is intelligible. 48 month child has a well-established language and deviation from adult speech are more in style than in grammar.

FACTORS AFFECTING LANGUAGE DEVELOPMENT

It is well known that not all children develop at the same rate. Some of the factors that affect language development are hereditary while others are environmental. In fact, there are more environmental factors that affect language development than those relating to heredity. Some of these factors identified as affecting language development are as follows:

Level of Intelligence: This factor relates strongly to heredity. Children born with mildly sub-normal brain conditions find the task of developing normal linguistic abilities an uphill task. It is a very slow and difficult process of them. Normal and bright children unlike these other ones, develop language with ease. They speak articulately with ease and efficiency.

Gender: It has been discovered that the gender of the child affects linguistic development. Girls are known to be superior in vocabulary and quality of articulation, than boys. This may not be applicable in all cases.

Bilingualism or Multilingualism: This is purely an environmental factor that relates to the presence of more than one language. In some homes, two languages may be spoken

at the same time, in others, even more than two are practiced. Where more than one language is spoken in a home, the child has to battle with trying to catch-up with two or more languages. Such confusing linguistic environment hinders the smooth and fast language development of the child.

Emotional Stress: Children under emotional stress situation have problem in language development or acquisition. Such children usually operate under parental pressure such that excessive fear and anxiety becloud all their attempts to acquire language under normal conditions of freedom and pleasure.

Socio-economic factor: This factor breeds many differences in human life. Some of the differences so created affect the child's negative or positive development. In the case of language, studies have shown that children whose homes are economically viable develop language faster than those who come from lower income and impoverished home.

CHAPTER SEVEN

INTELLIGENCE

Humans are distinguished from other animals by their great capacity for symbolic thought, abstract thinking, problem solving, and ability to learn new concepts. Most scientists and many psychologists collectively refer to these abilities as intelligence.

Until this century, individuals have used the word "intelligence" in an effort to describe their own mental powers as well as those of other persons. Consistent with ordinary language usage, "intelligence" has been deployed in anything but a precise manner. Individuals living in the West were called "intelligent" if they were quick or eloquent or scientifically astute or wise. In other cultures, the individual who was obedient, or well behaved, or quiet, or equipped with magical powers, may well have been referred to by terms which have been translated as "intelligent".

Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles. Although these individual differences can be substantial, they are never entirely consistent, a given person's intellectual performance will vary on different occasions, in different domains, as judged by different criteria. Concepts of intelligence are attempts to clarify and organize this complex set of phenomena. The study of intelligence is an important area of research, and a number of debates exist within the field.

There are debates on: The definition of the concept of "intelligence".
Whether it is reasonable to evaluate this multitude of mental abilities in a single measurement (i.e. one's IQ).
Whether the results of IQ tests are culturally biased or not.

The extent to which differences in IQ among humans, and groups of humans, are a result of genetic or environmental factors and how early environmental and genetic factors interact to influence brain structure.

What intelligence test scores mean, what they predict, and how well they predict?

Why individuals differ in intelligence, and especially in their scores on intelligence tests?
Whether various ethnic groups display different patterns of performance on intelligence tests, and if so what might explain those differences?

Intelligence has been a controversial issue that no subject in psychology has provoked more intense public controversy than it. From its beginning, research on how and why people differ in overall mental ability has fallen prey to political and social agenda that obscure or distort even the most well established scientific findings. Intelligence has been defined by prominent researchers in the field as:

The aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with the environment, Wechsier (1955).
The capacity to form concepts and to grasp their significance Terman, (1925).

The ability to judge well, to understand well, and to reason well Bock et al (1986).

Eysenck (1973) described intelligence as "success in problem solving, ability to learn, capacity for producing neogenetic solutions, understanding of complex instructions or simply all-round cognitive ability". Similarly, Gardner (1983), described intelligence as much more than IQ. According to him, high IQ in the absence of productivity does not equate to intelligence. In his definition, "intelligence is a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture". Consequently, instead of intelligence being a single entity described psychometrically with an IQ score, Gardner's definition views it as many things. He endeavoured to define intelligence in a much broader way than psychometricians.

There is therefore a general consensus among scholars that to be considered intelligent "individuals must be able to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, and overcome obstacles by taking thought" (Neisser et al, 1996).

TYPES OF INTELLIGENCE

Intelligence Quotient: This is ability to know book, solve mathematics, memorize things and recall subjects matters. It is defined in Revised Standard dictionary, as individual's ability to learn and reason. It is this meaning which

underlies its common psychometric notions such as intelligence testing, and intelligence quotient.

Psychometrically, tests of intelligence come in many different forms. In conventional forms intelligence test scores are converted to a scale in which the mean is 100 and the standard deviation is 15. The term "IQ" has historically been used to describe scores on tests of intelligence. IQ has been referred interchangeably with other conceptually similar concepts such as general intelligence factor (g), and cognitive mental ability. Hunter and his colleagues (Schmidt et al 1988; Ree & Earles, 1992) repeatedly report that scores on various intelligence tests predict a wide variety of job performance measures, with the mean of corrected correlations as high as 54. The APA task force on intelligence recently issued a report acknowledging that not only can people have many ways to be intelligent, but there are also many conceptualization of intelligence (Neisser, et al, 1996). Although the psychometrically sound IQ tests- the ones with which we are most familiar, it accumulated a substantial body of knowledge and received solid empirical support in predicting job performance. There are other forms of intelligence that standardized tests cannot easily access: wisdom, creativity, critical thinking, practical knowledge, social skill, interpersonal effectiveness. Eagly (1978) echoes this and challenged I/O psychologists to assist managers to identify and develop these skills.

PRACTICAL INTELLIGENCE (PQ)

Some psychologists argue that mental ability has several important aspects and is not based on one form of intelligence test alone (Neisser, et al, 1996). Sternberg, for example, suggests the need to balance between academic intelligence (book smarts, or what is previously referred to as "g" or cognitive mental ability above) on one hand, and creativity and especially practical intelligence (street smarts or common sense) on the other. They argued that tasks for academic intelligence tests usually are (1) formulated by others, (2) have little or no intrinsic interest, (3) have all needed information available from the beginning, (4) are dis-embedded from an individual's ordinary experience, (5) are well-defined, have but one correct answer, and (6) have just one method of obtaining the correct solution. In direct contrast, the tasks for practical, real life work problems often (1) are unformulated or in need of reformation, (2) are of personal interest, (3) are lacking in information necessary for solution, (4) are related to everyday experience, (5) are poorly defined, (6) have multiple "correct" solutions, and (7) have multiple methods for picking a problem solution (Sternberg, Wargner, Williams & Horvath, 1995).

Sternberg and his associates demonstrated in a series of studies that performance on measures of practical intelligence predict real life criteria such as job performance, but is relatively unrelated to performance on intelligence tests and other common selection measures. They proposed to supplement existing cognitive ability tests in predicting job performance with additional measures based on this new

construct, practical intelligence. This PQ construct may shed some light in explaining why highly job-related tests such as Assessment Centres work well in predicting job success.

SOCIAL INTELLIGENCE (SQ)

Social intelligence has its origins in E. L. Thorndike's (1911) division of intelligence into three facets, pertaining to the ability to understand and manage ideas (abstract intelligence), concrete objects (mechanical intelligence), and people (social intelligence). In his classic formulation: "By social intelligence it meant the ability to understand and manage men and women, boys and girls to act wisely in human relations." Similarly, Moss and Hunt (1976) defined social intelligence as the "ability to get along with others. Vernon (1987) defined social intelligence as the person's "ability to get along with people in general, social technique or ease in society, knowledge of social matters, susceptibility to stimuli from other members of a group, as well as insight into the temporary moods or underlying personality traits of strangers."

Social intelligence shows itself abundantly in the nursery, on the playground, in barracks, factories and salesroom, but it eludes the formal standardized conditions of the testing laboratory. It requires human beings to respond to time, to adapt its responses, and face, voice, gesture, and mien as tools". Nevertheless, true to the goals of the psychometric tradition, the abstract definitions of social intelligence were quickly translated into standardized laboratory instruments for measuring individual differences

in social intelligence (Taylor, 1986; Taylor & Fiske, 1975; Walker & Moran, 1991).

Helder(1958) develop tests for coping with other people, not just understanding them through their behaviour but what they referred to as "basic solution-finding skills in interpersonal relations." Because successful coping involves the creative generation of many and diverse behavioural ideas, these investigators labeled these divergent-thinking abilities creative social intelligence. The six divergent production abilities defined by Hendricks et al are:

Divergent production of behavioural units: the ability to engage in behavioural acts which communicate internal mental states;

Divergent production of behavioural classes: the ability to create recognizable categories of behavioural acts;

Divergent production of behavioural relations: the ability to perform an act which has a bearing on what another person is doing;

Divergent production of behavioural systems: the ability to maintain a sequence of interactions with another person;

Divergent production of behavioural transformations: the ability to alter an expression or a sequence of expressions; and

Divergent production of behavioural implications: the ability to predict many possible outcomes of a setting.

EMOTIONAL INTELLIGENCE (EQ)

According to Time Magazine (1995) "IQ gets you hired, but EQ gets you promoted". Emotional intelligence according to Salvey cited in Goleman's (1995) book, includes the following five domains: The ability to identify your emotion, the ability to manage your feeling, persistence and optimism despite setbacks, empathy, and social skills, understanding one's own feeling, empathy for the feeling of others, and managing emotion in a way? To enhance living are important qualities for both personal and work life. This sense of self-awareness and of being smart about what we feel has probably cornerstoned and importance of EQ. Due to its complexity, Goleman noted that it may not be possible to design a valid paper-and-pencil measurement of EQ.

On the other hand, Arvey, Renz and Driskill (1996) proposed a model that could lead to the assessment of individual differences in emotionality in order to improve current selection procedures. They indicated that there are individual difference in terms of the particular content or types of emotion displayed, the amplitude of emotion, and the duration of emotion triggered by particular stimuli in working settings, which, if properly measured, could add incremental validity in predicting relevant job behaviour and outcomes over the measures.

CHAPTER EIGHT

HISTORICAL PERSPECTIVE TO THE STUDY OF INTELLIGENCE

The history of the influence of the development of intelligence theory is given in examination of "time periods". In each, consequential works and noteworthy individuals will be considered.

Period One

"Modern Foundations" was influenced by such notable names as John Stuart Mill, Francis Galton, and Charles Darwin. Mill (1966) theorized his "tabula rosa", or blank slate, stating that all humans were born with little, if any, intelligence. Due to "nature", no hereditary or genetic factor contributed to intelligence. Nurture bears considerable weight when defining intelligence, yet to negate the influence of nature, or heredity, on intelligence is absurd. On the complete opposite sweep of intelligence theory was Galton (1869), father of modern psychology and father of eugenics, who postulated that intelligence was all "nature". Galton was the first to make this claim and support it with evidence in his Heredity Genius (1869), and probably the first to explore the implications of his cousin Charles Darwin's "Origin of Species" for the study of intelligence. Galton applied emerging statistical concepts to psychology and promoted anthropometric testing as the "measure of a man". Galton was Darwin's half cousin, and like Darwin, was interested in functional aspects of behaviour. Unlike Darwin, however, Galton's interest lay in measurement.

Galton believed that measures of sensory function were predictive of intelligence. So, he measured vision, hearing, and olfaction. He invented the terms "association test" and the "digit-span test", both of which continue to be used as an item types in modern tests of intelligence. In many ways, Galton can be said to be one of the main founders of psychometrics.

Period Two

"The Great Schools", expounded the "look inside the mind" to describe what humans were thinking theory, or "introspection" approach. Wilhelm Wundt (1832-1920) and John Dewey (1859-1952) presented two significant perspectives in psychology: structuralism and functionalism. However, both lacked convincing research methodology. Introspection did not quite meet the mark of requirement for plausibility. Empirical evidence was lacking yet Dewey, a towering figure in curricular reform, did make a definite and defining contribution to education-the child-centred curriculum with foci on knowledge, or intelligence, as the total of experience. In 1890, William James fired one of the first assaults at the mental disciplinarian notion of transfer when he reported that his experiments on memory had failed to show any improvement in what mental disciplinarians had imagined to be a concrete faculty of memory. Towards the end of Time Period Two, Clark Wissler (1901), a student at Columbia who studied under James Cattell (advocate of Galton's anthropometric testing), researched relationships between anthropometric testing and grade point averages of

college students. His finding shows that the correlation was poor.

Period Three

"The Great Schools' Influence"- saw theoretical and empirical research of intelligence gain in growth. Students of the "Great Schools' examined intelligence further, forming subsequent theories and programs. One of James Cattell's brilliant and illustrious students, Edward Lee Thorndike (1874-1949) conducted experimentation to discredit the mental disciplinarian concept of transfer. Thorndike, known as the father of behaviourism, concluded his significant critical studies by stating, that "improvement in any single mental function needs not improve the ability in functions commonly called by the same name. It may injure it" (Thorndike, and Woodworth 1901). The calibration of Thorndike's experimentation led to the beginning of intelligence testing. Thorndike became a leader in the United States in the application of scientific methods of inquiry to psychology and education. His early system of psychology was referred to as stimulus-response psychology and later connectionism. Due to this, Thorndike became a dominant influence on American teaching procedures. Parallel to the time of Thorndike's fitting the "feeble-minded" child to the demands of modern society. A strong proponent of the influence of nature (heredity) on intelligence, and of Galton, Goddard promoted social efficiency, developing a school for the mentally retarded. He believes that appropriate actions needed to be taken before "they are allowed to go out into life, and by the laws

of heredity… inevitably pass on to future generations their defects and even diffuse them in the population as a whole (Kliebard, 1995). Goddard first introduced the Binet test in the United States. At this time, Terman, a Stanford University Psychologist, along with Maud Merrill, further revised Binet's tests developing the Stand –Binet intelligence Tests. Using German Psychologist Stern's (1912) intelligence quotient formula (IQ = mental age/chronological age), Terman suggested multiplying the I.Q. by 100 for simplification. Terman is also noted for his longitudinal study of high I.Q. students, "Terman's Termites". Piaget first entered the field of intellectual development when working in Binet's intelligence test items. Piaget took into account the cognitive structure underlying the child's actions. Thus, Piaget's Developmental Theory" began to emerge. It was not until the 1960s, however, that the Western Hemisphere enveloped its impact on intellectual development.

Period Four

Advances in testing and statistics promoted the standardization of intelligence testing and achievement during "Contemporary Explorations". The previous influence of the "Great Schools" time period encouraged furtherance of the "g" intelligence theories and paved way for differing investigations of intelligence that led to the emergence of multiple intelligence theories. The notion of a general factor that underlied intelligence was not accepted by Louis Thurstone (1938), who, along with T. G. Thurstone, proposed an alternative theory based upon analyses of performance on a large battery of mental tests administered

on undergraduates at the University of Chicago. In his research on mental abilities, Thurstone found evidence for a set of primary mental abilities that were labeled Verbal Comprehension, Number Facility, Rote Memory, Perceptual Speed, Space, Induction, Deduction, Word Fluency, and Arithmetic Reasoning (Kamin, 1974). These factors, or abilities, served as a basis for the formulation of the Primary Mental Abilities (PMA) Test. Thurstone believed "g" to be of little value. Thus, Thurstone's theory was freeing. Wechsler (1958) defined intelligence as the global capacity of a person to act purposefully, to think rationally, and to deal effectively with his or her environment. It is this notion of intelligence as "the overall capacity of an individual to understand and cope with the world around him that led to the development of the Wechsler Adult Intelligence Scale (WAIS), and later in 1974, the Wechsler Intelligence Scale for Children (WISC), both based on the Wechsler Scale, which clusters test scores into verbal and performance intelligence. From 1940s, factor theories developed, that represented a reconciliation of Spearman's "Two Factor Theory" and Thurstone's "Primary Mental Abilities" theory. Following in line with the belief in a single general intelligence factor, Vernon (1987) proposes a hierarchy with general intelligence at the top, verbal-educational and practical-mechanical abilities at the second level, and more specific abilities at lower levels (Sternberg, 1982). Guilford (1981), after studying officer candidates in the Air Force, Navy, Coast Guard, and Marines, proposed an extension of Thurstone's theory that incorporated its factors and added

many others. Guilford posited 120 distinct intellectual abilities representing the structure of intellect. These factors were organized along a three-dimensional "cube model" that interacted to determine different specific factors. His model, however, became too complex to the extent that it was extended to 240 "intelligence".

Period Five

"Current Efforts" trends in intelligence theories and research have provided new and speculative perspective, reliable genetic and neurological research methodologies, and advances in statistical analysis. Standardized testing has indeed been de-emphasized, in some ways, and formation of more complexes multiple intelligence theories and/or trends in intelligence measurement have emerged. Jensen (1993), a well-known advocate of the importance of heredity in intelligence, again purported the "nature" theory founded in Galton's earlier distinguished works. According to Jenson, people had little hope for attempts to train their given intelligence. He asserted that "once a dummy, always a dummy". Catell (1971) proposes a "Multiple Factor Theory" in which Thurstone's and Spearman's views of intellect were synthesized. Cattell's hierarchical theory is in many ways similar to Vernon's theory. When the name Howard Gardner is mentioned, "how one is smart rather than how smart one is" comes to mind. Gardner's (1983) "Multiple Intelligence Theory" (MI Theory) holds center stage in many educational arenas. Approaching intelligence from a developmental perspective, Gardner opposes intelligence test scores and rather argues for performance based assessment of

intelligence. Knowing that all children take in and process information differently naturally leads to a non-standardized approach to assessment. In his book, *Frames of Mind* (1983), Gardner describes his theory in the tradition of multifactor theories like those of Thurstone (1938) and Cattell (1971).

Robert Sternberg was one of the first advocates of the process approach to intelligence. In his book, intelligence, information processing and analogical reasoning, Sternberg proposes an information processing theory of individual differences in analogical reasoning. In 1984, Sternberg advanced a broader theory of intelligence that elaborated his earlier work. His "Triarchic Theory" includes three sub-theories, each addressing issues in defining and measuring human intelligence. Gardner's theory of multiple intelligences and Sternberg's triarchic theory represent the most sophisticate efforts to date to bridge the gaps between the traditional approaches to intelligence.

Another recent theory is that of Carroll (1993), who expressed his agreement with, and summarized much of, Spearman's study of intelligence in his book, *Human Cognitive Abilities*. Groundwork for his "Three-Stratum Theory of Intelligence" was laid by what he referred to as Charles Spearman's enormous contributions to this present day theory (Dennis et al, 1941).

Intelligence theories have made their way through the winding path of a plethora of foundational beliefs, postulations, and research.

APPROACHES TO THE STUDY OF INTELLIGENCE

Psychometric Approach

Ever since Alfred Binet's great success in devising tests to distinguish mentally retarded children from those with behaviour problems, psychometric instruments have played an important part in European and American lives. Tests are used for many purposes, such as selection, diagnosis, and evaluation. Many of the most widely used tests are not intended to measure intelligence itself but some closely related construct: scholastic aptitude, school achievements, specific abilities, etc. Such tests are especially important for selection purposes. For preparatory school, it's the SSAT; for college, the STA or ACT; for graduate school, it's the SSAT; for college, the SAT or ACT; for graduate school, the GRE; for medical school, the MOAT; for law school, the LSAT; for business school, the GMAT. Scores on intelligence-related test matter T and the stakes can be high.

Intelligence tests: Tests of intelligence itself (in the psychometric sense) come in many forms. Some use only a single type of item or question; examples include the Peabody Picture Vocabulary Test (a measure of children's verbal intelligence) and Raven's Progressive Matrices (a nonverbal, untimed test that requires inductive reasoning about perceptual patterns). Although such instruments are useful for specific purposes, the more familiar measures of general intelligence, such as the Wechsler test and the Standford-Binet, include many different types of items, both verbal and nonverbal. Test-takers may be asked to give the meanings of words, to complete a series of pictures, to

indicate which of several words does not belong with the others, and the like. Their performance can then be scored to yield several subscores as well as an overall score.

By convention, overall intelligence test scores are usually converted to a scale in which the mean is 100 and the standard deviation is 15. (The standard deviation is a measure of the variability of the distribution of scores). Approximately 95% of the population has scores within two standard deviations of the mean, i.e. between 70 and 130. Individuals rarely perform equally well on all the different kinds of items included in a test of intelligence. One person may do relatively better on verbal than on spatial items, for example, while another may show the opposite pattern. Nevertheless, subtests measuring different abilities tend to be positively correlated: people who score high on one such subtest are likely to be above average on others as well. These complex patterns of correlation can be clarified by factor analysis, but the results of such analyses are often controversial themselves. Some theorists (Spearman et al 1950) have emphasized the importance of a general factor, g, which represents what all the tests have in common; others (e.g., Thurstone, 1938) focus on more specific group factors such as memory, verbal comprehension, or number facility. One common view today envisages something like a hierarchy of factors with g at the apex. But there is no full agreement on what g actually means: it has been described as a mere statistical regularity (Thompson, 1939), a kind of mental energy (Spearman et al 1950), a generalized abstract

reasoning ability (Gutman, 1977), or an index measure of neural processing speed (Reed etal 1996).

There have been many disputes over the utility of IQ and g. Some theorists are critical of the entire psychometric approach (Ceci, 1990; Gardner, 1983; Gould, 1978), while others regard it as firmly established (e.g., Carroll, 1969; Eysenck, 1982; Hermstein & Murray, (1994); Jensen, (1972). The critics do not dispute the stability of test scores, nor the fact that they predict certain forms of achievement – especially school achievement-rather effectively. They do argue, however, that to base a concept of intelligence on test scores alone is to ignore many important aspects of mental ability. Some of those aspects are emphasized in other approaches reviewed below.

Multiple Forms of Intelligence

Gardner's Theory

In 1983, American psychologist Howard Gardner proposed a theory that sought to broaden the traditional definition of intelligence. He felt that the concept of intelligence, as it had been defined by mental tests, did not capture all of the ways humans can excel. Gardner argued that we did not have one underlying general intelligence, but instead have multiple intelligences, each part of an independent system in the brain.

In formulating his theory, Gardner places less emphasis on explaining the results of mental tests than on accounting for the range of human abilities that exist across cultures. He draws on diverse sources of evidence to

determine the number of intelligence in his theory. For example, he examines studies of brain-damaged people who has lost one ability, such as spatial thinking, but retained another, such as language. The fact that two abilities could operate independently of one another suggested the existence of separate intelligence. Gardner also proposed that evidence for multiple intelligences came from prodigies and savants. Prodigies are individuals who show an exceptional talent in a specific area at a young age, but who are normal in other respects. Savants are people who score low on IQ tests- and who may have only limited language or social skills- but demonstrate some remarkable ability, such as extraordinary memory or drawing ability. To Gardner, the presence of certain high-level abilities in the absence of other abilities also suggested the existence of multiple intelligences. Gardner initially identified seven intelligences and proposed a person who exemplified each one. Linguistic intelligence involves aptitude with speech and language and is exemplified by Poet T. S. Eliot. Logical-mathematical intelligence involves the ability to reason abstractly and solve mathematical and logical problems. Physicist Albert Einstein is a good example of this intelligence. Spatial intelligence is used to perceive visual and spatial information and to conceptualize the world in tasks like navigation and in art. Painter Pablo Picasso represents a person of high spatial intelligence. Musical intelligence, the ability to perform and appreciate music, is represented by composer Igor Stravinsky. Bodily-kinesthetic intelligence is the ability to sue one's body or portions of it in various activities, such as

dancing, athletics, acting, surgery, and magic. Martha Graham, the famous dancer and choreographer, is a good example of bodily-kinesthetic intelligence. Interpersonal intelligence involves understanding others and acting on that understanding and is exemplified by psychiatrist Sigmund Freud. Interpersonal intelligence is the ability to understand one's self and is typified by the leader Mohandas Gandhi. In the late 1990s Gardner added an eight intelligence to his theory: naturalist intelligence, the ability to recognize and classify plants, animals, and minerals. Naturalist, Charles Darwin is an example of this intelligence. According to Gardner, each person has a unique profile of these intelligences, with strengths in some areas and weaknesses in others.

Gardner's theory found rapid acceptance among educators because it suggests a wider goal than traditional education has adopted. The theory implies that traditional school training may neglect a large portion of human abilities, and that students considered slow by conventional academic measures might excel in other respects. A number of schools have formed with curriculums designed to assess and develop students' abilities in all of the intelligences Gardner identified. Critics of the multiple intelligences theory have several objections. First, they argue that Gardner based his ideas more on reasoning and intuition than on empirical studies. They note that there are no tests available to identify or measure the specific intelligences and that the theory largely ignores decades of research that show a tendency for different abilities to correlate- evidence of a

general intelligence factor. In addition, critics argue that some of the intelligences Gardner identified, such as musical intelligence and bodily-kinesthetic intelligence, should be regarded simply as talents because they are not usually required to adapt to life demands.

Sternberg's Theory

To understand this theory, it is important to understand how it is different from some traditional concepts of intelligence. Sternberg fought his first IQ test as a young elementary student. By his own story, he lost (Sternberg & Grigorenko, 2000). A victim of test anxiety, he was saddled with low IQ score early in school. His teachers read his test score and for the first three years of his school career expected little of him. It was only the intervention of a fourth grade teacher who discounted tests that set him on the path to high achievement and success.

Now, as the IBM Professor of Psychology and Education at Yale University, Sternberg strongly battles against the hegemony of g-centric theories of intelligence.

In 1980s the American Psychologist Robert Sternberg proposed a theory of intelligence that, like Gardner's theory of multiple intelligences, attempted to expand the traditional conception of intelligence. Sternberg notes that mental tests are often imperfect predictors of real- world performance or success. People who do well on tests sometimes do not do as well in real-world situations. According to Sternberg's triarchic (three-part) theory of intelligence, intelligence consists of three main aspects: analytic intelligences as in Gardner's theory, but interrelated parts of a single system.

Thus, many psychologists regard Sternberg's theory as compatible with theories of general intelligence.

Analytic Intelligence

Analytic intelligence is the part of Sternberg's theory that most closely resembles the traditional conception of general intelligence. Analytic intelligence is skill in reasoning, processing information, and solving problems. It involves the ability to analyze, evaluate, judge, and compare. Analytic intelligence draws on basic cognitive processes or components.

Creative Intelligence

Creative intelligence is skill in using past experiences to achieve insight and deal with new situations. People high in creative intelligence are good at combining seemingly unrelated fact to form new ideas. According to Sternberg, traditional intelligence tests do not measure creative intelligence, because it is possible to score high on an IQ test yet have trouble dealing with new situations.

Practical Intelligence

Practical intelligence relates to people's ability to adapt to, select, and shape their real-world environment. It involves skills in everyday living ("street smarts") and in adapting to life's demands, and reflects a person's ability to succeed in real-world settings. An example given by Sternberg of practical intelligence is of an employee who loved his job but hated his boss. An executive recruiter contacted the employee about a possible new job. Instead of applying for the job, the employee gave the recruiter the

name of his boss, who are subsequently hired away from the company. By getting rid of the boss he hated instead of leaving the job he loved, the employee showed adaptation to his real-world environment. People with high practical intelligence may or may not perform well on standard IQ tests.

In Sternberg's view, "successfully intelligent" people are aware of their strengths and weaknesses in the three areas of intelligence. They figure out how to capitalize on their strengths, compensate for their weaknesses, and further develop their abilities in other to achieve success in life.

Sternberg and his collaborators have also developed measures of "tacit knowledge" in various domains, especially business management. In these measures, individuals are given written scenarios of various work related situations and then asked to rank a number of options for dealing with the situation presented. The results show that tacit knowledge predicts such criteria as job performance fairly well, even though it is relatively independent of intelligence test scores and other common selection measures (Sternberg & Wagner, (1993) Sternberg, Wagner, Williams & Horvath, Jensen, (1993); Schmidt & Hunter, (1993).

In another study, some investigators also demonstrated the relative independence of academic and practical intelligence. Brazilian street children, for example, are quite capable of doing the calculations required for survival in their street businesses even though they have failed mathematics in school (Carracher, Carraher, and Schliemann, 1985). Similarly, women shoppers in California

who had no difficulty in comparing product values at the supermarket were unable to carry out the same mathematical operations in paper- and pencil tests (Lave, 1988).

Sternberg's theory has drawn praises because it attempts to broaden the domain of intelligence to more exactly correspond to what people frequently think about intelligence. On the other hand, some critics believe that scientific studies do not support Sternberg's proposed triarchic division. For example, some propose that practical intelligence is not a distinct aspect of intelligence, but a set of abilities predicted by general intelligence.

SOCIOLOGICAL APPROACH

It is very difficult to compare concepts of intelligence across cultures. English is not alone in having many words for different aspects of intellectual power and cognitive skill (wise, sensible, smart, bright, clever and cunning); if another language has just as many, which of them shall we say corresponds to its speakers' "concept of intelligence"? The few attempts to examine this issue directly have typically found that, even with a given society, different cognitive characteristics are emphasized from one situation to another and from one subculture to another (Serpell, 1979; Super, 1983; Wober, 1974). These differences extend not just to conceptions of intelligence but to what is considered adaptive or appropriate in a broader sense.

These issues have occasionally been addressed across sub-cultures and ethnic groups in America. In a study conducted in San Jose California, Okagaki and Sternberg

(1993) asked immigrant parents from Cambodia, Mexico, the Philippines and Vietnam, as well as native-born Anglo-Americans and Mexican- American about their conceptions of child-rearing, appropriate teaching, and children's intelligence. Parents from all groups except Anglo-Americans indicated that such characteristics as motivation, social skills, and practical school skills were as or more important than cognitive characteristics for their conceptions of an intelligent first-grade child.

Health (1983) finds out that different ethnic groups in North Carolina have different conceptions of intelligence. To be considered as intelligent or adaptive, one must excel in the skills valued by one's own group. One particularly interesting contrast was in the importance ascribed to verbal vs. nonverbal communication skills- to saying things explicitly as opposed to using and understanding gestures and facial expressions. Note that while both of these forms of communicative skill have their uses, they are not equally well represented in psychometric tests.

How testing is done can have different effects in different cultural groups. This can happen for many reasons, including differential familiarity with the test materials themselves. Serpell (1979), for example, asked Zambian and English children to reproduce patterns in three media: wire models, or pencil and paper. The Zambian children excelled in the wire medium with which they are familiar, while the English children were best with pencil and paper. Both groups performed equally well with clay.

DEVELOPMENTAL PROGRESSIONS

Piaget's theory: The best-known developmentally-based conception of intelligence is certainly that of the Swiss psychologist Jean Piaget (1972). Unlike most of the theorists considered here, Piaget had relatively little interest in individual differences. Intelligence develops in all children through the continually shifting balance between the assimilation of new information into existing cognitive structures and the accommodation of those structures themselves to the new information. To index the development of intelligence in this sense, Piaget devised methods that are rather different from conventional tests. To assess the understanding of "conservation" for example, (roughly, the principle that material quantity is not affected by mere changes of shape), children who have watched water being poured from a shallow to a tall beaker may be asked if there is now more water than before. (A positive answer would suggest that the child has not yet mastered the principle of conservation). Piaget's tasks can be modified to serve as measures of individual differences; when this is done, they correlate fairly well with standard psychometric tests (Jensen, 1993).

Vygotsky's Theory: The Russian psychologist Le Vyhotsky (1978) argues that all intellectual abilities are social in origin. Language and thought first appear in early interactions with parents, and continue to develop through contact with teachers and others. Traditional intelligence test ignore what Vygotsky called the "zone of proximal development" i.e., the level of performance that a child

might reach with appropriate help from a supportive adult. Such tests are "static" measuring only the intelligence that is already fully developed. "Dynamic" testing, in which the examiner provides guided and graded feedback, can go further to give some indication of the child's latent potential. These ideas are being developed and extended by a number of contemporary psychologists (Brown et al, 1974; Eagly et al, 1990; Pallier etal 1997).

BIOLOGICAL APPROACH

Some investigators have recently turned to the study of the brain as a basis for new ideas about what intelligence is and how to measure it. Many aspects of brain anatomy and physiology have been suggested as potentially relevant to intelligence: the arborization of cortical neurons (Ceci, 1990), Cerebral glucose metabolism (Haier etal 1992), evoked potentials (Carl, 1994), nerve conduction velocity (Reed & Jensen, 1992), (Vernon, 1987).

This study has revealed a wide range of contemporary conceptions of intelligence and of how it should be measured. The psychometric approach is the oldest and best established, but others also have much to contribute. We should be open to the possibility that our understanding of intelligence in the future will be rather different from what it is today.

CHAPTER NINE

INTELLIGENCE TESTS AND THEIR CORRELATES

Tests as predictors

School Performance: Intelligence tests were originally devised by Alfred Binet to measure children's ability to succeed in school. They do in fact predict school performance fairly well. The correlation between 15 scores and grades is about 50. They also predict scores on school achievement tests, designed to measure knowledge of the curriculum. Note, however, that correlations of this magnitude account for only about 25% of the overall variance. Successful school learning depends on many personal characteristics other than intelligence, such as persistence, interest in school, and willingness to study. The encouragement for academic achievement that is received from peers, family and teachers may also be important, together with more general cultural factors.

The relationship between tests scores and school performance seems to be ubiquitous. Wherever it has been studied, children with high scores on tests of intelligence tend to learn more of what is taught in school than their lower-scoring peers. There may be styles of teaching and methods of instruction that will decrease or increase this correlation, but none that consistently eliminates it has yet been found (Cronbach et al, 1976).

What children learn in school depends not only on their individual abilities but also on teaching practices and on what is actually taught. Recent comparisons among pupils

attending school in different countries have made this especially obvious. Children in Japan and China, for example, know a great deal more mathematics than American children even though their intelligence test scores are quite similar. This difference may result from many factors, including cultural attitudes toward schooling as well as the sheer amount of time devoted to the study of mathematics and how that study is organized (Shettleworth, 1983).

Years of Education: Some children stay in school longer than others; many go on to college and perhaps beyond. Two variables that can be measured as early as elementary school correlate with the total amount of education individuals will obtain: test scores and social class background. Correlations between IQ scores and total years of education are about 55, implying that differences in psychometric intelligence account for about 30% of the outcome variance. The correlations of years of education with social class background (as indexed by the occupation/education of a child's parents) are also positive, but somewhat lower.

There are a number of reasons why children with higher test scores tend to get more education. They are likely to get good grades, and to be encouraged by teachers and counselors; often they are placed in "college preparatory" classes, where they make friends who may also encourage them. In general, they are likely to find the process of education rewarding in a way that many low-scoring children do not (Rehberg and Rosenthal, 1978).

These influences are not omnipotent: some high scoring children do drop out of school. Many personal and social characteristics other than psychometric intelligence determine academic success and interest, and social privilege may also play a role. Nevertheless, test scores are the best single predictor of an individual's years of education.

In contemporary American society, the amount of schooling that adults complete is also somewhat predictive of their social status. Occupations considered high in prestige (e.g., law, medicine, even corporate business) usually require at least a college degree- 16 or more years of education- as a condition of entry. It is partly because intelligence test scores predict years of education so well that they also predict occupational status, and even income to a smaller extent, (Jenen, 1973). Moreover, many occupations can only be entered through professional schools which base their admissions at least partly on test scores: the MCAT, the GMAT, the LSAT, etc. Individual scores on admission-related tests such as these are certainly correlated with scores on tests of intelligence.

Social Status and Income: How well do IQ scores (which can be obtained before individuals enter the labor force) predict such outcome measures as the social status or income of adults? This question is complex, in part because another variable also predicts such outcomes: namely, the socioeconomic status (SES) of one's parents. Unsurpringly, children of privileged families are more likely to attain high social status than those whose parents are poor and less educated. These two predicators (IQ and parental SES) are

by no means independent of one another; the correlation between them is around 33 (White, 1982).

One way to look at these relationships is to begin with SES. According to Jenen (1973), measures of parental SES predict about one-third of the variance in young adults' social status and about one-fifth of the variance in their income. About half of this predictive effectiveness depends on the fact that the SES of parents also predicts children's intelligence tests scores, which have their own predictive value for social outcomes; the other half comes about in other ways.

We can also begin with IQ scores, which by themselves account for about one-fourth of the social status variance and one-sixth of the income variance. Statistical control for parental SES eliminates only about a quarter of this predictive power. One way to conceptualize this effect is by comparing the occupational status (or income) of adult brothers who grew up in the same family and hence have the same parental SES. In such cases, the brother with the higher adolescent IQ score is likely to have the higher adult social status and income (Jenen, 1973). This effect, in turn, is substantially mediated by education: the brother with the higher test scores is likely to get more schooling, and hence to be better qualified as he enters the workplace.

Job Performance**:** Scores on intelligence tests predict various measures of job performance: Supervisor ratings, work samples, etc. Such correlations, which typically lie between r=30 and r=50, are partly restricted by the limited reliability of those measures themselves. They become higher when is

statistically corrected for this unreliability, in a study by (Hunt, 1976), the mean of the corrected correlations was 54. This implies that, across a wide range of occupations, intelligence test performance accounts for some 29% of the variance in job performance.

Although these correlations can sometimes be modified by changing methods of training or aspects of the job itself, intelligence test scores are at least weakly related to job performance in most settings. Sometimes 19 scores are described as the 'best available predictor' of that performance. It is worth nothing, however, that such tests predict considerably less than half the variance of job-related measures. Other individual characteristics such as interpersonal skills, aspects of personality, etc are probably of equal or greater importance, but at this point we do not have equally reliable instruments to measure them.

Social
Outcomes

Psychometric intelligence is negatively correlated with certain socially undesirable outcomes. For example, children with high test scores are less likely than lower-scoring children to engage in juvenile crime. According to Moffitt, et al, (1993) found a correlation of 19 between IQ scores and number of juvenile offenses in a large Danish sample; with social class controlled, the correlation dropped to 17. The correlations for most "negative outcome" variables are typically smaller than 20, which means that test scores are associated with less than 4% of their total variance. It is important to realize that the causal links

between psychometric ability and social outcomes may be indirect. Children who are unsuccessful in and hence alienated from school may be more likely to engage in delinquent behaviours for that very reason, compared to other children who enjoy school and are doing well.

In summary, intelligence test scores predict a wide range of social outcomes with varying degrees of success. Correlations are highest for school achievement, where they account for about a quarter of the variance. They are somewhat lower for job performance, and very low for negatively valued outcomes such as criminality.

GENDER AND INTELLIGENCE

Few topics in social sciences have produced more controversy than the relative influences of nature and nurture on intelligence. Is intelligence determined primarily by heredity or by one's environment?

The issue has aroused intense debate because different views on the heritaribility of intelligence lead to different social and political implications. The strictest adherents of a genetic view of intelligence believe that every person is born with a fixed amount of intelligence. Arthur Jensen is a proponent of the hereditarian view of intelligence and seems to endorse the hypothesis that the IQ gap is at least partly gene.

Today, almost all scientists agree that intelligence arises from the influence of both genetic and environmental factors. Careful study is required in order to attribute any influence to either environment or heredity. For example, one

measure commonly used to assess a child's home environment is the number of books in the home. But having many books in the home may be related to the parents' IQ, because highly intelligent people tend to read more. The child's intelligence may be due to the parents' genes or to the number of books in the home. Further, parents may buy more books in response to their child's genetically influenced intelligence. Which of these possibilities is correct cannot be determined without thorough studies of all the factors involved.

Scientists have found that the IQ scores of identical twins raised together are remarkably similar to each other, while those of fraternal twins are less similar to each other. This finding suggests a genetic influence in intelligence. Interestingly, fraternal twins' IQ scores are more similar to each other than those of ordinary siblings, a finding that suggests environmental effects. Some researchers account for the difference by noting that fraternal twins are probably treated more alike than ordinary siblings because they are the same age.

Some of the strongest evidence for genetic influences in intelligence come from studies of identical twins adopted into different homes early in life and thus raised in different environments. Identical twins are genetically identical, so any differences and any similarities must be due to genetics. Results from these studies indicate that the IQ scores of identical twins raised apart are highly similar, nearly as similar as those of identical twins raised together.

Another way of studying the genetic contribution to intelligence is through adoption studies, in which researchers compare adopted children to their biological and adoptive families. Adopted children have no genetic relationship to their adoptive parents or to their adoptive parents' biological children. Thus, any similarity in IQ between the adopted children and their adoptive parents or the parent's biological children must be due to the similarity of the environment they all live in, and to genetics.

There are two interesting findings from studies of adopted children. First, the IQs of adopted children have only a small relationship to the IQs of their adoptive parents and the parents' biological children. Second, after the adopted child leaves home, this small relationship becomes smaller. In general, the IQs of adopted children are always more similar to their biological parents' IQs than to their adoptive parents' IQs. Furthermore, once they leave the influence of their adoptive home, they become even more similar to their biological parents. Both of these findings suggest the importance of hereditary factors in intelligence.

People sometimes assume that if intelligence is highly heritable, then it cannot be changed or improved through environmental factors. This assumption is incorrect. For example, height has very high heritability, yet average heights have increased in the 20th century among the populations of many industrialized nations, most likely because of improved nutrition and health care. Similarly, performance on IQ tests has increased with each generation. Few scientists attribute this phenomenon to genetic changes.

Thus, many experts believe that improve environment can, to some degree, increase a person's intelligence.

DIFFERENCES IN GENDER INTELLIGENCE

Are women smarter or are men smarter? Psychologists have studied sex differences in intelligence since the beginning of intelligence testing. The question is a very complicated one, though. One problem is that test makers sometimes eliminate bias from the test. Intelligence tests, therefore, may not show gender differences even if they exist. Even then gender differences have been explicitly studied, they are hard to detect because they tend to be small.

There appear to be no substantial differences between men and women in average IQ. But the distribution of IQ scores is slightly different for men than for women. Men tend to be more heavily represented at the extremes of the IQ distribution. Men are affected by mental retardation more frequently than are women, and they also outnumber women at very high levels of measured intelligence. Women's scores are more closely clustered around the mean.

Although there are no differences in overall IQ test performance between men and women, there do seem to be differences in some more specialized abilities. Men, or average, perform better on tests of spatial ability than do women. Spatial ability is the ability to visualize spatial relationships and to mentally manipulate objects. The reason for this difference is unknown. Some psychologists speculate that spatial ability evolved more in men because men were historically hunters and required spatial ability to track prey and find their way back from hunting forays.

Others believe that the differences result from parents' different expectations of boys'/girls' abilities.

Many studied have examined whether gender differences exist in mathematical ability, but the results have been inconsistent. In 1990 American researchers statistically combined the results of more than 100 studies on gender differences in mathematics using a technique known as meta-analysis. They found no significant differences in the average scores of males and females on mathematics tests. Researches also indicate that the average girl's grades in mathematics course equal or exceed those of the average boy. Other studies have found that boys and girls perform equally well on mathematics achievement tests during elementary school, but that girls begin to fall behind boys in later years. For example, male high school seniors average about 45 points higher on the mathematics portion of the SAT than do females.

In a study which examine the performance of more than 100,000 American adolescents on various mental test, it was found out that on average, females performed slightly better than males on tests of reading comprehension, wiring, perceptual speed, and certain memory tasks. Males tended to perform slightly better than girls on tests of mathematics, science, and social studies. In almost all cases, the average sex differences were small.

Are differences in abilities between men and women biologically based or are they due to cultural influences? There is some evidence on both sides. On the biological side, researchers have studied androgenized females,

individuals grow up, they are culturally identified as female, but they tend to play with "boys" "toys", like blocks and trucks, and have higher levels of spatial ability than females who were not exposed to high levels of spatial ability than females who were not exposed to high levels of testosterone. Further evidence for a biological basis for spatial gender differences comes from comparisons of the brains of men and women. Some scientists speculate that this extra brain volume in males maybe devoted to spatial ability.

On the cultural side, many social scientists argue that differences in abilities between men and woman arise from society's different expectations of them and from their different experiences. Girls do not participate as extensively as boys do in cultural activities thought to increase spatial and mathematical abilities. As children, girls are expected to play with dolls and other toys that develop verbal and social skills while boys plays with blocks, video games, and other toys that encourage spatial visualization. Later, during adolescence, girls take fewer mathematics and science courses than boys, perhaps because of stereotypes of mathematics and science as masculine subjects and because of less encouragement from teachers, peers, and parents. Many social scientists believe cultural influences account for the relatively how representation of women in the fields of mathematics, engineering, and the physical sciences. It is important to remember that sex differences, where they exist, represent average differences between men and women as a groups, not individuals female or male reveals little about that person's intellectual abilities.

RACIAL AND ETHNIC DIFFERENCES

Numerous studies have found differences in measure IQ between difference self-identified racial and ethnic groups. For example, many studies have shown that here is about a 15-point IQ difference between African Americans and Whites, in favour of whites. The mean scores of IQ scores of the various Hispanic America subgroups fall roughly midway between those for blacks and whites. Although these differences are substantial, there are much larger differences between people within each group than between the means of the groups. This large variability within groups means that a person's racial or ethnic identification cannot be used to infer his or her intelligence.

The debate about racial and ethnic differences in IQ scores is not about if the differences exist but what causes them. In 1969, Arthur Jensen, a psychology professor at the University of California at Berkeley, ignited the modern debate over racial differences. Jensen published a controversial article in which he argued that black-white differences in IQ scores might be due to genetic factors. Further, he argued that if IQ has a substantial genetic component, remedial education programs to improve IQ should not be expected to raise IQ as they were currently being applied. In 1994 American psychologist Richard Hernstein and American social analyst Charles Murray renewed the debate with the publication the bell (Case, 1981). Although only a small portion of the book was

devoted to race differences, that portion of the book received the most attention in the popular press. Among other arguments, Herrnstein and Murray suggested it was possible that at least some of the racial differences in average IQ were due to genetic factors. Their arguments provoked heated debates in academic circles and among the general public. As discussed earlier, research supports the idea that differences in measured intelligence between individuals are partly due to genetic factors. However, psychologists agree that this conclusion does not imply that genetic factors contribute to difference between groups. No one knows exactly what causes racial and ethnic differences in IQ scores. Some scientists maintain that these differences are in part genetically based. Supporters of this view believe that racial and ethnic groups score differently on intelligence tests partly because of genetic differences between the groups. Others think the cause is entirely environmental. In this view, certain racial and ethnic groups do poorer on IQ tests because of cultural and social factors that put them at a disadvantage, such as poverty, less access to good education, and prejudicial attitudes that interfere with learning. Representing another perspective, many anthropologists reject the concept of biological race, arguing that races are socially constructed categories with little scientific basis. Because of disagreements about the origins of group differences in average IQ. Conclusions about these differences must be evaluated cautiously.

Some research indicates that the black-white differential in IQ scores might be narrowing. Several

studies have found that the difference in average IQ scores between African Americans and white has shrunk to 10 points or less, although research has not established this trend clearly. The National Assessment of Educational progress, a national longitudinal study of academic achievement, also shows that the performance of African Americans on mathematics and science achievement tests improved between 1970 and 1996 when compared to whites.

Educators and researchers have focused much attention of explaining why some ethnic groups perform more poorly than others on measures of intelligence and academic achievement. Another topic of research is why some ethnic groups. Particularly Asian-Americans, perform so well academically. Compared to other groups, Asian-American students get better grades, score higher on mathematics achievement and aptitude tests, and are more likely to graduate from high school and college. The exact reasons for their high academic performance are unknown. One explanation points to Asian cultural values and family practices that place central importance on academic achievement and link success in school with later occupational success. Critics counter that this explanation does not justify why Asian-American have higher-than-average IQs. However, most studies showed no difference between the average IQ of Asian-Americans and that of the general population. Some studies of Asians in Asia have found a 3 to 7 pint IQ difference between Asians and whites, in favor of Asians, but other studies have found no significant differences.

ENVIRONMENTAL EFFECTS ON INTELLIGENCE

The "environment" includes a wide range of influences on intelligence. Some of those variables affect whole populations, while others contribute to individual differences within a given group. Some of them are social, some are biological; at this point some are still mysterious.

Social Factors

It is obvious that the cultural environment – how people live, what they value, what they do – has a significant effect on the intellectual skills developed by individuals. Rice farmers in Liberia are good at estimating quantities of rice (Gate, 1917); children in Bostswana, accustomed to storytelling, have excellent memories for stories (Dube, 1982), both of these groups were far ahead of American controls on the tasks in question. On the other than Americans and other Westernized groups typically outperform members of traditional societies on psychometric tests, even those designed to be "culture-fair."

Cultures typically differ from one another in so many ways that particular differences can rarely be ascribed to single causes. Even comparisons between subpopulations are often difficult to interpret. If we find that groups living in different environments (e.g., middle-class and poor Americans) differ in their rest scores, it is easy to suppose that the environmental difference cause the IQ difference. But there is also an opposite direction of causation: individuals may come to be in one environment or another

because of differences in their own abilities, including the abilities measured by intelligence tests. Waller (1971) has shown, for example, that sons whose IQ scores are above those of their fathers also tend to achieve a higher social class status; conversely, those with scores below their fathers' tend to achieve lower status. Such an effect is not surprising, given the relation between IQ scores and years of education reviewed.

Occupation: Earlier, we noted that intelligence test scores predict occupational level, not only because some occupations require more intelligence than others but also because admission to many professions depends on test scores in the first place. There are also be an effect in the opposite direction, i.e. workplaces may affect the intelligence of those who work in them. Kohn (1973), who interviewed 3000 men in various occupations (farmers, managers, machinists, porters…), argued that more "complex" jobs produce more "intellectual flexibility" in the individuals who hold them. Although the issue of direction of effects complicates the interpretation of their study, this remains a plausible suggestion.

Among other things, Kohn and Schooler's hypothesis may help us understand urban/rural differences. A generation ago, these were substantial in the United State. Averaging about six IQ points or 0.4 standard deviations (Terman & Merrill, 1937; Seashore, Wesman and Doppelt, 1950). In recent years the difference has declined to about two points (Kaufman & Droppelt, 1976; Reynolds et al, 1983). In all likelihood this urban/rural convergence

primarily reflects environmental changes; a decrease in rural isolation (due to increased travel and mass communications), an improvement in rural schools, the greater use of technology on farms. All these changes can be regarded as increasing the "complexity" of the rural environment in general or of farm work in particular. (However, processes with a genetic component, e.g., changes in the selectivity of migration from farm to city, cannot be completely excludes as contributing factors).

Education: Attendance at school is both dependent and an independent variable in relation to intelligence. On one hand, children with higher test scores are less likely to drop out, more likely to be promoted from grade to grade and then to attend college. Thus the number of years of education that adults complete in roughly predictable from their childhood scores on intelligence tests. On the other hand schooling itself changes mental abilities, including those abilities measured on psychometric tests. This is obvious for tests like the SAT that are explicitly designed to assess school learning, but it is almost equally. The evidence for the effect of schooling on intelligence test scores takes many forms (Ceci, 1990). When children of nearly the same age go through school a year apart (because of birthday-related admission criteria), those who have been in school longer have higher mean scores. Children who attend school intermittently score below those who go regularly, and test performance tends to drop over the summer vacation. A striking demonstration of this effect appeared when the schools in one Virginia country closed for several years in

the 1960s to avoid integration, leaving most Black children with no formal education at all. Compared to controls, the intelligence-test scores of these children dropped by about 0.4 standard deviations (6 points) per missed year of school (Green et al, 1964). School also affects intelligence in several ways, most obviously by transmitting information. The answers to questions like "who wrote hamlet?" and "What is the boiling point of water?" are typically learned in school, where some pupils learn them more easily and thoroughly than others. Perhaps at least as important are certain general skills and attitudes: systematic problem-solving, abstract thinking, categorization, sustained attention to materials of little intrinsic interest, repeated manipulation of basic symbols and operations. There is no doubt that schools promote and permit the development of significant intellectual skills, which develop to different extents in different children. It is because tests of intelligence draw on many of those same skills that they predict school achievements as well as they do.

Family background: No one doubts that normal child development requires a certain minimum level of responsible care. Severely deprived, neglectful, or abusive background must have negative effects on a great many aspects of development, including intellectual aspects. Beyond that minimum, however, the role of family experience is now in serious dispute (Baumrind, 1996; Jackson, 1993; Scarr, 1988). Psychometric intelligence is a case in point. Do differences between children's family background (within the normal range) produce differences in their intelligence

test performance? The problem here is to disentangle causation from correlation. There is no doubt that such variables as resources of the home (Gottfredson, 1997) and parents' use of language (Hart & Risley, 1992, in press) are correlated with children's IQ scores, but such correlations may be mediated by genetic as well as (or instead of) environmental factors.

Biological Factors: Every individual has a biological as well as a social environment, one that begins in the womb and extends throughout life. Many aspects of that environment can affect intellectual development. We now know that a number of biological factors, including malnutrition, exposure to toxic substances, and various prenatal and perinatal stressors, result in lowered psychometric intelligence under at least some conditions.

Nutrition: There has been only one major study of the effects of prenatal malnutrition (i.e. malnutrition of the mother during pregnancy) on long-term intellectual development. Stein et al (1975) analyzed the test scores of Dutch 19 year-old males in relation to a wartime famine that had occurred in the Winter of 1945, just before their birth. In this very large sample (made possible by a universal military induction requirement), exposure to the famine had no effect on adult intelligence. Note, however, that the famine itself lasted only a few months; the subjects were exposed to it prenatally but not after birth.

In contrast, prolonged malnutrition during childhood does have long-term intellectual effects. These have not been easy to establish, in part because many other

unfavourable socio-economic conditions are often associated with chronic malnutrition (Ricciuti, 1993; but cf. (Sigman, 1995). In one intervention study, however, pre-schoolers in two Guatemalan villages (where undernourishment is common) were given adlib access to a protein dietary supplement for several years. A decade later, many of these children (namely, those from the poorest socio-economic levels) scored significantly higher on school related achievement tests than comparable controls (Pollitt et al, 1993). It is worth noting that the effects of poor nutrition on intelligence may well be indirect. Malnourished children are typically less responsive to adults, less motivated to learn, and less active in exploration than their more adequately nourished counterparts.

Lead: Certain toxins have well established negative effects on intelligence. Exposure to lead is one such factor. In one long-term study (McMichael et al, 1988; Baghurst et al, 1992), the blood lead levels of children growing up near a lead smelting plant were substantially and negatively correlated with intelligence test scores throughout childhood. No "threshold dose" for the effect of lead appears in such studies. Although ambient lead levels in the United State have been reduced in recent years, there is reason to believe that some American children – especially those in inner cities-may still be at risk from this source. (Newport et al, 1977).

Alcohol: Extensive prenatal exposure to alcohol (which occurs if the mother drinks heavily during pregnancy) can give rise to fetal alcohol syndrome, which includes mental

retardation as well as a range of physical symptoms. Smaller "doses" of prenatal alcohol may have negative effects on intelligence even when the full syndrome does not appear. Snyderman et al (1988) found that mothers who reported consuming more than 1.5 oz, of alcohol daily during pregnancy had children who scored some five points below controls at age four. Prenatal exposure to aspirin and antibiotics had similar negative effects in this study.

Perinatal Factors: Complications at delivery and other negative perinatal factors may have serious consequences for development. Nevertheless, because they occur only rarely, they contribute relatively little to the population variance of intelligence (Broman et al, 1975). Down's syndrome, a chromosomal abnormality that produces serious mental retardation, is also rare enough to have little impact on the overall distribution of test scores.

The correlation between birth weight and later intelligence deserves particular discussion. In some cases low birth weight simply reflects premature delivery; in others, the infant's size is below normal for its gestational age. Both factors apparently contribute to the tendency of low-birth-weight infants to have low test scores in later childhood (Lubinsky et al, 1997). These correlations are small, ranging from .05 to .13 in different groups (Broman et al, 1975). The effects of low birth weight are substantial only when it is very low indeed (less than 1500gm). Premature babies born at these very low birth weights are behind controls on most developmental measures; they often

have severe or permanent intellectual deficits (Rosetti, 1986).

According to a report, titled 'Intelligence: Known and unknowns, written by APS's Task Force on Intelligence. The task force convened in January 1995 to prepare a dispassionate and authoritative report in response to the fall 1994 publication of Hernstein and Murray's the Bell Curve. 'Their book sparked a new and vigorous round of debates about the meaning of intelligence test scores and the nature of intelligence itself.

Differences in genetic endowment contribute substantially to individual differences in (psychometric) intelligence, but the pathway by which genes produce their effects is still unknown. The impact of genetic differences appears to increase with age, but we do not know why.

Environmental factors also contribute substantially to the development of intelligence, but we do not clearly understand what those factors are or how they work. Attendance at school is certainly important, for example, but we do not know what aspects of schooling are critical.

The role of nutrition in intelligence remains obscure. Severe childhood malnutrition has clear negative effects, but the hypothesis that particular "micro-nutrients" may affect intelligence in otherwise adequately-fed populations has not yet been convincingly demonstrated.

There are significant correlations between measures of information processing speed and psychometric intelligence, but the overall pattern of these findings yields no easy theoretical interpretation.

Mean scores on intelligence tests are rising steadily. They have gone up a full standard deviation in the late fifty years or so, and the rate of gain may be increasing. No one is sure why these gains are happening or what they mean.

The differential between the mean intelligence test scores of Blacks and Whites (about one standard deviation, although it may be diminishing) does not result from any obvious biases in test construction and administration, nor does it simply reflect differences in socio-economic status. Explanations based on factors of caste and culture may be appropriate, but so far have little direct empirical support. There is certainly no such support for a genetic interpretation. At present, no one knows what causes this differential.

It is widely agreed that standardized tests to do sample all forms of intelligence. Obvious examples include creativity, wisdom, practical sense and social sensitivity.

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