CHAPTER III

NATURE OF INTELLIGENCE

Homo Sapiens is the most intelligent species on the globe and yet man is not definite as to what intelligence is. There are divergent views regarding the nature of intelligence. Of course, this does not mean that no attempts have been made towards the determination of the precise nature of it.

Let us start with the hypothesis that man is born with some inborn capacities. He can imagine things. He can work out things mentally. He can reason too. But the capacity differs from person to person. There are some who can manipulate well while the rest can reconstruct things and situations. All such persons are said to possess intelligence.

About the inborn capacities of an individual two useful discussions have come from Ballard (1932) and Knight (1933). Most of the psychologists agree that some general innate capacity may be recorded as underlying all our abilities. In the 17th and 18th centuries it was believed that this capacity was

unalterable . But later this view emerged that this inborn capacity can be greatly stimulated by a favourable environment and that it can get depressed under unfavourable conditions of upbringing. In order to test this inborn capacity it was suppose is clear that we must have such a test which measures this capacity alone and which does not measure the experiences of an individual.

Definitions of Intelligence

Intelligence has been defined differently by different psychologists. A study of the thirteen definitions from thirteen psychologists which appeared in the American Journal of Educational Psychology in March and April 1921 reveals that the ideas of different psychologists about the precise nature of intelligence are different. Ballard has aptly said, "while a teacher tried to cultivate intelligence and a psychologist tried to measure it, no body seemed to know what precisely intelligence was"[1].

There are different definitions of intelligence though these do not differ from one another much. Some psychologists believe that intelligence is a concept outside the province of psychology. Terman for example, believes that a person aiming to measure the intelligence must not first be asked to give a definition of it.

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[1] Ballard. P.B.: Mental Tests, University of London Press, 1949, p.23.

There is no agreement amongst the psychologists with respect ~~of~~ to the precise definition of intelligence. The most quoted definitions of intelligence are those from Terman, Thurstone, Woodworth, Patterson, Colvin, Sandiford, Cyril Burt and Rexknight. Terman defines intelligence as ability to do abstract thinking. Thurstone considers it to be the capacity to make impulses focal at their early unfurnished stage of information; Woodworth regards it to be simply acquiring capacity and Patterson calls it a biological machanism by which the effects of complexity of stimuli are brought together and given a united effect in behaviour; Colvin defines it as the ability to learn to adjust to one's environment. Sandiford regards it to be a function of the central nervous system; Cyril Burt calls it an inborn all round mental ability and Rexknight defines it as the capacity for rational constructive thinking. Considering the above definitions carefully, it seems that Terman's definition for intelligence is too narrow. This definition clearly implies that children stand excluded from the category of the intelligent. It is obviously clear that this definition is too negative in character. As Spearman points out, it also excludes concrete thinking as a factor of intelligence. In the same manner when other definitions are analysed they are found wanting in one respect or the other. Thurstone's words ..... early unfurnished stage of information ..... create greater difficulties than what are caused by the problem itself.

Woodworth's definition is incomplete in so far as he does not clearly define what he means by 'capacity' In the same manner Cyril Burt includes the term 'mental' which has raised great controversy and discussion. Similarly considering all the other above mentioned definitions under a critical perspective, it becomes obvious that the definitions by themselves are lacking in comprehensiveness and the clarity of meaning in one way or the other.

Binet's Definition : -

Binet defines intelligence in terms of comprehension, inventiveness, persistence and critical analysis. Here again the terms are not clearly defined. Rex Knight gives a good explanation of the nature of intelligence. He emphasises the fact that the qualities and relations discussed and the correlations deduced from any situation must be relevant to some question or aim. But it seems to suffer from one defect. As Woodworth points out it fails to take note of 'retentiveness' which is an essential feature of intelligence.

From the above discussions it is clear that the definitions of intelligence conform to three different groups.

I. Those definitions that emphasize intelligence as a single human attribute.

II. Those that regard it as a complex product of two or more human attributes.

III. Those that regard intelligence as a term comprehensive of a large number of human attributes.

Concept of Intelligence : -

Although it has been believed since times

immemorial that the capacity of an individual to attain any stature in life is determined by the amount of intelligence he or she possesses, yet a scientific study of the nature of intelligence started only with the beginning of the present century. During the last five decades numerous instruments for the measurement of intelligence have been devised and we are now in a position to measure almost precisely and definitely the intelligence level of every person. However the nature of intelligence still continues to be a matter of analytical study. During the last few decades a number of descriptive concepts based upon the analysis of the data of experienced testers have come forth. Binet regards intelligence as a thought process having three characteristics : (i) the tendency to take and maintain a definite direction (ii) the capacity to make adaptations for the purpose of attaining a desired end and (iii) the power of autocriticism. Terman who has made notable contributions in the field of measurement of intelligence has referred to it in these words: " An individual is intelligent in proportion as he is able to carry on abstract thinking"[2]

Spearman contributed the famous Two Factor Theory. According to him: 'Every different intellectual activity involves a general factor 'g' which is shared with all intellectual activities and a specific factor 'S' which it shares with none". Spearman arrived at

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2 Terman L.M. : "Intelligence and its Measurement" Journal of Educational Psychology, March 1921. p.128

this conclusion when he statistically analysed the performances on intelligence tests and discovered that the different activities such as arithmetic work, reasoning etc. were correlated with one another in a special manner. To this relationship he gave the name 'tetrad equation'.

Thomson who in collaboration with Brown conducted researches on Spearman's Two Factor Theory arrived at the conclusion that Spearman's statistical techniques were erroneous. He argued that the Two Factor Theory was a possible but not a necessary formulation from the statistical results. (Brown and Thomson, 1921). As for the interpretation of the tetrad differences and hierarchical order Sir Godfrey Thomson has offered another explanation through his Sampling Theory . According to this theory 'Any activity such as mental test calls upon a sample of bonds which the mind can form and some of these bonds are common to two tests and cause them correlations". (Theory of Bonds p.31)

Cyril Burt propounded his view-point that intelligence is the power of readjustment to relatively novel situations by organising new psycho-physical combinations.

Thorndike has suggested three different kinds of intelligence. They are :
(i) abstract intelligence, (ii) mechanical intelligence and (iii) social intelligence. Abstract intelligence implies the capacity for abstract thinking; mechanical intelligence implies the amount of physical dexterity and efficiency while social intelligence

refers to the capacity of an individual to adjust himself or herself to the changing social environment.

Thurston has put forth his view-point in the form of Factorial Analysis Theory. He considers intelligence as consisting of seven different factors:
(i) number facility (ii) word fluency (iii) visualising (iv) memory (v) perceptual speed (vi) induction and (vii) verbal reasoning.

Vernon regards intelligence as a very fluid collection of overlapping abilities comprising the whole of mental life.

As noted in the above paragraphs over the past several years the concept of intelligence as general innate ability has been subjected to a barrage of criticisms. Factorial Analysis such as Thurstones (1938) has disparaged the idea of a general factor.

Environmentalists such as Halsey (1959) and the investigators such as Stoddard and Wellman (1940) have questioned the notion that intelligence is predetermined or fixed. Developmental research pioneered by Piaget (1947) suggests that intelligence is ultimately bound up with the continuous interaction between organism and environment while the possibility of critical periods and irreversible influences in mental development is now seriously held (Hebb 1958).

The question of the innateness of the general factor 'g' can be circumvented by insisting only on its comparative stability in relation to lower order factors. Evidence to support such stability comes

from various sources. Woodrow (1938) demonstraced that the general factor was relatively unaffected by differential practice in a thirty three variable analysis, while group factors changed considerably. Hofstaether's (1954) factor analysis of the longitudinal mental development of children in the Berkeley growth Study revealed a stable general factor increasing in size between the ages of 4 and 8 and remaining steady throughout pre-adolescence. Tests with high 'g' loadings and negligible group factors have shown less susceptibility to cultural change.

Theoretically the stable 'g' factor is compatible with the hypothesis of Hebb (1949) and Ferguson (1956) which suggests that abilities are developed primarily by positive transfer from the old learning to the new. Early superiority in processing and integrating skills should lead to increasingly broad and cumulative superiority of intellectual development in a variety of fields. Vernon (1960) sees support for the general construct in the developmental approach for those who early in life acquire a large stock of perceptual schemata and verbal habits are better able to build up more complex and more flexible schemata necessary for conceptual thinking. So the general all inclusive logical structures accumulate and proliferate producing a broad general factor which although difficult to define behaviourally, continues to account for most of the statistical variance in any battery of ability tests.

In a comprehensive review on theories and research on intelligence, Hunt (1961) draws attention to the

compatibility of apparently diverse interpretations of intelligence being best ~~a~~ EX pplicable in hierarchical terms. A hierarchical factor structure with Spearman's 'g' at the apex, is precisely what will be expected from considering abilities as the accumulative effects of the transfer of training or learning in varied situations. Piaget's conception of accomodation corresponds to the notion of transfer of training. The general factor at the top of the hierarchical model is of great importance. To qualify as a measure of an all-embracking intellectual ability, while relatively free from the vagaries of environmental circumstances, a test must show a substantial loading on the general factor at the top of the hierarchy. Culture reduction is of little value if the test does not sample extensively that common denominator or transfer basis of the fluid set of abilities we understand by intelligence.

Before the development of his Intelligence Scale, Binet did much research on different kinds of thinking activities and thus indirectly recognised that intelligence has a number of factors. The variegated nature of tasks found in Stanford Revision of the Binet intelligence Scale points to the same fact that ~~Stanford~~ Terman regarded intelligence as a composite of different factors. In fact, a factorial approach in understanding the nature of intelligence is well accepted.

The Two-Factor Theory:-

Spearman's Two-Factor Theory suggests a sharp contrast to Thorndike's Three-Factor theory with regard

to the interpretation of the nature of intelligence. According to Spearman, every intellectual activity is dependent primarily upon, and is an expression of, a general factor common to all mental activities. This factor designated by the symbol 'g' is possessed by all individuals, but in varying degrees, of course, since people differ in mental ability; and it 'g' operates in all mental activities, though in varying amounts, since mental tasks differ in respect to their demands upon general intelligence. Spearman characterized this general factor as mental energy, because in the realm of an intelligent activity, it has a role similar to that of physical energy in the physical world. Like all other scientific concepts, the general factor can be observed and known only through its specific manifestations. The 'g' factor becomes manifest when a psychological test is administered to an individual. Though his patient experimental study, Spearman arrived at the generalisation that in addition to the general factor common to all mental activities; each mental activity might also be a member of a "group"; and each has also its own specific factor. Of the kinds of factors, the general one is regarded as the essential measure of intelligence. A sound test of intelligence is one that will sample adequately the 'g' factor in a variety of activities and the best test materials are those that call for the largest amount of the general factor. Spearman arrived at his conclusion by observing through test administration that the scores

of the same person on tests of different types had a high correlation. The arrangement of the coefficients of correlation in a descending order, Spearman termed, the hierarchical order. The possibility of arranging a table in hierarchical order is an evidence to show that all the intercorrelations in it can be explained by means of a single general factor common to all the tests.

Since no empirical table will show perfect hierarchical order, because the coefficients of correlation are subject to random errors of sampling, it was necessary to devise a means of testing whether any departure from perfect hierarchical order was evidence for the presence of group factors or that it could be regarded as due to random errors. The criterion used by Spearman was thecalculation of a set of quantities called the tetrad differences. If a,b,c,d are any four tests in the table, then their tetrad difference is the quantity:

$$r_{ab} \cdot r_{cd} - r_{ac} \cdot r_{bd}$$

If the table is a true hierarchy, all tetrad differences will be zero.

Criticism of Two Factor Theory : -

The theory has been subjected to much criticism both on psychological and statistical grounds. Being based on vanishing tetrad differences, it is tenable only if the talent differences show this property in all cases. In actual fact they are scarcely equal to zero. Even if some allowance is made for sampling errors, some of them show an appreciable magnitude.

The discovery of this fact gave birth to two more views :

(i) the existence of group factors in addition to 'G' and (ii) a new interpretation of the hierarchical order.

Group Factors : -

In a matrix of correlations, some of the tetrads do not vanish but show appreciable values of difference. It can be shown by factorial analysis that over and above one general factor, there exist one or more group factors common to some of the tests. As a result of the researches into two factor theory, a number of more groups factors such as 'V', the verbal factor, 'K' the spatial factor; 'N' the number of factors have been discovered. Spearman himself was convinced of the existence of a number of factors other than 'G' and 'S' but he believed that the number of these factors was not so large. Thus Spearman's theory was regarded to be correct by Spearman school.

Criticism of Spearman's Theory : -

Spearman's theory has, however, been attacked from the various angles.. Sir Godfrey Thomson considers Spearman's assertion of a general factor from the hierarchical order as erroneous. He holds that the hierarchical order and the zero tetrad differences can be explained by his Sampling Theory according to which any activity such as a mental test, calls upon a sample of bonds which the mind can form, and that some of these bonds are common to two tests and cause their correlation (Thomson 45). He even shows that the hierarchical order can be produced by random overlap

of group factors without a general factor (Brown and Thomson p. 195).

The Sampling Theory

According to the Sampling Theory the hierarchical order or zero tetrad differences is the most probable connection to be found among the correlation coefficients. The Sampling Theory neither denies nor asserts general ability though it says that it has not been proved nor does it deny the specific factors. On the other hand it does deny the absence of group factors (Brown and Thomson p.189)

Multiple Factor Theory : -

Spearman's two factor theory has been discarded also by Thurstone who gave the Multiple Factor Theory. This theory is an analysis of the factors of human ability. In 1938 Thurstone published an analysis of 56 tests administered to 240 college students. This investigation revealed that there was no 'G' factor at all, but there was a series of distinet multiple factors such as V.P.I.N.M.D.W and S where V stands for Verbal, P for perceptual speed, I for inductive reasoning, N for number facility, M for rote memory, D for deductive reasoning, W for word fluency and S for space of visualisation. Spearman reworked Thurstone's work and found some validity in it. But he showed that they could equally well be analysed to yield a large general factor and smaller group factors. Both the solutions are equally valid mathematically.

Thurstone, Kelley and many other American

psychologists have divided up 'G' among multiple primary factors. Thurstone, however, has ~~lately discovered~~ postulated super factors different from primary factors and called them second order general factors of which 'G' may be one. He considers the first order factors specific and the second order factors general.

According to the twentieth century American Psychologist Guilford[1] the different factors of intelligence can be grouped into some groups. The idea of the classification of factors arises from the fact that some factors of intelligence resemble oneanother in some ways. In spite of the fact that each factor of intelligence can be distinctly recognized, Guilford suggests some possible methods of classification. On the basis of the basic kind of process or operation involved when different factors of intelligence are called into play, these factors can be classified into five major groups;

(i) factors of cognition (ii) memory (iii) convergent - thinking (iv) divergent - thinking and (v) evaluation. Cognition means discovery or rediscovery or recognition and memory means retantion of what is cognized. Convergent-thinking and divergent-thinking are both productive thinking operations. In convergent-thinking the information leads to one right answer or to a recognized best or conventional answer. In divergent-

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1 Jenkins James J and Patterson Donald G. Guilford J. P (Edited by) Three faces of Intellect Methuen & Co.Ltd.London 36 ESSEX Street W.C. 2 1961.p.469-479.

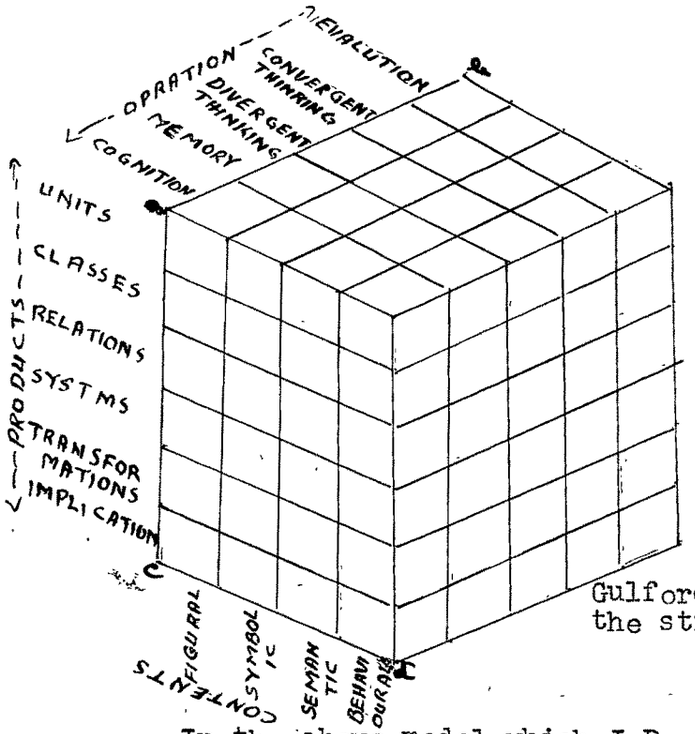
thinking we think in different directions; sometimes we search and sometimes we seek variety. In evaluation we reach decisions as to goodness, correctness, suitability or adequacy of what we know, what we remember and what we produce in productive-thinking. A second way of classifying the intellectual factors is according to the kind of material or content involved. The factors known thus far involve three kinds of material or content. The content may be figural, symbolic or semantic. Figural content is concrete material such as is perceived through the senses. It does not represent anything except itself. Visual material has properties such as size, form, colour, location or texture. Things we hear or feel provide other examples of figural material. Symbolic content is composed of letters, digits and other conventional signs, usually organised in general system such as the alphabet or the number system. Semantic content is in the form of verbal meanings or ideas for which no examples are necessary.

When a certain operation is applied to a certain kind of content as many as six general kinds of products may be involved. There is enough evidence available to suggest the figure six. Regardless of the combinations of the operations and content, the same six kinds of products may be found associated. The six kinds of products are: units, classes, relations, systems, transformations & implications. The factor analysis reveals that these are the only fundamental kinds of products that we can know.

~~These~~

These can serve as basic classes into which one might fit all kinds of information psychologically.

The three kinds of classification of the factors of intellect can be represented by means of a single solid model shown below.



Gulford's cubical model representing the structure of the mind.

In the above model which J.P. Guilford called the "Structure of Intellect"[4], each dimension represents one of the modes of variation of the factors. Along a b dimension are found the 'operations', along a c the products and along c d the various kinds of content. Along c d instead of three, four contents have been represented; the fourth kind of content being designated as 'behavioural'. This category has been added on a purely theoretical basis to represent the general area sometimes called 'Social Intelligence'. Each cell in the model calls for a certain kind of ability that can be described in terms of operation, product and content, for each cell is at the intersection of a unique

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4 Jenkins James J and Patterson Donald G (Edited by)
Guilford J.P.
Three faces of Intellect
London Methuen & Co. Ltd. 35 ESSEX St. W.C.2 1961. p. 758

combination of kinds of operation, content and product A test for the ability of that type should have the same three properties. As is clear from the figure, the first layer provides us with a matrix of 18 cells (if we ignore the behavioural column for which there are as yet no known factors) each of which should contain a cognitive ability.

The Cognitive Abilities : -

These are the unique abilities that fit logically into 15 of the 18 cells for cognitive abilities. Each row presents a triad of similar abilities having a single kind of product in common. The factors of the first row are concerned with the knowing of units. The ability to cognize symbolic units is measured by tests like the following :-

a/- Put vowels in the following blanks to make real words.

L -- V -- R

P -- RR -- T

D -- SS -- T

b/- Re-arrange the following letters to make words :-

S O R W O R

L Q I U C K Y

H O S E W

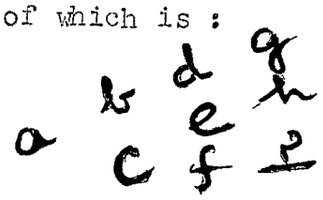
The ability to cognize semantic units is the well known factor of verbal comprehension, which is best measured by means of a vocabulary test with items such as

Charity means --

Generosity means --

Poverty means --

A figural test is constructed in a completely parallel form, presenting in each item four figures, three of which have a property in common and the fourth lacking that property. Ordinary space tests such as Thurstone's Flags, Figures and Cards or Part V (Spatial Orientation) of the Guilford - Zummerman Aptitude Survey (GZAS), serve in the figural column. The system involved is an order or arrangement of objects in space. A system that uses symbolic elements is illustrated by the Letter Triangle Test, a sample item of which is :



What letter belongs at the place of the question mark?

The ability to understand a semantic system has been known for some time as the factor called general reasoning. One of the most faithful indicators is a test composed of arithmetic reasoning items. A test item from Necessary Arithmetic Operations as given below can be used to measure semantic ability.

A floor 50 ft. wide and 20 ft. long cost Rs. 500/- to plaster it. What is the cost per square foot?

The Memory Abilities : -

The areas of the memory abilities have been explored less than some of the other areas of operations and only seven of the potential cells of the memory matrix have known factors in them. These

cells are restricted to three rows : for units, relations and systems. The first cell in memory matrix is occupied by two factors, parallel to two in the corresponding cognition matrix. Visual Memory Span Test conforms to the conception of memory for semantic units. The formation of association between units such as visual forms, syllables and meaningful words as in the method of paired associates would seem to represent three aoilities to remember relationships involving three kinds of content. We know of two such abilities, for the symbolic and semantic columns. The memory for a known system is represented by two abilities very recently discovered (Christal 1956). Remembering the agreement of objects in space is the nature of an ability in the figural column and remembering a sequence of events more or less has the similar implications. Considering the blank rows in the memory matrix, we are led to expect abilities to remember classes, transformations and implications as well as units, relations and systems.

The Divergent - Thinking Abilities :-

The unique feature of divergent - production is that a variety of responses is produced. It always comes into play where there is trial and error thinking. The well-known ability of word - fluency is now regarded as a facility in divergent production of symbolic units. The parallel semantic ability has been known as ideational fluency. The divergent production of class ideas is believed to be the unique feature of a factor called "Spontaneous Flexibility" A typical test instructs

the examinee to list all the uses he can think for a common brick and he is given eight minutes. If the uses given are quite numerous, the examinee earns a fairly high score for ideational fluency. If the uses fall into the same class, he earns a very low score for "Spontaneous Flexibility If the uses do not fall into the same class, the examinee earns a high score for "Spontaneous Flexibility" also. A current study of unknown but predicted divergent production abilities include testing whether there are also figural and symbolic abilities to produce multiple classes. An experimental figural test presents a number of figures that can be classified in groups of three in various ways, each figure being usable in more than one class. An experimental symbolic test presents a few numbers that can also to be classified in multiple ways. A unique ability involving relations is called " Associational Fluency". It calls for the production of a variety of things related in a specified way to a given thing.

The Convergent - Production Abilities:-

Of the eighteen convergent- production abilities expected in the cubical block, twelve are now recognized. In the first row pertaining to units, we have an ability to name figural properties (forms or colours) and an ability to name abstractions (classes, relations and so on). It may be that the ability in common to the speed of naming forms and the speed of naming colours is not appropriately placed in the Convergent-thinking matrix. One might expect that the thing to be produced

in a test of the convergent production of figural units would be in the form of figures rather than words. A better test of such an ability might somehow specify the need for one particular object, the examinee to furnish the object.

A test for the convergent production of classes (word grouping) presents a list of twelve words that are to be classified into four and only four meaningful groups no word to appear in more than one group. A parallel test (Figure concept test) presents twenty pictured real objects that are to be grouped into meaningful classes or two or more each.

Convergent-production having to do with relationship is represented by three known factors all involving the "education of correlates" as Spearman called it. The given information includes one unit and stated relations, the examinee to supply the other unit. Analogies tests that call for completion rather than a choice between alternative answers emphasize this kind of ability with symbolic unit. Only one factor for convergent production of systems is known and it is in the semantic column. It is measured by a class of tests that may be called ordering tests. The examinee may be presented with a number of events that ordinarily have the best or the most logical order, the even being presented in the scrambled order. There are undoubtedly other kinds of systems than temporal order that could be utilised for testing abilities in this row of

Convergent -

Production matrix.

Evaluative Abilities : -

No area in the Intelligence Block has been explored so much as the area concerning Evaluation Abilities. This area has received the best investigation of all the operational categories. Through a systematic analytical study it has been recognized that only eight evaluative abilities fit into the evaluation matrix. But at least five rows have one or more factors each and also three of the usual columns or content categories. In each case evaluation involves reaching decision as to the accuracy, goodness, suitability or workability of information. In each row, for the particular kind of product of that row, some kind of criterion or standard of judgement is involved. In the first row, for the evaluation of units, the important decision to be taken pertains to the identity of a unit. In the figural column we find the factor long known as "Perceptual Speed". Tests of this factor invariably call for decisions of identity. The clear example of this is Part IV (Perceptual Speed) of GZAS or Thurstone's Identical Forms. In the symbolic column is an ability to judge identity of symbolic units in the form of series of letters or numbers or of names of individuals. The ability to judge the identity of symbolic units can be measured by tests like the following:-

a)- Are numbers of the following pairs identical or not?

6958423	--	6958463
8432564	--	8432587
2945321	--	2445321

Such types of tests are common in tests of clarical aptitudes. There should be a parallel ability to decide whether two ideas are identical or different.

Constancy of I.Q.:-

In intelligence testing there is another issue for discussion. It is related to the predictive validity of intelligence testing. To be reliably predictive the measurement taken at one time should tend to remain constant. At least it is assumed so. A good deal of thought has been given to the constancy and fluctuations of I.Qs in repeated testings. The following paragraphs attempt to summarize the present views on the problem.

Measured intelligence tends to remain rather constant from year to year, from the ages of 6 to 11 or 12 years and ~~therefore~~ Intellectual efficiency probably reaches its peak sometime during the early twenties and remains fairly stable until about 35 at which time some loss in efficiency becomes apparent and the loss seems to increase rather steadily until around 60. The question of whether or not I.Q. remains constant over extended periods of time is vital to educational planning . However, even if the I.Q. did fluctuate rather remarkably, it would still be profitable to measure it in terms of finding out what conditions cause it to fluctuate and if these fluctuations were predictable and perhaps controllable. One of the difficulties encountered in the making of studies of stability of I.Q. is the fallibility of the tests of intelligence. The perfection of intelligence tests as the instruments for the measurement of intelligence is very often doubted and they perhaps

do not measure the same function at different age levels. The efficiency of intelligence tests as the instruments for the measurement of intelligence is influenced also by the problem of motivation. Tests of ability try to measure the best possible performance of the individual. We have little assurance particularly with young children that they are performing at their best level. It may be that the child is frightenend, insecure or disinterested and not trying. These things will of course contribute to the variability of Intelligence Quotient. How much of the variation in measured intelligence is due to real changes in intellect is a serious problem.

Since environmental factors have a direct bearing upon the flowering of intelligence, it becomes obviously clear that the earlier this potential is measured after birth and before environment can have significant effect on it, the more stable would be the measurement. But unfortunately this does not appear to be the case as early measures of intelligence have not proved to be good predictors of later achievement on tests of intelligence.

It has however been a common experience to observe that there are not considerable variations in I.Q. after sixteen. After sixteen the fluctuations in I.Q. in excess of five I.Q. points in either direction have been noted in exceptional cases only. In 1962 Broadway and Thomson presented data which showed that vocabulary and abstract thinking abilities continue to increase

in adulthood. This observation supports Cattel's hypothesis that crystallised intelligence can reach its maximum after biological maturity. Bloom also like Hunt and others treated intelligence as a developmental concept which is modified as the individual interacts with his environment. The effect of environment was found to be greater in the earlier stages of life. The implications suggest research efforts in which improved utilization of information about early environment may be made. Research is also needed to find out the possibilities of the development of intelligence in the later stages of life.

Thus, even today, the various inferences about nature of intelligence are as controversial as ever, However, from the operational point of view intelligence described in statistical terms appears to be a better course. As far as the present work is concerned, the hierarchical conception of intelligence given by Burt [5] and Vernon [6] is regarded as the most useful model for assessing intelligence.

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(London, 1940)

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BF 431 V 356

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