

CREATIVITY IN STUDENT ARCHITECTS

by

HARALD-EDWIN SCHMIDT, M.A. (VICTORIA, N.Z. 1961)

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WHAT IS NEW?

Something borrowed is in each of us
And with the originality,
Which is only an originality of degree
And not of kind
We have to be thankful
To the force of all forces,
The first mover.

H.E. Schmidt (1959)

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CHAPTER I

THE PROBLEM

1. The Aim

One of the most important aims of psychological research is to bring order into a world where unlimited variations of human behaviour exist, and describe it in as few fundamental dimensions as possible. The point of departure is often certain aspects of everyday behaviour and the research is for common fundamental denominators. In many areas of human development, tests for the assessment of the individual's potential can be beneficial and useful in placing the individual into a certain category or a certain vocation.

The present study involves an attempt to develop tools with which to predict and measure the academic success of architecture students. In greater detail the aim is to assess the predictive value of a battery of tests in distinguishing between high and low creativity-level architecture students, and to explore the relationship between creativity, motivation, and visualization. By the same token the tests are expected to provide personality profiles typical of the two creativity levels.

The theoretical importance of the study can be seen in:-

- 1) the study of what effect the factors, field-dependence/field-independence have on creative ability;
- 2) the investigation of motivation and its relation to creative production;

- 3) the identification of the anxiety level which is best suited to help further creativity;
- 4) the demonstration that a certain amount of visualization is needed for creativity to take place;
- 5) how much hostility, prejudice and intolerance is a hindrance to the development of creative ability;
- 6) the assessment of correlation between academic achievement and creativity for the architecture student sample;
- 7) the development of new measurements of creativity, motivation and visualization.

The ultimate aim is to provide a means of selecting architecture students before they begin their studies so that those who are unlikely to succeed may be eliminated. In summary, this investigation is concerned with theoretical and practical aims which will lead to the establishment of the personality profile of the successful architecture student. This involves the development and use of predictors of creative ability and the validation of such predictors against the lecturer's rating and academic success.

2. The Architect as Artist and Scientist

Architecture is unique in its requirements for creativity because in it creativity and success are so interwoven that they are practically synonymous. The architect must not only be able to be creative on the drawing board, he must also have knowledge of the history of architecture and building construction, and be able to keep up with new methods and materials and maintain his creative role as a designer. He is that rare combination of creative artist and disciplined scientist, responsible not only for the planning of new buildings, but also for supervision of the

construction. He must be able to communicate with the labour force, the contractor and the director of the client organization.

In his occupation the architect is unique because he must express himself clearly in speech, in writing and through drawing and planning. The architect must fill many roles. He is a man of culture and of the world, an artist and technician who creates useful and enjoyable things which suit its occupants or users and fit into their environment.

"One who studies a successfully practising architect will soon be impressed by his juggler-like ability to combine, reconcile and exercise the diverse skills of businessman, lawyer, artist, engineer, and advertising man, to say nothing of author-journalist, psychiatrist, educator and psychologist" (MacKinnon 1962b, p.12). In no other profession is one able to observe creativity in so multifarious expressions.

The architect in his striving for success must be both artist and scientist, and therefore he is a perfect model for the study of creativity in these domains. Architecture is personal and impersonal at the same time. The creative product is therefore an expression of the architect and at the same time meets the demands of an external problem. In the architect's profession, as in no other occupation, we can expect to find the most general characteristics of a creative person.

The successful architect must both be artist and scientist, he must delight the eye on the one hand, and show firmness and usefulness on the other. Architecture is of all occupations the best example for the study of the creative phenomenon as a whole.

3. MacKinnon's Study of Architects

The first and the only important study on creativity of architects was directed by MacKinnon and much publicised in his article "The Nature and Nurture of Creative Talent" (1962a), complemented and supplemented by his paper "The Personality Correlates of Creativity: A Study of American Architects" (1962b). MacKinnon's study lays the foundation for this dissertation.

He and his associates started their study by asking a panel of five experts to nominate independently the 40 most creative architects in the United States. They submitted 86 names of which 13 were nominated by all five experts. Later, 11 editors of the major American architectural journals rated the creativity of 64 of the 86 originally nominated architects. These 64 architects were invited to participate in this study. Forty of these architects accepted the invitation and these again rated the creativity of the 64 invited architects, including themselves. The editors' ratings of the invited architects correlated + .88 with the architects' own ratings (MacKinnon 1962 a & b).

The group of 40 who had accepted the invitation, were invited at a time to come to Berkeley, California for a weekend of intensive testing in the

Institute of Personality Assessment and Research. This group of 40, which we shall henceforth call Architects I, was not only given tests of personality and creativity but also interviewed to uncover life history and reveal the present structure of personality. They were given problem-solving tests and were put in specially contrived social situations of a stressful nature.

Later two more groups of architects were invited to partake in this study. Architects II, consisted of 43 architects who had had at least two years' working experience and were also associated with one of the architects from group I. Architects III comprised 41 individuals who had never worked with any architect of group I. Groups II and III were subjected to nearly all of the tests given to group I but they were not interviewed and their testing was done independently at home.

The following tests were among those that were used (MacKinnon 1962b):

A General Information Survey

Terman Concept Mastery Test (intelligence)

Minnesota Multiphasic Personality Inventory (psychological health)

California Psychological Inventory (psychological type)

Gottschaldt Figure Test

Strong Vocational Interest Blank (interest in occupations)

Barron-Welsh Art Scale of the Welsh Figure Preference
Test (artistic sensitivity scale)

Myers-Briggs Type Indicator (temperament characteristics)

Gough Adjective Check List

Allport-Vernon Lindzey Study of Values

FIRO-B (Schutz) (interpersonal behaviour)

A Mosaic Construction task (creativity).

The results obtained by MacKinnon in his study revealed that the highly creative persons "are inclined to have a good opinion of themselves, as evidenced by the large number of favourable adjectives which they use in the self-description and by the relative high scores they earn on a scale which measures basic acceptance of the self". In addition, it was found that the "self-images" differed from the highly creative to the less creative. Architects I saw themselves more often as "inventive, determined, independent, individualistic, enthusiastic and industrious". In contrast, Architects II and III described themselves more often as "responsible, sincere, reliable, dependable, clear thinking, tolerant and understanding" (MacKinnon 1962a, p. 487).

Regardless of their level of creativity the self-descriptions of all architects were remarkably alike. All of them desired "more personal attractiveness, self-confidence, maturity, and intellectual competence, a higher

level of energy, and better social relations". Besides these similarities, "Architects I would ideally be more sensitive, while both Architects II and III wish for opposites if not incompatibles: they would ideally be more original but at the same time more self-controlled and disciplined" (MacKinnon 1962a, p. 487).

The relationship between intelligence and creativity for Architects I. was found to be zero. The individual scores on the Torrance Concept Mastery ranged from 39 to 179, and the correlation between intelligence and rated creativity was $-.08$, which confirms the hypothesis that a more intelligent person is not necessarily a more creative one.

Aspects of intelligence, other than verbal ability, might be of some importance in the creativity of an architect. In the Gottschaldt Figure Test, which requires that one identifies and isolates simple geometric figures, the creative architect had a higher score than other architects and had by far the highest mean score of all occupations that have been tested (MacKinnon 1962b).

The intelligence of the creative architect is not expressed only "in narrow and rather specialized skills and abilities" (MacKinnon 1962b, p. 22). The results of the General Information Survey which consists of questions about sport, music, literature, history, geography, restaurants, drinks and similar subjects, and which has been constructed to test "an individual's general knowledge of the world and

culture in which he lives", showed the creative architect to be among the highest scorers (MacKinnon 1962b, p.23).

The popular conception of associating genius with insanity needs to be qualified through the findings of the relation between psychological health and creativity (MacKinnon 1962a). On the Minnesota Multiphasic Personality Inventory (MMPI) which measures tendencies towards psychiatric disturbances, e.g. depression, hysteria, paranoia, schizophrenia, etc. The score of the creative architects was 5 to 10 points above the general population's average score of 50. Elevations of this magnitude are, "in general, less suggestive of psychopathology than of good intellect, richness and complexity of personality, and a general lack of defensiveness, we must also note that there is in the MMPI profiles of many of our creative subjects rather clear evidence of psychopathology, but also evidence of adequate control mechanisms, as the success with which they live their productive lives testifies" (MacKinnon 1962b, p.34). One striking difference between the general population and creative groups was the high score which the latter achieved on the femininity scale (Mf) of the MMPI. The tendencies of Architects I to score high on the femininity scale were also demonstrated on

this preference. The correlation of +.48 between creativity.

9.

the Strong Vocational Interest Blank and on the California Psychological Inventory (CPI). MacKinnon (1962a, p.488) states that "the more creative a person is the more he reveals an openness to his own feelings and emotions, a sensitive intellect and understanding self-awareness, and wide-ranging interests including many which in the American culture are thought of as feminine".

The Barron-Welsh Art Scale of the Welsh Figure Preference Test presents to the testee a set of 62

abstract line drawings ranging from simple and symmetrical Preference Test presents to the testee a set of 62

abstract line drawings ranging from simple and symmetrical creative architects on this test was only surpassed by the artist group. An institute scale, "which measured the preference for perceptual complexity", similarly showed that the creative group preferred complexity and asymmetry. The more creative the person is, the stronger this preference. The creative architects showed a correlation of +.48 between this test and rated creativity.

The architects were given a 1-in 8" x 10" mosaic construction test which consisted of pieces of 22 available colours. There was a "significant low positive correlation of +.38 between the number of colours the subject chooses and his creativity as rated by the experts" (MacKinnon 1962a, p.489).

This test in conjunction with others, demonstrated that the creative person is "especially disposed to admit complexity and even disorder" into his perception "without being anxious by the resulting chaos".

The Myers-Briggs Type Indicator revealed that the creative person is open to experience both from within and without. This results in flexibility and spontaneity (MacKinnon 1962a). "The majority of our creative writers, mathematicians and architects are perceptive types" (MacKinnon 1962a, p. 489). "For architects, preference for perception correlates +.41 with rated creativity" (p. 489). Although two-thirds of all the groups tested by MacKinnon (1962a) scored as introverts, "there is no direct evidence that introverts as such are more creative than extraverts" (p.490).

The scores on the Strong Vocational Interest Blank demonstrated that interests and values of all highly creative groups are different from those of the less creative. The creative subjects showed "interests similar to those of the psychologist, author-journalist, lawyer, architect, artist and musician" (MacKinnon 1962a, p.490).

The Allport-Vernon-Lindzey Study of Values which measures the individual's relative strength of theoretical, economic, aesthetic, social, political and religious values, showed that all creative groups had their highest

scores on the theoretical and the aesthetic, the aesthetic being the highest for the creative architect (MacKinnon 1962a, p.490).

behaviour, the FIRO-B, the creative architects demonstrated less desire than other professions to be included in group activities (MacKinnon 1962b). This test reveals that the majority of architects are introverts and that their professional duties of interaction with others are not especially liked. But if these architects have to interact with others they tend to do it in a dominant and often very skilful manner.

The profile of the creative architect as seen through the California Psychological Inventory can be summed up as follows (MacKinnon 1962a, p.490).

"He is dominant (Do scale); possessed of those qualities and attributes which underlie and lead to the achievement of social status (Cs); poised, spontaneous, and self-confident in personal and social interaction (Sp); though not of an especially sociable or participative temperament (low Sy); intelligent, outspoken, sharp-witted, demanding, aggressive, and self-centred; persuasive and verbally fluent, self-confident and self-assured (Sa); and relatively uninhibited in expressing his worries and complaints (low Wb)".

Further, "he is relatively free from conventional restraints and inhibitions"; "he is strongly motivated to achieve in situations in which independence in thought and action are called for"; "he is definitely more psychologically minded"; "more flexible" "and possessed of more femininity of interest (Fe) than architects in general" (Op. cit., p.490).

It might also be of value to turn to the life histories of MacKinnon's creative architects to see what kind of experience nurtures creativity. Not every one had a happy home and favourable life circumstances; a minority was treated harshly by parents. For some, thinking about careers came early in childhood, for others, several years after completion of university training. For many creative architects the choice of a profession became difficult because of their many other interests and skills. Several of them started out as painters and sculptors. The one thing which almost all of them had in common, was that "one or both of the parents were of artistic temperament and of considerable skill". In most cases it was the mother who in the architect's childhood nurtured his artistic potentialities.

In school and university the creative architect was an above average student. He was not outstanding, averaging about a B grade, and was noted for the independence with which he worked. He was profoundly sceptical, accepting nothing on faith, while being "spirited in his disagreement". The self-assertive independence which manifested itself in school and university is still part of the creative architect. Two Institute scales, one measuring self-assertiveness and the other independence, correlated + .34 and + .43 with rated creativity. (MacKinnon 1962b, pp. 31-32).

In a further evaluation of MacKinnon's 1962a & b study at the Institute of Personality Assessment and Research of the University of California at Berkeley, Hall and MacKinnon (1969) divided the original sample of 124 architects into two subsamples of 62 architects in order to work out a multiple regression solution for the prediction of creativity in the first sample that could be cross-validated in the second. Their initial multiple correlations ranged from .80 to .35, and cross-validated coefficients from .55 to .20. The specific cross-validated coefficients were as follows: Adjective Check List, .38; California Psychological Inventory, .47; FIRO-B, .41; Minnesota Multiphasic Personality Inventory, .20; Myers-Briggs Type Indicator, .42; Strong Vocational Interest Blank, .55; and Allport-Vernon-Lindzey Study of Values, .38. This study focussed solely on concurrent validities and not on predictive validities.

In summary, we could say that according to MacKinnon and associates (MacKinnon 1962b, p.38) the results of the investigation demonstrated that the characteristics of the highly creative architect as we have seen him, are "his high level of effective intelligence, his openness to experience, his freedom from petty restraints and impoverishing inhibitions, his aesthetic sensitivity, his cognitive flexibility, his independence in thought and action, his high level of energy, and his unceasing striving for creative solutions to the ever more difficult architectural problems which he constantly sets for himself".

4. Problems

MacKinnon's study (1962a & b) of creative architects who could be and were judged by what they had already produced concerned itself mainly with intelligence, psychological type, aesthetic discrimination, personal and social qualities, values and flexibility. If we consider research in creativity as a whole we have to note that all previous studies in creativity ignored the relationship between creativity, visualization and particularly motivation. Up to now, for example, a direct measure of drive strength has not been used in research on creativity.

MacKinnon used the California Psychological Inventory which measures motivation to achieve in both a conforming (Ac) and an independent (Ai) fashion. In the identification of creativity in student architects, however, more direct measures need to be considered.

In considering the relationship between creativity and intelligence, most studies, including MacKinnon's, noted little or no correlation between the two. Particularly with architects, it may well be that spatial and other types of intelligence are far more important for creativity than verbal intelligence.

MacKinnon revealed at least some aspects of the nature of the creative talent in architects, but he did not answer the question how we can early identify

and perhaps even encourage development of creative individuals.

It is one thing to distinguish the characteristics of a creative architect. It is quite another matter to note what traits the future creative architect will have in school and at the beginning of his university study. Also it is not certain that these same personality correlates in youngsters today will identify creative architects in the future. It is not at all certain that the self-reports of the creative architects are not misperception and self-deception.

The data collected by MacKinnon suggest that intelligence should not be overemphasized. A person who has the minimum of intelligence required for mastery of a certain profession, whether he performs successfully and creatively or not in that area, will be determined by non-intellectual dimensions.

In order to be really creative, certain motivational factors enter, and discipline and self-control are needed. These must be learned but should not be overlearned, they must be used flexibly, not rigidly or compulsively.

5. Gaps to be filled

The present study will try to fill some of the gaps which previous studies in creativity ignored, namely the relationship between creativity, motivation and visualization. For this purpose tests will

be used which can be divided into two groups: a) tests which have been used in former research in creativity and, b) tests which have never been used in research in creativity.

This research in creativity will fill in some gaps in:-

A. Applied fields

1. Stressing the motivational factor:-

- a) using an "objective" motivation test (drive and perseverance), which has never been used in any creativity study;
- b) producing a paper and pencil motivation scale;
- c) adapting the "Famous Sayings" test to South African conditions, and with specific reference to motivation.

MacKinnon (1962a & b) indicated that more creative architects pay less attention to small details than their less creative colleagues and are more willing to stop their activity when blocked, turning to other things. He does not, however, mention that they lack persistence and the ability to do routine work should it be required. In order to have reached their present position, the creative architects must, as students, have had a general component of drive which overcame routine work situations, since a certain proportion of routine is inherent in every job. To study what relationship drive and perseverance have to creativity in first year students of architecture, the Continuous Coded Addition, a continuous work test, was incorporated into our test battery as the "objective" measure of motivation; the "subjective" measures are the motivation scale of the "Famous Sayings" test, and the motivation scale which was especially developed for this study.

2. Stressing the visual factor of creativity.

3. Developing at least one non-verbal creativity test.

Since architects have not only to be creative on verbal tasks, but even more so on spatial tasks, their creativity has also to be tested in this area. Since no suitable creativity tests in the spatial field of creativity are available, one at least has to be developed. The new test aims the detection of common visual elements.

4. Using as a validation of creativity in architecture students a specially designed rating system expressed in terms of a nine point scale which will be completed by the students' lecturer.

Architecture is the art and science of creating useful and beautiful things. The lecturer of architecture, therefore, sees a piece of architecture as a creation involving the synthesis of

- | | |
|-----------------|-----------------------|
| a. Function | e. Finance |
| b. Material | f. Requirement (Plan) |
| c. Structure | g. Architectural Form |
| d. Construction | |

The student is graded according to this concept of the architectural task. This creative concept, if quantified, is perfectly suitable as a criterion for validating the creativity of the architecture student.

B. Theoretical fields

1. An investigation into the cognitive factors with emphasis on:-

- a) field-dependence/ field-independence
- b) visualization

The factors field-dependence/ field-independence and visualization can be understood as separate units or as an interaction. They are cognitive functions on the one hand and personality dimensions on the other. They show relation within the person and an interaction with other people.

Here we try to answer the question : What is the nature of creativity and how is it related to field-dependence and field-independence and other cognitive styles?

2. Research into the influence of hostility and intolerance.

Hostility, dogmatism and intolerance are hindrances to the full development of the individual and appears therefore to have a negative effect on creative ability. How large or how small this factor has to be to influence the creative process is here being investigated.

3. The importance of motivational factors in their interaction with creativity;

a) motivation

b) anxiety

Motivation, anxiety and perseverance are related factors which influence almost all human activity. In order to be creative, there has to be a channelled drive level. If the drive level is too low, nothing will happen, if it is too high and not channelled it is wasted energy.

The question is now: At what drive level does the creative individual work?

6. Hypotheses

The issues in this study lend themselves to the formation of hypotheses. The following hypotheses are proposed:-

HYPOTHESIS 1: That field-dependent Ss are less creative than field-independent Ss.

HYPOTHESIS 2: That highly motivated Ss are more creative than less motivated Ss.

HYPOTHESIS 3: That creative Ss display more "normal" anxiety than less creative Ss.

HYPOTHESIS 4: That highly creative Ss have greater facility for visualisation than less creative Ss.

HYPOTHESIS 5: That less creative Ss are more dogmatic than creative Ss.

HYPOTHESIS 6: That academic achievement in students of architecture is related positively to creative ability.

The final aim of the study is to obtain a predictive tool for assessing creative potential in aspiring architecture students. In Chapter III the hypotheses will be discussed in detail.

CHAPTER II

REVIEW OF RELEVANT RESEARCH1. The Criteria of Creativity

The question what is creativity and how can it be measured has up to now not been answered to the satisfaction of teachers, and scientists. The term "creativity" or "creative thinking abilities", lays claim to that constellation of generalized mental abilities that can usually be detected in creative achievement. Many psychologists and educators refer to these abilities as "divergent thinking", "productive thinking" or "imagination". Some researchers use the term "creativity" only to refer to a unique, particularized and substantive capacity; others object to the use of this term because "a generalized constellation of intellectual abilities, personality variables, and problem-solving traits" does not consist of all parts of the essence of creativity. Certainly we have to admit that the possession of creative abilities guarantees that a person will behave creatively, but not that he will produce creatively.

One of the first persons to think about general creative abilities was Burnham (1892), who distinguished between reproductive imagination and creative productive imagination. He noted that the mental abilities involved in remembering and reproducing information and concepts are quite different from those used in recombining original or novel impressions to produce new wholes.

Creative imagination was limited for him by re-productive imagination and varied in degree rather than in kind. Burnham claimed that "all children, unless they be idiots, have productive, creative imagination in some measure".

During the beginning of the twentieth century scientists generally championed the concept of a general, non-particularized content-free mental creativity. One of these scientists was Spearman (1930) who asserted that "the power of the human mind to create new content— by transferring relations and thereby generating new correlates— extends its sphere not only to representation of ideas, but also to fully sensuous representations, such as are given in ordinary seeing, hearing, touching, and the like in every one of us".

Simpson (1922) who also produced a test of creative imagination, defined creativity as the initiative that one manifests by his power to break away from the usual sequence of thought. Being interested in the identification of the searching, combining, synthetic type of mind, he recommended strongly that tests of creativity should be included in the traditional tests of intelligence, which, he maintained, call for reproductive kind of abilities and do not try to evaluate "a vital creative energy".

Creativity is usually expressed through abilities such as sensitivity to deficiencies, fluency, flexibility,

originality, and elaboration. This shows that creative thinking is related to all thinking, which is a complex mental process, and is partly unconscious.

We might find the key to creative thinking in the unconscious. The conscious mind is well organized and interconnected, it is a square shooter, characterized by its desire to organize. These characteristics are valuable for learning and organization, but they inhibit the very qualities that make it useful. Since it lives by rules it resists "irresponsible" speculation.

The unconscious or subconscious is another part of mind. Since the unconscious according to Freud, contains everything one has experienced since conception, it is a storehouse of immense capacity. Jung goes even a step further and believes that it contains memories that go back to one's ancestors. Therefore we could assume that, in the creative process, the pre-conscious guided by interest and emotional commitment, goes searching for data that would solve the open problem, and because the pre-conscious is not looking for logical answers people gradually build in a censor to protect the conscious mind. This censor is below conscious control but is not infallible and can be overcome by highly motivating and emotional factors.

Since most creative behaviour lies below the conscious level the censor seems to have a direct connection with the use of creative potential. If a

person has an open personality, and therefore is sensitive to the proddings of the unconscious, the censor, weak or can be bypassed, and so the person is able to behave and think more creatively by using more of his potential. The creator is therefore responsive to his own intuition and impulses.

We may now ask, how is the censor formed? The formation of the censor lies in our process of growing up, in our being brainwashed "to do the right thing" and to cooperate. This suggests that nearly all of us start out in life as highly creative, but, as we age, this creative ability is seriously undermined by bad habits of thought and action, with the result that we become too much interested in the interactions between people, and too little in keeping the belief in our own capability for creativity and constructive change.

Some evidence for this theory of creativity can be found in studies mentioned by Papanek (1964). This research was started by the hypothesis that creativity and age were related in such a way that by the age of 45 creativity was nearly completely lost. It was decided therefore to establish this fact experimentally. A selected test battery was given to a group of 45 year olds and to no one's surprise only 2% of the sample was found to be highly creative. In order to find out at what age creativity would increase persons aged 44, 43, etc. were tested. This monotonous task proved

that the percentage of the highly creative remained at 2%. When the psychologists reached the seven year olds, however, 10% of the sample turned out to be highly creative. Lowering the testing to five year olds the figure jumped to 90% creative.

A search through the literature on creativity will reveal the diversity of interest, motives, and approaches characteristic of the many experimenters. Creative ability has been viewed as a normally distributed trait, an aptitude trait, and an intrapsychic process, and as a style of life. It is seen as something to be found in all children and lost by most adults. It has been viewed as that certain something which produces innovation in science, performance in arts, or, in general, new thoughts. Creativity has been related or equated with, intelligence, productivity, originality and mental health. It is produced by self-actualization and by sublimation and restitution of destructive impulses.

Creativity research relevant to the present investigation is discussed under the criteria headings of process, product and measurement. Further discussion regarding both the creative person and situation appear under the heading, "The Creative Individual", and this is followed later by research findings relevant to the different hypotheses.

Process as Criteria:

The stages of forming a new thought are seen by Wallas (1926) as, preparation, incubation, illumination, and verification. Kneller (1966) uses the same phases, but adds one, so that he starts with insight. Wallas and Kneller note that these phases do not occur in an uninterrupted problem and solution sequence. Controversies concerning these phases have appeared about distinctness of phases of creativity and the relative importance of conscious or other modes of mental processes. Woodworth (1954) noted that incubation implies a theory which he could not accept. He believes that illumination is the result of putting the problem aside for a while, giving the mind a rest so that at this time it can remove itself from false sets and directions. Woodworth relates recall of something to creative insight. He sees the essential factor in illumination as the absence of interferences which usually hinder progress during the preliminary stage. Crutchfield (1961), in considering explanations of unconscious processes and the weakening of erroneous sets, assumes that incubation may permit, perhaps in many cases in the unconscious, new and better cues from the surroundings and from ideation to develop during the time one is occupied with other matters. Instead of investigating distinct phases, Crutchfield suggests a functional analysis of the manner in which each stage of the creative thinking process was functionally determined by prior steps, and in turn, governed later steps.

Insight is the most important action of the mind in creativity for Ghiselin (1958) and he sees the creative process as consisting of fewer phases. He notes the requirement for creativity as a fresh formulation, rather than a multiplication or elaboration. For him concepts of unconscious thoughts cannot be relied on, but diversion which is conceptualized as being related to what he calls "precon-figurative consciousness". He could have enlarged his concept of illumination, but nevertheless Crutchfield's ideas help to translate the somewhat literary descriptions of the process of creativity into much better conceptualized psychological variables.

A creative process is for Harmon (1956) any process by which something novel or new is produced; this can be an idea, an object or a new form or arrangement of old elements. What is important is that this new idea must contribute something to the solution of a certain problem, in other words, the creative process is goal directed. For Harris (1959) the creative process consisted of six stages: (1) realizing the need, (2) gathering information, (3) thinking through, (4) imagining solutions, (5) verifying them and (6) putting the new ideas to work. The difference between the electrified or illuminated minds of the highly creative people and the process in the average person is the speed of process from the first phase to the last.

I. Taylor (1959) takes a different view in that he claims that creativity cannot be described as scientific

and artistic, because it involves a different way of thinking, and a different approach to problems. He suggests five levels of creativity. Expressive creativity is the most fundamental form and probably necessary for subsequent stages. It can be identified with the spontaneous drawings of small children. The second level is productive creativity: here the tendency is to restrict and control free play or action in order to improve techniques. The next stage is inventive creativity: new and uncommon relationships are found between what had before been regarded as separate parts. Few people reach the fourth stage of innovative creativity. This level involves significantly modifying the basic foundations or principles of science or art. "Emergentive creativity" is the highest form where "an entirely new principle or assumptionemerges at a most fundamental and abstract level". Here we enter the world of the abstract where few people can be productive. For I. Taylor the core of the creative process is the ability to mould experiences into new and different organizations, the ability to perceive the environment plastically, and to communicate the experiences to others.

For Stein (1956) creativity is a process of hypothesis formulation, followed by hypothesis testing, and the communication of the results which are the resultant of social transaction. He stresses the interaction between environment and individual in which the early childhood

environment facilitates or inhibits creativity. Stein (1956, p. 172) suggests an empirical definition of manifest creativity: "Creativity is that process which results in a novel work that is accepted as tenable or useful or satisfying by a group at some point in time". If an individual does not satisfy the requirements of the above definition, but demonstrates on psychological tests similar test results to individuals who do manifest creativity he is noted for his potential creativity.

Product as Criteria:

The emphasis on product as criteria of creativity is encountered more often than that of process. It is usually found in investigations in scientific or industrial settings, but is also not neglected in artistic and humanistic settings. In studies of this nature creativity is seen as a unitary or multifaceted trait which is distributed in the general population similarly to other intellectual or personality traits (Gamble, 1959, p. 292). To measure and study creativity through its products, is believed by a multitude of researchers to be the best way of studying creativity.

Gamble (1959) reports that the product of creative behaviour should be the first object of study. He claims that products can be judged as creative and that the term can then be applied to the behaviour which has produced the product. The individual who demonstrated this behaviour can then be classified as possessing to some degree the trait of creativity.

McPherson (1956) proposed a number of possible criteria of creativity when he reviewed the problem of determining "relative levels" of patents. Ghiselin (1958) disagrees with McPherson and suggests two levels of creativity. The higher level of creativity produces some new element of meaning or some new order of significance, while the lower level furnishes further improvements or development to an established body of knowledge by initiating some advance in its utilization.

While the usefulness of investigating creativity through creative production remains an unsettled issue, Harmon (1958), D. Taylor (1958), C. Taylor (1959), Shapiro (1968) and others have investigated the relationship between criterion variables and determinants of judges' creativity ratings. Harmon found a correlation of .61 and .76 between judged creativity and the subject's number of publications. D. Taylor noted a correlation of .69 between ratings of creativity and ratings of productivity judged by supervisors of research personnel. Shapiro's correlations between supervisors and productivity was extremely low. D. Taylor (1960, 1961) assumes that distinctions between decision making, problem solving and creativity can best be made by using the product as criterion. A considerable number of measures were refined by C. Taylor to produce 56 scores on each group of research scientists. Some of the refined measurements were supervisors, peers, examiner, and self evaluations; the

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