

Nature of Intelligence

Intelligence is a mental power or faculty. It is very difficult to give a logical definition of intelligence. Psychologists differ among themselves with regard to the nature of intelligence just as the idealist philosophers differ with regard to the Absolute. There is a saying that 'so many psychologists, so many definitions of intelligence.' It is, therefore, needless to say that there is no definition of intelligence which is acceptable to all.

Man differs from the lower animals in so many important points that no comparison can be instituted between them. Hereditary behaviour-pattern is sufficient for the lower animals to adapt themselves to the environment. On the other hand, the human baby, after birth, remains for a few years completely dependent on others. What we understand by human behaviour is mostly learnt or acquired. The learning goes on for long and ultimately the hereditary behaviour patterns yield place to newer behaviour patterns. These newer behaviour patterns help man to adjust himself to new situations. Evolving new behaviour patterns and adjustment with new and changed circumstances are due to a special power or capacity. This power has been characterised as intelligence by many psychologists.

In the case of primitive man, intelligence was not much needed. Primitive man was in most cases led by instincts. He lived in a simple environment and there was practically no problem, in the present day sense of the term, for him to face. As time passed, the primitive man's environment became more and more complex ; and his instincts could no more help him to adjust with this changed circumstances. He then found it necessary to employ his intelligence for solution of such problems. So, we find that the primary task of intelligence is to help one in solving problems and also help one in the matter of adapting oneself to new or changed environments.

Intelligence is so subtle that it is very difficult to understand its nature. Behaviourists have sought to understand and measure intelligence by one's performances and conversations. But they have failed to present clearly the nature of intelligence. We can only say that individual differences in intelligence are evidenced and, hence, this intelligence is innate power. Everybody has intelligence in a greater or smaller degree and it can also be measured to some extent.

Psychologists have variously defined intelligence. Thorndike has called it the '*sum of various capacities.*' According to Cyril Burt, intelligence is '*the power of readjustment to relatively novel situation, by organising new psycho-physical combinations.*' Pintner, following Burt, defines intelligence as '*an evaluation of the efficiency of a reaction or a group of reactions under specific circumstances.*' Dearborn holds that '*intelligence is the capacity to profit by experience.*' According to Terman, '*an individual is intelligent in proportion as he is able to carry on abstract thinking.*' Woodrow has defined intelligence as '*a capacity to acquire capacity.*' There are some psychologists who define intelligence as that faculty which is measured in intelligence-tests.

The above definitions may be grouped under three classes. Some definitions have laid stress on abstract thinking, some on the capacity to learn and some on the capacity of adjustment. We think that the definitions which fall under the last group are more important than the others. We may define intelligence as the inborn capacity or power to associate ideas with events and to adjust ourselves with environments. But we cannot thereby ignore the capacity to learn. Without the capacity to learn, it is not possible to adjust ourselves with environments. Most psychologists will agree that intelligence involves all the three abilities mentioned above and perhaps even something more. Intelligence is certainly some kind of ability which characterises one's manner of dealing with environment and his problems. Considering the various aspects, Rex and Knight have sought to define intelligence as '*the capacity for relational constructive thinking directed towards the attainment of some end.*'

We have seen how and why a man learns in his day to day life.

There are also cases where a man learns after unsuccessful activities. There are seen individuals differences in learning. He is surely more intelligent who learns first. So in the matter of intelligence also, there is individual difference. To take an example,—Ram, Shyam and Jadu (all of the same age) are given separately three quinine pills to swallow. All of them threw the pills away immediately after putting them in the mouth. Next day the same pills are given. Ram and Shyam refused to accept the pills, whereas Jadu put the pill in his mouth. Next day, Elkosin pills are given. Ram refused, but Shyam and Jadu put the pill in their mouth. Here we may say that Ram is more intelligent than the other two. He has been able to understand the similarity of the two pills. Shyam is also more intelligent than Jadu, because on the second day he refused to accept the pill. Hence, intelligence help us in ascertaining the relation between different things.

Theories of Intelligence

From the hoary past philosophers and psychologists have been trying to explain the nature of intelligence but in vain. We are ashamed to say that the exact nature of intelligence still remains a mystery. But the baffling nature of intelligence could not pour cold water on the enthusiasm of the psychologists who tried off and on to unveil the mysterious nature of intelligence. And in course of time, several theories have been clustered around the nature of intelligence. Of these theories only three are important, each of which is presented here.

(a) **The Faculty Theory** : According to the faculty theory, intelligence consists of a number of relatively independent and largely correlated and specialised abilities of various types such as memory, imagination, honesty and language and reasoning ability. This theory is closely related to the *disciplinary conception of education*. The essence of the Disciplinary conception of education can be given in a few words ; namely that it is the process of learning rather than the thing learned that is important and basic thing in education. The pseudo-science of phrenology is also one of the planks upon which the faculty theory stands. The balance of expert opinions is now so solidly against the faculty theory that as a theory concerning the nature of intelligence, it

has no value whatever. Even the physiologists have found no evidence of nerve-centres corresponding to the alleged faculties of mind.

(b) **Spearman's Two-factor Theory** : The famous British psychologist, *Spearman* presented his two-factor theory in 1904. In his epoch-making book 'The Abilities of Man,' he shows that there is a common factor in all intellectual activity of man. He calls this common element g . This g is not what is called intelligence itself, it is a general factor that enters into all intelligent activity. According to him g depends on the general mental energy with which each individual is endowed. In addition to g , Spearman recognised special abilities or s factors. It should be remembered that g is, according to Spearman, present, in specific as well as in group factors.

(c) **Primary Mental Abilities Theory** : Spearman's pioneering work gave impetus to a large number of psychologists. In a sense his work may be regarded as a starting point for the present 'factor analysis' approach to the nature of intelligence. What Spearman did do was to make clear the new meaning of intelligence, which existed in rather a nebulous state in the mind of the educated class; to formulate an entirely new theory, based on new methods, both of which were to receive a further development in subsequent times.

Soon after the publication of Spearman's magnum opus 'The Abilities of Man,' a number of enthusiastic psychologists began to make frantic search for basic factors in mental ability. In course of time, these psychologists claimed to have discovered some primary abilities or factors. Sir Cyril Burt by his painstaking investigation found three group factors—verbal, numerical and practical. In order to determine total activity, these special factors must combine with g . Spearman compared these s factors to a large number of engines, which could be enlivened by the energy g . The s -factors are modifiable factors. Education and training can bring about change in these factors, whereas g is born and not educable. Spearman also recognised the existence of broad group factors. These group factors, such as mathematical ability, verbal and spatial ability arise from the

lapping of numerous *s*-factors. These group factors are not so general as *g*, but certainly not so limited as *s*-factor. To be more precise, take the instance of a person whose mathematical ability (which according to Spearman is a group factor) is high. We may expect him to be good not only in mathematics, but in physics, engineering, and higher technical know-how as well, because in all these activities mathematical ability is a 'must'. Thus according to the Spearman's two-factor theory, a general factor *g*, group factors and many *s* or specific factors constitute intelligence in school subjects in addition to a general factor. But the investigators of Minnesota Study of Mechanical Ability did not find a general factor *g* in their investigation. So, the investigation questioned the very basis of Spearman's two-factor theory. Among the factor analysts, Thurstone raised the standard of revolt against Spearman's two-factor theory. In 1938 he began to publish his investigation results serially. In all his investigations he did not find *g* at all, but he found seven distinct multiple factors. The seven main or primary factors are as follows : Verbal (*V*), Perceptual speed (*P*), Number (*N*), Memory (*M*), Reasoning (*R*), Word-fluency (*W*), Space or visualisation (*S*).

The findings of Thurstone produced great effects in the field of psychology. Though Thurstone's findings have mathematical and psychological basis, they cannot be accepted as final. Thurstone's primary factors are not unchangeable or fixed in their respective sphere. Spearman himself criticised the finding of Thurstone. Spearman pointed out that as Thurstone's tests were closely related they could equally well be analysed to yield a general factor as well as group factors. The subsequent investigations carried on by factorial psychologists both in America and in Great Britain prove beyond doubt the existence of a *general factor*. The U. S. E. S. Investigations found factors like verbal (*V*), perceptual (*P*), motor speed (*T*), number (*N*), clerical (*Q*), finger dexterity (*F*), space (*S*), logic (*L*), manual dexterity (*M*), aiming (*A*), and also a general factor.

Psychologists like Vernon, Burt, Guilford have made important contribution in the field of Factor analysis. Godfrey Thomson, of the U. K., a psychologist, has put forward a new theory of

intelligence of late. This theory is called *the Sampling Theory of Intelligence*. According to this theory human mind contains innumerable units of energy, the identity of which cannot be described at the present moment. According to Thomson the complection of a particular mental activity is possible because of the combination of a number of such units of energy during a mental process, but how and which ones of those units of energy combine for the purpose noted above will depend upon the nature of that peculiar mental activity and also on the energy-content of those units of energy which determine the process in which some quanta of energy come together and others keep apart.

The above-mentioned theories concerning the nature of intelligence jointly or separately have failed to explain the true nature of intelligence. Each of these theories is still in experimental stage and hence cannot be accepted as final. It is not too much to say that these theories explained are not as yet perfect in all respect. It has not yet been possible to isolate and identify the ultimate factors of mental ability. And the question, what then is intelligence still requires solution.

The Difference between the modern psychology of mental and

Intelligence tests. How do they resemble or differ from Achievement test.

Some Psychologists and almost all laymen regard intelligence as a single ability common to all intellectual processes. We do not accept this all-pervading intelligence but we do accept that intelligence is an ability or capacity of some kind. It operates in various ways. It is found in higher rather than lower mental processes and in novel situations.

Pure intelligence cannot be tested. When we say that we measure intelligence by using intelligence tests we mean more or less 'innate, general cognitive efficiency' as Burt puts it. An intelligence test is a form of examination no doubt, but its main task is to get a sample of the quality of one's intelligence and it is also a fruitful procedure for finding out what a person is capable of doing. In short, intelligence test seeks to measure the strength, precision or effectiveness of the present operation of any mental activity. "Intelligence or mental tests are instruments for measurements of individual abilities or types of behaviour, with maximum emphasis on differences due to original nature rather than to training or environment."

Many a psychologist believes that there is practically no difference between Intelligence test and Achievement test. In favour of their assumption they put forward the thesis that both the tests depend upon knowledge or skill. There is some truth in their assumption because pure intelligence cannot be tested.

all the intelligence tests depend upon some sort of knowledge or skill. But a serious student of psychology will not fail to discern the difference between an Intelligence test and an Achievement test. The former intends to discover the capacity of the individuals concerned. It means that the intelligence tests do not bother about the use that has actually been made of natural abilities of the individuals concerned. To be more precise, the Intelligence test tries to measure the inherent capacity of an individual, or group of individuals. On the other hand, Achievement tests try to measure the actual achievement which the individuals concerned have made. To be more clear, Achievement tests try to measure the products of training or education. They are intended to find out what use has actually been made of natural abilities of the individuals concerned.

But it is a fact that both are intimately related to each other because the aim of both is to measure the present efficiency of the individual.

In conclusion, we may say that Intelligence tests do contain factual materials and it has not been possible to construct an Intelligence test absolutely free from knowledge and skill which have largely been learnt. The justification for the inclusion of factual items in an Intelligence test is that almost all the persons get the same opportunity in learning such facts and that the individual differences in answering test items show difference in intellectual level of the individual concerned. But still it would be our endeavour to keep Intelligence tests free from factual material as far as practicable. Kelley and Cattell are of opinion that the correlation co-efficient between an Intelligence test and an Achievement test should remain between .40 and .60. It means that the factual knowledge and learnt skill should be kept at a minimum in a good intelligence test.

Intelligence tests are of various kinds. They are classified according to their respective aims and objectives.

(a) **Individual Intelligence Test (verbal) or Individual test of general Intelligence** : This type of Intelligence test is most widely used by educators and psychologists. Verbal Individual Intelligence tests are largely modelled after the Binet-Simon test.

This type of tests presupposes a certain mastery of language. The new revised Stanford-Binet test of Intelligence (Ferman & Merrill's Revised M form Scale) is today the best known and most widely used individual test of general intelligence. Wickeel's intelligence test falls in this category though it is meant for the adult.

(b) **Group Tests of Intelligence (verbal)** : There is certainly a difficulty in the use of Individual Intelligence tests widely. It requires enough money and time. To meet this problem Group tests of intelligence have been evolved to take the place of Individual Intelligence tests. This type of tests originated in America during the First World War (1914-18). The Army Alpha and the Army Beta Tests were developed for use in selecting Army recruits for officer's training. Shortly after the war, Otis, Terman and others began to bring out Group Tests meant for schools and colleges. The Lorge-Thorndike Intelligence Test is an example of this type of test. The Army General Classification Test (AGCT) also come under this category. It is needless to point out that this type of tests largely depends upon language. The advantage of group test that it covers large number of candidates in a short time.

(c) **Non-verbal Intelligence Tests (Individual)** : There was a drawback in Intelligence Test (both individual and group), that most of the tests presuppose a certain mastery of language and naturally to those who have language difficulties tests like Binet-Simon are not fair. Hence, to obviate this difficulty non-verbal tests have been devised in which the examinees have to do something with their hands. Some psychologists claim that these tests give a fairer test of general intelligence. Pass-along Test, Form Board and other types of Performance Test belong to the category of Non-verbal Individual Intelligence Test. The so-called Paper-pencil Tests also come under this type. The Kellogg-Mortimer Revised Beta Examination is an example of Non-verbal Individual Intelligence Test (Paper-pencil variety).

(d) **Non-verbal Group Intelligence Tests** : This type of tests require motor or manual rather than verbal responses. In these tests language is required neither in administering them nor in responding to them. The Army Beta and the Detroit First Grade Intelligence Test belong to this category.

The importance of verbal Individual Intelligence Test (and Group) can never be over-estimated. These tests constitute the most accurate devices for the measurement of intelligence. These tests also help us understand the nature of the gradual development of intelligence.

This type of tests help in the classification of pupils in schools according to ability. They help in detecting mental deficiency or dullness, and for selection. The selection of applicants for college or professional school largely depends upon Intelligence Tests.

Another use of Intelligence Tests is in the field of educational guidance and vocational selection.

The final practical use of Intelligence Tests is the measurement of the efficiency of educational institutions. Here, efficiency means the relationship between achievement and capacity.

~~The structure of the Binet Scale of Intelligence (or any of its revision).~~

From our everyday experience, we find those who are good in one kind of activity are also good in other kinds of activities. For example, in the class-room a pupil good in Arithmetic is also good in, say, English ; he may not be equally good, but not usually bad. From that we infer that there is something in the pupil which is responsible for doing well in different fields. The Layman says, his general intelligence plays its part. Among psychologists we find some people holding similar views. (The general intelligence makes its expression through language, ideas or concepts. Binet of France, a psychologist, started with the help of a psychiatrist named Simon the present practice of mental testing by putting a number of questions involving thought and observation so that the subject could give answers rather from the result of his own experience and reflection than from what he learnt from schools or homes. Binet in 1905 arranged 30 simple items for testing some abnormal children of different ages. But the difficulty was that no mental grouping was possible).

In 1908 he devised another test consisting of 60 items retaining the 30 items of 1905 test. He also prepared Mental Age grouping of tests of 3 to 13 years old. This test was standardised on an

examination of 200 poor children of Paris. In 1911 he made another revision. In his revision he transferred some tests from one group of age to another.) Binet Tests, as Terman puts it, believed that in intelligence three factors are involved—a tendency to take and maintain; the capacity to make adaptation for the purpose of attaining a desired end; the power of auto-criticism. Binet devised intelligence scale but he did not understand intelligence very clearly. (He also introduced the concept of mental age. He got the age norms for a given test by giving the test to a representative group of appropriate age range, dividing the total group into smaller groups on the basis of age, and computing the average score for each succeeding age group.) Usually, such groups are divided by month intervals.

The Binet-Simon tests formed the basis of numerous other tests conducted in America, England and Germany. (The Binet-Simon tests underwent important modification and revision. Why did the need for this modification arise at all? First, Binet applied his tests upon poor Parisian children. This may not be familiar to all children, so it may not be followed by one and all.) It means Binet did not care to take sufficient care to standardise his test. (Secondly, Binet Tests depend on scholastic ability.) (Lastly, it is very difficult to understand what Binet wanted to measure. His tests lack in clear objective.) But it is no denying the fact that Binet laid the foundation of modern mental testing programme. (There is a good correlation between Binet's intelligence test and scholastic attainment and for diagnosis of mental deficiency it is a good test no doubt.)

Binet Tests were not only tests but schemes and accordingly some prominent psychologists have offered modifications of the original Binet-Simon tests. (New Revised Stanford-Binet Test of Intelligence (Revised by Terman and Merrill in 1937) is today the best known and most widely used individual test of general intelligence.) This test is also called Terman-Merrill Tests. It should be noted that most of the modern verbal individual intelligence tests include performance tests as well as tests that depend largely on language.

The essential tasks of the framers of the Revised Binet-Simon Tests were the following :

- (a) They had to modify their tests according to the children of the place.
- (b) Immediate change in the age assignment of the tests was made.
- (c) Too easy at the lower end of the test, difficult at the higher end. Even some items of Binet-Simon Test were rejected because they were of lower validity.
- (d) Different mental age scale and point scale have been introduced and partial credit system was introduced.)

Some examples of Individual Intelligence Test :

3 Year old Child. (Binet-Simon).

- (a) Ask to show nose, eyes, mouth etc.
- (b) Repeating two digit-numbers.
- (c) Naming own sex.
- (d) Surname.
- (e) Naming simple objects as knife, key etc.
- (f) Describing pictures.)

Items illustrating the 1960 Revision (L.M.form) of the Stanford-Binet Intelligence Scale Year II.

- (a) Three-hole form board (places forms in holes).
- (b) Delayed responses (finds toy animal after it has been hidden).
- (c) Identifying parts of the body (indicates named parts on doll).
- (d) Block-building ; Tower (builds tower model after demonstration).
- (e) Picture Vocabulary (names common objects while looking at pictures of them).
- (f) Word-combinations (spontaneous word-combinations made by child during the session are noted).

The general procedure in administering the new Stanford-Binet Test (M form scale) : The subject should be made to sit comfortably in a room, free from noise and distraction. The test materials

should be properly arranged in order for presentation. A friendly attitude should be maintained between examiner and the examinee. In course of getting his acquaintance, the examiner may elicit some of the examinee's likings so that in order to get better response the examiner may fit into the examinee's liking. By this way subject's name, age and class he reads, position in the family are ascertained. In short, the examiner is directed to make sure that the subject understands what is to be done and in all cases the burden of proof is with the examiner to show that the examinee has responded in a way that is representative of his ability. So this apparently useless part of work establishes a thorough rapport with the subject which is the essential prerequisite of an intelligence test.

After rapport has been established the examiner will give directions to the subject in most intelligible, lucid and unambiguous form. In between tests of different age levels, the subject should be allowed to take rest for a while.

If the subject is successful on all tests at one level, the examinee passes on to the higher levels and continues on through the scale until the subject fails to answer all tests at one age level. To be more clear, if a child of six passes all the 6 items of 5 year age level, then 5 will be the age level to start with and the tests relating to 6 year age level is to be administered. If he passes all the items of 6 year age level further upward tests are to be given.

The child's mental age is determined by given credit for the number of years below the level on which he passes all tests. For example, if he answers all the items relating to six year age level then his basal mental age will be 6 years. He will add to this amount the year and months of credit assigned to the higher level tests he passes.

Let us take an example for making it more clear—

Ram is a child of 6 years old. His parents want to know his intelligence Quotient. In order to get this they seek help from a psychologist. Now the question arises—how the psychologist will determine the I. Q. of the boy? The psychologist will

determine the I. Q. by Terman and Merrill revised M from scale. He will follow the procedure noted above.

(The psychologist will try to learn from school record and also by way of conversation from the boy the actual age, which is called *chronological age* of the boy.) After satisfying himself that the boy is 6 years old, the psychologist will administer the test relating to 5 year age level. that is, tests of an age level prior to the chronological age of the boy. So 5 is the age level to start with. As the boy passes all the 6 items easily, the tests relating to 6 year age level is administered. Here also the boy answers all the 6 test items correctly. So the age level pertaining to this age level is taken to be the basal mental age of the boy. Now considering that the boy can answer questions pertaining to advanced age level and hence may credit higher mental age, further upward tests are given.

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|-----|----------------|----------|------------------------------|
| (a) | Age level VII— | 6 items— | the boy passes in 4. |
| (b) | „ „ VIII | „ „ | „ in 3. |
| (c) | „ „ IX | „ „ | the boy fails to respond any |

Scoring : The age level to begin with in this experiment is 6. Hence 6 is the basic mental age of the boy. And the final age after which the boy fails to answer any question is the final level reached. Now considering the scoring standards of age level 6, 7, 8 and 9 the boy's score is tabulated.

Basal age	...	6 years.	
<i>Tests of Age level</i>	<i>Total no of item</i>	<i>Total scoring standard in respect of time</i>	<i>Actual credit.</i>
VII	6	12 months	$\frac{12}{6} \times 4$ = 8 months
VIII	6	12 months	$\frac{12}{6} \times 3$ = 6 months

Therefore, the total Mental Age of the boy is 7 years 2 months.

102
(Calculation of I. Q. : Intelligence Quotient (I.Q.) denotes quantitative measure of human intelligence.) Prof. Stern Germany evolved this system and thereby revolutionised the Mental Testing programme. The I.Q. is easy to calculate and very convenient to refer to even in popular expositions; and is derived by dividing a person's mental age by his chronological age $\left(\frac{M.A.}{C.A.} \right)$ and multiplying the result by 100 $\left(\frac{M.A.}{C.A.} \times 100 \right)$

Then the I.Q. of this boy of 6 years with a mental age of 5 years 2 months has $\frac{86 \text{ months}}{72 \text{ months}} \times 100 = 119$, an I.Q. of 119 (approx.).

It is generally believed that I.Q. of a person remains more or less constant throughout his life. This, says Burt, has been 'demonstrated by a formidable array of investigations'. We cannot but accept this view of Burt because it tallies with our conception of intelligence as an innate ability, which cannot be increased by training though it does mature as years roll by.

Distribution of Intelligence : Relationship between Intelligence and occupation.

18.
(d) I. Q. : Intelligence Quotient denotes a quantitative measure of human intelligence. Intelligence has been generally conceived to be a composite organisation of abilities to learn, to grasp broad and subtle facts, specially abstract facts, with alertness and accuracy, to exercise mental control and to display flexibility and sagacity in seeking the solution of problems. This highly abstract mental ability is quantitatively expressed in the form of a ratio. This ratio is arrived at from the mental age obtained from a number of standardised questions divided by chronological age $\left(\frac{M.A.}{C.A.}\right)$. In order to avoid any fraction the ratio is multiplied by 100 which ultimately forms the respective I.Q. or the quantitative measure of intelligence. If we assume that differences in intellectual maturity constitute a means of measuring differences in intellectual capacity of brightness the I.Q. may be regarded as a measure of brightness.

Constancy of I. Q. : The average of all I. Q. remains constant at 100. But it does not necessarily mean that the individual I.Q. must remain constant. One may go up or down in intelligence without disturbing the average. But in general and within certain limits the individual I. Q. tends to remain the same.

An individual's I.Q. may fluctuate to some extent. He may feel better and work better on some days than on other days. Some test items suit him better than other items though they are of same difficulty level. But, on the whole, the individual child's I.Q. remains fairly, though not absolutely, constant. So the I.Q. obtained in childhood has considerable predictive value. If a child at the age of 6 has an M.A. of 8, i.e., an I.Q. of 133,

can be predicted that probably his M.A. at the age of 10 will be about 13.

Intelligence and Memory : It is popularly believed that