

abilities and skills.

Recent research has demonstrated that both students with high I.Q. and highly creative students, even though their average I.Q. differed as much as 25 points, showed no differences in academic achievements. This appears to be because certain creative thinking abilities might contribute to certain kinds of achievement. This permits the creative student, who has a lower I.Q. score to equal the performance of his less creative but more intelligent counterpart (Getzels and Jackson, 1962).

There has been a number of studies in which intelligence and creativity tests show a very low correlation with one another, but a close relation between either one and academic achievement remains an open question. Ripple and May (1962), Flescher (1963) and Edwards and Tyler (1965) found no evidence for the conclusion that creativity is as closely related to achievement as is intelligence. Thorndike (1963) pointed out that separate tests being used to measure creativity show only a slight relationship one to another, so that some creativity tests might be related to achievement and others might not. Torrance (1962) believes that the variation in the results between the studies could have something to do with J.E. Anderson's (1960) ability-gradient concept, which suggests the hypothesis that below some critical point (115-120) differences in I.Q. are major determiners of differences in academic achievement. Beyond this critical point, differences in creative ability

may be more closely related to differences in achievement.

In a direct test of one aspect of the ability-gradient concept, Yamamoto (1961) found that I.Q. above 120 had no effect on the academic achievement of a highly creative group. Such results as lower correlations between creativity and academic achievement obtained from a 'normal' I.Q. group (Ahrens, 1962) instead of high-I.Q. groups (Getzels and Jackson, 1962; Mosteller, 1963) gave further support to the Anderson ability-gradient concept. Existence of an I.Q. threshold was also contra-indicated in studies showing a strong correlation between measures of intelligence and academic achievement for high I.Q. groups (Holland, 1961; Mosteller, 1963). Circirelli (1965) found that the relationship between creativity and achievement was weaker than some previous studies suggested, and varied with the measures used.

Recently two studies have focussed their attention on academic achievement in students of architecture. Danneborg and Lueneborg (1969) studied students of architecture for over four years. Course grades and faculty ratings were taken throughout four years for 228 students of architecture. Four sets of variables were used in the prediction: Architectural School Aptitude Test scores; Architectural School Aptitude scores complemented by 18 traditional academic predictors; the traditional battery alone; Architectural School Aptitude scores complemented by 16 biographic and interest items. They found that

Architectural School Aptitude scores are a poor predictor for long term academic success. If, however, the Architectural School Aptitude Scores were complemented with academic or biographic variables their predictive validity was somewhat improved. Karlins and others (1969) investigated some factors related to architectural creativity of graduating architecture students. They tested 17 advanced architecture students at Princeton University, and used the Remote Associates Test as a measure of creativity. The students were independently rated on creative ability (with a high interjudge reliability) by two professors well-acquainted with their work. Subjects' performance on the Remote Associates Test was unrelated to creativity. Rated architectural creativity did not correlate with standard measures of academic aptitude and achievement. It was related to the quality of the students' independent design projects and their performance on a spatial factors test.

In summary, the conflicting evidence available demonstrates that clarification of the nature between academic achievement and creativity is needed. The most important conclusion that can be drawn on the basis of the abovementioned results is that the generalizations which have sprung from Getzels and Jackson and the Torrance about the relationship of creativity scores to academic achievement are rather limited. They apparently do not apply to all kinds of students, all kinds of disciplines or

or all kinds of intelligence and creativity tests.

4. Summary of Creativity Research

Since the year 1950 national concern about our reservoir of talent and abilities has increased more and more. This seems to be reflected in the growing quantity of research in the area of creativity. A bibliography by T.A. Razik (1965) on creativity and related problems lists 4,176 items. It covers publications up to December 1964, of which half of the entries are published later than 1950. A quarter of the publications are dated 1960 and later. L.I. Martin's (1965) bibliography about psychological investigations into creativity covers the field from 1954 to January, 1965. We cannot help but notice that the field is rapidly expanding, making it, therefore, more and more difficult to keep up with developments. In order to keep abreast of research in creativity a bibliography and analysis was written by Schmidt (1969). It covers the period from where Razik and Martin left off including research and publications in creativity up to January 1968. It consists of over 837 entries of which 183 are Doctor's dissertations and 158 are books, to mention just two items.

There is a strong interaction between economic and political factors and the sciences, psychology not excluded. Supply and demand usually takes care of itself, and creativity seems to be the result of such action. The needs

have not been met and suspicion has fallen on the standard of intelligence tests, which seem to have failed in selecting creative, talented children for the future needs of society.

The term creativity is used in many different connections, but in current research stresses "discovery" and "innovation". The space race and the great need for discoveries and innovations in our industries have stimulated research in creativity. Because of this, scientific creativity has been emphasized, and the questions are asked, how do we distinguish the creative scientist from other scientists: Is he more intelligent? Is he more strongly motivated? Does he have a different personality? Is he affected by heredity, environment, or education?

The interest which was sparked off by science has found its way into nearly all spheres of society. It has been broadened to include the act of creation itself, the processes which underlie this act, and the characteristics of all creative persons. Man now seeks to isolate and nurture creativity and to find a criterion, so that people and/or products can be classified on a scale of creativeness. In addition, he seeks to define creativity. In the past researchers have defined creativity in terms of the product of the process and in terms of the process itself. The emphasis has been on identifying creativity by the product, but this raises more problems, because of the difficulty of judging which products

are more creative. Many examples of creative work have stayed unrecognised for many years, decades or even centuries.

The definition of creativity applies also to areas of human behaviour. Many persons are creative who are not assessed or who appear to produce something intangible. The housewife and mother would be good examples here.

In spite of the problems involved, research not only continues but also expands into several aspects of the creative process and product. Creativity is assessed on the basis of products, by authorities in pertinent fields, peer groups, and supervisors or teachers. The central problem here is the criterion. Artists, architects, writers, physicists, engineers and other research scientists among many others have been studied in this way. The bibliographies mentioned contain many of these studies.

Another criterion used has been the score on creativity tests. These tests have been constructed on the assumption that some of the characteristics of successful performance on these tests, such as originality, divergent thinking, flexibility, fluency, elaboration and others, have been found to be characteristics of the creative individual. The name "creativity test" comes from this assumption. The main problem is not only the scoring of these tests, but also finding a suitable cut-off point. The problem here is one of validity. The scoring of these tests raises a multitude of questions: are the higher scorers of these tests creative in one field or in many,

now or later? Is it really possible to use these tests as predictors of creativity? If the answers to these questions are not positive, much of the research work on school children and students has been wasted.

Work needs to be done particularly in the validation of these creativity tests, and newer and better tests have to be developed. There are various ways in which tests of creativity could be validated. For prediction, the best method would be a follow-up study of all the subjects tested, similar to that of Terman and his associates with gifted children, in order to assess the value of the creativity test results in relation to creative performance in later life. If high scorers were found to have produced more creativity than low scorers, what other factors would have to be taken into consideration? Certainly, this method would necessitate waiting many years until the children have become adults; records would have to be kept and follow-up studies made. It would not be wise to abandon the tests until such time as their real value could be determined. Efforts are now being made to provide validity by discriminating between people on the basis of certain test scores and then retesting them to ascertain whether these scores are related to other characteristics which may or may not have value as indicators of creativity.

Research has concentrated on studying the creative process not only in individuals, but also in groups. The highest type of creativity can be assumed to come from out-

standing individuals. The individual can be creative. Can the group also be creative? Is this process for the group the same as for the individual? Can a group be more creative than an individual? And can research on the creative process in individuals cause other persons to be more creative? These and other questions need to be settled.

In general there is a large gap between the potential of an individual and his creative performance. Properly directed creativity and educational programs can help us close the gap between the two. Research suggests an environment which asks for creative ideas and rewards this behaviour. In such a climate, individuals, perhaps groups, with high potential for creativity are likely to be recognized and encouraged to use it. The practice of the past, and in too many cases the present, making people fearful or anxious of making mistakes, restricting their ideas, will in most cases do at least hinder creative behaviour.

Current Emphases:

The array of data pertaining to creativity has been analysed from many diverse points of view. Research in a wide range of disciplines have produced insights about the creative process in terms of their own theories and experience. The result is a disorganized mass of unrelated insights or theories and sometimes

disagreements and contradictions. Psychologists, teachers, scientists, engineers, businessmen, artists, writers, sociologists and theologians have contributed information reflecting their own particular concern. For example, the theologian believes creativity to be an expression of omnipotent or absolute power operating in the cosmos. Psychologists examined the dynamics of personality and human behaviour. Engineers and scientists have interpreted creativity as the result of implicit mental forces that are activated completely through conscious involvement. Artists and writers have looked for inspiration as it is expressed in the products which are created. Businessmen define creativity as the process of satisfying needs evolved out of the process of co-ordinating the functions of business establishments. The more that is read and studied about the creative act, the more evident it becomes that this act is affected by so many complex factors as to make it impossible to produce an adequate definition from one centrally located point of view. There are interactions between many diverse factors and forces. The relationship of physiological, psychological, sociological and physical-environment, as also hereditary conditions, is continuously present in any creative ability.

The growing edge of research includes new discoveries in creativity and related factors; it involves some improvement in identification procedures; it includes research on teaching creativity or teaching creatively, which

may considerably accelerate the pupil's learning, as well as stimulate his divergent thinking abilities and his originality. Further research into the characteristics of the effective creative teacher of the creative student, as well as the teachers' training and background will very probably be required.

Identification of the potentially creative individual, his guidance, new methods of teaching the co-ordination and communication of research are areas in the process of development. It is already possible now to make some tentative statements in these areas, and it is hoped that, shortly, more definite answers can be given which could help to influence school practices and policy.

Looking at the period from January 1965 to the present, there are certain areas in which the research in creativity has concentrated itself in the English and other languages. These areas are:

1. Academic Achievement
2. Divergent Thinking
3. Intelligence
4. Originality
5. Personality
6. Problem Solving
7. Scientists
8. Teaching Creativity
9. Creativity Theories
10. Measurement
11. Tests
12. Research conducted in other than English speaking countries.

Beginnings have also been made in such areas as creativity and mental illness; creativity and the criminal; creativity in monkeys; creativity and hypnosis; its relation to extra-sensory perception, to psychedelic agents, and to L.S.D. and other drugs. Much of the research has been done at institutions of higher learning. This is clearly illustrated by the multitude of master and doctoral dissertations not to mention other publications.

It might be of some value to mention what effect creativity studies have had in South Africa.

1. Shapiro (1968) studied the creative research scientists. He found a) definite evidence of validity for the battery of predictor tests used in his study and support for the idea that there are at least quantitative, if not qualitative, personality differences between high and low creative scientists; b) that scientists assess their own personal behaviour and personality characteristics more accurately than do supervisors; c) that there was also no relation between creativity and intelligence scores.

2. Shmukler (1968) investigated creativity factors in high school children. She administered tests of creativity which were used and developed by Shapiro (1968) and a) by factor analysis demonstrated that three of Guilford's hypothesized factors of creativity; sensitivity to problems, fluency and originality emerged and were independent of both the factor of intelligence and that of academic achievement; b) that there was some correlation between

intelligence and creativity up to a cut-off point of an I.Q. of approximately 110, beyond which creativity and I.Q. were no longer related; c) that self-ratings on personality variables, accepted as related to creativity, were positively related to creativity scores; d) that academic achievement and teachers' ratings were not related to creativity scores.

3. Robertson (1965) investigated the relationship between creativity, intelligence and academic achievement. He found a) that school subjects and mental age correlate highly, but no significant correlations were found between these and any of the creativity variables, with the exception of Word Association; b) that Torrance tests correlated highly with each other and with the creativity factors but creativity and intelligence appeared to be independent of each other.

4. Swart (1967) informed the public about the importance of creative thinking in a series of five talks broadcast by the English Service of the South African Broadcasting Corporation. The content of these talks covered "awakening our imagination", "using our imagination", "encouraging our imaginations", "overcoming negative approaches" and "our imaginations and the future".

5. Gunes (1970) pragmatic aim was to work towards a test or battery of tests for the selection of Fine Arts students at a university. She attempted to establish

both predictive and concurrent validity for the five tests which were chosen as representing some of the more promising approaches to the field: accordingly first year students, fourth year students and artists were tested. The tests which were suggested by me: the Preconscious Activity Scale, the Making Symmetric Designs (NIPR), and the Seeing Faults test (NIPR) emerged as significant predictors of some of the criteria of the first year students. However, the results suggest that the relationships between creativity, criteria and later performance are rather more complex.

South Africa is becoming creativity-conscious but a great deal needs to be done to overcome traditional thinking and to place creative thinking ability in its proper position so that this country is able to use its potential to the fullest.

CHAPTER III

FORMULATION OF HYPOTHESES

The main assumption which underlies this investigation, is that students of architecture can be divided into "high creative" and "low (less) creative" groups according to test scores and that each group has a different personality profile.

Six hypotheses have been made and these will be dealt with in greater detail in this chapter. The discussion will concern itself with theoretical and experimental studies which did help to formulate these particular hypotheses, insofar as they have not been dealt with in Chapter II.

The theoretical implications for each particular hypothesis cannot be seen as a separate entity since they frequently refer also to other hypotheses. The overlap is extensive, and the six hypotheses have to be seen as interdependent to some degree.

I. FIRST HYPOTHESIS: THAT FIELD-DEPENDENT Ss ARE LESS CREATIVE THAN FIELD-INDEPENDENT Ss.

In the preceding discussion in Chapter II under the sub-heading of Field-Independence-Dependence and Creativity it was noted that Witkin and associates (1962) did most of the theoretical and practical research in the area of field-

independence - dependence and that some theorizing has been done to connect creativity with field-independence - dependence.

We saw that the possible interaction between creativity and field-independence had been almost overlooked. It is hard to understand why this has happened since the literature contains many statements that creative individuals perceive the world differently from others. Similarly Witkin and associates (1962) showed a relationship between field-independence and intelligence, but neglected to mention the neighbouring topic creativity. Among the studies mentioned in Chapter II which tackle the problem systematically only the one of Spotts and Mackler (1967) is worthy to be considered in more detail.

Spotts and Mackler (1967) gave 138 undergraduate university students a battery of tests consisting of intelligence, creativity and field-independence measures. The field-independence-dependence measures were the Embedded-Figures Test (EFT) and the Hidden Figures Test (HFT). They found that persons with field-independent cognitive styles were consistently more creative on the tasks used in this study than persons with field-dependent orientation. Significant differences between the creative test performance of these two groups were obtained in both matched and independent group comparisons. The relationships between creativity and intelligence were weak and typically non-significant. In other words their hypothesis that male university students who demonstrated a field-independent performance on the EFT will

obtain significantly higher creativity scores on experimental measures of creative thinking ability who demonstrated a field-dependent perceptual style. The EFT has been supported.

The differences between the field-independent and field-dependent person have been discussed in the literature. The present study is based on the assumption that the relatively high level organization and personality of the field-independent persons and the vulnerable mode of functioning which can be found in field-dependent persons will be demonstrated in the test scores, as they have become similarly evident in areas of personality functioning.

The following tests will be used as a measure of field-independence - dependence; the Gottschalk Embedded-Figural Test and the Pattern Relationship Test (NIPR) version of Raven Progressive Matrices. These and other tests will be discussed.

II. SECOND HYPOTHESIS: THAT HIGHLY MOTIVATED PERSONS ARE MORE CREATIVE THAN

From the preceding discussion in Chapter II, subheading of Motivation and Creativity we see many and diverse views on this subject. There has been considerable number of attempts to link motivation and creativity. Particularly the names of Murray (1938), Gough (1962a & b) should be mentioned here. In the absence of knowledge, it would appear that a complete theory of creativity has only been constructed by Maddux (1975) who bridges the gap between creativity and motivation by giving us two motives: the need for

quality and the need for novelty. A person who has the necessary talent, whose need for novelty is dominant and whose need for quality is weak is the individual with creative ability.

Maddi (1965) tries to support his theory with some experimental data. The support presented is mainly for the novelty of production's part of his theory. In three multi-variate studies he used four pictures in a TAT-type task to collect imaginative productions from 60-87 males. He established low correlations which he defended on the basis that "need for novelty is only one of the many necessary factors in the production of creative acts".

Up to now the best example of the use of motivation in connection with creativity is the experiment conducted by Laughlin, Doherty and Dunn (1968). They administered to 348 male and 348 female high school students an intentional concept-formation task (INT) as a cover for a later incidental concept formation task (INC). They divided their sample into high, medium and low creative according to their score on the Remote Associates Test and compared these with high, medium and low intelligence scores. Motivation was manipulated by ego-involved vs. task-involved instructions. Their results showed: 1) an increase of both INT and INC directly as a function of both creativity and intelligence, 2) no main effects of ego-involved vs. task-involved motivation for either creativity or intelligence groups,

3) greater INC for males under ego-involved instructions and females under task-involved instructions, 4) a significant creativity $\times$ motivation $\times$ sex interaction for INC, 5) a significant intelligence $\times$ motivation and intelligence $\times$ sex interactions for INT.

Motivation is a term usually used in reference to mechanism operative in incentives or drives. It seems that motivation is direct in that it appears to be goal seeking and has a measure of intensity in the sense that the goal can be pursued with more or less vigour and persistence. Motivation may include drive, perseverance and fear of failure, and it may be affected both by the internal state of the organism and by the environment. It could also be said to include conditions which arouse and regulate the behaviour of the organism. However, there appears to exist little agreement on how motivation should be defined, not to mention how it should be measured.

Arousal theory (Cofer and Appley, 1964) predicts less effective performance as motivation becomes excessive because of its general inverted-U curvilinear relationship between performance and motivation. Similarly, drive theory (Logan, 1959) assumes that high motivation will hinder performance on a complex task, but it may increase performance on a simple task. However, creative responses are by definition both low in an individual's response hierarchy and high in complexity. It could therefore be expected that they will be hindered by excessive motivation.

A study mentioned by Wallach and Kogan (1965) also suggests that motivation and creativity may interact, as a function of sex. They found differential relationships between

creativity, learning and personality characteristics for fifth year school boys and girls.

It is assumed by the author that motivation may be measured "objectively" (direct) or "subjectively" (indirect). The "objective" measure in this study is the "Continuous Coded Addition", a continuous work test; the "subjective" measures are the "Famous Sayings" test which has been adapted to South African conditions by the author and the "Work Attitude Scale" which has been developed by the author. These tests will be explained in greater detail in Chapter V.

III. THIRD HYPOTHESIS: THAT CREATIVE Ss DISPLAY MORE
NORMAL ANXIETY THAN LESS CREATIVE
Ss

The section in Chapter II Anxiety and Creativity discusses some of the experimental and theoretical implications of the relationship of anxiety to creativity. The suggestion that anxiety is a drive originates with Spence (1956). According to him a person with a high level of anxiety should score lower on tests requiring quick adaptive changes, and therefore on creative tasks, which require adaptability. If the assumption that anxiety is a motivating factor is correct, then the relation of anxiety to performance should be similar to the relation between motivation and performance - i.e. low motivation or extremely high motivation produces poor performance; but motivation which lies between these two extremes produces good performance (Yerkes & Dodson, 1908).

Research concerned with the relationship between creativity and anxiety has been discussed in Chapter II. Here we will review some of the studies on the relationship between general anxiety and academic performance. Experiments using general anxiety measures at the college or university level have been carried out by Bendig(1957 & 1958), Gilmore (1951), Grooms and Endler (1960), Klug and Bendig (1955) and by Spielberger and Katzenmeyer(1959). Of the studies mentioned only the last three made adequate provision for the control of ability. Spielberger and Katzenmeyer(1959) assessed the relation between the MAS and grades for a sample of male students divided into three groups according to high, medium or low ability. The results indicated that the MAS had a low (-.18) negative correlation with grade point average for the medium ability group, and no correlation with the other two groups. Klugh and Bendig (1955) found no correlation between the MAS with grades and ability. But when the MAS became part of a predictive test battery, it added significantly to the multiple correlation. This may indicate that the MAS apparently increased the validity of the battery by suppressing some of the grade-irrelevant factors in other predictors. Grooms and Endler (1960) noted that anxiety increased the predictability of grades, but this was true mainly for students having a high level of anxiety. In other words, for the highly anxious individual the correlation was enhanced over what it would have been had anxiety not been taken into consideration.

In a study carried out by Sarason (1969) on university students to discover whether test anxiety was independent of more general anxiety as measured by the MAS, he found that test anxiety was partly independent of the more general measure. The correlation for males was .41 and for females .49. It was also found that test anxiety had a low negative correlation with achievement. One has to keep in mind that ability was not controlled, and if it had been, the correlation between test anxiety and performance might have disappeared.

A large study carried out by Alpert and Haber (1960) on a sample of male university students had three aims. Firstly, they wanted to examine the relationship of general anxiety scales (such as the MAS) and specific anxiety measures, and to what extent each related to academic achievement. Secondly, they wanted to assess the relationship of anxiety to aptitude; and thirdly, to determine the effect of anxiety on performance. In other words they wanted to discover whether a distinction between "facilitating" and "debilitating" anxiety would be a useful tool for predicting academic achievement. General anxiety was found not to be related to specific test anxiety. Furthermore, they found that specific anxiety measures were superior to general tests in the prediction of academic achievement. In addition, they found that when test anxiety was differentiated into "facilitating" and "debilitating" types, each accounted independently for some of the variation in achievement. This

suggested that the relationship of anxiety to academic performance, like that of motivation, may be non-linear. If this is true we can assume that extremely low anxiety is an indirect index of a very low level of achievement motivation and thus produce higher levels of academic performance. However, if anxiety were to reach a high level it would hinder academic achievement. If this assumption is correct, the relation between anxiety and academic achievement would be curvilinear.

Examination of this research makes it apparent that further facts on the relationship between academic performance, creativity and anxiety are still needed, and attention should also be paid to motivation factors, of which anxiety may be one, possibly an important one. It is quite possible that low anxiety level is related to moderate intensity of motivation and high anxiety to extremely high intensity of motivation or drive. The instrument used in this study will be the Taylor Manifest Anxiety Scale (MAS) which will be discussed in detail in Chapter under test descriptions.

IV FOURTH HYPOTHESIS: THAT HIGHLY CREATIVE Ss HAVE
GREATER FACILITY FOR VISUAL
THAN LESS CREATIVE Ss

Not much can be added to the section on Visual and Creativity which has been discussed in detail in
II. Van Lennep (1962, 1966a and 1966b) and Walkup (1966)

to be noted as laying the theoretical foundation for the visualizing process which is assumed to occur during the process of creative production. However, experimental studies seem to be lacking.

If we analyze the work of recent Nobel prize winners (Walkup, 1965a) it becomes obvious that quite a few, perhaps most of them, achieved their fame by great leaps of imaginative insight of visualization; leaps which, at the time they were accomplished, may have had very little experimental or observational basis. Concepts come to mind like the double helix, a most impressive modern demonstration of the unity of life; or of quantum mechanics, associated with the name of Dirac, and of the complementarity due to Niels Bohr. All these and many others were far removed from the work of the laboratory. Nevertheless, they are important scientific theories because, though imaginative constructions of a wide generality, they were also close enough to physical or biological realities to permit experimental verification.

It is known that thought can be accompanied by representations other than just mere words. Even Aristotle admitted that we cannot think without images. A good example of the power of visualization is mentioned by the famous mathematician J. Hadamard (1954). He quotes a letter which was sent to him by Albert Einstein. Here Einstein discusses his mental process.

"(A) The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The physical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be "voluntarily" reproduced and combined. ..."

"(B) The abovementioned elements are, in my case, of visual and some of muscular type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be reproduced at will."

(Hadamard, 1954, pp. 142/3)

If we look deeper into the literature of creativity we note that Crutchfield (1961) mentions that "at the very core of the creative process lies the necessity for the combining or recombining or transforming of the cognitive elements of the problem in a novel and adaptive way". The creative individual is able to ignore orthodox means of solving problems; as a general rule common solutions do not hinder him. In general, ordinary ideas and formulations are treated as unsatisfactory because in many cases closer investigation usually reveals their oversimplified nature. The creative individual prefers complexity to simplicity and this is shown not only by observing his daily routine but also in experimental situations.

Until very recently most psychologists followed the lead of Wallas (1926) in dividing the creative process into four stages: preparation, incubation, illumination, and

verification. Although this is an arbitrary mould into which to pour such a fluid substance as creativity, the second and third phases dramatize particularly well the visualization ability of concern here. Incubation could be seen as the temporary abandonment of conscious, rational problem-solving endeavour, often observed when an individual has reached an apparent dead end in tackling his problem. Now attention is turned some place else, non-conscious impulses take over and facilitate the creative process, which culminates in the stage of illumination, or the discovery of a solution for the perplexing task. The psychoanalyst sees this peak experience as an integration of primary and secondary processes, made possible by the accessibility of pre-conscious and unconscious material. While creativity involves not only the task of dissecting pieces of data and making a conscious, determined effort to untie their meaning, it also involves the task of relaxing and letting the whole task or problem proceed in the direction it chooses.

Needless to say the creative individual has to get himself involved in the details of the problem for classification, clarification, and definition, but must still hold the detached view of the entire task from time to time in order to bring into focus the whole phenomenon that cannot be dissected and to bring back into focus elements which had been sacrificed previously. We note that the blending together of involvement and detachment is an unusual occurrence because it depends upon a developmental phase

which is not a fully developed part of the mental equipment of every individual - i.e. the process of visualization.

What then is the missing ingredient in the process of creativity? It is "how the person knows". The creative individual seems to have stumbled upon a way of knowing and to have developed to a high degree the unusual ability to visualize mentally in an area in which he is creative. In the broadest sense of the word visualize here means not only mental synthesizing of ocular experiences, but also of many sensory experiences. It also appears that successful creating depends on the degree to which these mental images can be manipulated and the ability of the individual to sense the new combinations of properties.

The hypothesis is here advanced that the creative individual appears to have stumbled upon and then developed to a high degree of perfection the ability to visualize, perhaps almost to hallucinate, in an area in which he is creative. In order to investigate the phenomenon of visualization more closely two new tests have been developed by the author; other spatial conception tests will also be used. All these tests will be fully discussed in Chapter V.

V. FIFTE HYPOTHESIS: THAT LESS CREATIVE Ss ARE MORE
DOGMATIC THAN CREATIVE Ss

Material related to this hypothesis has been discussed to some degree in the section on Openness to Experience and Creativity which can be found in Chapter II. Experimentation

concerning the relationship of creativity to dogmatism and other negative factors has been also discussed in the above mentioned section.

Dogmatism, hostility, intolerance and prejudice are negative personality factors which developed through heredity and environment and are practised by the individual because they become a habit, because they give security, or because of other related factors. We can assume that the person who is dominated by these negative personality factors manifests some form of rigidity and rigidity is in general, thought of as a personality trait of the field-dependent individual. We assume that the opposite of rigidity is flexibility and that flexibility helps the creative process.

The point of departure for this investigation was the notion that the degree to which different people are inclined toward creative production often seems to be negatively correlated with the degree to which they have a need for ready made ideas within the various fields of life, and on the whole with the rigidity manifested in various situations. One of the aims of the study is to determine broadly whether it is possible to establish empirically that these negative personality factors are behind the different ways of acting, thinking and believing in all the various respects mentioned above. We are interested here, in other words, in the relationship between creativity and factors of rigidity.

The study, particularly concerning this hypothesis, may thus be characterized as primarily exploratory. It is also hoped that the outcome would also serve a more pragmatic, predictive purpose: if the way a person thinks, acts or behaves in one particular situation is not an isolated phenomenon within the personality but rather an aspect of a common fundamental factor, then it must be valuable to know the person's position as to the factor in question so as to make it possible to make predictions about his behaviour in other situations. The more comprehensive this factor is, the more numerous and far-reaching its predictive value.

In the present study our ambition has been to anchor our hypothesis in a number of variables referring to the subject's behaviour, his expressed attitudes and opinions, etc. It has been found in investigation within the domain of behavioural science that the results obtained are the function not only of the variables integrated, but also of the character and composition of the individual studied. To understand this factor better we can hypothesize a rigidity-flexibility construct which is a multi-determined functional unity, with both hereditary and early environmental, situational and cultural determinants integrated as constituting factors.

The test employed to prove this hypothesis, is the "Rokeach Dogmatism Scale". Certainly we have to keep in mind, as has already been mentioned, that there is an interaction between the different hypotheses, and that they

should not be taken as separate entities. For example in this case, hypothesis I, is strongly interwoven with the material covered here.

VI. SIXTH HYPOTHESIS: THAT ACADEMIC ACHIEVEMENT IN STUDENTS OF ARCHITECTURE IS RELATED POSITIVELY TO CREATIVE ABILITY.

The section Academic Achievement and Creativity of Chapter II devotes a brief exposition to studies which connect creativity and academic success. Here is mentioned a study by Karlins and others (1969) in which the relationship between academic success and creativity was investigated in graduating students of architecture. The measure of creativity, the Remote Associates Test, was found unsuitable and rated creativity was not related to academic achievement. The following study mentions, more or less by accident, the difficult approach chosen by the student and the achieving of better academic grades.

Lansky and Peterson (1968) studied the relation between structural choices of first year architecture students and the quality of their hand-carving in a 6-in. wood cube. Their predictions focussed a) upon the number of edges the student left intact on the original cube and b) on several quality measures. They found that most students would leave no edges intact (0s); students who left 3, 4, 6 or 12 edges intact had higher scores on the integration of mass and

space than the 0s; the 3s, 4s, 6s, and 12s were done by students who had more academic success during the previous, the first academic quarter, than their colleagues.

Chapter II states that conflicting evidence exists about the relationship between academic achievement and creativity. For this and other reasons this hypothesis is of great value, because success^x and creativity seem to be positively correlated in architects. Architecture seems to be the best example of nearly all disciplines to study academic achievement and its relation to creativity.

Academic achievement will be measured through the final grades which the student receives at the end of the first year. Further, as validation of creativity in architecture students a specially designed rating system expressed in terms of a nine point scale will be used which will be completed by the students' lecturer(s).

^xThis does not necessarily mean financial success.

CHAPTER IV

PILOT STUDIES

Six pilot studies were administered to test the suitability of :

- a) foreign tests, e.g. the Taylor Manifest Anxiety Scale (MAS), the Preconscious Activity Scale and the Famous Sayings test;
- b) new tests, e.g. the Work Attitude Scale, Making Symmetric Designs and the Common Elements;
- c) to investigate the interaction of the above-mentioned tests with South African tests, e.g. the Continuous Coded Addition, the Seeing Faults and the Consequences Test.

The nine tests used in the pilot studies were : MAS, Continuous Coded Addition, Work Attitude Scale, Famous Sayings test, Preconscious Activity Scale, Seeing Faults, Consequences, Making Symmetric Designs and Common Elements. These tests are discussed in greater detail in the following chapter.

The Taylor Manifest Anxiety Scale (MAS) was given to 251 first-year students at the Johannesburg College of Education and to 162 first-year students at the University of the Witwatersrand. The purpose of this research (Schmidt, 1970a) was to investigate whether the MAS could be usefully applied to a group of South African college and university students,

and attempts were made to derive representative data for these groups.

Means and standard deviations were calculated for both main groups and for the male and female subgroups of the university students. Nearly all (93%) Ss from the college were females. Results are shown in Table I. Tests were performed to assess the significance of differences in means between the predominantly female college group and the university total and subgroups.

TABLE I

MAS Means & Standard Deviations and Level of Significance

		N	Mean	S.D.	sign.	Level
College of Education	(1)	251	7.98	4.18	.01	(1 & 2)
University, Female	(2)	112	10.13	4.29		
University, Male	(3)	50	9.56	5.01	.01	(1 & 3)
University, Total	(4)	162	9.96	4.50	.01	(1 & 4)

In addition, an item-analysis was carried out for each of the two main groups in order to obtain quantitative information about the consistency of item selected and validity of individual test items.

100.

TABLE II

MAS Reliability Coefficients

Reliability Coefficients	N 251	
Kuder-Richardson 20	0.805	
Kuder-Richardson 14	0.806	
Loevinger	0.263	
Horst	0.831	
Max. possible variance	53,490	

As shown in Table II, reliability coefficients were found for the total scale. (except for Loevinger reliability estimate) be overconservative, and in this case, too, coefficients) were found for the total scale. showed a correlation of less than 0.1 with the score which indicates that, for use with local items appear to need revision. However, it is keep these items, because the MAS has already in its present form and also since the elimination of these items would increase the reliability coefficient a whole very little. It should, however, be these items are less suitable for South African American conditions.

The results of this experiment show:

- a) That the test has acceptable internal consistency when applied to two groups of White South African university students.

- b) That it shows a significantly different "anxiety" self-rating for these groups - the university group being the more anxious.

At a later study (Blumberg and Schmidt, 1970) the MAS was given to a large sample of white first-year student teachers, and the results were compared with their grades, which were used as measures of academic performance. The measures of academic performance were (a) practical teaching; (b) final examination and (c) assignment work. A strong correlation was found between the measures of academic performance. However, there were only low correlations between the MAS, the general anxiety measure, and two of the measures of academic performance.

The year before the actual experiment took place a battery of tests was given to thirty-three students who were randomly selected from all the first-year architecture students of the University of the Witwatersrand and ranged from 17 to 29 years of age, with a median age of 19.8 years (Schmidt, 1970b). All except one student were male.

The following scales were administered: 1. The MAS; 2. The "Seeing Faults" test developed by Shapiro (1968) which provides a measure of creativity and is explained in greater detail in the next chapter; 3. The Continuous Coded Addition, a continuous work test developed at the N.I.P.R. by Reuning (1968) also explained in the next chapter; and 4. A Work Attitudes Scale designed by the author for this project.

The means and standard deviations were calculated for the sample and are shown in Table III.

TABLE III
Means and Standard Deviations of Pilot Study of First
Year Students of Architecture

		Var.	Mean	S.D.
1. Age		1	19.818	2.284
2. Anxiety (MAS)		2	8.333	4.442
3. Work Attitude Scale		3	21.030	6.970
4. Seeing Faults		4	11.970	4.838
5. Total	Continuous Coded Addition	5	1608.879	267.074
6. Accuracy		6	239.576	23.820
7. Neatness		7	187.865	68.390
8. Slope		8	.635	.531
9. Convexity		9	2.725	1.923
10. Fluctuations %		10	5.865	1.811
11. Initial Drop		11	4.000	6.676

Table IV shows the correlation matrix of the eleven variables measured. Variables five to eleven belong to the Continuous Coded Addition. The intercorrelations of age and test scores indicate the presence of common developmental and/or motivational factors. The MAS and the newly designed motivation scale which was completed immediately after the fairly exhausting Continuous Coded Addition, appear to reflect different aspects of motivation. Both scales are significantly correlated with various scores on the Continuous Coded Addition.

There are significant positive correlations between age and 'total' score on the Continuous Coded Addition, between anxiety

and 'accuracy', between 'work attitude' and 'total' score and between 'work attitude' and 'slope'. There are significant negative correlations between the Work Attitude Scale (motivation) and 'fluctuation' and between 'slope' and 'fluctuation'. The negative correlations of fluctuations with total and other Continuous Coded Addition scores suggest that absolute (not %) average fluctuations should be scored.

Although this experiment involves only a small sample, its results suggest the conclusion that each of the three motivational indices, - the MAS, the Work Attitude Scale, and the Continuous Coded Addition - can make valuable contributions to the assessment of motivation in its various aspects. The study indicated no significant correlation between the only creativity measure included, "Seeing Faults" and any of the other measurements. A possible explanation for this may be the "critical" component of the "Seeing Faults" task, which makes this test rather specific.

TABLE IV

CORRELATION MATRIX OF PILOT STUDY OF FIRST YEAR STUDENTS
OF ARCHITECTURE

		1	2	3	4	5	6	7	8	9	10
Age		1	1.00								
Anxiety (MAS)		2	.20	1.00							
Work Attitude Scale		3	.02	-.05	1.00						
Seeing Faults		4	-.10	-.10	-.20	1.00					
Total	Continuous Coded Addition	5	.32 ^x	-.00	.34 ^x	.05	1.00				
Accuracy		6	.14	.34 ^x	-.20	-.19	.18	1.00			
Neatness		7	-.05	.10	-.05	-.22	.02	.30	1.00		
Slope		8	.09	-.14	.51 ^{xx}	-.01	.18	-.17	.04	1.00	
Convexity		9	-.02	-.20	.06	-.08	.16	-0.00	.04	.23	1.00
Fluctuations %		10	-.19	.05	-.52 ^{xx}	-.14	-.44 ^{xx}	.15	-.07	-.47 ^{xx}	-.16
Initial Drop		11	.11	.18	-.04	-.09	.13	.17	.02	-.26	-0.00

^x significant at the 5% level

^{xx} significant at the 1% level

Another instrument which was to be used in the final study was the Famous Sayings test (Bass, 1958). Before this test could be administered it had to be adapted to South African conditions. Certain items had to be changed, i.e. "You can't get dollars by pinching nickels" to "You can't get rands by hoarding cents"; and "Success against odds is the greatest of American ideals", to "Fighting adversity is the highest of South African ideals". This test, which is described in the next chapter, consists of 131 proverbs or famous sayings and is divided into the following four measures:

1. Conventional Mores (CM)
2. Hostility (HO)
3. Fear of Failure (FF)
4. Social Acquiescence (SA)

After its adaptation to South African conditions the Famous Sayings test was administered to 338 South African College of Education students (Schmidt 1969d). The sample was investigated according to education and sex, but emphasis in reporting will concern itself with the whole group.

Table V gives the means, S.D.s, skewness and kurtosis for the total group and Table VI gives the correlation matrix for the four measures, education and age. The ^x above a correlation indicates that the significance level is above 1%.

In addition, an item-analysis was carried out for the group in order to obtain quantitative information about the consistency of item selection and validity of individual test items.

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Name of thesis Creativity in Student Architects 1971

PUBLISHER:

University of the Witwatersrand, Johannesburg

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