CHAPTER II
THEORETICAL PERSPECTIVE OF INTELLIGENCE

2.1 Introduction

2.2 Definitions of intelligence

2.3 Classification of intelligence tests
   2.3.1 Individual versus group test
   2.3.2 Verbal test versus non verbal test

2.4 Theories of intelligence
   2.4.1 Uni-Factor Theory
   2.4.2 Spearman's Two Factor Theory
   2.4.3 Gardner's Frames of Mind
   2.4.4 Thurstone’s Group Factor Theory
   2.4.5 Thorndike's Multi factor Theory
   2.4.6 Vernon's Hierarchical Theories
   2.4.7 Guilford's Three Dimensional Model of Intellect
   2.4.8 Thomson's Sampling Theory
   2.4.9 Burt’s Hierarchical Group Factor Theory
   2.4.10 Sternberg’s Triarchic Theory

2.5 Role of heredity and environment on intelligence

2.6 Culture fair tests of intelligence

2.7 Trait organization in the test

2.8 Conclusion
CHAPTER II
THEORETICAL PERSPECTIVE OF INTELLIGENCE

2.1 INTRODUCTION

The study of human intelligence is perhaps the most controversial area in psychology. At the same time, psychometric assessment of intelligence is a flourishing enterprise and a prominent aspect of applied psychology.

Alfred Binet launched the field of psychological testing. He was asked by the French minister of public education to develop a test that could be used to identify children who would have difficulty in school so that they could be given special instruction. The Stanford-Binet intelligence scale which is still in use today was developed in 1916 while Lewis Terman, a psychologist from Stanford University, translated into English and revised the tasks created by Binet and his collaborator Theodore Simon in 1904.

The most commonly used I.Q tests for adults and children were developed by **David Wechsler**(1896-1981). Building on Binet’s pioneering work the Wechsler scales came to embody the psychometric assessment of intelligence. The Stanford-Binet and the Wechsler Series tests are standardized tests, which have to be individually administered and interpreted by a trained psychologist. A few of group tests which measure intelligence were also created for
mass, easy administration in a variety of educational, occupational and military contexts. Furthermore, tests similar to I.Q tests, such as the SAT(Scholastic Aptitude Test) and GRE(Graduate Record Examination) are widely used for selection and evaluation within the education system.

In 1904 British psychologist Charles Spearman proposed the existence of a general intelligence factor, g. He based this theory on a statistical technique which he invented, called factor analysis. Since its introduction, the factor g has been the cornerstone of psychometric models of intelligence. Furthermore, Spearman's g has often been used by researchers and theoreticians to make the case for the genetic basis of intelligence and the importance of environmental influences.

The nature versus environment debate in the context of the study of human intelligence is by far the most viciously contested aspect of this field. This is the case because psychometric I.Q tests have been misused to label certain ethnic and racial groups as superior or inferior based on the belief that these tests measure genetically based non-modifiable aspects of human performance. This strong genetic determinism view is also used for the promotion of the neoconservative political agenda calling for the abolition of affirmative action which attempt to compensate for detrimental environmental factors experienced by certain groups within society. Even worse, genetic determinism of intelligence serves the eugenics
movement, which argues for genetic selection to produce superior human beings.

An additional important controversy surrounds the issue of the validity of I.Q tests. That is, such tests measure what they were intended to measure, namely, human intelligence. Prominent current researchers of human intelligence, such as Robert Sternberg and Howard Gardner argue that I.Q tests measure only a very narrow aspect of human intellectual performance. Such researchers also highlight the crucial importance of considering the cultural context for a proper evaluation of performance. Recently Mayer, Salovey and Goleman argued for a further extension of the concept of intelligence to include emotional intelligence. What all these views have in common is the argument that human intelligence is not unitary, rather, it involves multiple, dissociable facets.

Ever since "The Bell Curve" came out a few years ago, there has been more than the usual amount of controversy about intelligence: what it is?, whether it can be measured?, how much is inborn?, and whether it varies by race or group?. For perspective, let's take a quick look at the development of thought in this field.

The first intelligence test for school children was developed in Paris by Alfred Binet between 1905 and 1911. It was adapted by Stanford psychologist L. M. Terman (1877-1956) as The Stanford-Binet test, and Termed an intelligence quotient (IQ) test. It was the
first important test, has been revised through the years, and is the one most widely used.

Two British psychologists were also quite influential. Cyril Burt (1883-1971) and C. E. Spearman (1863-1945) both supported two principles: (1) intelligence is a single, measurable entity, and (2) it is innate and unchangeable. University of Chicago psychologist L. L. Thurstone (1887-1955) disagreed, with this, arguing that there were seven primary mental abilities: Verbal comprehension, word fluency, computational ability, Spatial visualization, associative memory, perceptual speed and reasoning. Another psychologist (Guilford) found 120 types of mental abilities.

The very fact that estimates for the number of primary abilities have ranged from Thurstone's 7 to Guilford's 120 or more indicates that vectors of mind may be fragments of mind.

Though well informed and persuasive, Gould is at odds with mainstream psychologists, who (in a statement signed by 52 psychologists, published in the December 13, 1994 Wall Street Journal), contend the following:

1. Intelligence exists as a very general mental capability involving ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. The brain processes involved are little understood.
2. Intelligence can be measured and I.Q tests measure it well. Nonverbal tests can be used where language skills are weak.

3. I.Q tests are not culturally biased.

4. I.Q is more strongly related than any other measurable human trait to educational, occupational, economic, and social outcomes. Whatever it is that I.Q tests measure, it is very important.

5. Genetics plays a bigger role than environment in intelligence, but environment has a strong effect.

6. Individuals are not born with an unchangeable I.Q, but it gradually stabilizes during childhood and changes little thereafter.

   The psychologists also make some generalizations about IQ’s by race but, they may mean little. Gould says "All modern human races probably split from a common ancestral stock only tens of thousands of years ago. The overall genetic differences among human races are astonishingly small." According to William Wiersma¹ “Educational research is not or at least should not be carried out in an information vacuumed”.

2.2. DEFINITIONS OF INTELLIGENCE

   The psychologists have sought to define intelligence exactly in order that understanding of this fundamental concept may be clarified. A variety of definitions have come up. Some of the definitions that have been appeared during the present study are as follows:
"Intelligence means the capacity to judge well, to reason well and to comprehend well." Binet (1960).

"It seems to us that in intelligence there is a fundamental faculty, the alteration or the lack of which, is of the almost importance for practical life. This faculty is judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances. A person may be a moron or an imbecile if he is lacking in judgment; but with good judgment he can never be either. Indeed the rest of the intellectual faculties seems of little importance in comparison with judgment" Binet & Simon (1960).

"Intelligence means the ability to think in terms of abstract ideas." Terman (1916).

"Intelligence means power of good response from the point of view of truth or fact." Thorndike(1960).

"Intelligence means the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment." Wechsler(1916).

"Intelligence means the degree of availability of one’s experiences for the solution of immediate problems and the anticipation of future one's” Goddard(1943).

"Intelligence means ability to undertake activities that are characterized by difficulty, complexity, and adaptiveness to a goal, social value and emergence of originals; and to maintain such
activities under conditions that demand a concentration of energy and resistance to emotional forces." **Stoddard (1943).**

"Intelligence means a set of abilities demanded in the solution of problems which require the comprehension and use of symbols i.e. words, numbers, diagrams, equations, formulas etc.."

**Garrett (1965).**

"Intelligence means capacity to reorganize one's behavior patterns so as to act more effectively and more appropriately in novel situations." **Freeman (1965).**

**Definitions of intelligence on the Web:**

- The ability to comprehend; to understand and profit from experience

- Intelligence is an umbrella term used to describe a property of the mind that encompasses many related abilities, such as the capacities to reason.

- Intelligence refers to discrete information with currency and relevance, and the abstraction, evaluation, and understanding of such information for its accuracy and value.

- Military intelligence, commonly abbreviated as milint, is a military service that uses intelligence gathering disciplines to collect information.

- Capacity of mind, especially to understand principles, truths, facts or meanings, acquire knowledge, and apply it to practice; the
ability to learn and comprehend; An entity that has such capacities; Information, usually secret, about the enemy or about hostile activities.

From various meanings of intelligence it could be concluded that intelligence means ability of an individual to solve the problems that has been received from general learning, experience, schools and environment.

As a matter of fact the definition should be clear and pinpointed to state the entire connotation of intelligence. But a study of several definitions reveals that in some respects they differ from each other. However, for the purpose of a study they can be classified into several groups.

The various definitions given by various psychologists are classified as below:

"Intelligence is what intelligence test measure" Such a definition of intelligence would seem to be vague for if the test constructors do not know what intelligence is, how can they know what kind of test to construct? Yet the statement provides a clue for achieving an understanding of intelligence in concrete form. For it, one has to peep into the content of the intelligence tests. They vary with regard to types of questions asked and tasks set. Roughly a three fold classification of abilities measured by these tests may be made on the basis of inspection of the test item.
According to Mehrens and Lehmann (1969), the definition of intelligence generally fall into one or more of following patterns:

* Ability to think abstractly
* Ability to learn
* Ability to integrate new experiences and adapt to new situations.

Each group of definitions places the emphasis upon ability to carry on abstract thinking. This means the effective use of concepts and symbols in dealing with situations, especially those representing a problem to be solved through the use of verbal and numerical symbols. The definitions of Binet, Terman, Garrett, Rex Knight, etc; contain more or less this view.

A second group of definitions laid stress on ability to learn. This ability can be measured directly by requiring the subject to learn a code or other materials in the test situation and then checking speed and accuracy of immediate recall. The definitions of Buckingham, Thorndike, Woodworth, Dearborn etc., seems to belong to this group. According to them, the child with greater general ability possesses extensive ability to learn and to gain wide range of experiences.

A third group of definitions states that it is an ability to integrate the new experiences and adapt to new situations. This means general mental adaptability to new problems and new
situations of life. It is the ability to reorganize one’s behavior patterns so as to act more effectively and more appropriately in novel situations. Thus more intelligent child can move easily and more extensively vary his behavior as changing condition demands. The views of Burt, Warren, Freeman, etc., correspond mostly to this group.

It's worth paying attention to the fact that the three groups of definitions are not and cannot be mutually exclusive. For most part their constructors differ in emphasize.

Obviously ability to learn must provide the foundation for adjustment and adaptation to changing or new conditions. Learning ability in the sense, only of acquisition of information and knowledge is not only sufficient criteria by which to evaluate one's level of ability. But a person who can reorganize and apply what he has acquired for the purpose of dealing with varied and novel situations is more intelligent. Thus a definition of intelligence as the ability to behave appropriately and effectively in new situations and a definition as the ability to learn are in fact two aspects of the same process.

The definition in the light of abstract thinking is also inseparable from the other two. A child learns abstractness through experience, through contact with and perception of the object, events, qualities, relationships etc., for which symbols stand.
The words and numbers are abstractness which represent objects, events, etc., can be dealt with as if they were the things themselves. This aspect of intelligence is itself the result of an individual’s development and learning. This aspect of definitions contributes to a child's ability to adjust or adapt to changing or, to adjust new situations, because through the use of symbols, he is able to considerably enlarge his range of behaving and adjusting, to extend his horizons, and to transcend the immediate concrete and specific situation.

Learning ability and adaptation in the novel situations are implied in Wechsler's(1916) definition; and abstractness with complexity, the number of different kinds and varieties of tests, lies at the heart of intelligence, defined by Stoddard. A new aspect is presented by both of them in definition of intelligence; vizly “drive” and “incentive” enter into intelligent behavior.

Comprehensive definitions have appeared in more recent years. Wechsler, whose contribution and recent tests will be referred in the next chapter, gives one of them. The other definition is of Stoddard. A few new aspects are implied in Wechsler's definition. Wechsler believes that an individual's intelligence is revealed by his behavior as a whole (global) and that intelligence involves behavior towards a goal. He also presents drive and incentives in the definition. Stoddard has not only included the ideas of all the three groups of definitions,
but he has gone beyond that and included several attributes of intelligence not included in the earlier definitions. He has discussed each of the attributes in detail.

"Degree or level of 'difficulty' is implied in all definitions; but Stoddard's contribution here lies in the fact that he rightly insists we must, in testing, distinguish between true difference in degree of difficulty and differences that only seems to exist, as between two or more test items, whereas there are no inherent differences in difficulty."

Some psychologists believe that several kinds of intelligence should be distinguished from one another. B. L. Thorndike(1960), divided intelligent activity into three types. They are as follows:

1. Social intelligence, or ability to understand and deal with persons; i.e. social adjustment.
2. Concrete intelligence, or ability to understand and deal with things, as in skilled trades and scientific appliances.
3. Abstract intelligence, or ability to understand and deal with verbal and mathematical symbols.

Out of the three kinds of abilities enumerated above abstract intelligence has received great impetus in current tests of intelligence. In the light of the discussion on the classification of definitions, Flanagan's (1960), observation from the prevailing tests is worth noting. Flanagan observed, all tests of general intelligence include
items which measure general ability developed through the influence of the following factors:

1. Heredity refers to the genetic constitutional individual differences in general ability.
2. Acculturation refers to general learning experiences, and
3. Special school training.

2.3 CLASSIFICATION OF INTELLIGENCE TESTS

Although a strict definition of intelligence has proven elusive, a number of psychologists have argued that it can be quantified, primarily through testing. In 1905, Alfred Binet and Theodore Simon devised a system for testing intelligence, with scoring based on standardized average mental levels for various age groups. In 1916, the Binet-Simon Intelligence Scale was expanded and reworked by Lewis Terman at Stanford University and later revisions called the Revised Stanford-Binet Intelligence Tests were published in 1937, 1960, and 1985. A highly successful series of tests, designed by psychologist David Wechsler, have been the Wechsler-Bellevue Intelligence Scale is a standard tool for intelligence testing today. All of these tests are administered to one individual at a time by a psychometrician. While no consensus of opinion prevails about what such tests actually measure; their use in education has great practical value in assigning children to suitable class groups and in predicting academic performance.
The Army Alpha Test, which was first administered to nearly two million new recruits in World War I, and the Otis Group Intelligence Scale, were forerunners of many other group tests that are administered economically and quickly to large numbers, and were thus effective for use in schools and industry. Standardized group tests are administered for college and graduate school entrance, and for a number of civil service positions.

The work of Binet, Terman, and William Stern paved the way for a method of classifying intelligence in terms of a standardized measure, with standardization ensured by the large number of individuals of various ages taking the test. German psychologist L. William Stern was the first to join the term intelligence quotient (IQ) to chronological age and mental age. Although Stern's method for determining IQ is no longer in common use, the term IQ is still used today to describe the results of several different tests. Today, an average IQ score is considered to be 100, with deviations based on this figure. Mentally retarded individuals usually score below 70 in IQ tests, and are classified according to functional ability through reference to a scale of low IQ scores.

One criticism of intelligence testing is that it is difficult to insure that test items are equally meaningful or difficult for members of different socio-cultural groups. Testing is often considered validated in part, however by finding that the quantity measured by the tests can be
closely correlated in American society with career and academic achievement. There has been a decline in interest in pure intelligence tests since 1920, with a corresponding increase in the number of mental tests that measure special aptitudes and personality factors.

Stanford-Binet Scale and Wechsler- Bellevue Scale are administered to one person at a time i.e. it is an individual test. But the mass testing began during the First World War with the development of Army Alpha Test and Army Beta Test for use in the United States Army. The former was a verbal test designed for general screening and placement purposes. The later was a non-language test for those who could not read.

Hence intelligence tests, developed or going to be developed could be classified as follows:
1. Individual test versus group test
2. Verbal test versus non-verbal test.

2.3.1 Individual test versus group test
(a) Individual Test
Stanford-Binet Test and Wechsler- Bellevue Test are called individual tests because they can be given to one person at a time. The individual tests are good for diagnosing purpose. They are mostly used in clinical setting. Performance tests are said to be individual tests. Individual tests are time consuming and require a highly skilled examiner in
administering a test, in interpreting responses, and in evaluating the subject's behavior during testing.

(b) Group Test

The test that can be given to many persons at a same time is known as group test. we are familiar with this kind of group test. The large group administered tests are aptitude tests. They are more restricted than IQ test in the range of skills and abilities that they attempt to psychometrically assess. The Army Alpha and Army Beta tests were the first aptitude tests. They were inspired by the success of the Sanford-Binet and developed by Robert Yerkes for quick large scale assessment of US Army recruits during World War I. The Army Alpha was a written test while the Army Beta was an oral version of test for those that could not read. The tests were successful within their limited intended goal of improving selection, placement and training for specific occupations within the army and proved the viability of large group psychometric testing to measure certain task or endeavor-specific skills.

For the group test the children are allowed to work at their own rate or the examiner directs them when to start and stop. For uniformity and objectivity of scoring, present day test consist of multiple choice items. Group test have been widely used in schools, industries and civil services.
2.3.2 Verbal test versus non verbal test

(a) Verbal Test
Most of the widely used mental ability tests, to some degree, depend on language and include tasks presented in verbal terms. S-B test and Army Alpha Test include the tasks testing the vocabulary by identifying the meaning synonym, antonym, completion of the sentences etc. The tests in which this type of items is included are called the verbal tests.

(b) Non-verbal Test
Tests, which require no reading and writing activity on the part of the subjects, are described as non-verbal tests. The children's mental ability can be tested by means of pictures. This type of tests consists of all the items into pictorial form. They are valuable for better diagnosis of cases that score less on verbal tests. It is better to use terms as 'pictorial' or 'no reading' rather than Non-verbal.

2.4 THEORIES OF INTELLIGENCE

Intelligence test presupposes a trait and factor approaches to the structure of intelligence. According to Brown (1970), the intellectual functioning can be described by a number of basic dimensions. More precisely, we need to know (1) the number of traits needed to (completely) describe a person, (2) the nature of these traits, (3) the relationships between these traits, and (4) the person's score on a measure (test) of each trait. The development of a theory of
intellectual structure has occupied the attention of a number of psychologists. Their attack has been both empirical and theoretical, but generally has been closely connected with intelligence testing and has utilized factor analysis as the primary analytic technique. Although research on the structure of the intellect has been proceeding throughout the twentieth century, there is still considerable controversy as to the validity of the proposed models.

Halstaed (1947), has characterized the theories of intelligence in terms of the number of factors or traits they postulate. But before looking into the theories developed in the twentieth century, it will be useful to peep into historical developments. Pointing to early history of testing, spearman summaries the old doctrines of intelligence by classifying them into three theories, viz.(1) Unifocal or Monarchic Theories, (2) Multi-focal or Oligarchic Theories, and (3) Non-focal or Anarchic Theories.

According to Monarchic view, one ruling ability controls all capacities of the man and that ability is recognized as intelligence. Like a monarch, intelligence is considered controlling all mental activities. But it is observed that the function of intelligence is divisible into several units uncorrelated and each unit is required to be measured separately. Hence, the psychologists have not agreed with this view.
According to oligarchic doctrine, the intelligence consists not of one but of a great few outstanding powers or capacities, requiring separate measurement. The functions of the mind are divided into different powers like memory, perception, attention, movement, invention etc. The theory is subjected to all objections raised against faculty of psychology.

Anarchic theory admits a multitude of independent elements and specific activity calls into play a number of these elements. The theory suggests that general intelligence is the average of abilities. Spearman criticizes that the theory is not at all workable without some auxiliary hypothesis of averaging.

The formal movement in testing intelligence began in the later part of the nineteenth century and developed in the twentieth century. Since then, several theories have been developed by psychologists to understand intelligence structure. The theories of distinguished psychologists have been stated here. To give flavors of the various approaches, precise of several historical interesting and currently fashionable models are presented hereafter.

2.4.1 Uni-Factor Theory

The simplest approach is to postulate a unitary ability i.e. a single general capacity. This view holds that although intelligence may be expressed in diverse fashions or may be directed toward a variety of activities, basically it is a single ability. Any test that provides a single
score (IQ) at least in a broad sense, representing a uni-factor approach considered too simplistic by most present day theorists.

2.4.2 Spearman's Two Factor Theory

One type of general intelligence model is that of Spearman, who was the first person to propose a theory of intellectual structure based on statistical analysis of data from psychological tests. Spearman proposed a two factors theory. The first factor was a general capacity or energetically mental factor, which was basically a reasoning factor. In addition to this general factor (labelled g), each test measure skills that were specific to that particular test; hence the second component was specific intelligence. Thus, although assigning primary importance to the general factor, the theory does recognize that other specific factors (and even other general factors) must be considered. The implication for measuring intelligence, however, is that the best test would be one saturated with general intelligence.

Spearman was an early psychometric psychologist who believed that there was a single basic general intelligence which he called g, a single dominant broad intellectual ability factor. He believed that g interacted with a factor specific to each individual mental task, S which was the individual ability that would make a person more or less skilled at a given mental task. In other words, Spearman's idea was based on the observation that if a person has a good vocabulary, there is a better than 50-50 chance that they have a good memory and
that they are also good at mathematics. Likewise, if a person is good at mathematics, they are also probably likely to have a good vocabulary or memory. These associations aren’t perfect, but they are usually true. General intelligence, g was the conceptual explanation for why people’s scores generally tend to correlate across subjects, and the specific abilities or skills, S explained the differences in the individual scores. So, there's a different S for mathematics, a different S for vocabulary, a different S for memory, and so forth for each type of cognitive task.

Spearman's later method was to evaluate what are called tetrad difference. If a, p, b, q stand for abilities and \( r_{ap}, r_{bq}, r_{aq}, r_{bp} \) are coefficient of correlation between the various pairs, then

\[
\begin{align*}
  r_{ap} \times r_{bq} - r_{aq} \times r_{bp} &= 0
\end{align*}
\]

Spearman calls this relation tetrad equation. Critically observing this theory in actual practice, tetrad differences generally deviate from zero. Commenting on the theory Vernon states factor analysis is an exploratory and suggestive rather than a conclusive technique. But two features of Spearman's theory are thoroughly substantiated and a third feature is definitely wrong. The feature where Spearman went wrong was his belief in determinacy of 'g' that would yield one and the same ‘g’.

Thomson criticizes the theory by arguing that the two factors theory was possible but could not get a necessary inference from the
statistical results. Thurstone accepts the tetrad differences method only as a historical interest and states that when more than one factor is required, tetrad differences criterion cannot be applicable. But as the practical inference of this theory, the test constructors generally select the test items, which considered to be saturated with 'g'.

2.4.3. Gardner's Frames of Mind

H. Gardner (1983) proposed a theory of independent multiple intelligences. Originally there are seven types of intelligence which are as follows:

1. Linguistic: abilities to use vocabulary, do verbal analysis, understand metaphors, and comprehend and produce verbal material

2. Musical: understanding and expressing oneself through music and rhythmic movements or dance, or composing, playing, or conducting music

3. Logical-Mathematical: involves numbers and computing skills, recognizing patterns and relationships, timelines, ability to solve different kinds of problems through logic

4. Visual-Spatial: involves visual perception of the environment, ability to create and manipulate mental images, and the orientation of the body in space
5. Bodily-Kinesthetic: physical coordination and dexterity, using fine and gross motor skills, and expressing oneself or learning through physical activities

6. Interpersonal: understanding how to communicate and understand other people and how to work collaboratively

7. Intrapersonal: understanding one's inner world of emotions and thoughts, and growing in the ability to control them and work with them consciously.

Gardner came to his point of view because he had come to consider standard tests or other assessments used to measure IQ to be inconclusive. He argued the IQ did not predict or fleet school outcomes or success in life. Gardner holds each individual has varying levels of these different intelligences, and this accounts for each person's unique cognitive profile. In a sense, comparing his point of view to Spearman's, Gardner would say there is no G, only S’s and those S’s are more than just a skill or ability, but an independent form of intelligence up to themselves.

2.4.4 Thurstone's Group Factor Theory

The approach that is accepted by the large number of American theorists is one of group factors. This approach, which assumes that the fundamental dimensions can be represented by a relatively small number of fairly broad common factors, arose out of the work of Thorndike, Kelley and Thurstone. Particularly Thurstone, with his concept of primary mental abilities, has publicized the group factor
view. Although the exact abilities (group factors) found in any specific study depends upon several variables (e.g. the tests used, the nature of the sample tested and the method of analysis). The following factors have appeared with some regularity and have been confirmed by several investigators:

**Space:** The ability to visualize geometric patterns in space.

**Perceptual speed:** Quick and accurate noting of details.

**Number:** Quickness and accuracy in simple arithmetic computations.

**Verbal comprehension:** Knowledge of the meaning and relationship of words.

**Word fluency:** Ability to use many words.

**Rote memory:** Immediate recall of rote materials.

**Induction:** Ability to extract rules.

According to Cronbach, "Thurstone's theory had great influence on all subsequent classification of abilities. Cronbach gave 56 tests to students of university of Chicago and found six predominant factors: Verbal (V), Number (N), Spatial (S), Word fluency (W), Memory (M) and Reasoning (R).

To measure intellectual ability, therefore, has to construct a one battery composed of tests, which individually measured one of the group factors. If the tests in the battery do, in fact, measure the
primary mental abilities, any complex intellectual task or skill can be represented by a weighted composite of the relevant group factors.

2.4.5 Thorndike's Multifactor Theory

As the name of the theory indicates, intelligence is said to constitute of a multitude of separate factors, or elements, each one being a minute element of ability. Any mental act, according to this theory, involves a number of these minute elements operating together. Any other mental act also involves a number of the elements in combination.

According to Thorndike(1960), "There is really no such factor as "general intelligence" there are only many highly specific acts, the number of such depending upon how refined a classification we might wish to make and are capable of making”

In constructing a mental test, Thorndike himself feels that his "atomistic" theory and the multitude of minute elements of ability are of less practical significance than the conception that many of them operate together in any situation demanding intelligence.

2.4.6 Vernon's Hierarchical Theories

The basic idea of this approach is that intellectual structure can be conceived of as a hierarchy, extending from one or more broad general factors through group factors to more and more specific factors. Vernon(1950) has proposed a model (See Figure -1) where general factor is subdivided into two major group factors - a verbal
educational (V: Ed) factor and a practical mechanical (K:M) one. Each of these categories is further subdivided into group factors and then into more and more specific factors. At the third level of the hierarchy, which represents minor group factors, we might find a spatial factor similar to Thurstone's group factor. At the next lower level, this factor might be further subdivided into three more specific factors.

1. The ability to comprehend spatial relations using the body as a point of reference.
2. The ability to manipulate mentally a series of visual objects through a sequence of motions, and
3. The ability to make left right discriminations.
VERNON'S DIAGRAM OF POSSIBLE HIERARCHY OF ABILITY

FIG. 1
The hierarchical approach represents an intuitively satisfying collection of data and, since tests can be constructed to represent any level in the hierarchy, it is a useful tool for guiding test construction.

2.4.7 Guilford's Three Dimensional Model of Intellect

The most recent theory is Guilford's three-dimensional model. Guilford conceives of intellectual functioning as having three dimensions: Operations, Contents and Products. Operations are the processes involved in intellectual behavior in Guilford's system are cognition, memory, divergent thinking, convergent thinking and evaluation. The contents of these operations may be figural, symbolic, semantic and behavioral. And, third, the products may be units, classes, relations, systems, transformations and implications. Thus, the model contains 120 cells (5 operations x 4 contents x 6 products), each of which represents a distinct factor that is measured by a separate test.

In Guilford's scheme, the well-known verbal comprehension factor (vocabulary) becomes the ability to cognitive semantic units. From the theorist's viewpoint, Guilford's precisely defined and integrated model has much to recommend, including the advantage of being able to specify in advance the nature of currently unmeasured intellectual abilities.

The various models presented are both conceptual and heuristic devices, because their comparative validity has not been determined.
Whichever model a particular investigator adopts will generally be a function of his individual preferences. No test is explicitly derived from a hierarchical theory, and Guilford's model is too new to be the basis of any widely used test.

It is observed that not all test constructors have based their work on a particular theory of intellectual structure. In fact, the dominant approach has been an empirical one of attempting to predict a specific criterion with the maximal accuracy. Thus tests of intelligence have been developed, not in accord with a prevailing theory of intellectual structure, but by including skills that previous research has shown to be predictive of academic success. "Guilford claims to have demonstrated empirically that 82 of the 120 different structures of intellect factors exist". Empirical considerations, rather than theoretical considerations were pre-eminent.
2.4.8 Thomson's Sampling Theory

Thomson and Thurstone have criticized Spearman's two-factor theory. Thomson believes that the hierarchical order and zero tetrad difference can be explained by his sampling theory. His view is that the coefficients of correlation are the results of common samplings and combination of independent factors that are present in two tests; determine the coefficient of correlation between the two. The theory is the same as that of Thorndike except that Thomson considers practical usefulness of the concept like 'g'. Thomson believes that if
several tests call upon many elementary factors in common, they will give appearance of having one common comprehensive factor.

According to the theory, any performance is considered as being carried out by a sample group factors. The theory does not deny the intelligence, for if the samples are large, there will of course be factors common to all activity. On the other hand, it does not affect the intelligence if the sample may not large as this and no single factor may occur in any activity. Thomson has become somewhat ambiguous in the explanation of his own theory.

2.4.9 Burt’s Hierarchical Group Factor Theory

According to this theory, abilities are classified into three types:
1. General Ability entering into every test belonging to a certain broad genesis.
2. Special Abilities, each limited to certain group, and
3. Individual Abilities, peculiar to a particular test.

Burt's says that "The set of factors can be arranged in a hierarchical order as shown in the scheme. While recognizing group and specific factor, he does not deny the 'g' factor"

2.4.10 Sternberg’s Triarchic Theory

Robert Sternberg (1985) proposed in his Triarchic theory that there are three forms of intelligence: analytical, creative and practical. In Sternberg’s views current intelligence testing does not test all three forms of intelligence. He holds that current
psychometric tests only appreciably tap analytical intelligence which allows an individual to quickly break down problems and be able to see solutions. This form of intelligence also consisted of numerous subcomponents which enabled this analytical ability, but the key is that they all serve the process of analyzing problems. While people high in this form of intelligence can break down problems they do so from the basis of their acquired knowledge. They may not necessarily be good at creating new ideas or knowledge.

Creative intelligence involves synthetic thinking, the ability to put together knowledge and understanding in new and intuitive ways. Often, individuals with the highest conventionally measured IQs are not good at this form of thinking. And people with high levels of creative intelligence, such as artists, are often unidentified by conventional IQ tests because there are not currently any tests that can sufficiently measure the attributes involved in creating new ideas and solving new problems.

Practical intelligence is basically related to street smarts or common sense. It involves the ability to apply creative and analytical intelligence to everyday situations. Those high in practical intelligence are superb in their ability to succeed in any setting. Even if they are limited in their creative and analytical intelligence, they are able to use these skills to their best advantage. In the end, Sternberg reminds us that an individual is not necessarily restricted to
having excellence in only one of these three intelligences. Many people may have integrated all three very well and even have high levels of all three intelligences.

After clarifying the theoretical perspective of intelligence, it is important to understand what is the role of heredity and environment on intelligence. The role of heredity and environment is discussed in the next point.

2.5 ROLE OF HEREDITY AND ENVIRONMENT ON INTELLIGENCE

Because psychologists cannot agree as to what intelligence is or how many intellectual factors there are, they obviously cannot agree as to the etiology of intellectual differences. The score on any test of ability is a result of how well a person performs on that instrument at a particular time. There is a question of the relative influence of heredity and environment. This controversy has raged for years with equally strong support on both sides of the argument. To a considerable degree the argument has been implemented and intensified by the development of intelligence tests. The debate on the relative influences of heredity and environment, while often apparently useless, is nevertheless concerned with a question of fundamental importance to educators and psychologists. Obviously, if a child's capacity for accomplishment were determined solely by inherited traits or heredities, education necessarily would have quite a
different outlook and philosophy than it would in a less deterministic frame of reference.

Many investigations and experiments have been made on this question from the time of Galton to the present. One method of investigation involves studies of persons who are obviously brilliant, feebleminded, or degenerate, to determine whether such trait tend to run in families. Most of these studies show that they do. Even though the question is not satisfactorily answered. The result of studies, which involves the transplanting of children from a poor environment to a good one shows equivocal: some children show general and marked improvement in intelligence and other traits, others do not. In summary, it may be said that the heredity - environment issue is far from settled. During the last hundred years there appears to have been a gradual shift from a viewpoint strongly hereditarian to one more favorable to the environmentalist point of view. Of course there are extremists who would rule out entirely one or the other point of view, but most educators and psychologists, believing that what the individual becomes is the result of an interaction of heredity and environment.

As Noll(1957), has put it, "The great mathematician, Sir Isaac Newton, if he had been brought up among African Bushmen would probably have become a remarkable bushman but he would never have discovered the laws of motion".
Without going into detail it may be said that, by far, the most popular current opinion is that there is an interaction between heredity and environment. The original question, "Which one of these factors affects an intelligence test score?" was replaced by "Which one contributes the most?" This question, in turn, has been replaced by "How do heredity and environment interact to affect test scores?" If we wish to see mankind behave more intelligently, heredity and environment, or both, must be improved. Since man can manipulate environment more readily than heredity (assuming that the practice of eugenics will not be given serious consideration in the near future), control of environment is the obvious method. While psychologists do not as yet have the complete answer to this, progress has been made in terms of the sophistication of the question asked. Intelligence test scores are not solely dependent upon either environment or heredity: both are relevant.

2.6 CULTURE FAIR TESTS OF INTELLIGENCE

The terms culture-free and culture-fair are to some extent misnomers. A "culture-free" test is one on which scores are completely uninfluenced by experience in a particular environment. Such a test would give a fair comparison of mental abilities in different countries and across different social classes.

The problem of cultural influences on test performance has been studied for many years. Originally, investigators attempted to develop
tests that would eliminate all effects of culture and presumably measure the individual's inherent abilities and personality traits. However, it soon became apparent that because the cultural environment operates upon an individual and interacts with hereditary factors from the moment of birth or even before, any attempt to develop a culture-free test was doomed to failure. Consequently, the emphasis in test construction has shifted to the development of culture-fair tests, i.e. those that, while not eliminating cultural effects, attempt to control certain critical variables, thus making the test equally fair to all persons.

To accomplish this, procedures must be developed to control the influence of parameters which are important determiners of test performance but they vary widely between cultures e.g. language, speed, role of competitiveness and the motivation to do one's best etc.

Regardless of the approach used in constructing a culture-fair test, its effectiveness will be determined by accumulating validity evidence. That is, unless it can be demonstrated that the test is fair and equally valid for various cultural groups, it cannot be said to have attained its purpose.

**Tannenbaum** in reviewing the Culture-Fair Intelligence Test writes as in essence, then, it must be admitted that the long pursued goal of demonstrating equality among national and international sub-populations on some measure of intelligence has not been reached by
this test. Is it, indeed, a goal worth pursuing? Even if, it were possible to devise a test so antiseptic as to clean out inequality not only among subcultures but also among other groups showing differences in test intelligence, such as those classified by sex, age, education, geographic origin, body type, physical health, personality structure, and family unity—what kind of instrument would we then have? Since such a test must be perfect so thoroughly to omit tasks that reveal these group differences, or substitute others that show "no difference", what could be possibly measure? What could it predict? Covering up group differences in this way does not erase test bias. Rather it delimits drastically the kinds of information one can gather about problem-solving strengths and weaknesses associated with groups as well as individual.

2.7 TRAIT ORGANIZATION IN THE PRESENT TEST

The present test includes two types of items: first is a verbal type which includes items designed to measure student's verbal, reasoning and numerical ability; while the second is a non-verbal type which includes items designed to measure the student's reasoning ability like concepts involving similar relationship between figures, the counting of geometrical figure, the image of an object as seen in the mirror.
2.8 CONCLUSION

In this chapter theoretical perspectives of intelligence have been discussed in detail. This would provide the investigator proper guideline for the contraction of the test.

In the next chapter, the investigator has also described various research work done India & abroad in the area of intelligence.
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