CHAPTER 1

INTRODUCTION
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1.1. Meaning of Intelligence

The English word 'intelligence' ordinarily meant the quality of knowing or understanding or the ability to understand or comprehend. The word is derived from the old French 'intelligence' which had its origin in the Latin term 'intelligentia', meaning perception or discernment (Webster, 1953, p.904). Its salvage to scientific terminology from the quagmire of philosophical theorising may be ascribed to Spencer who adopted it to designate an innate, universal or general cognitive capacity, while Galton usually mentioned of it as 'general ability' or 'natural ability' (Burt, 1954, p.64). It still remained to be explained, defined and established to be of any practical use in a rapidly developing behavioural psychology of the modern age, although no final word could be said of it even after more than half a century of research and successful testing.

Who does not ask what intelligence or general mental ability is? And who among psychologists, does not know the answer? Time and again the question is asked challengingly and answered rather uncompromisingly in many learned deliberations and scientific inquiries. We do not unfortunately have a straightforward and univocal answer. There has been an enduring record of inquiries made particularly by psychologists
defining intelligence in as many ways as could be thought of with varying degrees of agreement between their expressions. One such record of undoubted value is the 'Symposium' (Whipple, 1923, p.16) of early twenties of this century, where, as many as fourteen psychologists coined fourteen different definitions of intelligence. This uncertainty about an agreed definition of intelligence still persisted in the fifties or sixties of our time and there is no doubt that, 'It is psychologists again who, although they have been testing intelligence with some success for over forty years, have failed to reach any agreed definition as to what it is they are measuring.' (Vernon, 1950, p.3). A.G. Wesman addressing the American Psychological Association in 1967 struck a similar note when he said, '...... there appears to be no more general agreement as to the nature of intelligence or the most valid means of measuring intelligence than was the case 50 years ago' (1968, p.267).

That intelligence has been defined in many different ways by various thinkers does not mean anything like a complete failure in understanding and defining the nature of this kaleidoscopic phenomenon. Rather, most of these definitions provide as many viewpoints about this construct of great powers exhibiting its numerous tentacles through an endless variety of intellectual performance. Terman as early as 1919 (p.44) said of these definitions, 'They differ mainly in point of view or in the location of the emphasis'. A similar note
was struck by Pintner (1931, p.51), 'Many definitions of intelligence have been proposed by psychologists, and these vary greatly according to the standpoint from which the psychologist views this problem ......... They spring from different points of views'. Vernon (loc.cit.) finds much overlapping between such views. These differences of viewpoint in the definitions have led authors to place them into convenient classes for elucidating the basic characteristics. According to one author (Pintner, 1931, pp.47-51), the classification is four-fold: (i) biological, (ii) educational, (iii) faculty type, and (iv) empirical. The biological definitions emphasize the importance of individual adjustment to a constantly changing environment; the educational definitions pinpoint the importance of the learning capacity of an individual; the faculty type definitions lay great stress upon mental faculties like association, memory etc.; and finally, empirical definitions originate from actual experiences in the field of intelligence testing. Another classification by Heim (1954, p.4) does not differ very much from the preceding one. He distinguishes between the following types of definition, vis., (i) a priori vs empirical; (ii) biological vs psychometric; and (iii) academic and theoretical vs practical. Burt (1947, p.129) does not like to enter into this controversy and he would rather let a 'real' definition about the nature of intelligence wait and consider a 'nominal' definition essential before considering how intelligence could be measured.
It is not intended at this stage to add a critical estimate of all details concerning various concepts or definitions of intelligence and make one more fragmentary attempt to redefine it, at least from the point of view of a true or real definition. It is rather more important to state explicitly what is intended to be measured through a test or how the term 'intelligence' is to be used in connection with a test being constructed and standardised. Naturally, the search for a meaning of the term 'intelligence' will depend much upon the point(s)-of-view held by the author with respect to the basic assumptions that determine the nature and quality of a test. If a true or real and complete definition of intelligence is wanted as some unreasonable critics would demand it, how better can we respond to than emphasising what Terman (1919, p.47) said some fifty years ago, 'To demand .......... that one who would measure intelligence should first present a complete definition of it, is quite unreasonable. As Stern points out, electrical currents were measured long before their nature was well understood ....... The best that can be done in advance of such data is to make tentative assumptions to tests which will show their correctness or incorrectness.'

As the proposed test is chiefly intended to be used among high school pupils, one basic assumption is that it will serve as an indicator of performance in scholastic work more particularly where the verbal factor is predominant. It
will essentially be a measure of general mental ability or 'g' since '..... g will enter into everything the child says, thinks, does or attempts, both while he is at school and later on in after life' (Burt, 1947, p.133). It is not intended to be a test of achievement or attainment where success is dependent upon how much one has learnt about a subject or subjects; but a test of innate or inherent ability that helps in learning any kind of material while at school or in real life. This assumption is the same as what Buckingham (in Whipple, 1923, p.16) regards as the 'ability to learn, and as measured to the extent to which learning has taken place or may take place'. This capacity is also sometimes referred to as inborn as we find in Colvin (ut. sup.) in the sense in which he uses it, i.e., 'Intelligence itself is not inborn, only the capacity to become intelligent', and which is, 'a group of innate capacities by virtue of which the individual is capable of learning in a greater or less degree in terms of the amount of these innate capacities with which he is endowed'.

This ability to learn has been emphasised all through by many tests constructors in many well-known tests of intelligence or general mental ability meant particularly for use among school and college students. Among these, a group test of much wider application is the High-School Edition of Scholastic Aptitude Test by the American Council on Education. This objective test is designed 'to measure learning ability
or scholastic aptitude' and according to the publishers, '........ teachers, counsellors, and administrators find its results valuable ........' (1953, p.1). Similarly, the Henmon-Kelson Tests of Mental Ability are designed 'to measure those aspects of mental ability which are important for success in academic work' (Lamke and Nelson, 1957a, p.3). Another short test of general ability prepared by Thurstone is called 'Mental Alertness Test' and is designed '..... to measure an individual's capacity for acquiring new knowledge and skills' (Thurstone, 1952, p.1). The authors of a similar test published by the Science Research Associates are more explicit when they explain how performance in school courses is closely related to the ability to learn: 'Learning ability is related to all human pursuits — school courses, careers, leisure activities. This ability is known as general intelligence .. .....' (SRA Verbal etc., 1947, p.1). A test composed of similar material like that of the preceding test by Lorge and Thorndike is ascribed as an abstract intelligence test where this quality is defined as, '......... the ability to work with ideas and the relationship among ideas' (Lorge and Thorndike, 1957, p.2), which is not very far from the ability to learn, particularly in a class-room situation.

The concept of general intelligence then, from the test-constructors point of view, is influenced more by practical considerations than by theoretical evaluation of multi-dimensional views concerning its nature. It is these
practical considerations that prompt test-constructors to accept intelligence as an ability to learn, or to solve problems, or to prepare one to cultivate knowledge or skill in a special field of work. It is also taken as an ability that facilitates comprehending of the content of a school course. In accepting such a simple meaning of intelligence, test-makers are amply rewarded as they have been since the time of Alfred Binet, and no good test is lost because of their inappropriateness. It will be shown a little later how theories of intelligence have influenced the trend in the development of psychological tests and why our incomplete understanding of the intellect is bound to restrict test-constructional work within certain limits of acceptable criteria. Intelligence, like electricity, has evaded theoretical inquiries of scientists and is not fully understood in spite of voluminous researches carried out in different parts of the world; though, like electricity again, intelligence can be put to use to solve many complexities of human life.

1.2. Theories of Intelligence

Apart from numerous conjectures and surmises on intelligence and its nature by distinguished thinkers from the very olden days of human civilisation to the present era of technology, there has been a scientific way of restrained thinking on the subject based upon analytical or rational interpretation of experimental evidence. This comparatively new field is known as the factorial analysis of human ability. It
has a well developed methodology of research that originated in the early years of this century. A factor is called by different names like 'causes', 'faculties', 'parameters', 'functional entities', 'abilities' or 'independent measurements' (Thurstone, 1947, p. 56) and is hypothesised to explain variances in human behaviour under varying conditions of living.

(i) Two-factor theory: It was Charles Spearman (1904, p. 284), who by devising special methods of calculation, proposed for the first time that human ability could be explained as constituting of two factors, and he called these g and s. The factor g accounts for all coefficients between variables of a battery of tests and s accounts for the portion of reliable variance that does not correlate with other tests. Spearman justifies this kind of arrangement of factors in a positively inter-correlated test battery from the point of view of what is known as the 'criterion of proportionality', in which, any two columns of coefficients in a matrix are in simple direct proportion. When this proportionality is obtained in a matrix, tests arrange themselves in a 'hierarchy' i.e., the tests with the highest coefficient appear at the top and tests showing other coefficients with gradually lesser values appear at the lower rows with the lowest appearing at the bottom. An acceptable test for this criterion is the vanishing of 'tetrads' or the second order minors (Holsinger and Harman,
1941, p. 68). When we have, for example, \( n = 4 \) and \( m = 1 \), the tetrads are,

\[
\begin{align*}
\tau_{12} \tau_{34} - \tau_{14} \tau_{23} &= 0 \\
\tau_{13} \tau_{24} - \tau_{14} \tau_{23} &= 0
\end{align*}
\]

In actual practice, however, the tetrads do not vanish entirely due to the presence of what Spearman calls, the sampling errors.

Spearman next explains that \( g \) is a central intellectual energy present in all intellectual operations although he refuses to identify it with intelligence. The \( s \) factors he compares to a large number of mechanisms or engines which could be activated by the general mental energy. The \( s \) factors are largely affected by education and training, whereas \( g \) is innate and ineducable (Vernon, 1950, p. 13). The factor \( g \) is common to all abilities inter-correlated by the tetrad equation. It is universal and physiologically a kind of nervous energy due to general plasticity of the mind. It is analogous to some kind of an energy and is capable of being transferred from one mental operation to another of a different nature. Spearman, in fact, believes that intelligence comprises of three abilities: (i) the ability to observe one's own mental processes; (ii) the ability to educe relations; and (iii) the ability to educe correlates (Knight, 1950, p. 18).

(ii) Group factor theory: One serious drawback of the two-factor theory is the denial of commonnesses (residual
overlap) between variables that account for certain types of ability which while less general than \( g \) are not accountable by specific factors alone. For, the process of 'purification' to establish a perfect hierarchical order cannot be carried on without tempting the experimenter to discover undue similarity between tests and that whole groups of tests sometimes fail to conform the hierarchy (Thomson, 1951, p.63).

Spearman, however, came to recognize in an indirect manner such commonnesses between variables as 'broad factors' by redefining the scope of \( s \) as being 'boundless' with 'intrinsic' and 'extrinsic' constituents (Spearman and Jones, 1950, p.78).

Soon after Spearman published his results establishing the two factors, other factor analysts started reporting about group factors in addition to \( g \) and \( s \). Notable among these are Burt (1917), Kelley (1928), Paterson and Elliot (1930) and Stephenson and Elkoussey (between 1917 and 1935) as summarized by Vernon (1960, p.15). They located several group factors like verbal, numerical, spatial, mechanical etc. besides locating \( g \) in all such studies. According to this newer group of theorists, there are three factors that one can arrive at by analysing intellectual functions: \( g \), \( s \), and group factors.

(iii) **Sampling-factor theory**:- Thomson proposed a new scheme of specific abilities in which 'each test calls upon a sample of the bonds which the mind can form, and that some of these bonds are common to two tests and cause their correlation' (1951, p.309). He believes in a general ability
but does not think it to be as basic as what Spearman thinks it to be. General ability is also not a purely inherited, fixed quantity. It is just the total number of 'bonds' whereas group factors are limited number of elements combining to form a smaller sample within the bigger sample.

(iv) **Multiple-factor theory** :- The group factor theorists, particularly in Britain (Burt and his followers) insist that there shall always be a g factor in every analysis. Their methods are applied in such a manner that they invariably lead to a g factor; but contrary to this, the multiple factor theorists (Thurstone and his followers) contain themselves by extracting one or more factors depending on the type of variables they use in an experimental set up. Thurstone by using a centroid system of analysis, analysed some 57 psychological tests administered upon 240 university students into a tentative list of 9 common factors which are called primary mental abilities (Stoddard, 1943, p.159). In this monumental analysis of human abilities Thurstone did not mention anything about a g factor and this caused the g-factor theorists to establish their own camp with followers particularly from the Spearmanian school. The latter started working on Thurstone's data and reported g-factor loading of tests, e.g., in an analysis by Eysenck, a g component of 30.8 percent was reported and other workers including Spearman reported other percentages (Vernon, 1950,p.20).
Thurstone did not begin his work with a clean slate, but he did begin with the design that Spearman had drawn save the meaning and interpretation that adorn the whole of two-factor theory. Thurstone states this situation plainly in *Multiple Factor Analysis*: 'When I wrote the tetrad equation to begin his inquiry, I discovered that the tetrad was merely the expansion of a second-order minor, and the relation was then obvious. One might speculate as to whether multiple-factor analysis would have developed earlier if this interpretation had been started earlier. If the second-order minors must vanish in order to establish a single common factor, then must the third-order minor vanish in order to establish two common factors, and so on? .......... Instead of dealing with the proportional columns and rows of a hierarchy and the vanishing tetrads, we now deal with the same relations in terms of the properties of unit rank, namely, proportional columns and rows and vanishing second-order minors. This formulation generalises to the properties of higher rank' (1947, p. vi). Thurstone next encountered difficulties with the factor matrix where factor loadings presented a dismal look devoid of psychological meaning. Here, he employed the principle of 'simple structure' for a meaningful interpretation of test-vectors. What he did was to rotate the reference frame either orthogonally or obliquely to achieve a simple structure and through an analytical procedure give the most suitable working name to a particular factor.
Thurstone sought a reconciliation between Spearman and Thomson and believed that an accord could be achieved through the application of the newly found second-order factors: 'The tetrad differences vanish when there are no primary factors common to the four tests of each tetrad, the correlations being determined only by the general second-order factor' (Ibid., p. 420). But the Atlantic between British and American theorists still persists with the British writers making g as large as possible and attributing group factors only when the residuals necessitate them and American authors either introducing g as a second-order factor, or, if a primary one is unavoidable, tending to minimize its importance (Vernon, 1950, p. 130).

(v) Facet analysis: Of more recent theorising on factorial analysis is Guilford's (1956, pp. 267-193) presentation of an outline of the human intellect in which he conceives of the intellect as having a structure of three 'faces' vis., contents, operations or processes and products. He analyses content into four sub-classes (figural, symbolio, semantic, behavioural) to rehabilitate various types of test materials generally used in ability testing. Secondly, the products are subdivided into six sub-classes (units, class, relations, systems, transformations, implications) signifying the resultant of intellectual functioning upon various materials. Finally, the operations are sub-classified into five divisions (cognition, memory, divergent thinking, convergent thinking, and evaluation) of intellectual activity from a simple operation like cognition to a complex
operation like that of evaluation. This three-dimensional scheme embodies 120 distinct cubicles or cells of unique intellectual work that can explain any situation in which an individual can solve a problem. Guilford has so far abstracted 12 factors and it will certainly take a long time to cover the rest of the factors to establish finally the three-dimensional ideal.

Guttman has called this cubical model a 'facet design' and outlines the rudiments of a 'facet analysis', pointing out the possibility that standard factor analyses of the tests from all the cells in Guilford's grid might not only uncover expected specific abilities stemming from the three-way interaction of operation, content, and product, but also more general factors as well (Jaekson and Messick, 1967, p. 418).

From the above portrayal of various factor theories relating to intelligence, several conformable features can be realised to which an impartial observer may not be so censorious because of geographical alienation, and these are:

(a) That g or the central intellectual factor (Spearman) or a second-order general factor (Thurstone) can always be found if an analysis is made in that direction.

(b) That group factors (Burt, etc.) or broad factors (Spearman, etc.) or multiple factors (Thurstone, etc.) are acceptable to all theorists in accounting for residual overlap among test elements.
(c) That specific or unique factors are implied in all factorial studies, the nature of which is dependent upon the type of tests included in a battery. A specific in one battery may become common in another (Thurstone, 1947, p. 75).

However, the exact relationship between these factors, in so far as an all-inclusive picture of the whole human intellect is concerned, is neither discernible in Guilford's structure nor known otherwise, and therefore, factor theories of intelligence can be considered as incomplete and open to further investigation.

Mental ability factors have contributed most in the field of test development rather than in the obscure field of theorisation. Besides a large number of verbal, non-verbal and performance tests of intelligence, we have a growing field of aptitude testing where factorial studies have made it possible to use sophisticated psychological tests for better selection, classification, and guidance of individuals in the prime of their life.

1.3. Intelligence and its Measurement

(1) Individual testing

The proper assessment of intelligence with a measuring 'scale' began with the work of Binet and Simon when they introduced in 1905 a test that could roughly distinguish children into different ability groups like idiots, imbeciles, feebleminded etc. (Freeman, 1939, pp. 85-88). Although the scale was a success, several defects were noticed and the authors promptly brought out a revision
of the test showing significant changes over the older scale. Test items were now allocated to different ages from 3 to 13 years and the concept of 'mental age' was introduced for the first time to indicate the level of mental growth as measured by the test. It was this 1908 scale that took the world by unusual interest, and it went out of France for trial in other countries. Binet brought out the third and the last version of the test in 1911 just before his death but it was almost as good as the 1908 scale. It is not possible here to give an account of a great number of versions of the Binet test in different languages and in many progressive countries of the world. The most well known are the American revisions of Stanford Binet (1916, 1937, 1960) prepared under the supervision of Terman and his colleague Merrill (1960). This is the most successful series of intelligence tests of our time and the most extensively used one in the English speaking world (Anastasi, 1961, pp. 207-210). Terman borrowed the term IQ from Stern, and this term is now as widely used as kilometers or pounds by modern men of an enlightened world.

Around 1915, a team of American psychologists under the leadership of Yerkes broke away from the idea of awarding credit in terms of mental age equivalents and developed a scaling method where credit or partial credit was given in terms of points, a total of which in a test was ultimately compared with the average or standard performance of a given age-group (Goodenough, 1949, pp. 61-62). By referring a score
to a table of such standards one can easily find out the corresponding mental age. The introduction of this technique of scaling was favoured by many in the field of test construction primarily because forms in the new scale could easily be revised and prepared for different groups.

Later on the idea of a point scale was conveniently applied in the development of some performance tests like the Pintner-Paterson Scale, Arthur Point Scale, Army Performance Scale, Merrill-Palmer Scale and many more of the type which began playing an important role in measuring intelligence of individuals who were at a disadvantage to use materials involving linguistic dressing. It has also been possible by using this method to develop and standardise hundreds of different tests covering a field wider than ability testing.

(ii) Group testing :-  Soon after Yerkes developed his point scale, an opportunity came in the wake of the first World War for a trial of intelligence tests among larger groups of individuals. This was because individual tests like the Binets were considered too time-consuming. The psychologists of the U.S. army had to find out some shorter, convenient test that could be administered to smaller groups of new recruits for rapid classification. They were guided in this work mainly by an unpublished group test prepared by Otis and finally developed two tests, Army Alpha for English speaking recruits, and Army Beta for non-English speaking
recruits (Anastasi, 1961, pp. 11-12). These two tests were found to be greatly successful and later on instilled a new vigour to the whole testing movement. Organized mass testing of intelligence in education and other fields came to be almost an institutional or social convention. Regarding the application of such tests in the U.S. school system, Traxler et al. write, 'World War II gave great impetus to mental tests as well as/kinds of testing, since there was once more need to classify and use the abilities of large numbers of persons as quickly as possible. With rapid development in the post-war period, mental testing forms an important part of the systematic programs of objective testing adopted in schools of all kinds throughout the United States' (1953, p. 5).

Group tests of general mental ability now form the largest area of test development (excluding educational tests) as may be noted from publications in the United States and India. Such tests of general mental ability demonstrate the use of various materials (verbal, non-verbal) in differently arranged format (homogenous tests and heterogeneous batteries) capable of indicating either a single score or differential scores.

1.4. Uses of Intelligence Tests

It was a very practical consideration that led Binet and his colleagues to devise a method by means of which the retarded children could be distinguished and given special treatment for their education. The natural course for him was
to construct a test (as mentioned) and apply it to the entire satisfaction of those who entrusted him with the work. His work is a confirmation of the fact that psychological tests can be used in social welfare work like that of providing special care to the mentally retarded. Binet's work is a great landmark in the history of scientific psychology and from his time to the present such tests have never looked back. Nearly half a century after the publication of Binet's test, intelligence testing has grown to be a huge affair and 'Despite the various criticisms heaped upon modern intelligence examination, it has proved itself to be of inestimable value when properly used .......... of the many uses which have been made of the tests, the following eight probably take into consideration the ones which have yielded the most beneficial returns:

1. Analysis of individual achievement in light of individual aptitude

2. Analysis of group achievement in light of group aptitude

3. Educational supervision

4. Aid in the selection of curricular offerings

5. Educational guidance of the individual

6. Vocational guidance of the individual

7. Analysis of the characteristics of various racial and social groups

8. Analysis of individual needs of delinquent and criminal cases (Humphreys and Boynton, 1952, p.609).
Since Binet's time, we may note two important changes in intelligence testing that have expanded the field to its modern ramifications and these are, (1) the use of a technique by means of which a group can be tested as successfully as an individual, and (2) the detailing of the concept of intelligence to include group factors so that a single testing can give multiple or differential scores with better predictive value. In fact, psychologists have grown to be more inclined toward using tests showing factored scores than global scores though the utility of general ability or intelligence tests is not entirely ignored. In a very interesting survey of opinion on this subject conducted among a representative group of 79 psychologists, 55 suggested that psychologists should concentrate on measuring separate intellectual factors instead of general intelligence ....... But 75 percent of the same group suggested that the global score of intelligence would rather meet well the practical need of classifying individuals in respect of general ability in both educational and occupational or vocational fields' (Kornhauser, 1945, pp.3-6).

(1) Intelligence tests and education :- In an invitation lecture requested by President Conant of Harvard to name any outstanding achievement of the social sciences in recent decades, O.D. Stoddard spoke engagingly of the vast accumulation of reliable and valid testing instruments of human ability that had been put to successful use in the
classification, selection and guidance of individuals (Cronbach, 1949, p.3). That the testing movement distinguishes itself quite creditably among various achievements of social sciences is due largely to certain vital issues bearing on our civilised life as one of the most progressive species of the animal kingdom. National goals on the one hand and education and employment on the other demand a closer examination of human resources that can be harnessed for maximum utilization and here come in the psychological tests for a fulfilment. Perhaps, the most widely applied field is education or training.

For a long time the American educational procedure has been concerned with methods of uniform instruction among homogeneous groups of pupils and their experience with the Army tests stimulated ability grouping in the elementary and high schools. As a result, numerous critical accounts have been published in journals and books some criticising adversely the policy of large scale ability testing but many supporting the cause of it. Regarding experimental evidence on this subject, Cook writes that, 'Experimental studies were summarised and the conclusion reached that the evidence slightly favoured ability grouping where adaptation of standards, materials, and methods were made ......' (1951, p.18).

Ability grouping has the strongest support not so in the middle range as it is in the extremes of subnormality and supernormality. Cyril Burt of England seems to be more
emphatic in having a child tested for his general ability. Thus he writes, '........... in all questions of school organisation, in all questions of class promotion, but above everything, where subnormal and supernormal pupils are concerned, the teacher, besides examining the child's acquired school knowledge, should also possess some means of gauging his inborn mental capacity' (1947, p. 2).

The importance of intelligence testing is very convincingly brought out by Boynton in citing the case of a boy who was failing in the fifth grade. Upon testing his intelligence by two different tests, the intelligence quotient was found to be 180. The Principal of his school then put him in the seventh grade where he immediately became quite outstanding and continued to be so till graduation with distinction. Relating this case with a great optimistic note Humphreys and Boynton write, 'If intelligence tests are: (a) carefully selected, (b) properly administered, (c) accurately scored, and (d) conservatively interpreted they may be of tremendous assistance in practical educational activities' (1952, p. 605).

There has been a growing tendency among psychologists to use intelligence tests for the purpose of predication of scholastic achievement. Correlation reported from time to time are usually positive, although the values range from low to fairly high coefficients. Chauncey and Frederiksen observe that the predictive value of tests of general mental ability is fairly high for average achievement in subjects as reading
and arithmetic (1951, p. 114). Humphreys and Boynton (Ibid) observe that 'correlation coefficients between tested intelligence and later academic achievement range from .40 to .60'. They also remark that, 'if scores on a standardised achievement test are used in place of marks as the later criterion of academic success, the correlations are considerably higher'.

The predictive quality of general ability tests are not of the same order for different school subjects, a fact we must remember in estimating the value of such tests. For example, in a very systematically done study of International Examination Enquiry, we note how the general ability scores correlate differently for English and Arithmetic and the following considered opinion (McClelland, 1949, p. 20) are of inestimable value:

'The intelligence (by which we mean simply whatever is measured by the intelligence tests which we used) is more highly correlated with English than with Arithmetic.

'That intelligence is more highly correlated with the tests than with the examinations.

'That intelligence is more highly correlated with the tests and examinations than with the teachers' estimates.

The predictive ability of such tests then is dependent on what type of tests are being used for measuring intelligence as well as achievement. From the point of view of intelligence, a verbal ability test is found to be more
efficient in measuring success in our schools. Such a test provides substantial congruent validity with standard achievement tests (Coleman and Ward, 1956, pp. 524-526). Terman and his coworkers found that a vocabulary test alone could give an estimate of a child's mental age within one mental year what a full scale (Stanford Binet) could estimate about the same fact (Goodenough, 1949, p. 4). Again Goodman (1944, p. 138) notes that 'Verbal ability correlates higher than any other of the abilities with semester point average and individual college courses'.

Although an ordinary general ability test with the verbal element is found to be very helpful specially in the higher grades; the tendency, as mentioned before, has been with such group tests to show differential scores. A good number of American tests (Henmon-Nelson Tests for example) which formerly showed only a global score have recently been revised to show at least two scores excluding a combined score (Buros, 1965, p. 462). The two most common separate scores are V for verbal ability and N for numerical ability.

1.5. Intelligence Testing in India

Scientific psychology as an independent academic expanse of study was first initiated in the Calcutta University in the year 1915, and from that time upto the present its growth and development have been impressive, particularly after India attained her independence in 1947 (Psychology
Psychology is now being taught in 35 Indian universities, and research and other activities thrive in many institutions like the Defence Science Organisation, Bureaux of Psychology and Educational and Vocational Guidance, Institutes and Hospitals etc. Joshi (1964, p.32) records a total of 1365 papers presented to the Psychology and Educational Sciences Section of the Indian Science Congress during the period from 1925 to 1963. 26.8 percent of these papers are categorised under Experimental Psychology and 9.8 percent cover the field of Psychometry. But from the point of view of published material, Krishnan puts the number at 342 of which the majority relate to measurements, tests and repeat researches of work done elsewhere outside the country (Shanmugam, 1966, pp.51-52).

It was several years later after the birth of modern scientific psychology in India, a Christian missionary of a Lahore college (now in Pakistan), C.H. Rice undertook the work of standardising the 'Binet Scale' in the early twenties and published the results in 1929 (Jalota, 1965, p.96). The test was developed as a point scale and standardised among 929 school boys from 5 to 16 years of age. This work was followed by several other attempts at standardisation of which Menzel (1942, p.164) has noted some eight versions carried out in Hindi, Urdu, Bengali, Marathi, Kannada, Panjabi, Tamil and Telugu.
Just about when Rice or Maity (1926) was working on the Binet scale, efforts were made to experiment with group verbal tests among Indian children. The first test was either a complete adaptation of foreign tests or development of tests with elements drawn mainly from such tests. Chatterjee, for example, reported studies with Burt's group tests, or Jha worked on Hindi adaptations of the Simplex Mental Test and the Terman Group Test, or Jalota selected elements from Burt and Terman and added few of his own to prepare a battery (Jalota, 1965, p. 97). Work on such tests was at first steady till the attainment of independence, but the last two decades have shown considerable progress in the field of mental testing with backing from many newly founded universities and institutions of higher learning.

Regarding earlier attempts at testing, Jalota regretted about the paucity of published material in a survey of intelligence testing, although, he admitted that his latter work 'is in great contrast with the half-page that he could provide in 1952' (Ibid. p. 104). In this survey, a total of 74 tests are reviewed and Tripathy (1967, p. 4) analyses them as shown in the second column of the following table (p. 28).

This analysis shows a greater preponderance of group tests, and that too of the verbal type. It may be that materials for such tests are comparatively easier to obtain and handle and convenient for standardization through individual
effort. The exact figure about how many of these tests are standardised in part fulfilment of a post-graduate thesis (Ph.D.) is not known, although 7 unpublished Ph.D. theses are cited by Jalota (Ibid., pp.105-107) in a reference bibliography of 56 items.

Table 1.1 Showing number and percentage of different types of intelligence tests developed in India.

<table>
<thead>
<tr>
<th>Types</th>
<th>Tests in Jalota's survey</th>
<th>Tests in Indian Handbook</th>
<th>Per-</th>
<th>Per-</th>
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<tr>
<td></td>
<td>Percent</td>
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<tr>
<td>Group Verbal</td>
<td>39</td>
<td>52.7</td>
<td>57</td>
<td>58.8</td>
</tr>
<tr>
<td>Group Non-verbal</td>
<td>11</td>
<td>14.9</td>
<td>22</td>
<td>22.7</td>
</tr>
<tr>
<td>Verbal+Non-verbal</td>
<td>4</td>
<td>5.4</td>
<td>6</td>
<td>6.2</td>
</tr>
<tr>
<td>Verbal Individual</td>
<td>3</td>
<td>4.0</td>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>Non-verbal Individual</td>
<td>16</td>
<td>21.6</td>
<td>4</td>
<td>4.1</td>
</tr>
<tr>
<td>Mixed</td>
<td>1</td>
<td>1.4</td>
<td>3</td>
<td>3.1</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>100.0</td>
<td>97</td>
<td>100.0</td>
</tr>
</tbody>
</table>

A more recently published account of Indian tests is a handbook (1966) by the National Council of Educational Research and Training, in which unfortunately, several known works do not appear. An analysis of different types of tests mentioned in the handbook is shown along with Tripathy's analysis of Jalota's account in Table 1.1. Here also we have a greater percentage of group tests mainly of the verbal type. As many as nine Indian languages including English are
covered by these verbal group tests in which Hindi takes the highest position with 26 tests. Other languages in the descending order are English(10), Marathi(7), Gujarati(6), Kannada(4), Telugu(2), Bengali(1), and Panjabi(1).

Besides verbal group tests, the demand for non-verbal group tests is conspicuous in these two analyses, although they are not commensurate with the Indian scene of application where economic and socio-cultural differences vary so widely from place to place. Perhaps these analyses do not represent many more natural needs of scientific psychological testing in India where psychologists have to work with whatever limited means they can afford to carry on big work in a smaller way. This is evident from the fact that we do not as yet have an ability testing programme of an all-India character: 'we have yet to have a scale of intelligence which would give a reliable measure of the intelligence of children sampled from various parts of the country' (Prosad, 1950, p.12).

(1) **Intelligence Testing in Assam:** Assam is the easternmost state of the Indian Union with a population of nearly 12 million scattered over a wide range of territory of 47 thousand square miles bordering three foreign countries, Burma, Pakistan, and China. The original inhabitants are called Assamese who constitute the bulk of the population (57 percent) and they speak a language called Assamese or Assamiya belonging to the family of north-Indian languages.
The rest of the population speak various languages of which Bengali occupies the major place (17 percent). Several other Indian languages and a large number of tribal dialects are spoken by the rest of the population. In the 1961 census as many as 84 different mother tongues are listed in the tables (Census of India, 1961, pp. 360-363).

Assamese is one of the sixteen major Indian languages recognized by the Indian Constitution and is also the regional language in the Brahmaputra Valley of the state of Assam. It has a rich literature as old as any of northern India, and has been the medium of instruction since education of the State was reorganized along modern lines by British educators. According to a recent publication by the National Council of Educational Research and Training, 2,84,286 pupils in 972 sections attend high-school classes VII, VIII, IX and X and the number of pupils in lower classes and the primary classes are still greater. Of these 972 sections, the medium of instruction is the regional language (Assamese) in 735 sections, the percentage being approximately 75 (Second All-India Educational Survey, 1967, Tables 67, 129, 152). From this it is evident that a large number of pupils attend classes and receive their education primarily through Assamese.

Although Assam has a stable system of education for a fairly long time, psychological testing of any kind is practically unknown excepting few sporadic application upon
selected groups like residential school candidates. The state's Vocational and Educational Guidance Bureau (Notes on, 1968, p. 26) was opened in 1956 and for the whole period of nearly 13 years, no programme of testing has been taken up and only non-testing techniques are employed for guidance. The Board of Secondary Education has also not published any information regarding any activity concerning the development of psychological tests and two universities of Gauhati and Dibrugarh conduct examinations in the same traditional manner. Joshi (1964, p. 32) in his analysis of research papers, has not mentioned a single work under the heading psychometry although some papers from Gauhati are reported under educational psychology.

1.6. Research Problem and Characteristics

It has been made clear in the preceding section that Assam has yet to enlist her name in the field of intelligence testing though progress in most Indian states has been quite rapid and encouraging. A large majority of school-going pupils justifies the development of such tests for use in hundreds of schools scattered over the state. Although a non-verbal test would have been more appropriate from the point of view of the multi-lingual nature of the school-going population covering the whole region, the development and use of a group verbal test in Assamese for use at the senior level is considered feasible and practicable accounting for the fact that
the mother-tongue and the medium of instruction of the highest number of pupils is Assamese and a verbal test might do well to predict their academic proficiency. Therefore, the problem of the present research project is aimed at as,

**The Construction and Standardization of an Omnibus Type Group Verbal Point-scale Test of Intelligence or General Mental Ability in Assamese for Use Particularly Among High-School Pupils of Classes VII, VIII, IX and X** and entitled:

**THE CONSTRUCTION AND STANDARDIZATION OF A VERBAL GROUP TEST OF INTELLIGENCE IN ASSAMESE FOR SENIOR HIGH SCHOOL STUDENTS.**

(i) Characteristics of the Proposed Tests:

(a) A Group Test:— Although group tests cannot acquire the natural qualities of individual tests, they enjoy certain significant advantages over their old rival of which Cronbach (1949, p. 172) considers economy and practicality to be the reasons for their being commonly selected by test constructors and users. The same author believes that under favourable conditions they are as reliable and have high predictive validity as do comparable individual tests. Likewise, economy and practicality have been the decisive factors in electing to develop a group test in the present project. Moreover, such tests insure uniformity of procedure since, 'the role of the examiner is reduced and simplified and scoring can be more highly automatic' (Anastasi,
A group is here considered to be a small class of pupils to whom the test can be conveniently administered through generalised mass communication.

(b) A Verbal Test: It is also considered to develop a verbal test rather than a non-verbal because its usefulness is anticipated primarily among senior high school pupils whose language learning is substantially developed to an acceptable standard. Such tests for use among grown up pupils are also favoured by several authorities of whom here is a line from P.E. Vernon: 'For most scholastic and many vocational, purposes verbal group tests are far more useful than any non-verbal test, because scholastic attainment is itself so largely a matter of vied as well as g' (1960, p.72). Swineford (1948, p.67), in an experimental study, obtained a large contribution of g to the marks in arithmetic, science and verbal subjects like reading, English, spelling and history. As a subsidiary evidence, we may also note that the constructors of the famous Stanford-Binet tests detected higher efficiency of verbal items like abstract words, vocabulary, analogies, verbal absurdities and the like over manipulative items in the scale in differentiating degrees of general intellectual ability from the point of internal consistency of items (Terman + Merrill, 1960, p.12).

c) A Spiral-Omnibus Test: A spiral-omnibus test is one in which different types of items appear in a single sequence spiralling in some order over the entire
length of presentation which ultimately results in a single score. It is contrasted with a battery type test where heterogeneous subtests are presented in some order separately with a separate time-limit and mode of administration ultimately resulting in separate scores for different subtests. With the present test, a battery type of arrangement of elements in different subtests is desired for the preliminary tryout leading to item-analysis; although, a spiral-omnibus test is sought to be compiled for the final stage of standardisation depending upon homogeneity of items and simplicity and practicality of group testing in one school period of instruction. It is hoped that the population will not be sophisticated enough to skip over harder items and that changing of set from one kind of operation to another (flexibility) would rather aid the main purpose of testing intelligence which is also a kind of flexible adjustment of an individual to a changing environment (Q. V., Vaughn, 1951, pp. 179-180).

(d) A Point-Scale Test: The test is designed to be a point-scale test where a successfully answered item is given a point or a score and such points gained by an individual in the whole test is evaluated by comparing with appropriate norms of his age or grade. It is needless to repeat here that such group tests are usually constructed as a point-scale using either centile norms or some kind of a sigma-score norms. The characteristics of a point-scale
as noted by Yerkes and reproduced by Stoddard (1943, p.141) are considered to be more suitable for the proposed test.

(e) A Test for Senior High-School Pupils: The test is intended to measure primarily the intelligence of pupils of senior high-school classes (VII, VIII, IX and X). A verbal test is found suitable (as stated earlier) for such students and the grouping of these four classes into one level should not complicate things as items are proposed to be selected in such a manner as to avoid different information-content of school subjects in these classes. Norms are to be prepared separately for these grades for evaluation of scores, and validities for the criterion of scholastic achievement are planned to be reported in due course. As the test is designed to be a point-scale test, norms for other groups and validities for other criteria may be established if such application is thought necessary in future.
SUMMARY

In this chapter a case is made out for the present research project of test construction and standardisation. First, the meaning of the term 'intelligence' is derived from the point of view of a test constructor and next a short account of factorial theories is given to aid our understanding of the subject. In the third and fourth sections, a brief history of intelligence testing is traced out and uses of such testing is discussed. In the fifth section, Indian attempts at intelligence testing are narrated summarily and the need of such testing in Assam is discussed. Finally, the research problem is stated and its important characteristics are established in the last section of the chapter.