SNELL, Galen Robert, 1934-
RELATION OF COGNITIVE STRATEGIES TO CERTAIN MEASURES OF INTELLIGENCE AND CREATIVITY.

University of Arizona, Ph.D., 1967
Education, psychology

University Microfilms, Inc., Ann Arbor, Michigan

RELATION OF COGNITIVE STRATEGIES TO CERTAIN MEASURES OF INTELLIGENCE AND CREATIVITY

by

Galen Robert Snell

A Dissertation Submitted to the Faculty of the

COLLEGE OF EDUCATION

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

1 9 6 7

THE UNIVERSITY OF ARIZONA

GRADUATE COLLEGE

I hereby recommend that this dissertation prepared under my direction by Galen Robert Snell entitled Relation of Cognitive Strategies to Certain Measures of Intelligence and Creativity be accepted as fulfilling the dissertation requirement of the degree of Doctor of Philosophy

Dissertation Director   Date 7/7/67

After inspection of the dissertation, the following members of the Final Examination Committee concur in its approval and recommend its acceptance:*

7/10/67

7/11/67

7/7/67

7/11/67

*This approval and acceptance is contingent on the candidate's adequate performance and defense of this dissertation at the final oral examination. The inclusion of this sheet bound into the library copy of the dissertation is evidence of satisfactory performance at the final examination.

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Galen R. Snell

ACKNOWLEDGMENTS

The author expresses sincere appreciation to his advisor, Dr. Robert L. Wrenn, for his unfailing patience and guidance in this research project. Deep appreciation is also expressed to the other members of the doctoral committee, Dr. Roger J. Daldrup, Dr. Gordon A. Harshman, Dr. Richard M. Martin, and Dr. Cecil A. Rogers. Their time, energy, and knowledge were of great help in regards to this study.

The author is grateful to those graduate student colleagues who have helped in formulation of the problem and who cooperated so willingly in allowing the author the use of their quiz section periods for experimental purposes. The author is also grateful to his mother-in-law, Mrs. Eugene L. McClure, for her many hours of help in scoring the test of creativity.

Of those many other people who deserve the author's sincere appreciation, none is more deserving than his wife, Ruth. Her constant encouragement and faith in her husband, backed up by many hours of typing and editing gave the needed incentive to bring the present study to a successful completion.

Last but not least, though many have helped in the preparation and completion of this study, the author takes full responsibility for its contents.

TABLE OF CONTENTS

TABLE OF CONTENTS--Continued

LIST OF TABLES

LIST OF ILLUSTRATIONS

ABSTRACT

When early philosophical writers attempted to explain cognitive structure and process, they often used the concept of the soul or interaction of the individual with his environment. With the advent of psychological testing the emphasis turned to intelligence. J. P. Guilford, using factor analysis, produced an extensive model of the structure of the intellect including a distinction between convergent and divergent thought processes. Convergent thought process has been identified with that area of research known as intelligence. Divergent thought process has been identified with those mental factors generally labeled creative. Convergent thinking proceeds toward a type of response that is restricted in answer and solution. Divergent thinking has to do with responses that leap into the production of unique responses.

J. S. Bruner's concepts of cognitive strategies have been introduced as they relate to the above intelligence-creativity dichotomy. Bruner is concerned with how the mind deals with the total complexity of our environment. He concludes that we categorize the world by means of cognitive strategies. Categorization is the process whereby people, objects and events are placed into classes, and are responded to in terms of class membership rather than individually. The mental processes that categorize people, objects and events are called strategies. Two types of strategies, superordinate and complexive, were identified

by Bruner. The present study proposes that these two cognitive strategies (superordinate and complexive) relate to the mental processes of intelligence and creativity as identified in Guilford's theoretical system. That is, intelligence factors and superordinate strategies are related mental processes. Creativity and complexive strategies are also related mental processes. The purpose of the present study is to test these relationships.

Four experimental groups of twenty subjects each were isolated from three hundred and sixty-six college freshmen on a dimension of creativity and of intelligence. These groups were High intelligence-High creative, High intelligence-Low creative, Low intelligence-High creative, and Low intelligence-Low creative. All eighty subjects were given a modified version of Bruner's test of cognitive strategies. Four hypotheses predicted different ratio expectations between superordinate and complexive responses to Bruner's test of cognitive strategies. A fifth hypothesis predicted a higher frequency of total superordinate and complexive responses for certain experimental groups.

Statistical analysis of the ratio of predicted responses between complexive and superordinate strategies was not computed for hypotheses one through four since few complexive responses were given and a ratio would have been meaningless. Three t tests of means were computed to total responses as proposed in hypothesis five. Significant results were obtained at the .05 level indicating a higher frequency of total responses for the High intelligence-High creative group than for the Low intelligence-Low creative group. Comparisons of total responses among the other groups were not significant.

Discussion regarding hypotheses one through four centered on the unexpected paucity of complexive responses. It was proposed that cultural conditioning of children toward superordinate thought processes might explain the lack of complexive responses. Also the place, time and social situation of test administration may have decided consequences on the emission of complexive responses.

Finally, the problems encountered in defining and identifying creativity were discussed. Implications for further research were suggested.

CHAPTER I

INTRODUCTION

Man's thoughts have naturally evolved to the point of questioning how these thoughts arise. Some of these thoughts took on a crude or primitive tone. One example of a primitive concept was the discussion of the nature and the attributes of the soul. The soul was thought of as an entity of man that existed apart from the body. Evidence of this was inferred from the sleeping and waking state. The coma was also interpreted as a disappearance of the soul. When health was restored, the soul reappeared. Aristotle disdained this separation of body and soul. He wrote that the soul could be identified as the mind. The mind was not a "given" but was structured by interaction with the environment. An explanation of this developed structure, for Aristotle, was to be found in mental processes such as memory. Memory was explained in terms of contiguity, similarity and contrast (Murphy, 1949). This concept of mental development by interaction with environment was carried to great height in the nineteenth century by the associationists. However, the dualistic concept of mind and body as "created givens" was extolled by the torchbearers of faculty psychology. Intelligence was treated under such terms as intellect, judgment, reason and will, all given to the individual by virtue of being born. Thus early thinkers have attempted

to explain cognitive structure and process. These theories arose from philosophical attempts to explain the phenomena they saw within themselves and the world around them.

Early psychological investigators of the nineteenth century such as Weber, Fechner, etc., experimented primarily with generalized descriptions of human behavior. Individual differences, now known to characterize the process, were generally ignored. Sir Francis Galton in England, Alfred Binet in France, and James McKeen Cattell in the United States brought about the acceptance of studying individual differences in the area of intelligence (Anastasi, 1961). Karl Pearson, following the work of his teacher, Galton, developed statistical procedures as a means of measuring intellectual differences. Nevertheless, the term intelligence was not often used. Spearman (1927) complained that, "Right up to the present day a large number, perhaps even the majority, of the best accredited books on psychology do not so much as bother to mention the word 'intelligence' from cover to cover." Even though the study of intelligence was not given immediate acceptance in psychology, the movement was on its way.

Early within this movement intra-individual differences as well as inter-individual differences led to the notion that there were different, or measurably discrete, mental processes being tapped by the tests being developed. Before the turn of the century Dearborn (1898) observed that when Harvard students and faculty were asked to give imaginative responses to ink-blots, two of the "poorest" records

were given by students of "a highly developed intellect." Colvin (1902), in studying school children determined the utility of two category systems: "logical power" and "spontaneity." In a replica of this study Colvin and Meyer (1906) concluded: "Logical power shows no pronounced relation to any type of imagination except the visual" (p. 91). Another early study by Laura Chassel (1916) involved giving many different tests, some requiring stereotyped responses, others requiring original responses. The former tests were much like our standard intelligence tests of today, whereas the latter tests were quite similar to tests now used to delineate "divergent thinking" or creativity. Chassel found that performance on the intelligence tasks had very little relationship to performance on the creative tasks.

Even though different mental processes were recognized as existing, the movement of intelligence testing followed primarily the guidelines of Binet's Le development de l'intelligence chez les enfants (1908). Terman's (1925) studies of the gifted child did not greatly influence a shift toward those factors of the mind outside the intellectual sphere. A quick perusal of the Education Index and the Psychological Abstracts under the headings of "Creativity," "Intelligence" and related subjects brings the above into sharp focus showing primary emphasis in the area of intelligence.

The Mental Process of Convergence and Divergence

With the advent of factor analysis, mental structure and process were again opened up to new experimentation and theory

building. Interest turned to the relationship of intelligence and creativity. One of the most comprehensive treatments in this interrelationship has been given by Guilford (1959). By means of factor analysis, forty-seven known factors of intellect were obtained. Guilford proposed a comprehensive theoretical model of the "structure of the intellect" based upon these factors. This model is tri-dimensional. On one plane lie the materials or contents of the intellect. That is, the intellect in order to function must have some subject matter on which to work.[1] The second major means of classifying intellectual abilities is according to the product that evolves from the operations of the intellect. Thus the end results of intellectual functions may be a unit of thought (figure, symbolic structure, or concept) or a relationship between units. A third plane of Guilford's dimensional scheme is classification of kinds of operations the intellect performs upon the materials of thought. Guilford distinguished five different operations. The first of these is cognition which has to do with the

---

1. Guilford conceives this subject matter as coming from four sources. The first source he calls figural. This material is the concrete material of matter. It can be seen (lines and forms which have shape, size, color, texture, gradations), heard (rhythms, melodies, speech sounds), touched, etc. Thus the figural aspect of the material content of the intellect is constituted under the general category of concrete intelligence. Second is the material Guilford calls conceptual or semantic. This consists of verbalized forms of meaning. The third source of materials or contents of intellect is symbolic materials. Examples here are syllables, numbers, words, and code materials. Probably the abilities of a person in the areas of semantic or symbolic materials would be recognized as the category of "abstract intelligence." Guilford adds a fourth area as a content of intellect -- the behavioral. Thus, the area of intellect may well include social relations as seen on a dimension of empathy.

ability to discover the different materials described above. A second is the operation of memory within each area of cognition. Another class of operations is that of making evaluations upon the information and conclusions of other intellectual operations. In the fourth and fifth areas of operations we come to those processes proposed by Guilford which concern this dissertation. Given the materials on which the intellect can work; given the cognitive and memory functions within the intellect, there needs to be some operation whereby the intellect is able to bring about production of other information by means of the thinking process. Historically, the associationists attempted to explore this possibility by such concepts as mental chemistry and apperceptive mass. Guilford (1959) uses the terms convergent thinking and divergent thinking to distinguish two ways in which the intellect produces new information from existing cognitions.

> Convergent thinking proceeds toward a restricted answer or solution. If asked, "What is the opposite of high?" You would respond with "Low." This is an example of convergent thinking. If asked, "What is two times five plus four?" You would have no other alternative than to say, "Fourteen." But if you were asked to give a number or words that mean about the same as "low", you could produce several different responses, all satisfying the requirement, such as "depressed", "cheap", "degraded", and the like, and you would be correct. In this example we have an instance of divergent thinking (Guilford, p. 154).

Therefore, we see convergent thinking involves thinking toward an already known answer as in mathematics. It is uniquely factual. Divergent thinking is the ability to see many different answers through searching the intellect.

To understand the difference of convergent and divergent thinking we must first understand some of the traits that Guilford has

described that relate to creativity. The first trait is a generalized sensitivity to problems. This trait is identified as belonging to the evaluative abilities mentioned above under operations. It has to do with the judgment that everything is not right; thus possibly bringing with it the desire to straighten things out. This is not part of creative thinking, but sets the stage for productive thought. A second factor related to creativity is fluency of thinking, i.e., the fertility of ideas. Still a third factor is flexibility or the ability to produce a large diversity of ideas. A fourth factor is originality having to do with unusual responses or remote associations.

"Nonaptitude" traits such as motivation and temperament may well be important to creativity but little experimental evidence is available. A statement by Guilford (1959) will bring together the discussion thus far and its relation to creativity:

> To return to the abilities more clearly related to creativity, it is apparent that the traits of fluency, flexibility, and originality come in the general category of divergent thinking. The factor known as sensitivity to problems, however, has been placed in the category of evaluation and the factor of redefinition in the category of convergent thinking, as stated earlier. It is probably true that other abilities outside the divergent-thinking category also make their contributions to productive thinking. We might arbitrarily define creative thinking as divergent thinking, but it would be incorrect to say that divergent thinking accounts for all the intellectual components of creative production (p. 157).

In Guilford we find a distinction between creativity and other types of intellectual function -- a distinction being made between creativity and intelligence. It needs to be noted, however, that Guilford does not dichotomize these two functions into two adjacent

compartments. He is convinced that there is relationship between them as well as between other given intellectual factors. Even so, given factors of creativity are distinguishable and classed under divergent thinking as are different factors placed under convergent thinking. Operationally these two terms and their concomitant factors are helpful in conceptualizing the difference between creativity and intelligence. At the least they have been of heuristic value.

Operational Definition of Convergence and Divergence

In 1954 a symposium was held under the auspices of the American Association of Gifted Children to bring up to date the findings regarding giftedness. Getzels and Jackson (1962) wrote regarding this symposium:

> The most striking conclusion from the collection of papers [2] is that the things that could be said with certainty in 1954 about the gifted child did not differ substantially from Terman's [3] earliest findings. Although each paper is excellent in its own right, together they reflect a slackening of progress in our understanding of giftedness in children. Many of the statements made tentatively by Terman in 1925 could be made with greater conviction, and the importance of this should not be minimized. Yet by and large, further conceptual development and fundamental knowledge seems not to have been forthcoming. The crucial problem, for us, became "why" (p. 2).

In answer to the "why" they state that the primary obstacle is defining giftedness as "high I.Q." Thus any child that does not have a high I.Q. cannot be considered gifted even though he is very accomplished in other respects. This suggests that intelligence tests should sample all the

---

2. Strang (1954).

3. Terman (1925).

known cognitive abilities. Getzels and Jackson (1962) continue:

> On the contrary, the items on the typical intelligence test seems to us to represent a rather narrow band of intellectual tasks, relying chiefly on those requiring in Guilford's terms "convergent thinking" and neglecting those requiring "divergent thinking." To do well on the typical intelligence test, the subject must be able to recall and to recognize, perhaps even to solve; he need not necessarily be able to invent or innovate (p. 2-3)[4].

Here we see Getzels and Jackson making the distinction between creative factors and intelligence factors. They feel that, because this distinction has not been made, forward movement toward a greater understanding of giftedness and creativity has not been accomplished.

Within the framework of psychoanalysis this distinction between divergent and convergent thought has long been assumed. Considering the concepts of primary and secondary thought processes, authors such as Bischler (1937), Brill (1931), Freud (1948, pp. 13-21), Mayne (1965), Pine (1962), Rickman (1957), and Weiss (1964) have made this distinction. The primary process, located in the id, gives immediate and direct satisfaction of an instinctual wish. Freud says this process is not reality oriented but is wish fulfilling. It is the mental process of fantasy. The secondary process is found in the ego and consists of cognitive action guided by objective realities. Kris (1952, p. 283) cited the above group of authors when he stressed "regression in the service of the ego" as being important for creativity. Here he meant a partial and reversible regression into the primary process of thinking where fantasy was assembled that could then be sorted out by the

---

4. Wechsler (1966) has also stated that intelligence is wider than what is now being measured by well known intelligence tests.

secondary process. A similar idea was given by Koestler (1964, p. 284) in the process of what he called "reculer pour mieux sortir" (withdrawing in order better to advance).

Outside the psychoanalytic framework the intelligence-creativity dichotomy, or distinction, has been assumed by such authors as Andrews (1930), MacKinnon (1962), McCloy and Meier (1931), Ripple and May (1962), Simpson (1922), Torrance (1965), Wallach and Kogan (1965), and Welch (1946). A statement by Stevenson (1949) summarizes the distinction between intelligence tests and creativity.

> All well-made Intelligence Tests are exercises in 'objective' thinking, and it is far from true that the most intelligent person writes the best poetry. How to distinguish between creative and merely intelligent work is the crucial matter, and I am not likely to succeed in a description of the difference, except perhaps to say that the one is characterized by cognitive complexity, and the other by its 'pregnancy with newly expressed emotions' (p. 64)[5].

---

5. Guilford (1950) made the following statement, "Examination of the content of intelligence tests reveals very little that is of an obviously creative nature... Many believe that creative talent is to be accounted for in terms of high intelligence of I.Q. This conception is not only inadequate but has been largely responsible for the lack of progress in the understanding of creative people... If the correlations between intelligence test scores and many types of creative performance are only moderate or low, and I predict that such correlations will be found, it is because the primary abilities represented in those tests are not all important for creative behavior. It is also because some of the primary abilities important for creative behavior are not represented in the test at all... In other words, we must look well beyond the boundaries of the I.Q. if we are to fathom the domain of creativity" (p. 444-454).

Thurstone (1952) comments on this point, "To be extremely intelligent is not the same as to be gifted in creative work. This may be taken as a hypothesis. It is a common observation in the universities that those students who have high intelligence, judged by available criteria, are not necessarily the ones who produce the most original ideas. All of us probably know a few men who are both creative and highly intelligent, but this combination is not the rule. The

Therefore, it seems fruitful to operationally distinguish between creativity and intelligence. For the purpose of the study to follow, convergent thought will be used to associate those logical thinking processes that are emphasized by intelligence tests, and divergent thought will be applied to those intellectual processes which have to do with creativity. Two mental processes are now operationally defined according to the theoretical system of Guilford. It has also been shown that other authors have assumed this type of dichotomy in the mental structure. Another way of conceptualizing the mental process was given by Jerome Bruner. The relationship of Guilford's conceptualization to Bruner's theoretical concept of mental process is the purpose of this study. The next section deals with Bruner's concepts.

---

confusion between intelligence and creative talent is common. For example, Quiz Kids are often referred to as geniuses. They would undoubtedly score high in memory functions, including incidental memory and rote memory. But it is doubtful whether they are also fluent in producing original ideas" (p. 20).

Upon completing their study Getzels and Jackson (1962) conclude, "It seems to us that the essence of the performance of the high creativity adolescents lay in their ability to produce new forms, to risk conjoining elements that are customarily thought of as independent and dissimilar, to 'go off in new directions.' The creative adolescent seemed to need to free himself from the usual, to diverge from the customary behavior; he seemed to enjoy the risk and uncertainty of the untried and the unknown. In contrast, the high I.Q. adolescent seemed to possess to a high degree the ability and the need to focus on the usual and to be 'channeled and controlled' in the direction of the 'right' answer, the socially accepted solution. He appeared to shy away from the risk and uncertainty of the unknown and to seek the safety and security of the already established and the known" (p. 52).

Cognitive Strategies

Moving on, we find that Bruner (1962) is concerned with how the mind is able to deal with the total complexity of our environment, and in this regard parallels the thinking of some of the authors cited above. His conclusion is that we have the capacity to categorize. "To categorize is to render discriminably different things equivalent, to group the objects and events and people around us into classes, and to respond to them in terms of their class membership rather than their uniqueness" (p. 1). This discrimination regarding objects and events is done only upon those aspects from our environment which have special importance to us. The myriad of other parts in the environment at a given moment in time are not categorized, according to Bruner, because they are not important to us. Bruner stresses the fact that categories in which we group the events and objects of the world around us, are not something we discover as already existing in the world, but are constructions or inventions of the human intellect. Bruner (1962) has proposed that this categorizing of events and objects can best be explained and tested by a grouping of mechanisms he calls strategies.

> The phrase "strategies of decision-making" is not meant in a metaphoric sense. A strategy refers to a pattern of decisions in the acquisition, retention, and utilization of information that serves to meet certain objectives, i.e., to insure certain forms of outcome and to insure against certain others (p. 54).

The Relationship Between Cognitive Strategies and Convergent-Divergent Process

At this point it is worthwhile to compare some of the elements commonly shared by Bruner and Guilford. Bruner's concept of strategy

can be fit within the three main areas of intellect proposed by Guilford for purposes of comparison. Bruner talks about the events and objects around us which are important in the human's ability to categorize. These objects and events could be classed, in Guilford's system, under the materials or contents of the intellect. These objects and events would be the subject matter on which the mind works. Categorizing events and objects could readily be equated with the products area proposed by Guilford. Bruner's category would be equated to a unit of thought or the relationship between different units. Out of these categories come predictions on how an individual will use new objects and events in life's experiences. Strategies might be compared with Guilford's concept of operations, but this is not so clearly apparent from Bruner's early work.

Following from the work of Bruner, Olver and Hornsby (1966) describe different types of strategies used by a person to categorize events and objects. Different strategies were observed when subjects were given the task of telling how different items are alike. From the answers obtained, two primary strategies were discovered and designated as superordinate, and complexive. In superordinate groupings items are grouped together on the basis of some common characteristic. The basis here is one of conceptual grouping. In the complexive strategy, ". . . the subject uses selected attributes of the array without subordinating the entire array to any one attribute or to any set of attributes" (Bruner and Olver, 1963). The following examples illustrate complexive and superordinate strategies. When asked how a banana,

peach, potato and meat were alike, a six year old may say, "A banana is yellow, and a peach is red and yellow, or sometimes red and sometimes yellow, and a potato is light flesh, and meat is brown." This is a complexive response. An older child of sixteen might respond to the same items as "They're all something to eat," or "They're all food." Thus a superordinate response is given. It is important to note that the superordinate strategy is much more economical in being able to categorize the events and objects of human experience. The complexive seems to be of little, if any, help in codifying experience.

Olver (1966) used sixty subjects for her investigation of cognitive strategies. There were six age groups of ten subjects each. The first four groups (ages 6, 9, 11 and 13 years) were drawn from suburban public schools near Boston. A group of sixteen year olds came from a nearby suburban high school. A nineteen year old group consisted of freshmen at Harvard and Radcliffe Colleges. One of the significant findings of the study was that children at age six use strategies that are half complexive, half superordinate. By age nineteen a progressive shift has taken place so that only superordinate strategies are used in explaining how the different items in a given test array are alike. Olver and Hornsby explain this progressive use of superordinate strategies by students as due to intellectual growth that has come from their being in an "academic" setting. Thus the school situation (or even the general cultural situation) demands that the children put aside childish ways of thinking and become competent in consistent, logical ways of thought.

In comparing this to Guilford's system we have in superordinate strategies a referral back to the operations of the intellects -- and more specifically to those factors of operations under the heading of convergent thought.

> Obviously, the two approaches to grouping superordinate and complex are required in adult functioning, and though in our data we see one replacing the other, the replacement is probably more for public activities than for those done more subjectively (Olver and Hornsby, 1966, p. 79).

In this context Bruner's complexive strategies are identified as having their roots, to use Guilford's concepts, in those factors of operations identified in divergent thought. Thus it would appear that the function of the superordinate strategy might fall into those cognitive factors which are identified by means of conventional intelligence tests. In like manner it would appear that complexive strategies might be identified as belonging to those factors that are of a more creative character. The above discussion leads directly to a statement of the research problem, a proposed design for gathering data, and the hypotheses to be tested.

CHAPTER II

PROBLEM, INSTRUMENTS AND HYPOTHESES

This chapter contains the experimental problem and the design used. The method and tests for the selection of the experimental groups are discussed which leads directly into the experimental hypotheses.

The purpose of this dissertation is to determine the relationship between conventional notions of intelligent thought and creative thinking. More specifically a test will be made of the relationship between intelligence thinking and superordinate strategies, and the relationship between creativity and complexive strategies. A two by two design (Figure 1) is proposed to establish the experimental groups to assess these relationships:

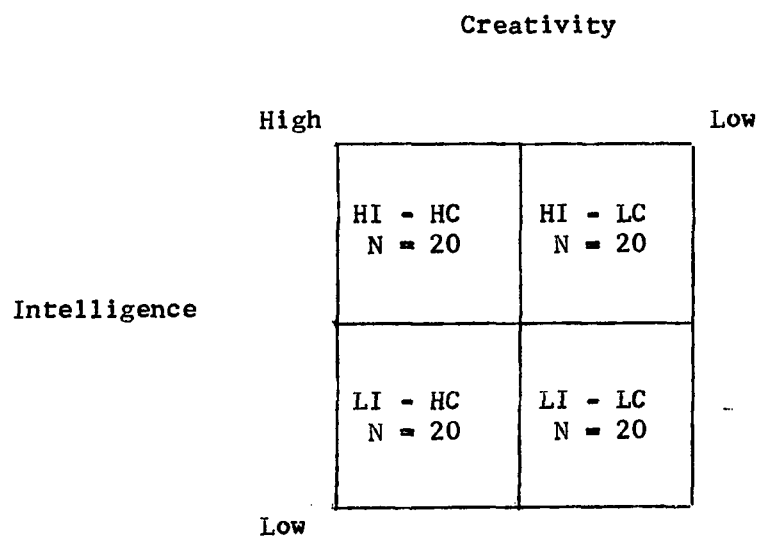


Figure 1. Two by two factorial design -- experimental groups

The above grouping is a variation of that which was first proposed by Getzels and Jackson (1959, 1962). The identification of subjects on creativity and intelligence has also been used by Palm (1959), Torrance (1959, 1960) and Yamamoto (1964 a, c, d). Following their example a High intelligence-High creative group will be formed of those subjects found to be in the top twenty per cent of a college freshman norm group on an identified measure of intelligence and creativity. A High intelligence-Low creative group will consist of subjects that are in the top twenty per cent in intelligence but in the lower fifty per cent in creativity. Low intelligence-High creative are subjects found in the lower fifty per cent in intelligence and the top twenty per cent in creativity. Low intelligence-Low creative are subjects found in the lower fifty per cent in both intelligence and creativity. The percentages used above were first proposed and used by Getzels and Jackson. These percentages are used in order that comparison can be made with these earlier studies on creativity.

In order to obtain the groups just described, measures of creative thinking and intelligence were given to the subjects. To complete the study a test of cognitive strategies was also given. Explanation of these tests are given here before the statement of the hypotheses.

A Measure of Creative Thinking

Several approaches have been proposed and used in the measurement of creativity. Most of these measures have been developed as a

result of Guilford's theoretical structure of the intellect. Three main test batteries have been developed by Guilford (1952), Getzels and Jackson (1962), and Torrance (1962). All are based primarily on concepts delineated in Guilford's system. In justification of the validity of these tests Guilford (1964) wrote ". . . our way of using factor analysis has one great advantage in that we do not have to worry about the criterion problem. Factor analysis provides its own criteria." Thus the validity claimed for the tests of creativity is that of construct validity in that those tests identify the factors proposed in Guilford's theoretical system.

Validity of these tests as compared with other criteria is generally lacking. To obtain concurrent validity by means of teacher, peer, or colleague ratings has proven quite difficult because the judges were seldom agreed as to what constitutes creativity in those being rated. Also strong halo effect is often seen in such ratings. Drevdahl (1956) obtained significant results by using concurrent validity. He used professor's ratings of students and compared these with tests of creativity developed by Guilford. However, other studies have not obtained significant findings.

That many researchers do not accept Guilford's posture that factor analysis provides its own criterion is quite evident (McNemar, 1964). Such disagreements are due to the many theoretical approaches which create differences in method (Yamamoto, 1965).

From the above discussion it can be seen that little study has been done on tests of creativity regarding validity, reliability, standardization and norms. It is extremely difficult to pick one test used in creativity research that meets the usual standards for a valid, reliable test.

Therefore, in consultation with Dr. Marie Hughes[6], a test of creativity (Appendix A, Part I) in the Guilford tradition was chosen with the recognition that the validity and reliability is of face value according to Guilford's theoretical system.[7]

Traits of originality, fluency, flexibility and elaboration have been used as scoring indices of tests of creativity in Guilford's theoretical system. Following the work of Guilford and his associates (Wilson, 1953) the scoring procedure used in this study was originality. This was accomplished by comparing the subject's total originality score with his own reference or norm group in order to obtain a score of creativity for each subject.

A Measure of Conventional Thinking

Identification of intelligence in the subjects was accomplished by use of composite scores on the American College Test (ACT) and Scholastic Aptitude Test (SAT). Since the University of Arizona accepts

---

6. Professor of Education, University of Arizona.

7. Two other tests of creativity were given to the subjects at the same time but not scored for inclusion in this dissertation (Appendix A, Part II and III). Further work is being done in order to publish university student norms for these tests of creativity. The first of these was used by Wallach and Kogan (1965, p. 34). The second is a test of creativity proposed by J. P. Guilford and edited by Dr. Hughes.

either ACT or SAT as a measure of scholastic aptitude, both measures were used in this study. Little problem was encountered in comparing these tests as norms are provided on both measures by the University of Arizona for its freshman class (1966-1967). A conversion table is provided in the ACT manual (1960) which allows comparison of the composite scores on ACT and SAT. By use of this conversion table it was found that percentile ranks among University of Arizona students could be closely approximated when SAT percentile rank was translated into the percentile rank of the ACT norms and vice versa.

Investigation of the literature found in the Psychological Abstracts and the Educational Index was made to obtain data regarding the correlation of student I.Q. scores on individual intelligence tests, such as Stanford-Binet or Weschler Adult Intelligence Scale with scores on group tests such as the ACT or SAT. Such research was not to be found. Personal correspondence with Dr. Vernon Odom (Appendix B) of the ACT regional office in Lubbock, Texas, requested information regarding such correlations. His reply stated that he knew of no such correlational studies but was quite certain there was a high degree of correlation between scores obtained on standard intelligence tests and ACT scores. Although no tangible evidence from correlational studies was found to show that ACT and SAT scores are comparable to individual measures of intelligence, it is commonly agreed that both individual and group measures of intelligence or aptitude place a high premium on convergent thinking as described by Guilford (1959).

A Measure of Cognitive Strategies

A modified design to that of Bruner's test of cognitive strategies (Bruner and Olver, 1963; Olver and Hornsby, 1966) was prepared. Two primary modifications were made in Bruner's test procedure[8] (Appendix C). The first modification was group administration of the paradigm instead of presentation to a single individual. A second modification was made in the type of response desired. Bruner requested a single, discrete response to the different grouping (paradigm) of items from his subjects. The Bruner test used in this study requested as many responses as could be given to the different paradigms. The purpose of this test was to measure the following hypotheses in terms of R = s/c where R = ratio, s = total superordinate responses and c = total complexive responses.

---

8. We gave children from age six to nineteen the task of telling us how different items are alike. We presented the words banana and peach, each typed on a small white card and spoken aloud as well, and asked the child, "How are banana and peach alike?" We then added potato to the list, first asking, "How is potato different from banana and peach?" and then, "How are banana, peach, and potato all alike?" Next we added meat, asking, "How is meat different from banana, peach, and potato?" and then, "How are banana, peach, potato, and meat all alike?" This procedure was continued until the array consisted of: banana, peach, potato, meat, milk, water, air, germs. At the end of the array we included an item about which we asked only how it differed from the preceding items; for example, stones was presented as the final item in the banana-peach list. We presented a second array of items in the same manner: bell, horn, telephone, radio, newspaper, book, painting, education, and in the contrasting item, confusion (p. 70).

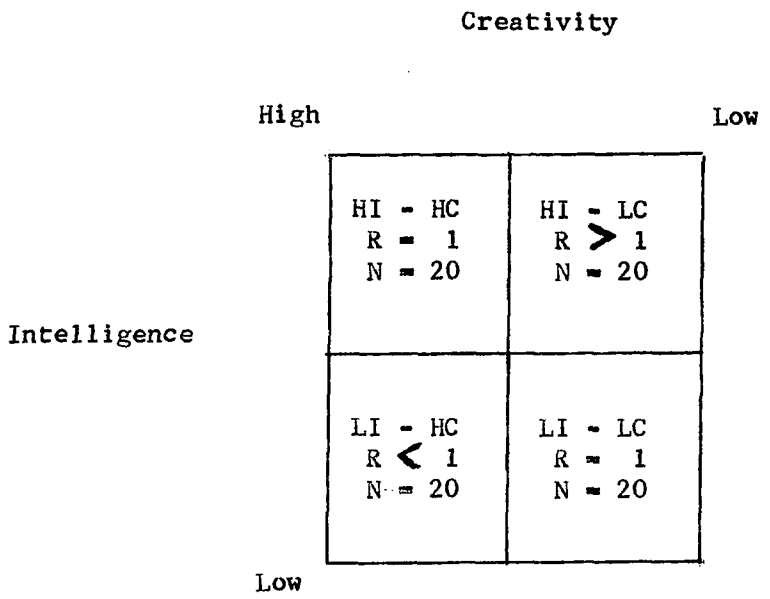


Figure 2. Presentation of design and hypotheses

Hypotheses Tested

With reference to the design diagrammed in Figure 2, the following assumptions and hypotheses are presented. Olver and Hornsby (1966, p. 77) present a graph which shows that in a discrete presentation of Bruner's paradigm (footnote on page 20) only superordinate responses were given by the nineteen year old subjects. This is in contrast to six year old subjects who gave half superordinate and half complexive responses. However, in their discussion, Olver and Hornsby wrote, "Obviously, the two approaches to grouping are required in adult functioning" (p. 79). They assumed that the replacing of complexive responses by superordinate responses, as people grow older, was an artifact of schooling where knowledge is learned in a public situation, They propose that complexive responses are still available to the person but in a more "private" situation. As already noted it is proposed

to change administration of the Bruner paradigm from a request for a discrete (single) response for each array to a request for a continuous (multiple) response. In line with the discussion of Olver and Hornsby this change in administration is proposed as a way to tap complexive responses as well as superordinate responses. Such studies as Bilodeau and Howell (1965) have shown that continuous association brings a variety of individual responses which are otherwise not obtained.

With the above in mind the rationale for the hypotheses below can be seen. The first four hypotheses are based on the assumption that the creative subject will emit a greater number of complexive responses than superordinate responses. Conversely, the intelligent subject will emit a greater number of superordinate responses. If the subject is equal in creativity and intelligence it is assumed he will do equally well in emitting both superordinate and creative responses.

The fifth hypothesis is based on the findings of Getzels and Jackson (1962, p. 25). Here it was shown that High-intelligence and High-creative subjects did equally well in scholastic work. Coupling this with Guilford's statement (page 6 above) that there is likely some inter-relationship between creative and intelligence factors it seems reasonable that the experimental group composed of High intelligence-High creative subjects will be capable of emitting more total responses than the other groups. It is assumed in the LI-HC, HI-LC (see below) groups that a depressed score will be observed because of the one low dimension found in these groups. As the low

group of subjects are depressed in both dimensions (LI-LC) it is assumed they will have the lower total of emitted responses.

Therefore the following experimental hypotheses are proposed.

H_1 In the High intelligence-High creative group (HI-HC) the ratio of total superordinate responses to complexive responses will equal one.

$H_1 : R = 1$

H_2 In the Low intelligence-Low creative group (LI-LC) the ratio of total superordinate responses to complexive responses will equal one.

$H_2 : R = 1$

H_3 In the Low intelligence-High creative group (LI-HC) the ratio of superordinate responses to complexive responses will be less than one.

$H_3 : R < 1$

H_4 In the High intelligence-Low creative group (HI-LC) the ratio of superordinate responses to complexive responses will be greater than one.

$H_4 : R > 1$

H_5 In terms of total number of responses emitted in each group, regardless of type, the following ranking is expected: High intelligence-High creative will have more responses than High intelligence-Low creative or Low intelligence-High creative

which in turn will have more responses than Low intelligence-Low creative.

H_5 : HI-HC > HI-LC or LI-HC > LI-LC

CHAPTER III

METHODS AND PROCEDURES

In the previous chapters intelligence and creativity have been operationally separated and described as convergent and divergent mental processes. This separation was based upon Guilford's theoretical system. Bruner's concept of superordinate and complexive strategies was proposed as approximating intelligence and creative thought processes. To test the validity of this comparison, four experimental groups of twenty subjects each were proposed. These groups were to be identified on the two dimensions of intelligence and creativity. Following the identification of these experimental groups the Bruner test of cognitive strategies was to be given to all eighty subjects in the experimental groups. The present chapter describes the subjects used and the testing conditions. As selection of the experimental groups was dependent upon the measure of creativity, the administration and scoring of the test of creativity is explained before the selection of the experimental groups is discussed.

Sample

The test of creativity was administered in a college introductory psychology course at the University of Arizona during November, 1966. This course was selected because of availability and it contained

sufficient numbers of students for the sample needed. These students met once a week in quiz sections. The test was administered during the regular meeting of these sections. Before the testing began it was determined that only those subjects would be used which had all three measures needed for completion of this study -- test of creativity, ACT or SAT score and Bruner's test of cognitive strategies. Of the students in the introductory course only freshmen were used since the only reliable norms available on ACT and SAT were obtained for the freshman class. A total of three hundred and sixty-six subjects met the above criteria.

Test of Creativity

Thirty-six minutes were given to complete the three page test of creativity (Appendix A). After twelve minutes the students were asked to continue to the second page if they had not already done so. They were also told they could go back to any part of the test if some other idea came to their mind. After twelve minutes they were requested to move on to the third page if they had not already done so. At the conclusion of thirty-six minutes the booklets were collected. As time did not permit scoring of the creativity test before the semester was completed Bruner's test of cognitive strategies (Appendix C) was given to all students two months later within the quiz sections previously mentioned. Twenty-five minutes were given to complete the Bruner paradigm. The following instructions were given after the paradigm was distributed, "You have twenty-five

minutes to complete this. If you can think of more than fourteen ways these are alike then put them down. In other words, put down as many as you can think of." Following completion of the paradigm, a short explanation was given to the students regarding the purpose of their participation.

With completion of this test all material was in hand for analysis. Bruner's test of cognitive strategies was set aside until the four groups needed for the design had been identified. The test of creativity (Appendix A, Part I) was scored according to uniqueness of the response. An example of this is given in Appendix D. Thus a subject who drew a B (letter) was given a score of 42 on this stimulus. This means that forty-two out of the three hundred and sixty-six subjects drew a letter "B" on the first stimulus. The subject who drew an anchor was given a score of 1 as it was a unique idea and he was the only one with that response from the entire group of subjects. Drawing ability was not made a factor in the scoring; only the idea shown was considered important. This procedure was followed for all eighteen of the stimuli. The eighteen responses were then summed and divided by the number of responses made. The score obtained was the creativity score for each subject. Table 1 gives the distribution of creativity for the three hundred and sixty-six subjects. It will be noted that a subject who had a high score is considered low in creativity, and conversely a low score indicates a high degree of creativity. As already stated (p. 17), only Part I of the creativity test was used to identify creativity in this study.

TABLE 1

CREATIVITY DISTRIBUTION

Creativity Score*	Number of Subjects
5 - 9	1
10 - 14	2
15 - 19	1
20 - 24	4
25 - 29	6
30 - 34	24
35 - 39	27
40 - 44	39
45 - 49	57
50 - 54	60
55 - 59	30
60 - 64	38
65 - 69	27
70 - 74	23
75 - 79	9
80 - 84	9
85 - 89	6
90 - 94	1
95 - 99	1
100 - 104	1

mean = 51

* a low score obtained by a subject indicates high creativity

Selection of Experimental Groups

Percentile rank was obtained for each of the subjects on ACT or SAT norms compiled by the University of Arizona. With these two measures in hand the four experimental groups were chosen according to guidelines set down on page 16. In the High intelligence-High creative group a total of twenty-four subjects met the criteria for inclusion. In the High intelligence-Low creative group thirty-one subjects met this criteria. In the Low intelligence-High creative group twenty subjects were included. In the Low intelligence-Low creative group thirty-three subjects met the criteria. As twenty subjects per experimental condition were called for by the experimental design, those groups which had more than twenty were reduced to twenty. Since the object of this study is to obtain as great a differential between experimental groups as possible, the groups were reduced to twenty in such a manner as to have as great an extreme as possible on both creativity and intelligence dimensions. Thus for example, in the Low intelligence-Low creative group those subjects were retained which had a combination of the lowest creative index and the lowest intelligence percentile rank as possible.

Test of Cognitive Strategies

Following identification of the eighty subjects, their tests (Appendix C) on cognitive strategies were scored according to superordinate, complexive and total responses. Superordinate responses were scored when the items are grouped on the basis of a given attribute that

is characteristic of each item. In scoring it was noted that whenever the word "both" or "all" preceded the attribute of the item, the response was usually a superordinate. Often the actual attribute given was not true of the array of items. Even so, it was scored as a superordinate response as superordinate structure was attempted. Examples of superordinate responses on array number four are "all have vitamins," "all are inspected for contamination," "all exist on earth," etc.

Complexive strategies are scored where the subject used selected attributes of the array of items without subordinating all the items of the array to any one attribute or set of attributes. Several types of complexive strategies have been identified by Bruner and Olver (1963) and Olver and Hornsby (1966). 1) Association complex -- The subject uses a connecting attribute for the first two items of the array and then attempts to connect the other items to this given attribute or bond. In the complexive responses given in the present study there were none of this type. 2) Key ring complex -- Here the subject takes one item and relates all the other items to it in some special way. In array number seven a response was given, "All have germs (germ is a germ)." Here the item "germs" is given focus and the rest of the array is related to it. 3) Collection complex -- Here a complementary contrasting or other type of related property that all the items have is focused upon; but the total array is not quite tied together by the attribute. Again there is more emphasis given to the individual items than to the total array. An example of this in array number four is,

"contain different colors, yellow, orange and red, brown, red, and white." 4) Edge matching complex -- Association links are formed between neighboring items. None of these were found in this sample. 5) Multiple grouping complex -- Here several subgroups are formed. The sign often given when this is used in this sample is the word "or". In array number six a subject wrote, "all solid, liquid, or gas."

CHAPTER IV

RESULTS AND DISCUSSION

Analysis of hypotheses one through four will be treated together. Hypothesis five will be separately analyzed. Following the results, a discussion of the results will be given. This chapter will close with a discussion regarding the identification of creativity followed by recommendations for further research.

Results

Statistical analysis of hypotheses one through four (see p. 23) was to be accomplished by the ratio R = s/c where R = ratio, s = total superordinate responses and c = total complexive responses (see p. 20). As can be seen on tables two through five (pp. 33-36) very few complexive responses were obtained in this study. This paucity of complexive responses carried through all four experimental groups. As the ratio predicted between superordinate and complexive responses did not occur, no statistical analysis was computed. The conclusion here is that hypotheses one through four must be rejected due to insufficient complexive responses to make the ratio meaningful.

The fifth hypothesis dealt with the total complexive and superordinate responses of the four experimental groups (see p. 23). Three t tests were computed to test significant mean differences. As shown on Table 6 (p. 37) a significant difference at the .05

TABLE 2

LOW INTELLIGENCE-HIGH CREATIVE GROUP

Subject	Complexive Score	Superordinate Score	Total
1		21	21
2	1	43	44
3	1	65	66
4		52	52
5		38	38
6		60	60
7		32	32
8		58	58
9		51	51
10		68	68
11	1	62	63
12	5	59	64
13		62	63
14	1	42	43
15	1	66	67
16	4	49	53
17		38	38
18	4	48	52
19		39	39
20	1	41	42

sum of total responses = 1013 sum of superordinate responses = 994
mean of total responses = 50.65 sum of complexive responses = 19

TABLE 3

LOW INTELLIGENCE-LOW CREATIVE GROUP

Subject	Complexive Score	Superordinate Score	Total
1		31	31
2		37	37
3		26	26
4	4	42	46
5	1	34	35
6		51	51
7		68	68
8	1	42	43
9		44	44
10	2	36	38
11		59	59
12		48	48
13		27	27
14		26	26
15		57	57
16		36	36
17		38	38
18	1	56	57
19	1	62	63
20		19	19

sum of total responses = 849
mean of total responses = 42.45
sum of superordinate responses = 839
sum of complexive responses = 10

TABLE 4

HIGH INTELLIGENCE-LOW CREATIVE GROUP

Subject	Complexive Score	Superordinate Score	Total
1		42	42
2	1	37	38
3		63	63
4	3	37	40
5		66	66
6		43	43
7		77	77
8		65	65
9		60	60
10		26	26
11		27	27
12		22	22
13		50	50
14		13	13
15		32	32
16		42	42
17		72	72
18		40	40
19		23	23
20	1	85	86

sum of total responses = 927 sum of superordinate responses = 922
mean of total responses = 46.35 sum of complexive responses = 5

TABLE 5

HIGH INTELLIGENCE-HIGH CREATIVE GROUP

Subject	Complexive Score	Superordinate Score	Total
1		47	47
2	3	75	78
3		73	73
4		52	52
5		37	37
6		30	30
7		46	46
8	1	71	72
9	1	59	60
10	1	59	60
11	1	60	61
12	1	31	32
13	1	29	30
14		60	60
15	1	62	63
16	2	70	72
17		32	32
18		56	56
19	2	31	33
20	1	42	43

sum of total responses = 1037 sum of superordinate responses = 1022
mean of total responses = 51.85 sum of complexive responses = 15

level was obtained between the means of the High intelligence-High creative group and Low intelligence-Low creative group. The other two statistical treatments comparing (1) the High intelligence-High creative group with the combined means of High intelligence-Low creative, Low intelligence-High creative groups, and (2) the Low intelligence-Low creative with the combined means of the High intelligence-Low creative, Low intelligence-High creative groups, were not significant at or beyond the .05 level of significance.

Therefore, the major experimental hypotheses were not confirmed with the exception of a portion of hypothesis five. Due to the small portion of positive results, generalizations should not be made from this data.

TABLE 6

MEAN DIFFERENCES BETWEEN EXPERIMENTAL GROUPS ON TOTAL RESPONSES

Groups Compared	M	M_{diff}	t	
HI-HC with LI-LC	51.85 42.45	9.40	1.970*	***
HI-HC with HI-LC, LI-HC	51.45 48.50	3.35	.286**	
LI-LC with HI-LC, LI-HC	42.45 48.50	6.05	.538**	

* 38 degrees of freedom
** 58 degrees of freedom
*** significant at or beyond the .05 level

Discussion

Hypotheses one through four

As hypotheses one through four were based on the assumption that complexive responses could be elicited by a methodological change of Bruner's cognitive strategies paradigm from discrete (single) responses to continuous (multiple) responses, the fact of few complexive responses demands attention.

The lack of complexive responses might be due to the cultural conditioning of children both in and out of school. Our culture places a great emphasis on the convergent response. Educational processes in our schools place a premium on the learning of facts and "proper" modes of thinking through a given problem or situation. Indeed, the child who gives a correct answer to a problem but deviates from the accepted method of obtaining that answer is negatively reinforced in the same manner as if the answer were incorrect. Thus, the developmental sequence of gorwing from childhood (where complexive responses are more acceptable because "he is only a child") to college age demands this growth toward superordinate response.

Following this line of reasoning it could well be that Bruner's paradigm was seen as a classroom exercise where superordinate responses are usually required. The importance of this idea of classroom exercise as having a negative effect is emphasized by previous researchers. Wallas (1921) proposed quite early that creative thought was the result of four stages; preparation, incubation, illumination and verification. MacKinnon (1961) verifies Wallas' early proposal by stating that:

> Observers are agreed that there are distinguishable stages or phases of creativity: (1) a period of preparation during which one acquires the knowledge, skills, and techniques, the elements of experience which makes it possible for one to pose a problem to himself, (2) a period of concentrated effort to solve the problem which may be quickly solved without much difficulty or delay, but which perhaps more often involves so much frustration and tension and discomfort that out of sheer self-protection one is led to (3) a period of withdrawal from the problem, a psychological retreat or going-out-of-the-field, often referred to as a period of incubation, (4) a period of insight accompanied by the exhilaration, glow, and elation of the "aha" experience, and (5) a period of verification, evaluation, and elaboration of the insight which one has experienced (p. I-1).

Rogers (1959, p. 76) wrote that of the stages given above, perhaps the most fundamental condition of creativity ". . . is that the source or locus of evaluative judgment is internal." Thus the value of the product created is not established by outside reinforcement, but inward considerations of worth. Wallach and Kogan (1965, p. 19) placed great emphasis on those stages and aspects of the creative process which emphasized the need of time for creative thought and an atmosphere which is free of evaluation. Therefore, it seems reasonable to ask if the lack of complexive responses might not be due to the attempt to obtain a complexive response in a culturally conditioned situation that gives set toward superordinate responses by (1) setting time limits, and (2) staging the test in the classroom, thus giving evaluative connotations. According to the authors cited above this culturally conditioned situation moves against the grain of ideal conditions needed for creative insight and activity. If so, the present study did not adequately control for the situation in which data were gathered.

Following closely on the above discussion a second possible explanation of the lack of complexive responses can be given. This has to do with whether or not Bruner's paradigm is so constructed as to make possible complexive responses by an adult population. By asking for multiple responses the author proposed to get behind the culturally conditioned situation. This was based on Olver and Hornsby's (1966) statement,

> Obviously, the two approaches [complexive and superordinate] to grouping are required in adult functioning, and though in our data we see one replacing the other the replacement is probably more for public activities than for those done more subjectively (p. 79).

It is of interest to note that out of the two experimental groups judged high in creativity (Tables 2 and 5) twenty of the forty subjects did use one or more complexive responses. This is compared with the experimental groups judged low in creativity (Tables 3 and 4) where nine out of the forty had at least one complexive response. Therefore, some of the subjects were able to jump the limits of the perceived situation and give complexive responses, especially those subjects identified as high in creativity. That some complexive responses were emitted indicates that this type of cognitive strategy is not completely lost as a process of growth or age. In Bruner's test, as used in this study, the subject may have felt he was asked to emit what appears to be a child's response if he gave a complexive response.

Closely related to the above discussion are considerations regarding the assumed ratio between superordinate and complexive responses. This study assumed there were equal population possibilities

of both superordinate and complexive responses from which the subjects could draw for their emitted responses. In light of the evidence of this study the question is raised whether or not in normal educational process the population of possible superordinate responses increase by greater proportion than the possible complexive response population. Evidence for this would be the great leap in knowledge obtained by children in the first twelve years of life, which according to Bruner is made possible by simplifying materials into superordinate strategies. From this point of view a ratio of a few complexive responses to many superordinate responses on well known material or contents studied in school situations may be the expected result. Only further use and research on Bruner's paradigm would clarify this.

Also of interest is some consideration as to why children lose their fantasy and play acting behavior as they become older. If only more superordinate categories are developed and complexive categories remain the same in number, the sheer weight of this dynamic developing aspect of cognitive growth would cause the lesser developed aspect of cognition to nearly drop out of sight. The tremendous pressure made by society to "grow up" and conform to cultural standards of the subject's age group extinguishes a great deal of behavior thought to be of a more creative nature.

Hypothesis five

In light of the small ratio of superordinate and complexive responses emitted the results obtained may well be without interpretative value. Even though one part of this hypothesis was found to be

significant at the .05 level (Table 6) the question is raised as to whether this is due to an interaction between intelligence and creativity or whether it is strictly an artifact of intelligence. A look at the sum of responses (Tables 2-5) in both total and superordinate responses columns shows a definite trent for decreasing responses from the High intelligence-High creative through the two groups with one low dimension (High intelligence-Low creative and Low intelligence-High creative) to Low intelligence-Low creative which is low on both intelligence and creative dimensions. That the second highest response total on both superordinate and total responses is found in the Low intelligence-High creative group gives some indication that this is not an intelligence phenomenon alone, but a cognitive interaction between the intelligence-creative process.

The findings here give some support to Getzels and Jackson's (1962) discovery that the high creative students, though in lower group in terms of intelligence, did as well in scholastic achievement as did the high intelligence student. In past educational discussion these students who did well in scholastic achievement but scored poorly on intelligence tests were called over-achievers. It was assumed they attained their high academic achievement through a difference in personality factors such as high motivation, discipline, compulsiveness, etc. Though a dichotomy is made between intelligence and creativity in order to study this area, the early words of warning given by Guilford that the two processes are distinguishable but are constantly interacting with one another was not adequately anticipated.

Further refinement in identification of mental processes outside those given for intelligence functioning may shed light on important factors in academic achievement -- at least among those who do well in academic evaluation.

The above discussion does not rule out, however, emotional and personality factors in responses given on Bruner's test. By closer examination of Bruner's test taken by the eighty subjects used in this study, motivational factors can be observed. The subjects were asked to give as many responses as possible to seven arrays. An element of compulsiveness could be involved in the number of answers given. This is made possible because many of the answers emitted for the first array could also be given for the second and third array. Motivational and personality factors such as compulsiveness and perseveration could be involved in copying the same responses given for one array for the other arrays where the answer would be correct. However, these effects are not expected to bias one group over another in any systematic way.

Identification of creativity

A factor complicating the whole field of creativity research is lack of agreement on a definition of creativity. Previously it was noted (p. 6, above) that Guilford introduced several traits as being related to creativity. These were (1) fluency of ideas, (2) flexibility and (3) originality. F. E. Williams (1967) and others in the field of creativity have expanded Guilford's traits of creativity by adding (4) elaboration, (5) curiosity, (6) willingness to take risks and (7) preference for complexity. Working definitions given by researchers are

usually given in terms of the above traits. Thus creativity is not defined in terms of its intrinsic characteristics but in terms of its manifest traits. It can be seen that any definition of creativity is accomplished by inductive reasoning. This approach approximates the oft quoted definition of intelligence, viz., intelligence is what intelligence tests measure. Such appears to be the state of the field.

The validity problem of creativity tests has been cited by Thorndike (1963), Yamamoto (1964b) and Wallach and Kogan (1965) among others. The distinction now being made in research between creativity and intelligence has been generally accepted. The question is how to establish valid tests to identify the dimension of creativity with creative behavior outside the test situation. As already noted (see p. 17) Guilford does not see this as a problem when seen from his factor analytic position. It appears, however, that the forward movement of the field of creativity demands that validity of tests become a major area of research.

Two primary problems which present themselves in obtaining validity are scoring procedures for tests of creativity and better control of experimental conditions within which tests of creativity are administered. Usually scoring has been done according to different traits of creativity, i.e., originality or uniqueness of responses, fluency or number of responses, flexibility or number of different categories of responses, and elaboration or details drawn on a stimulus demanding a motor response. A major problem which has been encountered in previous research is a low correlation between scores obtained using

different indices of creativity, as originality and fluency. Thus a given creative test, when scored by originality does not identify the same person as being creative as when scored by fluency. It is here the question is raised as to whether these tests are tapping a single process of creativity (as g is said to be running through all subtests of intelligence tests) or several different mental processes which are identified and named, with present knowledge, according to the respective factor used in scoring, i.e., originality, fluency, flexibility, elaboration, etc. There is little doubt this poses a problem for the researcher in creativity. Without better understanding on this point, all research in creativity is, of necessity, tentative. It is noted that the present study used originality as its scoring criterion. This scoring criterion needs to be remembered in any attempted interpretation or comparison of this study with other studies.

The second area needing attention in present research in creativity has to do with the experimental conditions within which tests of creativity are administered. Special problems may appear in the administration of tests of creativity because of certain characteristics that may be necessary for creative production (e.g., Wallas' four stages of preparation, incubation, illumination and verification). As already noted (see p. 39) Wallach and Kogan (1965) have concluded that two very important variables are freedom from press of time (temporal pressure) and an evaluative situation by an authority. They have come to this conclusion after assessing the results of their study which attempted to control for these two procedural variables. Such

control was accomplished by means of conducting the tests of creativity as part of play time activities free from any indication of hurry. The tests used were similar to those now being used in creative research (and in this dissertation). Wallach and Kogan obtained a high correlation between the scoring indices of originality and fluency on the same test and between the tests used to identify creativity. This gave indication that valid measures of creativity, as defined in Guilford's theoretical system, had been achieved. This prompted them to conclude,

> We have been able to provide an operational definition of creativity that does justify conceiving of it as substantially independent of the intelligence concept and as possessing a goodly degree of generality (p. 48).

From this study it appears that the variables of time and freedom from authoritative evaluation are important in identifying creativity in subjects.[9]

One other comment seems in order here. Wallach and Kogan used ten and eleven year old children in their experiment. Methodologically a way needs to be found by which their study could be replicated on college students. The importance of these variables may well hold for the college population. Indeed, these two variables of time and evaluation could possibly be more crucial because of greater sophistication of college subjects in the direction of seeing all tests in terms of intelligence.

Returning to the definition of creativity in terms of traits,

---

9. It needs to be noted that Wallach and Kogan used only two of the four common indices for scoring tests of creativity, originality and fluency. One could question whether they have shown anything other than that creativity can be defined in terms of originality and fluency traits.

it can be seen that traits 4-5 (see p. 44) are close to those concepts identified as motivational. To attempt a definition of creativity which includes such a broad and uncertain field as human motivation is to show the difficulties encountered in research on creativity.

Recommendations for further research

It is felt that the following areas are fruitful for further research.

1. The fact that some complexive responses were obtained in this study among college age subjects gives rise to the question of how available these complexive responses are in college or adult age subjects. Since the present study represents a specific age group, it may support the notion that complexive responses are almost "wiped out" by age 18 and beyond. This factor has not been given adequate attention in the literature. Experimentation with different paradigms ranging from concrete related concepts, as used in this dissertation, to more abstract related concepts would possibly produce more complexive strategies. The object here is to use relationships that are not well known by the subject thus freeing him from superordinate set. The result of these differing paradigm modifications could provide evidence whether early childhood modes of cognitive conceptualization are available later in life. Possibly the move from complexive strategies to superordinate strategies is not a maturational development, but is an indicator of understanding and mastery of a new field of experience or endeavor. Therefore learning any subject matter or new experience might begin at the complexive level of cognitive development. In this

manner new superordinate strategies are developed to deal with the mass of new material or experience. Experimental work by use of this paradigm might support this notion.

Granting the possibility of a relationship between creativity and complexive responses, the small number of complexive responses obtained in this study suggests problems in the identification of creativity in different age groups. The more developed the intellectual process at the expense of creative thought processes the harder it would be to identify creativity in the older subjects. Thus procedures used to identify creativity in younger children may be inappropriate for college age subjects. A whole field of study is available here in research on different age groups using tests of creativity proposed by different theoretical systems. Norms for these different age groups need to be established so further experimentation can be accomplished.

2. The availability of complexive response in college subjects might also be affected by different environmental and social situations. Variation of conditions in which this test is given is suggested. Do time, place, pressure, etc., have any effect on the emission of complexive responses?

Variation of conditions in administering the test of creativity is also needed. An example of this could be administration in different social situations to determine if differing results are obtained in various settings. The test of creativity could be given to college age subjects in (1) a classroom under timed and evaluative conditions, (2) in a counseling testing room where two untimed tests are presented

before the test of creativity is given, and where expression is made that the subject has all the time he wishes to complete this paper, and (3) at a party given at a private home where the test is given as one of the games played during the evening.

3. Other administrative procedures seem warranted regarding Bruner's test of cognitive strategies. The use of the continuous response method in presenting these paradigms is suggested as it allows less common responses to be given. A suggested modification of the present paradigm, and of other paradigms developed, would be fewer arrays given when the continuous response method is used. Thus instead of asking the subject to give as many responses to seven different arrays ranging from relating two words through eight words, the subject could be given three arrays. In this manner he would be asked to give as many responses as possible to two related words, then as many responses as possible to five related words and complete the test by giving as many responses as possible to the relationship of eight words. In this manner contaminating personality factors might be more adequately controlled.

CHAPTER V

SUMMARY

Early philosophical writers have attempted to explain cognitive structure and process. Some attempts used the concept of the soul, while others envisioned the mental structure as forming from an interaction with the environment. The renowned psychological investigators of the nineteenth century generally ignored individual differences in the mental processes. At the time of the twentieth century individual differences became an area of study with the advent of statistical procedures and the testing movement. The primary outgrowth was identification and study of intelligence.

Early in the testing movement, it was recognized that measurably discrete mental processes were being tapped. With the discovery of factor analysis these other mental processes were identified and named. Guilford (1959) pioneered in this area and produced an extensive model of the "structure of the intellect." That part of his model that has to do with this dissertation is the distinction between convergent and divergent thought processes. Convergent thought process has been identified with that area of research known as intelligence. Divergent thought process has been identified with those mental factors called creativity. Convergent thinking proceeds toward a type of response that is restricted in answer and solution. Divergent thinking has to do with responses that leap into the production of

unique responses. Guilford describes the following traits that relate to creativity, (1) a generalized sensitivity to problems, (2) fluency of thinking, (3) flexibility of thinking and (4) originality.

Bruner's concepts of cognitive strategies have been introduced as they relate to the above intelligence-creativity dichotomy. Bruner (1962, p. 1) is concerned with how the mind is able to deal with the total complexity of our environment. He concludes that we categorize the world by means of cognitive strategies. To categorize is ". . . to group objects and events and people around us into classes, and to respond to them in terms of their class membership rather than their uniqueness." The mental processes that categorize objects, events and people are called strategies. Two types of strategies, superordinate and complexive, were identified by Bruner. In superordinate strategy, items (objects, events and people) are grouped together on the basis of some common characteristic. The basis here is conceptual grouping. In the complexive strategy ". . . the subject uses select attributes of the array items without subordinating the entire array to any one attribute or to any set of attributes" (Bruner and Olver, 1963).

The present study proposed that these two cognitive strategies (superordinate and complexive) related to the mental processes of intelligence and creativity as identified in Guilford's theoretical system. That is, intelligence factors and superordinate strategies are related mental processes. Creativity and complexive strategies are also related mental processes. The purpose of the present study was to test these relationships.

Four experimental groups of twenty subjects each were isolated from three hundred and sixty-six college freshmen on a dimension of

creativity and of intelligence. These groups were High intelligence-High creative, High intelligence-Low creative, Low intelligence-High creative, and Low intelligence-Low creative. All eighty subjects were given a modified version of Bruner's test of cognitive strategies. The following hypotheses were tested:

H_1 In the High intelligence-High creative group (HI-HC) the ratio of total superordinate responses to complexive responses will equal one.

$H_1 : R = 1$

H_2 In the Low intelligence-Low creative group (LI-LC) the ratio of total superordinate responses to complexive responses will equal one.

$H_2 : R = 1$

H_3 In the Low intelligence-High creative group (LI-HC) the ratio of superordinate responses to complexive responses will be less than one.

$H_3 : R < 1$

H_4 In the High intelligence-Low creative group (HI-HC) the ratio of superordinate responses to complexive responses will be greater than one.

$H_4 : R > 1$

H_5 In terms of total number of responses emitted in each group, regardless of type, the following ranking is expected: High intelligence-High creative will have more responses than High intelligence-Low creative or Low intelligence-High creative which in turn will have more responses than Low intelligence-

Low creative.

H_5 : HI-HC > HI-LC or LI-HC > LI-LC

Statistical analysis of the ratio of predicted responses between complexive and superordinate strategies was not computed for hypotheses one through four since few complexive responses were given and a ratio would have been meaningless. Three t tests of means were computed for hypothesis five. Significant results were obtained at the .05 level between the mean difference of High intelligence-High creative and Low intelligence-Low creative groups. In comparing the High intelligence-High creative group with the combined means of the High intelligence-Low creative and Low intelligence-High creative groups no significance was obtained. The same results were found when the Low intelligence-Low creative group was compared with the combined means of the High intelligence-Low creative, Low intelligence-High creative groups.

Discussion regarding hypotheses one through four centered on the unexpected paucity of complexive responses. It was proposed that cultural conditioning of children toward superordinate thought processes might explain the lack of complexive responses. Also the place, time and social situation of test administration may have decided consequences to the emission of complexive responses.

The problem encountered in defining and identifying creativity was also discussed. Implications for further research are suggested for better understanding of the field of creativity and cognitive strategies.

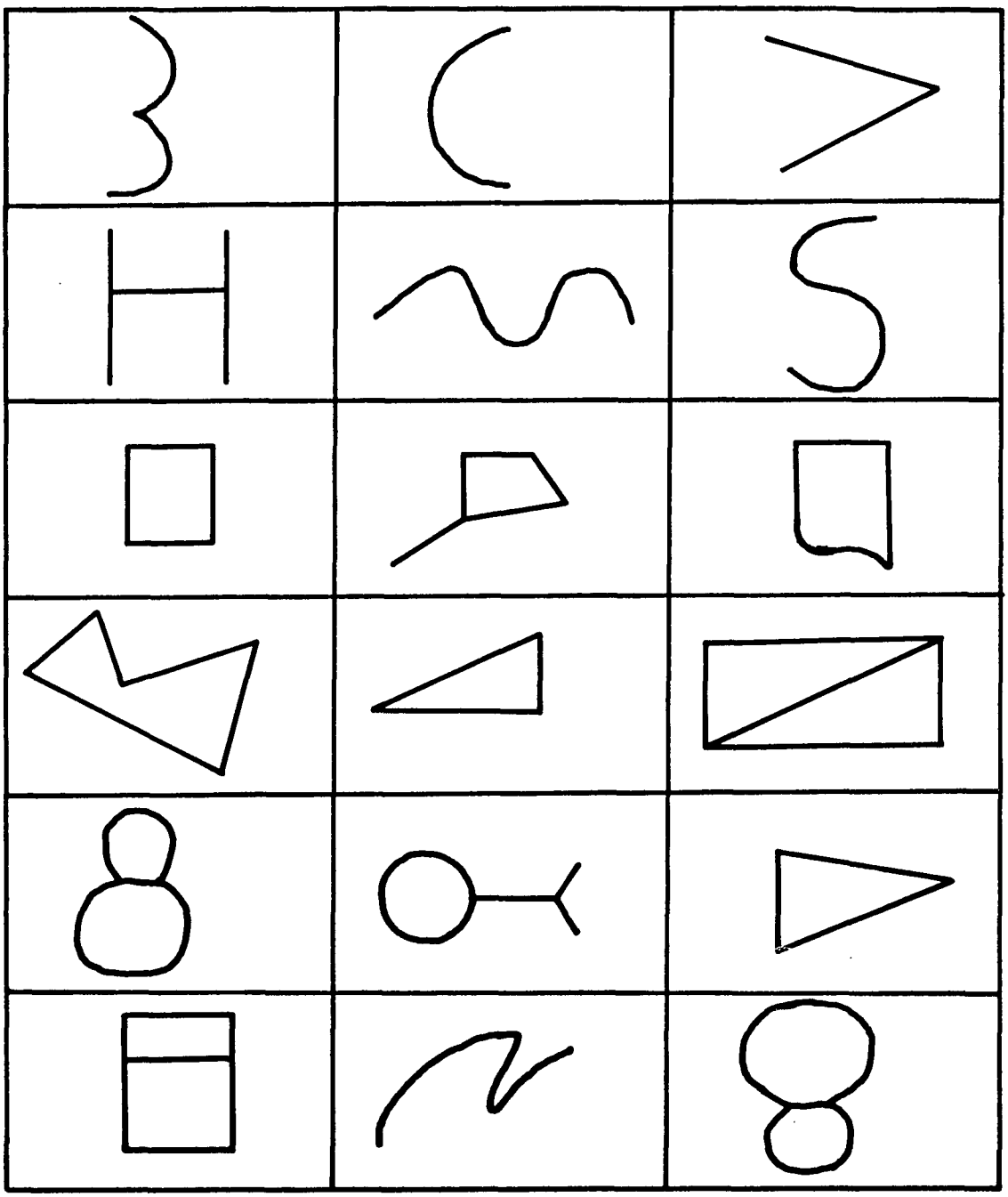
APPENDIX A

TEST OF CREATIVITY

APPENDIX A

TEST OF CREATIVITY

Part I. In each square there are lines which may suggest some object you would like to draw. Do with them what you will.



Creative Thinking

Part II

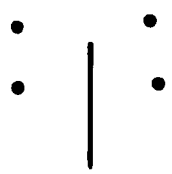
Each question below has a drawing. Write down all the things you think each of these drawings could be.

Example:

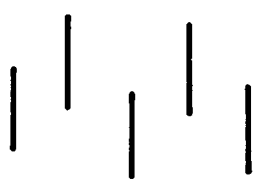
Answer: the rising sun, a porcupine, eyelashes, a brush, a carnation, a rainbow

• * * * * * * * * * * * *

1.

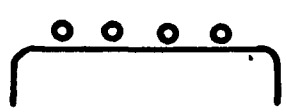


2.

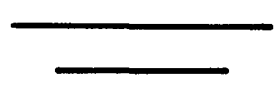


3.

4.



5.



Creative Thinking

Part III

Each question below has four words. You have to tell a very short story with two or three sentences using all four words.

Example: Armchair, ranch, watch, cards

Answer: The man in the armchair looked at his watch and decided to go back to the ranch. He put the cards in the desk, cleared up his desk, and soon left the office.

* * * * * * * * * * * *

1. Job, sky, sand, people

2. Bank, gun, pool, dream

3. Ring, car, grass, rope

APPENDIX B

LETTER FROM VERNON L. ODOM

C O P Y

APPENDIX B

October 19, 1966

Mr. Galen R. Snell
Department of Psychology, Counseling Bureau
The University of Arizona
Tucson, Arizona 85721

Dear Mr. Snell:

I have received your letter of October 15 inquiring about correlational studies between the ACT and the WAIS. While I do not know of specific studies as you requested, high positive correlations would be expected.

I am sending you a copy of our Technical Report which should be of help to you in this general area; although, not the specific information you requested. I am also sending you an ACT Research Report in this general area.

I sincerely regret that I do not know of studies as specific as the one you requested; however, I could give you names of institutions who have conducted correlational studies between the ACT Battery and other I.Q. tests. Please let me know if you desire this information.

Sincerely yours,

Vernon L. Odom
VLO/ba
Encls.

APPENDIX C

BRUNER'S TEST OF COGNITIVE STRATEGIES

C O P Y

APPENDIX C

In the following exercises you are to give as many ways as you can think of as to how these different things are alike. Any possible relationship between the items is acceptable. The two that come to mind need not be universally true. For example: How are a bell and horn alike?

1. Both have paint
2. Both make musical sound
3. Are conical in shape
4. Take someone to use them
5. Both made of metal
6. Both have handle
7. Both involve movement in order to work
8. Both manmade
9. Both have four letters
10. Used for alarm
11.
12.
13.
14.

1. Write down as many ways you can think of in which a banana and peach are alike.

1. 8.
2. 9.
3. 10.
4. 11.
5. 12.
6. 13.
7. 14.

2. Write down all the ways you can think of in which a banana, peach and potato are alike.

1. 8.
2. 9.
3. 10.
4. 11.
5. 12.
6. 13.
7. 14.

3. Write down all the ways you can think of in which a banana, peach, potato and meat are alike.

1. 8.
2. 9.
3. 10.
4. 11.
5. 12.
6. 13.
7. 14.

4. Write down all the ways you can think of in which a banana, peach, potato, meat and milk are alike.

1.	8.
2.	9.
3.	10.
4.	11.
5.	12.
6.	13.
7.	14.

5. Write down all the ways you can think of in which a banana, peach, potato, meat, milk and water are alike.

1.	8.
2.	9.
3.	10.
4.	11.
5.	12.
6.	13.
7.	14.

6. Write down all the ways you can think of in which a banana, peach, potato, meat, milk, water and air are alike.

1.	8.
2.	9.
3.	10.
4.	11.
5.	12.
6.	13.
7.	14.

7. Write down all the ways you can think of in which a banana, peach, potato, meat, milk, water, air and germs are alike.

1.	8.
2.	9.
3.	10.
4.	11.
5.	12.
6.	13.
7.	14.

APPENDIX D

SCORING RESULTS OF STIMULUS I, TEST OF CREATIVITY

APPENDIX D

SCORING RESULTS OF STIMULUS I, TEST OF CREATIVITY

Response Category	Total Responses Given
anchor	1
animal	
stimulus = back	2
stimulus = side	5
stimulus = whiskers	1
auditorium	1
B (letter)	42
balloons	1
bat	6
bird	8
bow and arrow	4
bow (ribbon)	1
brassiere	2
breasts	18
butterfly	2
candle	1
cells	1
cocktail glass	2
coffee pot	1
crown	1

Response Category	Total Responses Given
curtain	1
egg hatched	1
eight (numeral)	54
faces	1
face	
eyes	8
lines used for left side	1
mustache	1
profile left	2
profile right	15
figure	6
fish	1
flower(s)	15
fruit	3
geometric figure	28
glasses	9
ice cream cone	4
insect	2
lamp	1
leaf	2
lips smoking cigarette	2
moon	3

Response Category	Total Responses Given
mountains	3
papoose	1
sandals	1
seed	1
slip (lingerie)	1
snowman	14
stomach	1
symbol (music)	1
three (numeral)	6
timer (hourglass)	5
tree	1
umbrella	1
undecided	7
vase	7
waves (ocean)	2
worms	1

If the stimulus was left blank it was not included in the scoring.

REFERENCES

The American College Testing Program. Using the ACT scores on your campus. Chicago: Science Research Associates, 1960.

Anastasi, A. Psychological testing. (2nd ed.) New York: Macmillan Company, 1961.

Andrews, E. G. The development of imagination in the preschool child. University of Iowa Studies in Character, 1930, 3.

Bilodeau, E. A., & Howell, D. C. Free association norms by discrete and continued methods. Technical Report No. 1, 1965, Contract No. Nonr-475(10), Office of Naval Research and Tulane University.

Binet, A. A., & Simon, T. Le development de l'intelligence chez les enfants. Annals of Psychology, 1908, 14, 1-94.

Bischler, W. Intelligence and the higher mental functions. Psychoanalytic Quarterly, 1937, 6, 277-307.

Brill, A. A. Poetry as an oral outlet. Psychoanalytic Review, 1931, 18, 357-378.

Bruner, J. S., Goodnow, J. J., & Austin, G. A. A study of thinking. New York: Science Editions, Inc., 1962.

Bruner, J. S., & Olver, R. R. Development of equivalence transformations in children. In J. C. Wright and J. Kagan (Eds.), Basic cognitive processes in children. Monograph of Social Research in Child Development, 1963, 28, 125-143.

Chassell, L. M. Tests for originality. Journal of Educational Psychology, 1916, 7, 317-328.

Colvin, S. S. Invention versus form in English elements in the written work of school children. Pedagogical Seminary, 1906, 13, 91.

Dearborn, G. V. A study of imagination. American Journal of Psychology, 1898, 5, 183-190.

Drevdahl, J. E. Factors of importance for creativity. Journal of Clinical Psychology, 1956, 12, 21-26.

Freud, S. Formulation regarding the two principles in mental functioning. In Collected Papers, Vol., IV. Translated by Joan Riviere. London: Hogarth Press, 1948.

Getzels, J. W., & Jackson, P. W. Creativity and intelligence. Explorations with gifted students. New York: Wiley, 1962.

Getzel, J. W., & Jackson, P. W. The highly intelligent and creative adolescent: a summary of some research findings. In C. W. Taylor (Ed.), The third University of Utah research conference on the identification of creative scientific talent. Salt Lake City: University of Utah Press, 1959, 46-57.

Guilford, J. P. Creativity. American Psychologist, 1950, 5, 444-454.

Guilford, J. P. Progress in the discovery of intellectual factors. In C. W. Taylor (Ed.), Widening horizons in creativity. New York: Wiley, 1964.

Guilford, J. P. Traits of creativity. In H. H. Anderson (Ed.), Creativity and its cultivation. New York: Harper & Row, 1959. Pp. 142-161.

Guilford, J. P., Wilson, R. C., & Christensen, P. R. A factor-analytic study of creative thinking: II. Administration of tests and analyses of results. Los Angeles: Psychological Laboratory, University of Southern California, 1952.

Kris, E. Psychoanalytic exploration in art. New York: International University Press, 1952.

Koestler, A. The act of creation. New York: Macmillan, 1964.

McCloy, W., & Meier, N. C. Re-creative imagination. Psychological Monographs, 1931, 51, 108-116.

MacKinnon, D. W. The study of creativity. In Conference on "The creative person." The Institute of Personality Assessment and Research. University of California, 1961.

MacKinnon, D. W. The nature and nurture of creative talent. American Psychologist, 1962, 17, 484-495.

McNemar, Q. Lost: our intelligence? Why? American Psychologist, 1964, 19, 871-882.

Mayne, A. J. Creativity, psi, and human personality. Research Journal of Philosophy and Social Sciences, 1965, 2, 50-59.

Murphy, G. Historical introduction to modern psychology. New York: Harcourt, Brace & World, Inc., 1949.

Olver, R. R., & Hornsby, J. R. On equivalence. In J. S. Bruner, R. R. Olver, & P. M. Greenfield, et al, Studies in Cognitive Growth. New York: John Wiley & Sons, Inc., 1966.

Palm, H. J. An analysis of test-score difference between highly creative and high Miller Analogies members of the summer guidance institute. Minneapolis: Bureau of Educational Research, University of Minnesota, 1959.

Pine, F. Creativity and primary process: sample variations. Journal of Nervous and Mental Disorders, 1962, 134, 506-511.

Rickman, J. On the nature of ugliness and the creative impulse. In W. Clifford and M. Scott (Eds.), Selected contributions to psychoanalysis. London: Hogarth, 1957, pp. 68-69.

Ripple, R. E., & May, F. B. Caution in comparing creativity and I.Q. Psychological Reports, 1962, 10, 229-230.

Rogers, C. R. Toward a theory of creativity. In H. H. Anderson (Ed.), Creativity and its cultivation. New York: Harper & Row, 1959.

Simpson, R. M. Creative imagination. American Journal of Psychology, 1922, 33, 234-235.

Spearman, C. E. The abilities of man. New York: The Macmillan Co., 1927.

Stevenson, W. Testing school children. London: Longmans, Green and Company, 1949.

Strang, Ruth (Chairman). A symposium -- the gifted child. Journal of Teacher Education, 1954, 5, 210-232.

Terman, L. M., et al. Genetic studies of genius, Vol. I. Mental and physical traits of a thousand gifted children. Stanford: Stanford University Press, 1925.

Thorndike, R. L. The measurement of creativity. Teachers College Record, 1963, 53, 422-424.

Thurstone, L. L. Creative talent. In L. L. Thurstone (Ed.), Application of psychology. New York: Harper and Brothers, 1952.

Torrance, E. P. Explorations in creative thinking in the early school years: VI. Highly intelligent and highly creative children in a laboratory school. Minneapolis: Bureau of Educational Research, University of Minnesota, 1959.

Torrance, E. P. Educational achievement of the highly intelligent and the highly creative: eight partial replications of the Getzels-Jackson study. Minneapolis: Bureau of Educational Research, University of Minnesota, 1960.

Torrance, E. P. Guiding creative talent. Englewood Cliffs, N. J.: Prentice Hall, 1962.

Torrance, E. P. Constructive behavior: stress, personality, and mental health. Belmont, California: Wadsworth Publishing Company, Inc., 1965.

Wallach, M. A., & Kogan, N. Modes of thinking in young children: a study of the creativity-intelligence distribution. New York: Holt, Rinehart and Winston, 1965.

Wallas, G. The Art of Thought. New York: Harcourt, Brace & World, 1921.

Wechsler, D. Toward a broadened construct of intelligence. In Robert L. Wrenn (Ed.), Basic contributions to psychology: readings. Belmont, California: Wadsworth Publishing Co., Inc., 1966.

Weiss, F. A. Dreaming: a creative process. American Journal of Psychoanalysis, 1964, 24, 17-28.

Welch, L. Recombination of ideas in creative thinking. Journal of Applied Psychology, 1946, 30, 638-643.

Williams, F. E. The Macalester creativity project. Macalester College Bulletin, 1967, 55 (4).

Wilson, R. C., Guilford, J. P., & Christensen, P. R. The measurement of individual differences in originality. Psychological Bulletin, 1953, 50, 362-370.

Yamamoto, K. A further analysis of the role of creative thinking in high school achievement. Journal of Psychology, 1964, (a), 58, 277-283.

Yamamoto, K. Creative thinking: some thoughts on research. Exceptional Children, 1964, (b), 30, 403-410.

Yamamoto, K. Role of creative thinking and intelligence in high school achievement. Psychological Reports, 1964, (c), 14, 783-789.

Yamamoto, K. Threshold of intelligence in academic achievement of highly creative students. Journal of Experimental Education, 1964, (d), 32, 401-405.

Yamamoto, K. Creativity -- a blind man's report on the elephant. Journal of Counseling Psychology, 1965, 12, 428-434.