While the teacher tried to cultivate intelligence, and the psychologist tried to measure intelligence, nobody seemed to know precisely what intelligence was -

- P.B. Ballard

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3.1 Introduction

Throughout the twentieth century, attempts to measure general mental ability, or intelligence, have played a preeminent role in psychological testing. In earlier years, the idea of general intelligence held forth; during the last three decades, with a few exceptions, attention has focused on intellectual abilities. However, measures of general intellectual ability are still widely used and, in spite of their theoretical deficiencies, have shown practical utility.

Like all other scientific procedures the development of intelligence tests has to pass through various stages before attaining the present scientific and statistically perfect and reliable level. The present chapter is devoted to the review of the tests developed. Development of general ability tests can be studied under two stages:

(1) The Pre-Scientific Stage
(2) The Scientific Stage

3.2 The Pre-Scientific Stage

In France, Jean Esquirol (1772-1840) tried for the first time to differentiate between mental deficiency and
mental illness. Thereafter in 1860, Francis Galton, the English geneticist and eugenist, invented methods of measuring physical characteristics, keeness of the senses and mental imagery. In 1879, Wundt opened the first psychological laboratory in Leipzig and tried to establish quantitative psychological laws by working with his colleagues, though, the general laws have little to do with individual differences.

In U.S.A., J. McKeen Cattell used mixed procedures drawing from Wundt's and Galton's laboratories in 1890. Cattell was the first man who was interested in the range of individual differences.

Jastrow prepared tests involving touch, vision, memory and reaction time. Boas made tests for physical measurements of children and obtained teachers' estimates. Gilbert gave tests measuring height, weight, lung capacity, sensation, memory, suggestibility, etc. Kraepelin and Oehrn in Germany developed tests to measure perception, memory, association and motor functions.

Muensterberg developed more complex and varied tests, introducing speed factor. Wissler's study in 1901, discouraged him in applied psychology. However, his brief tests were proved to be unreliable.
In India too, a variety of puzzles and conundrums were set before the scholars and officers in the courts of Hindu kings and 'darbars' of Muslim kings expecting instant solutions from them. The person giving immediate answer was regarded as intelligent.

Thus, the early movements in measurement of mental ability could be traced out, but the experiments were not perfectly scientific. The objectivity in testing was still to emerge, still however, the outline of the pre-scientific stage provides a background to compare the early efforts of psychological testing with scientifically developed testing.

3.3 The Scientific Stage

Present day intelligence tests are based on the work of a French psychologist, Alfred Binet. Associated with him were, first, V. Henri, and later, Théodore Simon. There can be no doubt that Binet was the shining light and genius of this most important contribution to modern psychological methods, even though many others contributed to the developments. Thus, Binet is considered as the father of the scientific approach in intelligence testing.
The Stanford-Binet Intelligence Scale is the healthiest surviving descendant of Binet's original scale. Binet developed his test to identify slow learners in Paris schools. Using a definition of intelligent behavior that stressed the ability to take and maintain a definite direction or set, the capacity to adapt in order to obtain a given end, and the power of self-criticism, he developed a test which was first published in 1905 and later revised in 1908 and 1911. Although the test departed from the current practices along many dimensions, three aspects were of greatest importance.

* the use of complex mental tasks as test items,
* the use of an age standard, (the concept of the mental age was first introduced on the 1908 revision), and
* the attempt to measure general mental development rather than separate mental faculties.

The test became popular and several attempts were made to translate it and adapt it for American usage. The adaptation that caught on in the United States was Terman's version, first published in 1916, which has become known as the Stanford-Binet Test. Terman's test was an extension and improvement on Binet's scale and, in many respects,
uses Binet's scale only as a point of departure. The 1916 version was important for several reasons. It was the first test to provide detailed administrative and scoring instructions, recognizing that variations along these directions could produce wide differences in scores. Second, the concept of the IQ was introduced. Third, the need for securing a representative sample of subjects for standardizing the test was recognized.

The 1937 revision did not attempt to measure anything different from the 1916 form but only to do a better job of measurement. Two forms of the test were constructed, Form L and Form M. The test covered the age range from 1½ to 18 years and was standardized on over 3000 children. Selection of items was based on three criteria:

* the item measured behavior considered intelligent,
* the percentage of children passing the item increased rapidly with age, and
* the mean mental age (MA) of children passing and failing the item differed significantly.

The test was very heavily loaded with verbal materials to the exclusion of items measuring other types of intellectual functioning and the administrative procedure was time-consuming. But compared to the earlier form of the Stanford-Binet and other available intelligence tests,
the 1937 revision did sample a wider range of abilities, covered a wider age range, and provided more detailed instructions for administration and scoring.

The 1960 Revision of Stanford Binet Scale

As Brown\textsuperscript{1} states, "When making a decision regarding the desirability of revising an existing test, a test constructor must consider the advantages of a revision - e.g. elimination of obsolete materials, utilization of new techniques of test construction etc., and then weigh these against the disadvantages of such a revision - e.g. the time and cost of the revision, and the rendering irrelevant of much of the normative, validity, and experimental data about the test".

In this revision more effective items have been retained and rearranged, and deviation IQ has been introduced.

In order to illustrate the content of the test, four different age levels have been picked up. Its brief description is as follows:

\begin{itemize}
\end{itemize}
Age-II
1. Three-hole Form Board: Placing three geometric objects in form board.
3. Identifying parts of the body: Point out features on paper doll.
4. Block Building Tower: Build four-block tower by imitating examiner's procedure.
5. Picture Vocabulary: Naming common objects from pictures.

Age - VI
1. Vocabulary: Correctly define six words on 45 word list.
2. Differences: Telling difference between two objects.
3. Mutilated Pictures: Pointing out missing part of pictured objects.
4. Number Concepts: Counting number of blocks in a pile.
5. Opposite Analogies: Solve analogies like "Summer is hot; winter is ________".
Age - X

1. Vocabulary: Correctly define eleven words from the list of words.
2. Block Counting: Counting number of cubes in three dimensional picture, some cubes are not apparent.
3. Abstract words: Definition of abstract adverbs.
5. Word Naming: Naming as many words as possible in one minute.
6. Repeating six digits: Repeat six digits in order.

Average Adult

1. Vocabulary: Define 20 words correctly.
2. Ingenuity: Algebraic word-problems involving mental manipulation.
3. Differences between Abstract Words: Differentiate two related abstract words.
5. Proverbs: Giving meaning of proverbs.
7. Essential Differences: Give principle difference between two related concepts.
There are two limitations of Binet's tests:

1. Being verbal tests, they cannot be administered to the illiterate, deaf and mute, and
2. Being individual tests, they consume a great deal of time.

To minimize these limitations, two types of tests have been developed. They are:

1. Performance Tests, and
2. Group Tests.

3.4 Performance Scales

According to Mehrens and Lehmann, "A test is called a performance test if the tasks involved demand a manipulation of objects (e.g. making geometrical configurations with blocks) rather than an oral or written response."²

This type of test is most helpful in assessing the level of intellectual functioning for people who have language disabilities, deafness, blindness etc.

Some examples of performance scales are the Pintner-Patterson Scale (1917), the Cornell-Coxe scale, the Arthur point scale (1930), the Cattell Infant intelligence scale,

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the Merrill-Palmer Scales, and the Leiter Adult Intelligence Scale, the Koh's Block design (1923), Porteus Maze Tests (1914, 1924, 1950 & 1959), Alexander's Passalong Test, Collins and Drever's Performance Tests.

Wechsler Scales:

The Stanford-Binet Scale has certain drawbacks as a measure of adult intelligence. In the scale, the items developed for children have been inappropriated for adults. Then, too, use of the mental age concept is of a questionable utility with adults. And, thirdly, the available normative data were collected on children and not on adults.

The Wechsler-Bellevue Intelligence Scale was first published in 1939 and the scale was modified and restandardized as the Wechsler Adult Intelligence Scale (or WAIS) in 1955.

The Wechsler Intelligence Scale for children (WISC) was published in 1949. It is designed for ages 5 to 15. The Wechsler pre-school and primary scale of Intelligence (WPPSI) was published in 1967 for the ages 4 to 6½. For all the tests, Wechsler has computed Deviation IQs.

The 11 sub-tests of WAIS have been described in brief as follows:

**Verbal Scale**: It consists of 6 sub-tests.

1. **Information**: (29 items) which measure the range of the examinee's knowledge, retention of learned materials, and assess the examinee's cultural background.

2. **Comprehension**: (14 items) measuring judgement and common sense.

3. **Arithmetic**: (14 items) testing concentration, arithmetic ability, and problem-solving skill.

4. **Similarities**: (13 items) measuring logical thinking and conceptual ability; a good measure of general intelligence.

5. **Digit Span**: Tests attention and immediate memory by items requiring examinee to repeat series of digits either forward or backward.

6. **Vocabulary**: (40 words of varying difficulty). It is the best single index of full-scale IQ; indicates range of knowledge and cultural background.

**Performance Scale**: It consists of 5 sub-tests.

1. **Digit symbol**: Measures flexibility and ability for
new learning through a task requiring the substitution of symbols for numbers.

2. **Picture completion**: 21 items that require examinee to tell what is missing in a picture of a common object. Measures perceptual ability, particularly ability to differentiate essential from unessential details.

3. **Block Design**: Examinee reproduces designs with coloured blocks. It measures ability to analyse and organize.

4. **Picture Arrangement**: Requires examinee to arrange a group of pictures to tell a coherent story. It measures ability to comprehend a total situation.

5. **Object Assembly**: Task is to assemble pieces of a puzzle to form a common object. It tests perceptual ability and persistence.

The individual's score is based on the number of items answered correctly. For this reason, the WAIS is referred to as a point scale.

**Other Wechsler Scales**

The Wechsler Intelligence Scale for Children (WISC) is an extension to lower age levels. The format of the WISC
is similar to the adult scales, only one WISC sub-test (Mazes) does not appear in the adult form. Many of the WISC scales were constructed by adding easier items to the adult scale and eliminating some of the more difficult items.

In 1967, Wechsler Preschool and Primary Scale of Intelligence (WPPSI) was published for the age-groups 4-6½. The format of sub-tests is quite similar to the WAIS and WISC, but certain changes have been made (e.g. inclusion of more non-verbal tasks) to make the test appropriate for pre-schoolers.

3.5 Group Tests of General Ability

Group tests of general ability are typically composed of several types of items: vocabulary, general information, arithmetic and reasoning items. In particular, group tests of general ability are often heavily weighted with vocabulary items, either in the traditional form or in varied form, such as selecting the correct word for use in a sentence or in items of analogies. The widespread use of vocabulary items reflects the empirical finding that vocabulary is the best single index of intelligence. General information items are included to estimate the individual's range of knowledge. Arithmetic items generally involve simple computations. Reasoning items may be verbal or non-verbal analogies. By and large, group tests include the item-types
that have proven to be the most valid indices of intellectual ability.

Group tests share certain common features. Group administration permits more efficient testing of large number of persons. Group tests are usually paper and pencil tests with items cast in the multiple-choice format.

Although group intelligence tests were originally designed to be economical substitutes for individual tests, and still are widely used in just this manner, they have assumed an existence of their own. Group intelligence measures are also used for industrial and business screening. These tests are generally short, are constructed along traditional lines, and include items covering the common components of intellectual ability.

Now due to increasing popularity and demand of group tests, a need for construction and standardization of group tests of general ability has been felt. A brief outline of the existing group tests is given below.

Noteworthy Group Tests

1. **American Council Psychological Examination** (ACE):

   It is developed by L.L. & T.G. Thurstone in 1924 and has passed through various revisions. It is meant for college entrants.

2. **Army Alpha Examination** (1916, 1939)

   It is meant for secondary school students and adults. It consists of sub-tests like information, reasoning and practical judgement.

3. **Army General Classification Tests (AGCT)** 1945:

   It was developed during the world war II and was meant for age-group 9-16 and adults. The items are based on vocabulary, arithmetic, reasoning and block counting and they are arranged in spiral omnibus form.

4. **California Test of Mental Maturity (CTMM)**:

   It is developed by E.T. Sullivan, W.W. Clark, B.W. Tiesgs for K.G. to 12 with variety of items. Separate "Language" and "Non-language" IQs are offered. It is a widely accepted, current test.

5. **Culture-Free Intelligence Tests** (1950):

It is developed by R.E. Cattell, for ages 4 to adult. It is a non-verbal test consisting of matrices and other reasoning tasks. It is independent of language skill but is not truly free of cultural influences.


It is a verbal test meant for Grades 3-12.

7. **Kuhlmann-Anderson Intelligence Tests** (1963):

It is meant for grades K-12. It has 30 separate parts.

8. **Davis-Eells Games** (1953):

It is developed by Davis and Eells for grades 1-2, 3-6, full of pictorial items.

9. **Lorge-Thorndike Intelligence Tests** (1954):

The test is meant for K.G. to high school students. The test consists of verbal and non-verbal items.

10. **Otis-Lennon Mental Ability Test** (1967):

It consists of verbal and non-verbal reasoning items to obtain a quick measure of general ability of children from K.G. to 12th grade.
11. **Pinter General Ability Tests** (1945):

It consists of separate language and non-language tests for grades 4 to 9.

12. **Primary Mental Abilities Test** (1963):

It is meant for grades K.3. to 12. It consists of items measuring verbal meaning, spatial ability, perceptual ability, number facility, and reasoning ability.

13. **Progressive Matrices** (1951):

It is a non-verbal test for age-group 5½ to 11 years and is developed by J.C. Raven and H.K. Lewis.

14. **Semantic Test of Intelligence** (1952)

It is a non-reading test for testing conceptual reasoning.

15. **SRA Tests of General Ability (TCGA)** (1960):

The tests are developed by J.C. Flanagan for grades K.G. to 12. It eliminates school learned skills. The tests consist of two sub-tests, viz., information and reasoning. All the test items are in pictorial form.

"TCGA Part I (information) scores appear to relate more closely to Thurstone's Verbal Comprehension Factor and...
and Part II (reasoning) seems to relate to his reasoning factor. 6

It provides a measure of general intelligence using items not dependent upon formal school learning.

3.6 Group Tests of Intelligence Developed in India

In India, verbal and non-verbal group tests of intelligence have been developed in various languages such as hindi, panjabi, urdu, gujarati, marathi, gorkhali, bengali, malayalam and english.

The following table states the information about the tests developed in India.

Table 3.1

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Test</th>
<th>State or City</th>
<th>Investigator</th>
<th>Verbal Std. or Age</th>
<th>Non-verbal or Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group test of Intelligence</td>
<td>Assam</td>
<td>K.P. Bora</td>
<td>Verbal VII to X Stds.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Group tests of Intelligence</td>
<td>Bombay</td>
<td>G.C. Ahuja</td>
<td>Verbal 13 to 17 yrs.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Test of General mental ability</td>
<td>U.Pradesh</td>
<td>R.K.Tandon</td>
<td>Verbal For College students</td>
<td></td>
</tr>
</tbody>
</table>

contd.

<table>
<thead>
<tr>
<th>#</th>
<th>Test Description</th>
<th>Location/Examiner</th>
<th>Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Group tests of Intelligence</td>
<td>Bombay P.Ahuja</td>
<td>Verbal 9 to 13 yrs.</td>
</tr>
<tr>
<td>5</td>
<td>Group tests of Intelligence</td>
<td>Delhi M.S.Yadav</td>
<td>Verbal 8 to 12 yrs.</td>
</tr>
<tr>
<td>6</td>
<td>Group test of Intelligence</td>
<td>Rajasthan Prayag Mehta</td>
<td>Verbal 12 to 14 yrs.</td>
</tr>
<tr>
<td>7</td>
<td>Group tests of Intelligence</td>
<td>U.Pradesh Bureau of Psychology (Allahabad)</td>
<td>Verbal 12,13 &amp; above 14 yrs.</td>
</tr>
<tr>
<td>8</td>
<td>Group test of Intelligence</td>
<td>U.Pradesh M.C.Joshi</td>
<td>Verbal VIII-XI Stds.</td>
</tr>
<tr>
<td>9</td>
<td>General mental ability test</td>
<td>U.Pradesh Jalota</td>
<td>Verbal VIII-X Stds.</td>
</tr>
<tr>
<td>10</td>
<td>C.I.E. Verbal test</td>
<td>Delhi Central Institute of Education Delhi</td>
<td>Verbal Above 13 yrs.</td>
</tr>
<tr>
<td>11</td>
<td>Group test of Intelligence</td>
<td>Maharashtra A.K.Pathak</td>
<td>Verbal 9-13 yrs.</td>
</tr>
<tr>
<td>12</td>
<td>Self-taking Group test of Intelligence</td>
<td>Maharashtra A.W.Oak</td>
<td>Verbal 7-11 yrs.</td>
</tr>
<tr>
<td>13</td>
<td>Group test of Intelligence</td>
<td>Punjab P.S. Hundal</td>
<td>Verbal 13-17 yrs.</td>
</tr>
<tr>
<td>14</td>
<td>Test of Intelligence</td>
<td>Punjab J.B.Singh</td>
<td>Verbal VIII-X Stds.</td>
</tr>
<tr>
<td>15</td>
<td>Group test of Intelligence</td>
<td>Kashmir B.L.Kaul</td>
<td>Verbal 12-15 yrs.</td>
</tr>
<tr>
<td>16</td>
<td>Group test of Intelligence</td>
<td>Nepal R.E.Pandey</td>
<td>Verbal VIII-X Stds.</td>
</tr>
<tr>
<td>17</td>
<td>Group test of Intelligence</td>
<td>Kerala P.G.Pillai</td>
<td>Verbal Sec. School contd.</td>
</tr>
</tbody>
</table>
The tests developed in Gujarat State (India) have been shown separately in the table to follow:

<table>
<thead>
<tr>
<th></th>
<th>Non-verbal test of Intelligence</th>
<th>Bombay</th>
<th>G.H. Nafde</th>
<th>Non-verbal</th>
<th>VIII-XI Stds. &amp; College students</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Non-verbal test of Intelligence</td>
<td>Mysore</td>
<td>M.G. Premlata</td>
<td>Non-verbal</td>
<td>7-13 yrs.</td>
</tr>
<tr>
<td>20</td>
<td>Culture-free test of Intelligence</td>
<td>Assam</td>
<td>O.D. Trivedi</td>
<td>Non-verbal</td>
<td>X std. &amp; above</td>
</tr>
<tr>
<td>21</td>
<td>Non-verbal test of Intelligence</td>
<td>Kerala</td>
<td>A.S. Nayar</td>
<td>Non-verbal</td>
<td>VIII-X stds.</td>
</tr>
<tr>
<td>22</td>
<td>Non-verbal test of Intelligence</td>
<td>Delhi</td>
<td>I. Jain</td>
<td>Non-verbal</td>
<td>For Higher Sec. school</td>
</tr>
<tr>
<td>23</td>
<td>Abstract Intelligence Test</td>
<td>Bombay</td>
<td>M. Shah</td>
<td>Non-verbal</td>
<td>VIII-XI Stds.</td>
</tr>
<tr>
<td>24</td>
<td>Non-Language test of verbal Intelligence</td>
<td>Calcutta</td>
<td>S. Chatterji &amp; S. Mukharji</td>
<td>Mixed VIII Std.</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.2
Tests Developed in Gujarat (India)\(^7\)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the test</th>
<th>Investigator</th>
<th>Verbal, Non-verbal or Mixed</th>
<th>Std. or Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group test of Intelligence</td>
<td>K.G. Desai</td>
<td>Verbal</td>
<td>12-18 yrs.</td>
</tr>
<tr>
<td>2</td>
<td>Group test of Intelligence</td>
<td>Desai &amp; Bhatt</td>
<td>Verbal</td>
<td>12-18 yrs.</td>
</tr>
<tr>
<td>3</td>
<td>Group test of Intelligence</td>
<td>G.L. Bhatt</td>
<td>Mixed</td>
<td>V-VII Stds.</td>
</tr>
<tr>
<td>4</td>
<td>Non-language test of Intelligence</td>
<td>D.M. Bhavsar</td>
<td>Non-verbal</td>
<td>12-18 yrs.</td>
</tr>
<tr>
<td>5</td>
<td>Non-verbal group test of Intelligence</td>
<td>G.B. Shah</td>
<td>Non-verbal</td>
<td>7(\frac{1}{2})-14(\frac{1}{2}) yrs.</td>
</tr>
<tr>
<td>6</td>
<td>Group test of Intelligence</td>
<td>Lele and others</td>
<td>Verbal</td>
<td>11-16 yrs.</td>
</tr>
<tr>
<td>7</td>
<td>Non-verbal Group test of Intelligence</td>
<td>M.M. Patel</td>
<td>Non-verbal</td>
<td>14 to 16 yrs.</td>
</tr>
<tr>
<td>8</td>
<td>Verbal Group test of Intelligence</td>
<td>Jayaben Patel</td>
<td>Verbal</td>
<td>13-16 yrs.</td>
</tr>
<tr>
<td>9</td>
<td>Group test of Intelligence</td>
<td>J.M. Patel</td>
<td>Mixed</td>
<td>13-16 yrs.</td>
</tr>
<tr>
<td>10</td>
<td>General Ability Tests</td>
<td>M.T. Patel</td>
<td>Non-verbal</td>
<td>VIII-X Stds.</td>
</tr>
<tr>
<td>11</td>
<td>'Draw a man' test</td>
<td>Premila Phatak</td>
<td>Pictorial</td>
<td>Above 6 years</td>
</tr>
</tbody>
</table>

The present test being non-verbal in nature, the investigator has attempted to peep into the existing non-verbal group tests of intelligence developed in Gujarat State.

The first of this type of tests is developed by G.B. Shah.

1. **Gunvant Shah's Non-verbal Group Test of Intelligence (1964):**

   In Gujarat, G.B. Shah has done pioneering work by developing a non-verbal group test of intelligence in 1964 for the age-group 8 to 14 years. The test consists of seven sub-tests. Similarity, Classification, Analogy, Absurdity, Progressive Series, Substitution Code and Picture. The entire test includes 79 items.

   It is a speed test requiring about 45 minutes for administration. Reliability coefficient of the test is .86.

2. **Bhavsar's Non-Verbal Group Test of Intelligence (1967):**

   It is non-verbal in nature, meant for the children of Stds. IX, X and XI. It consists of 6 sub-tests like similar figure, classification, Analogies, Mirror reflection, series and completion. The testee is expected to attempt total number of 112 items for which the time allowed is 32 minutes.
First two items in each of the sub-test are provided for practice. Coefficient of reliability by split-half method is .93, that by test-retest method is .91 and by K.R.-21 is .91.


   The test is for the age-group 14+ to 16+. There are four sub-tests, having geometrical designs based on four forms: Series, Synthesis, Analogy, and Classification. It includes 80 test items. One practice item is provided for each sub-test. The time limit of the test is 40 minutes.

   The reliability coefficient by test-retest method with an interval of seven days is .93 and that with an interval of eight months is .82. The test validity against Desai test is established as .68.


   The test is developed for the pupils of standards VIII through X. It consists of two sub-tests, Information and Reasoning. It includes 75 items. Two practice items are given in the beginning of each sub-test. The time-limit for the test is 40 minutes.

   The reliability coefficients range from .82 to .94 by different methods. The test validity against Bhavsar's Test is established as .77.

The test is meant for the pupils of standards V through VII. The test includes two sub-tests: Information and Reasoning. It includes 76 items with two practice items in each of the sub-tests. The time limit for the entire test is 42 minutes.

The reliability coefficient of the test is .91.

### 3.7 Rationale for the Present Test

Nowadays there is a great demand of different types of tests by the teachers, administrators, counsellors, researchers and parents. Looking to the development of tests in advanced countries, work done in India seems to be less. Hence, the present investigator has modestly ventured to develop one more test along with a very few existing non-verbal tests for the students studying in higher secondary schools of Gujarat State.

On classifying the available tests on the basis of types, age-levels, grades, content, etc., it was observed that a very few non-verbal group tests exist in Gujarat. It was also felt from the review of the development of tests in India and abroad that it was essential for the group tests of general ability to consider some of the factors like time-limit, number of sub-tests, and weightage to environmental factors alongwith heredity factors.
As Anastasi puts it: "A practical difficulty encountered with separate sub-tests is that less careful examiners may make timing errors. Such errors are more likely to occur with several short time-limits than with a single long time-limit". 8

To eliminate this difficulty, the test ought to utilize less number of sub-tests and minimum possible time limit.

As to the role of heredity and environment in the determination of individual's general mental ability Ebil, Noll and Bauer state:

"The belief that intelligence is completely dependent on genetic influences without appreciable change by environmental factors is now seldom held. The current tendency is to give both heredity and environment some of the credit for performance of intelligence tests." 9

Widely popular Tests of General Ability of United States, were found unique in including all the elements discussed in the foregoing paragraphs. J.C. Flanagan advocating for this writes:


"Items measuring information and reasoning were selected for inclusion in the Tests of General Ability for two reasons. First, it appeared that these two abilities are dominant in most of the definitions of general intelligence. Secondly, a review of the literature indicate that these two abilities usually provide best predictions of school success". 10

It will be in fitness of things to bring into light about the inclusion of much wanted elements, in the test. By including 50% of the information items, the effect of environment in determining general ability has been duly considered. Information part of the test is designed to test pupil's familiarity with the world around him through experiences at home, in school, and in the community. The problems relate to general knowledge of his surroundings, gained through his deep observation of the surrounding environment. The reasoning part avoids any cultural content and tests the pupil's powers of abstract reasoning, which is very similar to genetic differences in general ability which are inherited and affect the individual's performance throughout life.

The equal weightage given to reasoning and information factors supports the current tendency; and the investigator will put forth first test of this type for the higher secondary children of Gujarat. It is felt that more number of sub-tests in group tests adds to the difficulty in administration, and moreover the growing generation finds it difficult to take test for a longer time. The present test pictorial in form; with two sub-tests and demanding about 45 minutes for administration might be considered unique.

Now looking to the list of work done in Gujarat, in the direction of intelligence testing, it can be observed that every test has its speciality. Most of them are adaptations of some foreign tests or conversion of some verbal test into mother tongue, Gujarati. It was also found that there is a necessity of a non-verbal group tests of general ability for higher secondary students, which must be standardized on the population of Gujarat. J.Z. Patel and M.T. Patel has worked in this direction by developing general ability tests for the students of standards V through VII and VIII through X.

The present test is a non-verbal test and is expected to serve as a tool to measure individual differences of students studying in standards XI and XII in their general ability.
The proposed research scheme, for the development of a general ability test for the students of higher secondary schools of Gujarat State, was instantly approved and granted research fellowship by the University Grants Commission at the advent of plus two pattern i.e., pattern of higher secondary schools in the administrative and educational structure. Thus, the investigator could provide at the right moment, the most essential tool to measure individual differences in general ability to all concerned with education of the higher secondary school pupils.