

CHAPTER

DEVELOPMENT OF THE TEST BATTERY

6.1 RATIONALE

Testing Versus Other Methods

It has been evident from the description of creativity concept given in the preceding chapters that measuring the amount of creative potential that any person is supposed to possess poses problems, for there can be no universal scale to do so. Creative products are not comparable to one another. Each product is unique when considered at the first occurrence. Enough mention has been made about different aspects of measuring creativity by product. - What would be measured? Is it material product or psychological product? Or a product below the level of awareness? If we are to identify processes, what should be the material criteria for identification and scaling?

There has also been enough consistency in the measurement of personality factors of the creative. It is doubtful whether scaling of personality traits is comparable to direct measurement by tests in differentiating individuals. Though 'Consistency' is forwarded as one of the merits of existing personality tests, identification through tests sheds light on the operations of mind involved and differs from what is observed through personality tests. Hence basic problem before a researcher remains unsolved and forces him to construction of tests.

On the other hand, there are biographic inventories. It is said that variance of criterion measures explained by such inventories is very high when compared to tests (Taylor, 241; Anastasi and Schaefer, 6). Though this adds to the merit of biographic inventories, it does not deny the merit of measurement of creativity by tests at a time when the operation is stimulated and the individual does the creative act.

As the purpose of identification of potentially creative individuals is to encourage and foster creativity, how far a biography as stipulated in the inventory and developed on the basis of biography of successful creative persons tallies with the biography of individual boy or girl who is yet to develop into fullness would be a matter for study.

A serious doubt about the validity of other measures like inventories and interviews is the low correlation with measures obtained through creativity tests. Taylor (237,241) once recognised that biographic inventory provided information somewhat different from tests. One recent analysis of same measures of creativity obtained through tests and different methods, namely, interviews and ratings shows very low convergent and discriminant validity (Goodman, Furcon and Rose, 105) suggesting operational differences in the measures. Biographic inventory (Taylor, 237,241) has very low correlation-ship with tests. Inventories and ratings seem to be subjective and indirect measures. Better methods of ratings or interview are to be evolved on the basis of theoretical targets.

For example, the existence of a factor like ideational fluency is well established, psychological meaningfulness of ^s much factors has been substantiated through factor analytic studies. When tests provide a better understanding of concepts, it would be worthwhile to establish the convergent validity with other methods by constant change and improvement of latter methods. Human judgement fails to reach what has been achieved through factor analysis. Judging creativity factorially through rating or interview method may be more difficult than deciding it as a whole. Then other methods have low relationship with tests which have been developed to measure those mental factors which

directly are responsible for creativity, may be, by relying upon other measures. We are committing serious injury to the concept which we want to investigate. All this suggests necessity for improving other measures. To a limited extent, this point would be considered while preparing for getting criterion measures in the present investigation.

The other side of the argument^e is about improving creativity tests. The researcher is on a constant pressure to evolve tests which are better and direct measures of a concept rather than to produce several peripheral criteria. When we rely upon the consistency of other means of identification, there is much meaning in their low relationship with direct measures. For it is possible that the peripheral measures might be explaining many other aspects besides the one that we have assumed to be represented by them. And it is also possible that there are other factors yet to be identified through tests and somehow considered while rating of interviewing. This is true of those factors in the behavioural content - category of Guilford's S.I. model (123) wherein many factors are hypothetical yet.

As to the predictive validity of all such methods of identification, only reasonable way seems to be to resort to follow-up studies, similar to the one which Terman conducted.

After having tapped different contents of human thought through tests, if tests fail to come out as means of identification, it makes one wonder what also could be creativity. What the present investigator wants to stress is the need for synthesis of all available research findings while validating his tests.

Survey of Test Operations

Whitehead (234, p. 157) once remarked that in creative thought common sense is a bad master; for the common sense means judging whether the new ideas look like old ones.

Almost all available creativity tests directly or indirectly seem to have been based on the present understanding among the psychologists that human creativity is involved in rare behaviour (Guilford, Torrance and others). Response to a particular test stimulus is a product itself. Thus statistical rarity has been considered to be a measure of originality factor without which creativity tests may be deemed to have lost their validity.

In evolving the present test battery, the author has given due place to different approaches to creativity testing viz., those of Guilford, Torrance, Wallach and Kogan, Mednick and Mednick, and Barron.

Well-known are Guilford's views on the nature of creativity. He has considered creative ability as consisting of sixteen or more factors (mostly belonging to operation-category of Divergent Thinking). Information necessary for the present study has been given in the earlier chapters devoted to review. For a detailed study readers are requested to refer to the original source (Guilford, 123).

Grouping of Factors

Of these factors three clusters seem prominent. In other words, grouping of these factors into three clusters seems to be possible. Even Guilford's descriptions which have been coming from ~~the~~ time to time ever-since he first brought S.I. model show a definite tendency towards such a grouping of creativity factors, namely, fluency factors, flexibility factors, and elaboration factors (Guilford, 119). In simple words, fluency refers to ability to give a number of responses. Flexibility refers to ability to make shifts either spontaneously or adaptively.

Originality has been claimed to be semantic adaptive flexibility (Guilford, 117). Redefinition factors which are odd representatives from the convergent block in the group of creativity factors have been regarded as one kind of flexibility (Guilford, 123). Flexibility group encompasses most important factors of creativity. It may even be

convenient in future to term 'Flexibility Group' as 'Originality Group', thus broadening the concept of originality to encompass different components of flexibility.

Elaboration refers to ability to give details. Giving more number of details would mean increasing elaboration. Elaboration adds to meaningfulness, most probably, decreasing ambiguity of a response.

Evolving Pure Factor Tests

In the course of nearly twenty years efforts by Guilford and his associates to evolve relatively pure factor tests have resulted in commendable success. For a new-test maker who is innovative these factor - tests are sufficient to give a clear idea of what operation a particular factor-test should demand. The tests, if comparatively studied, give relative nature of factors too.

However, the tests so evolved have shown themselves to be loaded on other factors too. As is evident, it is humanly impossible to break the unity of human actions through experimental control, though actions highly oriented to any particular aspect (such as factor-tests) can be found. Evolving pure representatives of different psychological factors stipulated in the S.I. model has been achieved by application of one or more of the following methods:

1. Making the operation involved in responding to the test item as nearly oriented to factor concept as possible.
2. Giving suitable instructions to elicit such responses which as nearly as possible, are oriented to a factor-concept.
3. Setting a suitable criterion for scoring the responses to a test item.

A measure of accuracy and check has been rendered through factor-analysis. Achieving same factor structure, relatively high loadings on the hypothesised factor with low negligible loadings on the others through repeated factor analysis has been an indication of the consistency with which tests stand.

In almost all factor analysis, one difficulty has been impossible to overcome : the test hypothesised as representatives of one factor getting substantial and in many instances significant loadings on one or more of the other factors. Probably pure factor-variance is hypothetical or simply a myth. There seems to be no human action which is factorially pure.

Inter-dependence of Factors

Research workers seem to have considerable agreement on the existence of mutual influence or inter-dependence of these factors. Guilford (123) has recognised the existence

of intercorrelations among intellectual factors as a general problem to be investigated. However, he recognises them as functions of person-population and test-population (p. 471);

He also speaks of intra-factor transfer (p. 475) introducing to an 'enlightened' idea of formal discipline.

Amidst all this speculation about factorial nature of mind, it seems reasonable to believe that what amount on each factor is called for by the individual in doing a particular 'act' is dependent upon the stimulus situation, what the individual possesses and what he intends to do. May be it is a matter of training too.

While constructing their tests of creativity for young children, Wallach and Kogan (274) observed, 'the individual who can produce a greater number of associates also will be the individual who can produce a greater number of unique ones' (p. 17). Studies regarding ordering of occurrence of events and their logical nearness to the stimulus seem to be not many in number. Christensen et al. (41) found that originality of a response increases after a first few responses. Fluency is negatively accelerated with time (123). Researchers have tried to express these relationships mathematically (Guilford, 123).

Considering interdependence of fluency and originality scores - Eise^uman (65) felt that "there is a sort of built-in

correlation between fluency and originality, since the person who gives many responses is likely to exhaust his common responses and move into more original ones".

These points simply suggest that basically some relationship exists between the measures like fluency, originality, etc.. Even elaboration can be said to be addition of unit ideas into some central idea. Pointing to the existence of relationship is not, the present investigator feels, to deny the existence of relatively recognisable aspects of factors of intellect.

Even the potential arguments put forward by Wallach and Kogan to defend the unity of creativity domain fall short when we see their failure to recognise the behaviour 'factors'. Denying the existence of factors by showing that there is some sort of functional organisation sounds like denying the individual existence of human beings by showing that there is evidence for the existence of a society or world! Existence of creativity domain and of factors seems to be analogous to the existence of a world and men in it! Selecting tasks to tests for different factors is analogous to selecting extremists of one sort or another in the world!:

Elsewhere Guilford has recognised that depending upon the availability of factorial resources within the individual, individual prepares his own way of attack when tests

requiring factor-tasks other than the ones which the individual is capable of are given (Guilford, 123).

Even to the evidence (Torrance, 256, Wood, 276, Fee, 71) provided for and against the two broader domains within creativity-verbal and visual - Guilford's cautious words that such specialisation among the individuals are nothing but result of 'translation' from one content to another and are a matter of interest, scope and training the individual gets - apply as well.

Stylistic differences have been observed in preference for dealing with verbal or visual material. This may also amount to the existence of different domains within creativity. These considerations lead to the following conclusion. Factors exist, relationships exist, functional unity exists. Hence, blind-defence in any direction - independent factors or no factors - will not be useful. But it is better to accept the factors as they are. That is, accepting the factors as independent to the extent of absolute independence or accepting the unity of creativity to the denial of factors might not even serve researcher's own creative mind of being skeptic and continuing search. For Torrance¹, factors or no factors - 'that is the way it is'.

¹Letter, E.P. Torrance to the present author, July 2, 1969.

All the considerations made in the preceding pages suggest treating different factors as they exist in the individual and to the extent these factors come into action in a particular act as a worthy approach to understanding of creativity phenomenon. We are satisfied if the operation of responding is regarded as creative one. Otherwise, as Torrance feared we may be getting dilated view of creativity in person.

Derivation of Multiple Scores

When fluency, originality and elaboration are insisted on simultaneously and the individual is left free to give as many different ideas with as much elaboration as possible in a given time, it is a matter of individual style, preference or natural tendency to go high in one or more of the three aspects. Here we see individuals as they are. It is doubtful, if we are to evolve pure factor tests, how far will this be achieved by controlling instructions. This will not be known until a study of each of these 'factor-tests' is done by scoring them for different factors and factor analysing intercorrelations of these scores. Guilford's 'Utility Test' was scored for fluency and flexibility both. Plot Titles was scored for fluency and originality both. 'Consequences' was scored for fluency and originality both. 'Make-a-figure' Test was scored for fluency and flexibility both. The four

tests mentioned just now seem to be examples of multiple scoring attempted by Guilford. Each test is essentially a fluency test scored for another factor.

In case of Plot Titles and Consequences instructions were varied to get different scores. In one of the Guilford's studies (142) all the four tests mentioned above were employed.

Neither of the two scores (fluency and flexibility) derived from utility test had significant loadings (.30 or above) on the unhypothesised co-derivative score (i.e., fluency score getting significant loadings on flexibility factor and vice-versa).

In the Plot Titles Test, fluency score showed a loading of .30 on elaboration which was neither hypothesised nor a co-derivative. Originality score went as hypothesised with originality factor. 'Consequences' fluency score went as hypothesised. However, 'originality' score went with flexibility with .31 as its loading and .27 on originality. Fluency score from Make-a-figure Test gave a loading of .41 of figural systems factor too. This was unhypothesised and not co-derivative score. Make-a-figure score for flexibility did not go with any factor. Another matter of importance is that all the co-derived scores had loadings of .20 and in some cases near .30 on their peers or on unhypothesised factors. As rotation to meaningfulness, to some extent, is

an affair subject to investigator's choice, these loadings (particularly near .30 loadings) deserve consideration. Getting loadings on unhypothesised factors is not uncommon in case of individual test scores (where multiple scores are not derived).

The above consideration leads us to the conclusion that multiple scores furnish better information or at least as much information as single scores from factor tests about the hypothesised scores and better about the nature of performance itself.

In case of multiple scores, unhypothesised factors on which the hypothesised score had loadings were mostly divergent thinking factors. This indicates the harmlessness of multiple scores. Creativity has been considered to be divergent thinking constellation of factors by the Guilford group.

Guilford too, prefers multiple scores provided that the scores differ from each other and supply more information¹.

One important point which Torrance considered was the unity of the creative act. Studying creativity in segments seems to be breaking the organisation of the act itself. By applying control through suitable instructions we might be controlling or impeding the creative act itself. We may

¹Better from Dr. J.P. Guilford Director, Aptitudes Research Project, U.S.C. to the author, May 19, 1969.

not be doing justice to the purpose (Torrence, 256). Credit goes to Torrance as he seems to be the first to derive multiple scores for fluency, flexibility, originality and elaboration together from a single set of responses to a test stimulus. Further the composite creativity score from his tests has acceptable validity and reliability. Factor analytic proof is pending. Factor analysis may be necessary because we know how, in Make-a-Figure Test, hypothesis for a shift score went wrong (Hoepfner, 142). Instead it had a considerable leaning towards fluency. Guilford has conceded this hypothesis.

Lack of proper studies which throw light on the mutual effect of factors has created considerable hesitation among researchers in obtaining a composite index of creativity. Bare assumptions which have proved useful in predicting the criterion may not necessarily give clear picture of nature of scores. Some researchers have not attached much importance to factor approach. Wallach and Kogan (274) derived two scores from the responses to the test stimulus. The scores are: (i) Number Score, and (ii) Uniqueness Score. Number Score can be said to be a fluency score and uniqueness score can be termed to be originality score. They have firmly attached themselves to the conviction of unity of creativity domain. Whatever be controversial nature of the arguments put forward by Wallach and Kogan, uniqueness and number scores are, nodoubt, multiple scores and together form a composite score

which can be considered to be a smaller version of what Torrance did. The authors Wallach and Kogan are satisfied with only two scores.

6.2 NATURE OF THE STIMULUS

What sort of person is the creative? What sort of stimulus situation is suitable to him? What are his likes and dislikes? What is considered to be creative product? In the introductory chapters, answers to these questions have been given with considerable elaboration on the basis of opinions of researchers in the field. These will be considered in brief as suggestive of stimulus requirements for a creativity test.

Creative person has been termed to be 'self-sufficient introvert' (Cattell, 38, 40). Absence of repression seemed to characterise creative person (Mackinnon, 187), tolerance for ambiguity (Barron, 19, 123); Eisenman (64, 65) stand as open evidences of nature of creative person. That is, creative persons like to be in an ambiguous situation and prefer complexity. Creative persons are capable of making remote associations through sustained or mediated associative activity (Mednick and Mednick, 200).

Creative products are statistically rare (Mackinnon, Guilford and others) and give either new dimension to existing system of information or entirely new ones (Ghisellin, 98). Somewhat chaotic, incubative or mixed feeling characterises creative process (Ghisellin, 98). Relative absence of repression is indicated in the biographies of creative persons (Mackinnon, 187).

Cattell used his 16 PF questionnaire to find personality characteristics of the creative persons. Experimentally Rorschach, TAT or HIT have been used to find personality characteristics. All the three contain ambiguous stimuli. Barron-Welsh Art Scale has been based on the hypothesis that creative persons prefer ambiguity and complexity and consists of black and white figures. Mednick's Remote Associates Test gives an opportunity for mediated associative activity.

Plot titles, consequences and utility Tests use either statistical rarity, cleverness or remoteness of responses as basis for getting originality score. Even in Minnesota Tests of Creative Thinking and Wallach and Kogan Tests of Creative Thinking, the principle of statistical rarity has been utilised to get originality and uniqueness scores respectively. Ghisellin constructed a Creative Process Check-list (Ghisellin, 99) which provides a linguistic schema expressive of creative process.

A stimulus, then, should cater to the needs of creative person and be 'gratifying'. It should be ambiguous and ^{should} characterise a schema, though chaotic, suggestive of many interpretations. Obviously an ambiguous stimulus is remote from reality and may be having blurred similarity to many real things or situations. For any person to specify real things as representative of the stimulus requires tolerance for ambiguity on his part.

Commenting on Rorschach responses Maria J. writes,

The occurrence of an experience of recognition presupposes the existence of certain degree of similarity between the incoming stimulus complex and a system of memory traces left behind an earlier perceptual process.

According to Gestalt theory, this correspondence does not imply absolute similarity based on identity of elements, but rather similarity of Gestalt character The author, thus, refers to "traces of earlier perceptual process". Guilford (123) talks about 'matrix of experience'. Mednick and Mednick (200) tell us about the 'prepared mind'. Many refer to new organisation emerging from old ones. May be the mind of the creative is permissive or tolerant to such disorders inside him.

Tolerance for ambiguity as defined by Bunder, (34), is the tendency to perceive ambiguous situations as desirable and gratifying. The ambiguous situation is characterised

by complexity, novelty together with certain amount of imbalance and disequilibrium in the phenomenon suggesting apparent insolubility.

It is this disposition by virtue of which the individual finds complex, ambiguous or remote situations as meaningful and gratifying; searches from the matrix of his experiences those configurations which have blurred similarity with new reality that leads to creative production.

When TAT or Rorschach present visual figural stimuli, Plot Titles, Utility Test, Consequences or RAT may be supposed to present semantic verbal stimuli. However, the latter tests seem to be more meaningful as far as stimulus nature is concerned. A via media seems to be Torrance's 'Just Suppose Test' which presents ambiguous but suggestive figural stimuli and a situation described verbally (Torrance, 256). TAT or the Rorschach were not designed with specific purpose of identifying the creative potential. Even some research findings contradict the assumption that ink-blot tests can be used to assess originality or creative ability (Roe, 218; Barron, 21).

Barron (21) showed that the following tests had construct validity in measuring originality; Unusual Uses, Consequences B, Plot Titles B, Rorschach), TAT Originality, Anagrams Q, Word Synthesis Originality, Ink-blot Originality. These had correlations between .38 and .62 with a standard

score sum used as a composite measure. Except Rorschach O^+ and Ink-blot Originality all the measures correlated significantly with staff-ratings.

In BWAs, individuals expression is limited; they are asked to tell whether they like or dislike a set of figures of varying ambiguity and complexity. RAT limits individuals expression in another sense. In RAT answers are presupposed or predecided. This point has been mentioned by Wallach and Kogan (274). They point to the fact that situations presented in RAT have been one and only right answer and do not give scope to the individual for divergent thinking. Rather getting presupposed answer is more a convergent act.

In the case of eight tests used by Barron (21) in his study, he points that all the tests are of free response type. "The respondent is not presented with alternatives devised by the test maker, but must instead summon from within himself his own way of solving problems, seeing plots, interpreting pictures, putting together the words or letters and so on....." (p.555). What is of interest to the present author is the nature of the stimulus. Each relies upon ambiguity of the stimuli in one way or the other. Even RAT gives sets of words, as described in the previous chapters, which are remotely related. The remoteness obviously means that the relationship is unclear or ambiguous. Adaptiveness to reality is one of the condition for creativeness (Meckinnon, 187).

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Barron (18) describes WIPT - Figures in the following words :

When one looks at the drawings that arouse such strong disagreement, one sees that some people are especially fond of simple and symmetrical designs, while others much prefer complex and a-symmetrical ones. The simple-symmetrical figures usually are drawn according to some easily recognised geometrical principles, and they are described by such adjectives as clean, regular, neat, well-ordered; the complex asymmetrical, figures are more commonly free-hand drawings and may be described as dynamic irregular, whimsical, complicated, messy or even chaotic.

Each was line drawing in black ink on 3 x 5 inch card. Later, figures for BWAS were chosen from this, in addition to some constructed thereafter. It has been speculated that the author (Welsh) was much influenced by BMPI (Sixth, MAYB).

A study conducted by Pine, P. (212) on 'Thematic Drive Content and Creativity' indicated creative person as one with heightened receptivity to 'drive derivatives' of thought.

Mackinnon writes -

Regardless of the level of his measured intelligence, what seems to characterise the creative person - and this is especially so for the artistically creative - is a relative absence of repression and suppression as mechanisms for control of impulse and imagery. Repression of creativity regardless of how intelligent a person may be because it makes unavailable to the individual large aspects of his own experience (Mackinnon, 187).

Hednick (199) mentioned that there is 'a desire' in the creative person 'for associative novelty'. By providing novel stimuli, the behaviour in which a creative person has been systematically engaging is reinforced.

The points mentioned above particularly the close association between stimulus nature, absence of repression, tolerance for ambiguity and free associative operation, seem to suggest that a test which presents ambiguous stimuli and asks for responses (which refer to things in reality) to be freely associated has much promise for being a creativity test. Wallach and Kogan's Pattern Meanings and Line Meanings seemed to the present author as being on the lines considered just above.

The figures used by Wallach and Kogan are simple ones unlike those Barron described. Obviously subjects in the Wallach and Kogan's study were young children of fifth grade. Age ranged between 10 and 11 years. Only a few figures seemed relatively structurally complex. To expect much variability in the complexity of stimulus is out of place as far as the age of the children are considered in Wallach and Kogan's study. Other tests used by them are similar to those of Guilford Group. As already pointed out, Guilford's Plot Titles may be considered a verbal analogue of non-verbal tests like Pattern Meanings and Line Meanings. Again creatively, this is true when we draw a remote relationship !

One question that was often discussed among the ink-blot psychologists is whether ambiguity is responsible for getting personality information. More the ambiguity more is the personality information that it derives. This has been a disputable assumption (Epstein, 69).

Sometimes, it has been argued that ambiguous item may not have its own response tendencies and can act as a clean slate for projecting the subject's own perception. As opposed to this, some argue that it has its own response tendencies. There is also a possibility that the situation fails to get responses from a particular individual at all. Under these circumstances, it may be advantageous to construct a sample of figures distributed along the ambiguity continuum so that the sample so chosen invariably touches distinct points in the perceptual field of subjects.

We do not know to what extent a stimulus figure is ambiguous. One assumption that seems reasonable is that the ambiguity increases as the number of suitable interpretations increases. In a given population of figures of varying ambiguity, figures can be selected on the basis of varying number of possible interpretations that each figure is capable of receiving in a given interval of time.

Depending upon investigator's skill and purpose, if a sample of figures of varying ambiguity (and complexity too) is prepared and tried, it will be possible to select figures

at different points of the distribution of figures obtained according to number of possible interpretations that an average individual can give.

What relationship ambiguity bears with complexity is not known. Number of parts that a figure contains may be one aspect to be considered in deciding complexity. Organisation may be another aspect. Visual figural stimulus has some advantage. As pointed out in the introductory chapter, visual figural stimulus involves least use of language. Hence, conveyance of meaning in verbal terms is not needed. Non-verbal tests are less affected by schooling than are the tests of verbal nature. There is better scope for introducing varying ambiguity and complexity without getting into the difficulty of conveying the situation through words. Any verbal description may give different meanings to different individual. Figural content has been considered as basic to all mental operations.

Discussion made in the preceding few pages on the nature of stimulus should not, however, be taken to mean that only visual figural stimuli would be used in the test proposed. This point will become clear in the later sections.

Nature of Responses

Much light has been thrown on the nature of responses by Mednick and Mednick. According to Mednick and Mednick, the

creatives are unreliable associationists. Mednick and Mednick hypothesised that the creatives have flat associative hierarchies (Mednick and Mednick, 200). That is to say that "There is no single response that is so dominant in them" (Mednick and Mednick, 200) as to occur first every time. Rather they have 'desire for associative novelty' and not for providing stereotyped responses. By providing a novel stimulus, the behaviour in which the creative person has been systematically engaging is reinforced. From this view point too, that creative persons may fare better in giving novel associations than other, as they like ambiguity and such stimuli which persist many interpretations seems to be valid.

It has been hypothesised that the non-creatives have steep associative hierarchies. Thus, the speed of response falls after initially starting high. It would seem that non-creatives poured in the beginning all stereotyped responses with no collection, in their reservoir, of non-stereotyped or remote ones to give out the prolonged responding. This results in steep fall in the rate of responses. The creatives, on the other hand, it has been hypothesised, do not show high speed in responding but maintain the rate with slow decrease for long time this tending to think and give more and more novel responses (Wallach and Kogan, 274). All this suggests that there is a cut-off point after which the non-creative

score increasingly less than the creative. The success of Guilford's cleverness score seems to be due to this fact. Eliminating ordinary responses would literally mean that we are eliminating those responses which occur most in the group and are thus stereotyped ones. A graphic description may be found in Mednick and Mednick (200) and Wallach and Hogan (274).

In some of the tests mentioned earlier, measures based on statistical rarity and meaningfulness have been taken as originality score. Deciding statistical rarity of responses would pose problem as original responses are never identical which would be crucial point in deciding the frequency with which a response occurs. This point, however, has not been discussed in the available literature on creativity.

That cleverness score and rarity meaningfulness score are both valid for measuring originality is indicative of synonymity between them. Probably discounting frequent responses would mean that we are discounting stereotyped responses which occur more below the cut-off point suggested previously. Finding that common responses tend to occur early in the response sequence, and the more original responses occur later (Christensen, et al., 47) is also suggestive of the above considerations.

As Mednick and Mednick pointed out, even words can be considered to be steep or flat associative hierarchies.

In Lednick's study, 'Table' and 'Comfort' as stimuli have been compared in terms^s of respective associative hierarchies. The difference in the slopes may be due to the different distances that the two stimuli have from the responses in the person's matrix of experience.

'Table' refers to an object and 'comfort' is a feeling. Both getting 'chair' as a first response is also very interesting to analyse. 'Table' and 'chair' are contiguous. 'Comfort' and 'chair' are remotely related because 'chair' is an object and 'comfort' is a feeling. 'Table' is a figural visual concept, whereas the latter is an abstract concept. Even in terms of Guilford's S.I. categories of content, the two are distant. One is figural and the other probably 'semantic'.^t Suppose a response such as 'moving'¹ to 'Table' is given, it seems original when compared to 'chair'. In the same way giving a response as 'weeping'² to 'comfort' (There is comfort after weeping!) also seems original. This simply is 'feeling' to 'action' relationship. Asking 'unusual uses' of a common object (Guilford's Test) or 'consequences' of an 'impossible' situation (Torrance, 256) seem to have been done to introduce stimulus-response distance or remoteness. Guilford (193) characterises creative ability as involving 'transfer recall'. It is not replicative (p. 319). Any response an individual is capable of giving can be made meaningful with respect to a

^{1,2} Fictitious examples.

stimulus; hence it is the remoteness or the stimulus-response distance that matters. This can only be considered with respect to the group provided the set of stimuli are same to each subject of the group. Hence, it seems feasible with a set of stimuli, one can decide what responses usually differentiate creatives from noncreatives. One such study with figural visual stimuli, which throws much light on the nature of responses that are given by creatives has been done by Richter and Winter (217). Creative subjects gave responses to Holtzman Ink-blot tests involving more definite form, colour, movement, human content, integration of blot-elements, pathogenic verbalisation, anxiety, hostility and abstract content. Guilford (123) regarded animal responses to Rorschach as common and hence not original. Clark, Veldman and Thorpe (42) found that high divergent thinking subjects gave responses involving movement, anxiety, hostility, colour, penetration and use of large areas of blots.

Torrance (256) considered ability to integrate elements as related positively to creativity and awarded bonus points for integrating more than one circle in a figure in the 'circles test'. Wallach and Kogan (274) considered only responses relating the stimulus figure as a whole and not responses relating to part figures, in their Pattern Meanings and Line Meanings. However, part responses or those meaningless or irrelevant ones were very few.

Wallach and Kogan's Tests seem to have one advantage over Torrance's Non-verbal Stimulus Tests - namely Picture Construction, Incomplete Figures, Circles or Squares. Each of these involve artistic skill restricting free expression of thought. Ideas can be expressed verbally at a much faster rate than through drawings. Not much difference between Torrance's Non-verbal Tests and Wallach and Kogan's Tests is seen in the mental operation involved in deriving 'real things' as responses from the given visual - figural stimulus. Further Wallach and Kogan's Tests do not require the subject to respond in writing. Allowing the subject to write would have been advantageous for deriving an elaboration score. As that was not the purpose of Wallach and Kogan and subjects were young children, the procedure adopted by them was quite appropriate.

Implications of the discussions made hitherto would be that with a set of figural-visual stimuli of varying ambiguity it is possible to differentiate the creatives from the non-creatives by eliminating frequent meaningful responses and counting from the remaining those which are clever, literary and indirect (or remote) ones known to be characteristic of the creatives. Obviously we are combining the principle of statistical rarity as well as some findings discussed earlier on the nature of responses which differentiate the creatives from the non-creatives.

Permitting the individual to write the responses verbally would be advantageous to get elaboration and flexibility scores.

Guilford (112) has presented a matrix presenting complete view of responses to different stimuli elicited in different occasions. Particularly the case of divergent thinking fits in to the paradigm well. If order of the responses is considered as 'different occasions' responses to different stimuli can be presented in the form of a matrix.

The Content Aspect

One more intriguing question in test construction is what content categories should be represented in the test. Content categories, as classified by Guilford are four: Figural, symbolic, Semantic, and Behavioural. The last being yet in the exploratory stage, more attention can be paid to three well-identified content categories. Creative persons from different fields are found to have different content orientations (Guilford, 125). Hence providing stimulus from different content categories or at least including those which evoke responses from each of the content categories may be useful condition while constructing the test. However, very little consideration has been given to this aspect in creativity research. Much explored content category seems to be semantic. Though 'Figural' tests are

advantageous, it is difficult to say which occupies the next position - figural or symbolic.

In Chapter IV, tests for different figural and symbolic factors of creativity developed by Guilford et al., have been given. In Torrance's or in Wallach and Kogan's Tests, it is difficult to judge content categories to which the responses belong. Symbolic content at least in the form of stimuli seems to be absent. However, it is difficult to say how subjects perceive the stimulus. Hence, it is quite possible responses belonging to all the categories come forth.

In the case of Wallach and Kogan's Tests, published results have been factor analysed by Ward (276) and Fee (74). Ward was able to identify one creativity factor and another factor defined by the number of responses given. These were distinct from factors identified as intelligence and test atmosphere. Fee recognised four first order and two second order factors. The two second order factors were identified as creativity and intelligence. Of the four first order factors, two were creativity-verbal and creativity-nonverbal and the other two were intelligence and attainment factors. Obviously the two first order factors - creativity verbal and creativity visual - sheds light into the two types of operations involved - verbal (probably semantic) and visual (probably figural).

Though factor analytic studies have not been done on Torrance's tests, they too seem to identify distinct domains namely verbal and non-verbal. Concluding on the basis of the low interrelations between verbal and non-verbal tests, Torrance and Gowan (260) stated 'they appear largely independent'.

When there seems to be no general rule regarding stimulus-content orientation, there is enough support to existence of creativity factors in all the three content areas. As to the nature of symbolic Creativity Tests only Guilford's Tests are better guides.

The proposed test which is intended to be used for secondary school-leaving children should include items involving symbolic operations, the absence of which is evident in the set of tests (other than Guilford's factor tests) which have been considered as measuring 'creativity' in general; otherwise, it may amount to a serious error. As is well known, subjects like mathematics and science occupy a place of pride in the secondary school curriculum. Hence, a test which does not take into account symbolic operations might be partial to the very purpose of identifying creative children. Discussions done in the preceding pages is more of speculative nature and should not be regarded as ultimate expression of author's opinion. The Author has

simply tried to give expression to what he felt before he attempted to construct items for his test.

Strategy for the Construction
of the Test:

In the light of the discussion done in the preceding pages, following strategy may be adopted in the present study for the construction of the test:

1. Testing may be through creative acts and not by factors.
2. Fluency, flexibility (originality too) and elaboration scores may be derived from the responses got to a single stimulus.
3. Test may contain figural stimuli of varying ambiguity.
4. Test may contain symbolic stimulus items.
5. Test may be so designed as to permit subject to write the responses.
6. Test may be analogous to Guilford's R-Matrix.
7. Verbal stimuli may be avoided in preference to figural and symbolic.
8. For originality score, a combination of statistical rarity - cleverness procedure may be adopted.

Description of the Test (Pilot Study Stage)

Test used in the pilot study stage consists of four parts. Each part is a response matrix analogous to R-matrix suggested by Guilford. First part contains twentyfive line drawings of varying ambiguity prepared by the author. Size of each drawing is 3 x 2 cm.. As far as possible, structure and possible analogy to real things has been varied in order to get a pool of twentyfive figures (See Appendix A-1) which are heterogeneous in nature and of varying ambiguity and complexity. Nature of the figures can be best described in Barron's words quoted earlier. In each test booklet, left extreme side of each page contains five figures arranged (pasted) vertically one below the other. Against each figure provision has been made for writing responses. That is against each figure there are rectangular blanks in a horizontal row. Each blank is for one response. In all there are six blanks for writing responses on the obverse and there is space for eight more responses on the reverse of the page so that maximum number of responses that one subject can write for each figure is fourteen. However, this should not be taken as a condition. If the subject wants to write more he is permitted to write wherever space is available mentioning the figure number to which it stands. For each figure the subject is to be given six minutes. Figures distributed in five pages were coded as D, E, F, G and H. Maximum number of responses and the time limit has been fixed

on the basis of try-out on a few children. Subjects are asked to write what the figure represents or contains in brief title-like descriptions.

A section on the right hand side of the obverse of a test page has been devoted to personal particulars of the subject. This part just now described has been named as 'Creativity Response Matrix I'. Hereafter this will be referred as 'CRM I'. Excluding time for instruction, CRM I requires two hours and thirty minutes to be completed. Figures distributed in five pages were coded as D, E, F, G and H with subscripts referring to the position of the figure say D_1 to D_5 , E_1 to E_5 and so on.

Second part consists of twenty-four figures (See Appendix A-2) arranged (in the same manner described above) in three pages. Each page contains eight figures. Variation of ambiguity and complexity has been somewhat controlled as the figures have been prepared using the same three letter shapes: O, V and I. Figures have been constructed by the author himself.

Any good combination of the three letter shapes obviously different from its peers has been retained as an item. No figure carries any specific or clear-cut meaning. Each is structurally single and would evoke, it is hypothesised, more figural responses. Thus, the figures in this part differ from those in the first part in that all have the same parts,

structurally, simple and well defined. Complexity as well as ambiguity do not seem to vary much. To respond to each figure, subject is given four minutes. Subjects are required to give things or subjects or even situations which is depicted by the figure. This part which is named as Creativity Response Matrix II will be referred briefly as CRM II henceforth. Excluding time for instructions, CRM II requires one hour and thirtysix minutes. Distributed (as in CRM I) in three pages, they are accordingly coded as A_1 to A_8 , B_1 to B_8 and C_1 to C_8 .

Third part is a symbolic sub-test. Subject is acquainted with nine letters of alphabet, viz., P, B, Q, M, Z, K, Y, T and S. Each is equivalent to a numeral in the order of its position from 1 to 9. Just as figures are given in CRM I and CRM II, so six letter-duplets (See Appendix A-3) are given one below the other at the left hand side of the test page. Subjects are required to convert the duplets into as many triplets of equal sum as possible in two minutes. It is however thought the test is a combination of two operations:

- (1) substituting letters to numbers and vice-versa,
- (2) splitting a number into sums of three numbers. This part is named as Creativity Response Matrix III which will be referred in short as CRM III henceforth. Excluding time for instructions, CRM III requires twelve minutes to be completed.

Fourth part too is a symbolic sub-test. Matrix form is maintained as in the above tests. This contains five sets of five positive numbers (See Appendix A-4). Subjects are to use all the five numbers of a set and all the four fundamental arithmetical operations ($+$, $-$, \times , and \div) only once and successively to get positive round numbers. Examples(to be worked out on the blackboard) will be given while giving instructions. Subject is required to work out the response within a blank space provided for the purpose. Excluding time for instructions, Creativity Response Matrix IV, as it is named so, required twenty minutes to be completed.