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CHAPTER



CREATIVITY AND INTELLIGENCE

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In the last chapter we surveyed various definitions of creativity. There was no unanimity either in understanding or in approaches to understand it. There were four major emphases - product, process, person, and environment - in the approaches. This was simply based on the implicit feeling that there is creativity in human beings.

There is another important issue left uncovered in the last chapter. That is about the distinction between creativity and intelligence. 'Intelligence' is a psychological concept of much long standing. First three decades of this century brought enough research literature on the concept. Several questions remain to be answered in definitive terms.

Apart from being 'intelligent', is there something in man that makes him creative? Or is it simply 'Intelligence'

that makes one creative? Where is the need for two psychological concepts - creativity and intelligence? If there are two such modes of thinking that decide human behaviour what is the relative importance of the two? Moreover, the two concepts have been subjected to similar doubts - whether they are unitary faculties of the mind, whether they are hereditary and so on. The present chapter gives a description of various theoretical standpoints developed to answer the problems. But it is true that the problems have remained as they are reducing the theories to merely a consensus of opinion of psychologists of a time when such a consensus existed. Because, the route to all psychological problems existed fundamentally in the understanding of psychic operations and the resultant human behaviour. Mostly all empirical concepts like intelligence and creativity have implications from behaviour itself - the rear entrance to the study of psychic - operations. This has increased the mystic nature of 'psyche' or 'mind' or its attributed properties.

The growth of concepts like soul, mind, personality, conscious, unconscious, horne, mneme, libido, elanvital or life-force or a host of others like instincts, emotions, urges, drives, self, will, id, ego, super-ego has been out of the fundamental faith in one's own existence. To cite various functions of mind - knowing, feeling, doing, memory

learning, reasoning, thinking, imagery, perception, attention were present in the verbal transactions of man before 'psychology' took possession of them. Man's ability to deal with situations and things has been much appreciated. The descriptions ranged from such words as good, active, quick, splendid, marvellous, etc., to very intelligent, creative, genius and the like.

Two reasons for such a development of various concepts are clear -

1. They grew out of the necessity to communicate what goes on inside one's own physical unit or body in the course of interaction with the external and what results out of differentiation.
2. The birth of 'I' feeling as a result of necessity to represent the 'physical unit' in the transactions with the external gave rise to various aspects and functions. It would be pernicious to disbelieve the existence otherwise.

In the course of evolution due to successful transaction with the external, two of the internal processes which made the following contribution have gained importance:-

1. Preservation of oneself and conservation of what is already with him as a 'physical unit' and all that is hereditary.

2. Furtherance by sudden leaps or glorifications due to some transcendent action in understanding and utilising what is around him. Such an action thus adds itself to heredity.

The first of the contributions has been due to man's efficiency in dealing with the external. It is more need based. Rather he has been working on the basis of experience or on careful utilisation of experiential facts and integrating such with himself. His life has been a strange changing, growing, enduring balance with the external. Such of the individuals who have shown excellent ability to do so have been described as 'intelligent'. They are said to be endowed with high 'intelligence'.

The second contribution is of a higher sort which is due to the transcendental understanding. At times, this has been merely a gamble with the external, of much more trial and error, and at times, even risky. The act has been to cross the accepted reality by taking it to be loosely held empiricism. It is a striving towards reality itself. Such crossings or leaps had often failed. They were even unintelligible to the intelligent men. Utility of this sort of action has been recognised sooner or later changing the whole face of accepted knowledge. Such men have been termed as 'creative'.

To put it in the words of Getzels and Jackson (94; p.14) there are two 'modes' of intellectual functioning.

The one mode tends toward retaining the known, learning the predetermined, and conserving 'what is'. The second mode tends toward revising the known, exploring the undetermined, constructing 'what might be'. A person for whom the first mode or process is primary tends toward the usual and expected. A person for whom the second mode is primary tends toward the novel and speculative. The one favours certainty, the other risk. Both processes are found in all persons but in varying proportions. The issue is not one of better or worse or of more useful or less useful. Both have their places, and both must be recognised for their differences, commonalities, interactions and distinctive functioning in the individuals psychic economy.

Their findings strengthen their convictions further. The intelligent individual focusses on stimulus 'using it as the invariant for the communication'. For him 'the issue is essentially one of conserving what others give to him. The creative individual tends to free himself from the stimulus. For him the issue is essentially one of what he wants to give'. (Getzels and Jackson, p.14). He has more wit and violence.

In the considerations hitherto mentioned there was an assumption - that life is something like a transaction with the environment. It is the nature of the organism to accept, reject or adjust to the environmental demands. If integration of new elements or principles with what is already existent, thus tending to increase in the hereditary stock is the process in growth and evolution of the organism, there is an

obvious dichotomy of our approaches. There are theorists who approach to the study of 'mind' or 'principle' from observed behaviour of the organism. There are others who approach the problem from the observed nature of matter.

Interest in the present investigation being in the study of creativity, the approach to the concept is from the observed behaviour. Though this fixes the direction, it will be pernicious if the approach from the other side is overlooked. And the approaches are complementary. While presenting various standpoints an attempt has been made to synthesise them rather than to analyse in order to gain wholesome understanding.

### 3.1 INTELLIGENCE : IS IT SOMETHING CREATIVE?

A retrospective look at the psychological literature of the early part of the 20th century gives us a picture of different notions held, during the time, about the nature of human intelligence. It was then generally agreed that large differences in hereditary endowment is responsible for intellectual differences (Burt; 35). A percentage of rich inheritance would result in intelligent progeny. Another notion was that better environmental conditions and educational facilities would ensure fuller development due to enough supply of information and training, the extent being fairly

predecided by one's heredity. Early recognition of high intelligence to give proper education was then a matter of social necessity, for, progress inevitably depended upon those who were born with rich hereditary endowment or intelligence capacity.

Alfred Binet (Garrett; 92) who for the first time brought the idea of 'mental age', held an opinion that there was a faculty of judgement or 'good sense' or 'adapting oneself to circumstances', which was responsible for the efficacy of human actions in different situations. He felt that each child is endowed with certain amount of native ability which is responsible for growth in thought process with age, the rate of growth being proportional to the amount inherited and had the following assumptions in mind about the nature of intelligence, while suggesting a measure ( $I.Q. = M.A./C.A. \times 100$ ) of intelligence as Terman (Kamath; 162, p.16) gives -

- (i) its 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 auto criticism.

'By intelligence' Garrett (92) writes while explaining Binet's contributions to psychological testing, 'it must be remembered, is meant ready adaptability to new situations,

mental alertness, keenness and ingenuity, not 'knowledge' and 'experience' which are the products of these and which usually increase with age . . . . ".

From Binet to the time Terman completed his studies of gifted subjects, much water had flown under the psychological bridge, and what Terman wrote reflected the changing conceptions of intelligence. Intelligence tests had drawn attention of educationists and psychologists all over the world, as they were continually being used to predict the future eminence of pupils in schools and colleges. A high performance in the tests was definitely a measure of future eminence, as Terman (Barbe, ed. 14) states -

"The genius who achieves highest eminence is one whom intelligence tests would have identified as gifted in childhood".

In evidence he (Barbe, ed. 14) cites various examples of early indications of eminence, of Macaulay who wrote compendium of history at 6, Ben Franklin, who displayed all characteristics of a future statesman at 17, Pascal who formed upto 32nd proposition of Euclid at 11 and Leibnitz who wrote 'An Alphabet of Human Thought' at 14, and concedes that 'both evidence on early development of historical geniuses and that obtained by follow-up of gifted subjects selected in childhood by mental tests', pointed to the conclusion that 'capacity to achieve far beyond the average' could be detected early in life by 'a well constructed



ability test that is heavily weighted with 'g' factor, 'g' stands for general ability as prominently measured by traditional intelligence tests like Stanford - Binet.

It is apt if a mention is made here how a notion about the existence of general ability or g-factor developed and was associated with traditional intelligence tests.

Charles Spearman, a British psychologist, conceived human intellect to be consisting of two factors - 'g' and 's' 'g' stood for general ability and s for special ability. For Spearman, 'g' was very important; for it is the ability which comes into play in all human actions and is largely responsible for individual differences. 's' may come into play simply to decide the broad nature of the intellectual act and how intelligently it is being handled is purely a matter of 'g' factor (Vernon; 270), Spearman's was a mathematical approach known as factor analysis which was later developed fully into a body of mathematical knowledge by Thurstone.

He also found that intelligence tests were highly saturated with 'g' (Vernon; 270). This finding was a mathematical proof to the efficacy of general intelligence tests in measuring intelligence as defined hitherto as ability 'to adjust or adapt'.

Factor analytical approach marks the beginning of a new era in the analysis of the data and mental testing. As a

full description about Spearman's work will be given later: it is enough for the present to note that 'g' did not withstand further rigorous analysis and retain its integrity. As a result of his extensive studies Thurstone found a few primary mental abilities (P.M.A.) as constituents of general ability.

The confidence with which Terman conceded about the efficacy of tests highly weighed with 'g' was due to the fact that such tests generally gave out a 'g' factor when factor - analysed.

The credit of changing much deteriorated idea that was prevalent prior to Terman that gifted children were mentally strange and physically inferior to normals goes to his undwindling interest in the early recognition of future eminence. The shift of interest to gifted children was a prelude to beginning of research in creativity. Anyway, it was not until Thurstone and later on Guilford directed much of their energies to the study of creative individuals a specific difference in the two forms of intellectual capacity was recognised.

Having traced the course of development of intelligence testing, and the assumptions on which the concept was based, it is worthwhile here to survey some more definitions of intelligence to see whether there is any commonality with definitions of creativity, to see whether intelligence

concept by definition stands for something creative. Definitions of creativity discussed in the last chapter will facilitate to draw an inference on their separability.

Ebbinghaus (Kamath; 162) considered intellectual ability as consisting of numerous kindred associations. It is an activity of combination followed by correction and completion of such associations. His was an associationistic point of view. Associationists generally conceive mind to be a bundle of bonds between different memory items, which they call associations. One's intellectual ability depends upon the number of associations he has. In line with this we know what advance in the associationism was necessary to incorporate creativity within its purview.

For Stern (Kamath; 162) it is the ability 'to consciously adjust such thinking to new requirements and conditions of life'.

Thorndike (Kamath; 162) the exponent of laws of learning which had profound impact on educational methods for the time to come after their formulation, defines intelligence as the power of good responses, the goodness being decided by the amount of truth or fact. Colovin (Kamath; 162) finds intelligence to be the ability to learn in terms of certain native tendencies.

William McDougall (193), the founder of school of purposive psychology, defines intelligence as 'the capacity to improve upon the native tendency in the light of past experiences'. Native tendencies are instincts which are causes for crude biological needs (urges) such as food seeking, mating, gregariousness, etc. Any move on the part of the organism to blind fulfilment of the instinctive needs puts it into danger if the situation is unfavourable.

Combs (43) defines intelligence of an individual as dependent upon the richness and variety of perceptions possible to him at a given moment. According to him, it refers to effectiveness of the individual's behaviour. Thurstone refers to his perceptual factor 'P' as quick intelligence (Garrett;91).

Apart from the definitions put forward from the point of view of functions of mind as well as from the situational requirements, different types of intelligence which are dependent on the broad types of activities were also recognised (Thurstone; 253). First was 'abstract intelligence' which is exhibited in handling of symbols - words, numbers, formulas and diagrams. 'Mechanical intelligence' which required in the individual ability to deal with objects mechanically or manipulate successfully. 'Social intelligence' (Thorndike; 251) was considered to be present in individual who becomes a statesman, businessman, politician, organiser, etc.

Wechsler (Vernon; 270) defines intelligence operationally as 'the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment.'

The word 'intelligence', according to Cyril Burt (Vernon; 279, p.27), owes to Aristotle who distinguished 'orexis' - the emotional and moral functions, from 'dianoia' - the cognitive and intellectual functions. 'Dianoia' was translated by Cicero as a combination of 'inter' and 'legere' (Inter=within; legere = to bring together, choose, discriminate) yielding a word 'intellegentia'.

'Intelligence', puts Woodworth (290), 'is a word known with the meaning of a verb or adverb. Intelligence is intellect put to use. Intellect is a comprehensive term for observing, understanding, thinking, remembering and all ways of knowing and of getting knowledge'.

Implicit in all the above definitions, is a dependence on the environmental situation, or an action that is called into play by the situation. Man is to adjust, incorporate and survive. He is simply to act according to the situation to find his life continued and preserved. Otherwise, he would perish. Thus, we find intelligence as that ability 'to adjust' or 'adapt' to changing situations or requirements. 'Power of good responses', 'profiting by experience', 'ability to learn' and such other phrases are indicative of such implicit idea.

After a brief survey of possible definitions, Sorenson (229; p.172) states, 'intelligence has been regarded as functional effectiveness of a person's abilities; the effectiveness of the mental processes of percieving, remembering and engaging or the extent of adjustment in the comprehensive sense'.

Guilford (123) extends 'adaptations' to mean learning when he writes -

"The common relating of intelligence to 'adaptation to new situations' in some definitions suggests relevance of learning, for adapting to new situations does imply learning .....".

In the context of definitions of 'creativity' given in the previous chapter, our consideration of intelligence as 'adjustment' to the changing 'situations' is conducive to the conclusion that the two concepts - creativity and intelligence - by definitions have very little in common. In other words, to argue that there is something creative in all adjustments done in order to survive is to say that there is no creativity other than dependence on chance situations which force men to do unknowingly something which later comes into recognition as creative. Such a notion leaves wide gap between itself and the notion about creativity that society has envisaged.

### 3.2 IS 'g' UNITARY?

It was mentioned earlier that 'g' as conceived by Spearman did not withstand rigorous analysis and retain its integrity. We shall see how much a beginning made by him of subjecting mental tests to mathematical analysis resulted in a new Theory of factors generating human thought and action in general, besides developing itself into a set of mathematical principles known as Factor Analysis. History of factor analysis and mental testing can never forget two names - Thurstone and Guilford - for their pioneering work in developing further what Spearman began.

Factor analysis is a method of analysing a set of observations or test scores of persons from their inter-correlations to see whether variations can be explained by a few basic variables known as factors.

Spearman, at first worked with four tests. Factor analysis begins with a table of inter-correlations. As all inter-correlations were positive Spearman was able to show when the ratios of inter-correlations of each of the two tests with other two tests were equal, that their variance could be explained for a single source. In other words, if all inter-correlations of the four tests were to be put in the respective cells of  $4 \times 4$  table, difference in cross products of any four inter-correlations of cells forming

corners of a square in the matrix is zero, then there could be a single factor causing variations in the four tests. The differences were named as 'tetrad differences', Spearman was able to find a considerable number of tests, the variations of which could be accounted by a single factor. Hence, the recognition of general intellectual factor and notation  $g$  (Fruchter; 86).

He soon found the necessity of some other factor which would explain the variance left unexplained by ' $g$ ' and he called it ' $s$ ', the specific factor. It was ' $g$ ', as he conceived it to be hereditary, which was important and could influence largely all our intellectual functioning. Specific factor ' $s$ ' was simply due to learning and training.

'In his view', writes Guilford (123), 'the best tests of ' $g$ ' are concerned in some way with relations'. Spearman, thus had a notion of ' $g$ ' as the ability to develop relations between things, ideas, etc., When two things or ideas are given, deducing a relationship was 'eduction of correlates'. When a thing or an idea and a relation was 'eduction of fundamentals'. Vernon (270) also mentions about Spearman's notion of ' $g$ ' as 'eduction of correlates and relations'.

Factor analysis was later developed into systematic body of mathematical knowledge resulting in an evaluation of



of Spearman's work. As noted by different writers and thinkers, there were some crucial drawbacks in Spearman's conception and proof of 'g' and they are as follows:

1. He conceived 'g' as hereditary and unitary simply on the basis of analysis of a few tests taken irrespective of the nature of the abilities and tests used, or the appearance or absence of 'g' was much a matter of dependence on the number and nature of tests. (Guilford; 123).
2. The appearance of 'g' is possible when the ana analyst decides that there should be a 'g' because the getting or vanishing of 'g' is dependent upon the way in which rotations are done. (Guilford; 123).
3. Sometimes the appearance of 'g' is due to increase of age in the sample during testing. (Guilford; 123)
4. He was wrong in claiming that the conventional individual or group intelligence test supplied an almost pure measure of 'g' plus small 's' for specific component. By doing so he ignored verbal, spatial, numerical and other important factors. (Vernon; 270)
5. It is basically wrong to say that the combined score in an I.Q. test indicates the different individual abilities as they are, as constituents of the test. Thus, it wipes out individual differences. (Guilford, 123).

6. Spearman's firm conclusion was that 'g' was unitary and hereditary and he attributed too little importance to 's' factors. (Vernon, 270)
7. The group tests often bring in other factors of more formal kinds like ability to do well in choice response items and capacity to work at speed. (Vernon, 270)
8. Sometimes, there are always specific components arising from errors due to imperfect reliability. (Vernon, 270).
9. It was doubtful whether statistically derived factors would be mental factors. (Vernon, 270)

In spite of all the criticisms Spearman's notion of 'g' still persists to remain. No doubt, it is because of its existence in all, some intuition which made Spearman to put forth his conception first. Spearman's work turned out to be very important turning point for the time to come in psychological experimentation and analysis, though 'g' lost its integrity to give rise to various factors forming leads to a factor theory of intellect.

When Thurstone took up the work with better methods of factor analysis (multiple factor analysis) developed by him wherein large number of tests could be analysed, he found it difficult to get a 'g' factor. The result was his oblique factor solution and recognition of 'g' as second order factor.

Guilford (123) gives opinion that as factor inter-correlations as derived from obliqueness of the factors were small, the magnitude of 'g' so derived from further analysis of factor inter-correlations decreases too much to permit any recognition.

As earlier pointed out, Thurstone (253) derived the factors which he called Primary Mental Abilities (P.M.A.). They are : Spatial (S), Perceptual Organisation (P), Numerical (N), Verbal Fluency (v), Word Fluency (T), Memory (M), Inductive Reasoning (I), Arithmetical Reasoning (R), and Deductive Reasoning (D).

In the preface to his book (Thurstone, 253) 'Primary Mental Abilities', he writes -

As far as we can determine at present, the tests that have been supposed to be saturated with the general common factor divide their variance among primary factors that are not present in all tests. We cannot report any general factor in the battery of fifty-six tests that have been analysed in the present study.....

A After Thurstone, there have been many analyses supporting his finding. As a result the factors such as verbal fluency, word fluency, numerical facility and reasoning have gained substantial support for their existence as independent factors. Besides there has been an increase in the number due to the addition of new factors found as factor analysis found its application in large scale in psychological testing.

### 3.3 CONCEPTS AND CONVICTIONS

An over-view of tests ever since the coming of Galton's reveals that a gulf between the principles involved in test construction and psychological conviction, prevalent at times, about the nature of intelligence, existed all along the history of mental testing, for the testing included many abilities of man when intelligence was conceived to be unitary.

Early tests in psychology were mostly sensori-motor in their nature. Darwinism had made so clear an influence on the subsequent psychological thought that measuring sensori-activity or physical thresholds occupied a major portion in Galtonian or Cattell's tests (Guilford, 123).

Cattell who is credited to have given a start to 'mental testing' in U.S.A., was more after Galton type tests even though he was the first to introduce the phrase 'mental testing'. (Guilford, 123). 'Intelligence' which stood for unitary mental ability had a very gloomy meaning, for, it represented all that could be measured by the then available tests.

Mental tests became more 'memory' tests after Ebbinghaus. As a result of careful experimental work, Binet, who was one of the strong critics of Galton's presumptions, had recognised the importance of such functions as abstractions, ideation, imagination, imagery, attention, etc., in measuring mental

ability. Large portion of his 1908 scale involved cognitive and memory abilities. When sensori-motor abilities occupied a minor portion, there were tests calling for such factors which are now generally called as productive thinking. (Guilford, 1923). Whether or not the tests designed to measure certain aspects, 'faculties' in his terminology, purely measured those aspects, Binet was right in employing variety of tests, for depending upon a particular type or concept would have led to lopsided perspective of individual's intellectual ability. On the other hand, he could not free himself to the contradiction of his own thinking, from the well-established notion of unitary intelligence. Thus, he employed a single composite score as a measure. We see this parsimony, continuing to exist, in the succeeding history of testing. For example, Terman, the famous exponent of Binet's tests in U.S.A., continued to believe about the unitary nature of intelligence, besides taking IQ as a sure predictor of future eminence. He simply defined intelligence as the ability to think abstractly (Terman; See Guilford, 1923). That is abstraction was simply a matter of differing understanding that could not be defined.

Wechsler, whose tests showed considerable rebuttal to the increasing dominance of Stanford-Binet of Terman's was keen enough to observe the change in the nature of tests of Binet scale from age to age. A difference in the nature of tests

obviously called for a difference in the abilities as the age level increased. He tried to avoid this drawback in his tests. But in the context of today's thinking, Binet was not altogether wrong in including different tests for different ages. His selection was based more on empirical considerations and the suitability of a particular problem to a particular age level. Factor analysis has shown that some factors which are found in adults may be absent in children. Regarding children's intelligence as a miniature of adult intelligence seems to be wrong. At the same time avoiding a particular type of test at a particular age level when it is present at other levels, for the simple reason that such a test could not be found or forming it is difficult to suit the difficulty level, is also wrong.

Another important change in the Wechsler's scale is the introduction of two broad categories of tests - verbal and performance. Here was a possibility of seeing individual's ability in two broad areas besides getting a combined measure. Wechsler too, was all too cognisant of the unitary nature of intelligence as his predecessors, even though changes he made in his scale were suggestive of 'factorial' nature of human intellectual ability.

One more important evidence suggesting the factorial nature of human ability is the differences in the performance in different parts of an intelligence test among individuals

having the same I.Q. This was also noticed earlier, much earlier than the advent of factor analysis. In the recent twenty-five years, this led to the concept of what is called, 'differential testing'. Tesman, one of the authors of D.A.T. (Tesman, 282) writes -

. . . . . Unfortunately the use of the label 'intelligence' and its ill-begotten offspring I.Q. deluded too many parents, teachers, and students into treating results from these tests as though over-all potential for learning were being appraised. While the main misconception still persists to some extent, it is far prevalent than it was and is happily clearly on the wane . . . . .

He further points that what is measured by intelligence tests is a group of two or more important abilities needed for scholastic success. Hence it is 'scholastic aptitude' that is measured by traditional intelligence tests. Anne Anastasi also has remarked elsewhere this shift in terminology.

That many abilities remained unaccounted hitherto in almost all the available intelligence tests has been one of the consistent findings of the past twentyfive years' research. And this finding made many psychological thinkers to search for a broad concept. Factor analysis of tests designed to measure what have come to be known as 'creative abilities' with traditional intelligence tests have brought forth new abilities.

Anastasi (4; p.13) points that traditional intelligence tests tried to measure those abilities which were important to one or the other culture. This is a point to be considered in the larger philosophical context. But what is important in the present considerations is the relative place of 'intelligence' as measured by available tests and <sup>s</sup>much abilities put under the rubric 'creativity'. This is needed in order to get a better understanding of human potentialities.

All along, the stereotyping of human thinking seems to have been encouraged due to convictions such as the one that intelligence is unitary and to the importance attached to the tests that had had a claim over the concept as its true representatives.

Anastasi (5) writes -

. . . . . It is certainly true that limited sample of cognitive functions included in standard intelligence tests is inconsistent with global connotations of test names. This is but one more reason for discarding the label 'intelligence test', as some psychologists have been advocating for several decades. To be sure, all test labels are likely to imply more generality than the tests really possess . . . . .

As regards mention by Thurstone, work on P.M.A.'s was an eye-opener. Continued factor analysis of tests brought forth the following important facts:

1. Intellectual structure may differ from age to age.
2. Same tests may represent different abilities at different age levels.



3. There are many abilities which have been poorly tested.
4. Equal composite scores obtained by different persons do not mean that they are equal in all the constituent abilities.

Considerations hitherto made pin-point to the primary necessity for a theory of human abilities in general, which should be broad enough to incorporate all the abilities already recognised and with enough speculative space for those which would come into light in the long run.

Secondly, they indicate a need for conducting of developmental studies of abilities. Finally, there is a need for collecting those combinations of tests which would successfully differentiate between such concepts as intelligence, creativity, aptitude, etc., according to the limits permitted by their 'cultural' meanings.

In this context, the author would like to mention that the credit of attempting to solve such problems goes to J.P. Guilford who after years of painstaking construction and analysis of tests in the Aptitudes Research Project, California, has come forth with a logical morphological model of intellect, which serves as a theory permitting enough leads to find or speculate abilities unaccounted hitherto. This has caused world-wide interest. The theoretical framework on which the author's research is based has been derived partly from

the structure of intellect theory, as it is generally called. of Guilford. In the foregoing pages the stand-point is, though briefly, made clear further.

### 3.4 STRUCTURE OF INTELLECT THEORY<sup>1</sup>

Structure of intellect theory contemplates that all human actions are due to interplaying of factors of mind. Thus, any performance when factor analysed yields itself into its constituent factors. Each factor can be described by its three facets - content, operation and product. There are four types of content - Figural (F), Symbolic (S), Semantic (M), and Behavioural (B). There are five kinds of operations - Cognition (C), Memory (M), convergent production (N), Divergent Production (D), and Evaluation (E). There are six kind of products - Units (U), Classes (C), Relations (R), Systems (S), Transformation (T), and Implications (I). If content, operation and product form mutually orthogonal faces of a three dimensional cube then there can be 120 factors with different kinds of combination of contents, operations and products. To indicate any factor or the respective cell in the structure of intellect model a trigram notation, the three letters of which stand respectively for operations, content and product facets, is used. Symbols have already been indicated above in the parenthesis after each of the categories

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<sup>1</sup>For detailed information, refer Guilford (123).

Thus, for example, DSU will give 'Divergent Production of Symbolic Units' or MTU stands for 'Memory for Semantic Units'.

Many times there is a possibility of misunderstanding operation categories as factors of mind, though it is true that operation content and product facets are descriptives of such a factor. The position of any factor is relatively fixed, for, the categories have been arranged according to the increasing order of complexity. Thus, there is continuity as each category is dependent upon preceding one. For example, if we take operation production, there is no memory without cognition, no convergent production without cognition, no divergent production without without 'probably convergent production, no evaluation without production. The same applies to content and product facets too. Hence, S-I theory should not be misunderstood as another form of faculty theory, for, it does not propose different independent faculties whose activity is based on simple associative principles.

Finally, the three dimensional classification of mental factors has led to a better understanding of traditional concepts such as memory, learning, reasoning, thinking, judgement, etc., Further S-I theory has to its credit a claim of incorporating all its predecessors and contemporaries.

All factors, known so far, have numbered to more than eighty. Remaining factors are simply speculative in nature and are yet to be recognised analytically. Thus they serve as leads to further research.

### 3.5 FACTORS OF CREATIVITY AND INTELLIGENCE

Since 1950, various factors important to creativity have been investigated. Factors like fluency and originality are comparatively old notions. Others like flexibility, redefinition and sensitivity to problems came to light mostly due to the work done in Aptitudes Research Project. Guilford himself points out work on creativity acted as a prelude to his S-I theory. One important aspect of factors of creativity such as fluency, flexibility, originality and elaboration that attracted his attention was that they as a whole belonged to Divergent Production Block of S-I model. There were, however, exceptions. Redefinition and sensitivity belonged to convergent Production and Cognition Blocks respectively.

Below given is a list of factors and their respective notation indicating their nature and place in the S-I-model:

1. Sensitivity to Problems (CMI)
2. Word Fluency (DSU)
3. Ideational Fluency (DMU)
4. Associational Fluency (DMR)
5. Expressional Fluency (DMS)
6. Figural Fluency (DFU)
7. Figural spontaneous Flexibility (DFC)
8. Figural Adaptive Flexibility (DFT)
9. Semantic spontaneous Flexibility (DMC)

10. Semantic Adaptive Flexibility (Originality) (DMT)
11. Figural Elaboration (DFI)
12. Symbolic Elaboration (DSI)
13. Semantic Elaboration (DMI)
14. Figural Redefinition (DFT)
15. Symbolic Redefinition (NST)
16. Semantic Redefinition (NMT)

Tests of divergent production abilities require subjects to produce various possible answers to a problem and since no clues or choices are given. Tests are not right-answer type questions. As most factors of creative thinking find their logical places in Divergent Production Category, now a look at the factorial nature of Traditional Intelligence Tests is of importance.

In almost all tests of intelligence, the individual is required to give a 'right' answer to test situation. Or if there are alternatives given, from which he has to select an answer, he is sure that one out of the given alternatives should be the right answer. His attention should be simply convergent upon the given alternatives without which he would have been left with greater number of alternatives. Thus, irrespective of whether the alternatives given or not, all that intelligence tests call for is a right solution to a given situation.

Getzels and Jackson (94; p. 20) write -

The conventional I.Q. test requires that the subjects know the common association to a stimulus and the accepted solution to a problem. In many of these tests the subject must respond to a stimulus for which only one 'unique' answer is correct. He is not asked to innovate, speculate ..... In short conventional I.Q. test toward the evaluation of those cognitive processes that have been called convergent, retentive, conservative more than those processes that have been called divergent innovative and constructive . . . . .

Even the dictionary (68) definition of an intelligence test points to the fact that it is a sample of cognitive tasks that are usual and expected. Further this is limited to any large cultural group or sub-groups. Vernon (270; p. 23) points to the fact that half the variance of an intelligence may be accounted by a verbal factor.

It has been pointed by Guilford (123; pp.471-73) that the conventional intelligence tests notably have tests representing CMU (Cognition of Semantic Units) and CMS (Cognition of Semantic Systems). The two factors respectively are verbal comprehension and general reasoning. Most dominant factor is CMU. Apart from these two dominant factors, in the Stanford-Binet, CFT, CMI, CFS, CMT, and WMI found to have been represented fairly. In TALS of the eleven tests, eight have been classified into cognitive category, two into memory, and one into convergent production category. Besides, the abilities such as CFT, CMU, CFS, MSI and BEU have been factor analytically recognised.

The above considerations tell us clearly that the observed relationship between the two types of performances (intelligent and creative) should be low; this has been supported by a number of studies done since 1960 to date. Apart from various studies done in the Aptitudes Research Project, we have others indicating their low relationships. Getzels and Jackson (94; p. 20) obtained a correlation ranging between .115 to .393 between Binet I.Q. measures and five creativity measures. Torrance (94; p. 25) found correlations ranging between - .02 to .32 between his creativity measures (T.T.C.T.) and other intelligence tests such as Millers Analogies, Stanford-Binet, Otis Quick Scoring, Buhlman-Anderson and California Test of Mental Maturity. Wallach and Kogan found low correlations not exceeding .23 between their creativity measures (Wallach and Kogan's Tests of Creativity) and Intelligence Tests which included Wechsler's Intelligence Scale for Children (WISC), School and College Ability Test (SCAT) and Sequential Tests of Educational Progress (STEP). Schlacht (224) reported a correlation of .30 between Remote Associates Test (RAT) of Creativity and Cattell's Culture Fair Intelligence Test.

Madans (188) reported a negligible relationship between TTCT and SCAT. Welsh (281) reported nil relationship of non-verbal (D-48) and verbal (Terman Concept Mastery Test) intelligence tests with creativity test (Welsh Figure

Preference Art Scale). One general principle that governs almost all creativity tests is that they call for many possible solutions to a situation, their creativity tests (originality, uniqueness, etc.,) being judged according to the statistical rarity of the solution. Studies quoted above cover almost all available intelligence tests. Whether creativity and intelligence are single dimensions by themselves or patterns of factors their separated-ness is clear enough.

There are others who have taken the low relationship between the two types of tests to support their argument that they are not separate dimensions or domains. Windholtz (287) found that thirteen out of thirtysix possible correlations between eight convergent thinking tests (Intelligence) and six divergent thinking tests (Creativity) were significant. This showed according to him, that the tests measured somewhat separate domains of intellectual ability. Tests taken together, the correlation of .43 between intelligence and creativity indicated that creativity is not distinct from intelligence.

One major source of low correlation that is always obtained between the two types of tests is the presence of CMU or verbal comprehension factor which is indispensable in all verbal tests. The presence of this factor has been found in almost all verbal tests of creativity. Thus, in Windholtz study the reason for the significant correlation between creativity and intelligence is evident. All tests were of semantic content.



### 3.6 CREATIVITY AND INTELLIGENCE: SPECULATION ABOUT THEIR PRESENCE IN THE INDIVIDUAL

Most commonly accepted opinion about the highly creative people is that they are moderately highly intelligent. For, empirically persons with below average intelligence have seldom been creatives. To reach a stage of high creativity, a person will have a mastery in the field. To have a mastery, it is necessary that one should be intelligent. This is a common sense approach in speculating a relationship. According to Getzels and Jackson, if persons are selected on the basis of performance in I.Q. tests, the highest 20 percent will exclude 70 per cent of the available creative talent. Thus creative persons need not necessarily be highly intelligent. But they have been found to be above average.

Guilford (123) has thrown enough light on this point by not simply relying on percentage results. He presents a scatter-plot of the individuals in the dimensions, viz., Divergent Production Abilities and I.Q. Strikingly enough, scatter plots have confirmed that persons low in creativity dimension may range widely in I.Q. but those who are low in I.Q. are consistently low in divergent production (Guilford and Hoepfner, 120). Thus, I.Q. is not a sure predictor of high creativity. In one of the articles Guilford has speculated about the possibility of curvilinear relationship

between mental age on verbal I.Q. and composite scores of creativity tests. With a starting of small relationship between the two measures, it may continue upto a limit on mental age above which there is relationship (Guilford: 116)

It is possible that there are certain behavioural factors producing such non-linear relationships. May be the creative person has the ability to support 'a tension' between convergent and divergent modes of thought.

In the Fifth Utah Conference, this question was raised by one of the participants asking whether there is any ability to 'integrate the use of abilities'. This was further concisely put as the ability to make 'strategies'. As Guilford opined, 'strategies' may be a form of 'Behavioural Systems' to a large extent (Guilford: 117). As behavioural factors largely remain unfound and speculative. Maybe, they are personality factors hinting at the necessity of intensive research on the lines envisaged by S-I theory.

At this juncture, the investigator wishes to make it clear that it is not the purpose of the present investigation to attempt to clarify experimentally the distinction between the two intellectual domains, namely, intelligence and creativity. As it is necessary to take a look at the position taken by different researchers for the reason that one should not be blind to the facts, an effort to describe the same was made in the preceding

pages of this chapter. The question of relating intelligence and creativity has not been attempted in the work done by the investigator; but an attempt to identify and measure creativity through an appropriate test in the light of previous discussion has been undertaken in the chapters that follow.