CREATIVEITY AND DREAMS

A Thesis

Presented in Partial Fulfillment of the Requirements for the Degree
Master of Arts

By

Wesley H. Sylvia, B. A.

* * * * * *

The Ohio State University

1973

Approved by

[Signature]

Adviser

Department of Psychology
The sincere gratitude of the author is expressed to Dr. Philip M. Clark for his steady encouragement and patience over the extended period of this investigation. Without his intellectual and moral support this study would never have been completed. He allowed the author the freedom to create and to search out an idea wherever it might lead while at the same time providing the experienced advice and suggestions for implementation of the basic ideas of this investigation. In short, Dr. Clark is everything an adviser should be.

Of special note also is the role of Dr. Lawrence J. Monroe for his help and cooperation to a total novice in the technical areas of modern sleep and dream research. His invaluable methodological suggestions and his insistence upon a thorough, credible investigation have certainly added to the quality of this work.

The author also wishes to express his indebtedness to the following individuals who provided assistance in judging and rating the dream reports, the scoring of EEG records, and electrode attachment and EEG monitoring: Karl Bachman, Dennis Thompson, Inese Kreinbring, Margot Kaebling, Keith Stagner, George Farion, Don Alexander, and Jim Witherell.

Finally, thanks are due the Department of Psychology, The Ohio State University for its assistance and support, and the Department of Psychiatry, The Ohio State University for its cooperation in providing the facilities of the Sleep Laboratory and the Psychometric Laboratory.
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHARTER I - INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Introspections and anecdotes</td>
<td>1</td>
</tr>
<tr>
<td>Armchair speculations</td>
<td>5</td>
</tr>
<tr>
<td>A survey of eminent individuals</td>
<td>6</td>
</tr>
<tr>
<td>Creativity and states related to dreaming</td>
<td>7</td>
</tr>
<tr>
<td>Psychoanalytic theory relating dreams and creativity</td>
<td>9</td>
</tr>
<tr>
<td>The sleep laboratory</td>
<td>11</td>
</tr>
<tr>
<td>The study of creativity related to dreams</td>
<td>12</td>
</tr>
<tr>
<td>Specific areas of examination</td>
<td>16</td>
</tr>
<tr>
<td>CHARTER II - METHOD</td>
<td>18</td>
</tr>
<tr>
<td>Pre-sleep phase</td>
<td>18</td>
</tr>
<tr>
<td>Selection of creativity measures</td>
<td>18</td>
</tr>
<tr>
<td>Administration, scoring, and results of creativity measures</td>
<td>21</td>
</tr>
<tr>
<td>Selection of subjects</td>
<td>22</td>
</tr>
<tr>
<td>Sleep laboratory phase</td>
<td>22</td>
</tr>
<tr>
<td>Pre-sleep phase</td>
<td>24</td>
</tr>
<tr>
<td>Sleep phase</td>
<td>25</td>
</tr>
<tr>
<td>Post-sleep phase</td>
<td>26</td>
</tr>
<tr>
<td>MMPIs</td>
<td>26</td>
</tr>
<tr>
<td>Transcription and analysis of dream reports</td>
<td>26</td>
</tr>
<tr>
<td>Scoring of EEG records</td>
<td>32</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS (CONT.)

CHAPTER III - RESULTS

Discriminability of high and low creative dream reports 33

Dimensions of differences between high and low creative dream reports 35

Word counts 35

Categorization of dream report elements 35

Dream settings 38

Rating scales 38

Electrophysiological parameters 38

Sex differences 41

MMPI results 41

CHAPTER IV - DISCUSSION

Conclusions and interpretations 43

Procedural evaluation 49

Further research 55

Dimensions of differences in dream reports 55

Problem solving aspects of dreams

Personality variables 58

Similarity of psychological processes of creativity and dreaming 58

REFERENCES 60

APPENDIX A 68
TABLE OF CONTENTS (CONT.)

APPENDIX B 82
APPENDIX C 83
APPENDIX D 84
APPENDIX E 86
Table 1 - Results of Discrimination Analyses.........................Page 34
Table 2 - Results of Dream Report Word Count Analysis.........Page 36
Table 3 - Results of Dream Report Content Categorization......Page 37
Table 4 - List of Dream Settings .....................................Page 39
Table 5 - Results of Rating Scales.................................Page 40
Table 6 - Results of EEG Analysis................................Page 42
Table 7 - Results of EEG Analysis................................Page 42
Appendix A - Battery of Creativity Tests and Sleep QuestionnairePage 69
Appendix B - Flexibility Categories for Brick Uses Test........Page 82
Appendix C - Summary Statistics and Correlations among Creativity Measures.................................Page 83
Appendix D - Subject and Group Scores and Percentages on Creativity Measures.................................Page 84
Appendix E - Rating Scales............................................Page 86
CHAPTER I
INTRODUCTION

The purpose of this study was to examine the relationship between the psychological processes of creativity and dreaming. There is an extensive body of what might be called nonexperimental literature that is suggestive of a very strong relationship. This literature includes armchair speculations, introspections, anecdotes, surveys, and theorizing, among other sources. However, at present there is a wide gap that separates the implications of this literature and experimental attempts to verify and clarify these implications. The present study was designed to be a tentative step in the bridging of this gap.

Introspections and anecdotes

That dreams have been given credit for such a tremendous range of discoveries and inventions in both the arts and sciences is indeed startling when one surveys the literature. In this section brief examples from many different areas ranging from flaked cereals to philosophical insights will be presented.
Keats (Hamilton, 1969), Bryant (Bigelow, 1905, p. 29), and Coleridge (1947; Porterfield, 1941, p. 90; Voronoff, 1941, p. 63) have all related instances wherein their poetry has sprung from their dreams. For example, in "The Land of Dreams," Bryant wrote:

The Merchants dream of storms, they hear them roar,
And often shipwrecks leap, or swim to shore.
I think of Natur's powers, my Mind pursues
Her Works, and e'en in Sleep invokes a Muse.
(in Bigelow, 1905, p. 29)

Coleridge composed "The Ancient Mariner" to embody the dream of a friend, and he reported that "Kubla Khan" sprang full-blown into his mind in a dream. Speaking of himself he wrote that "On awakening he appeared to himself to have a distinct recollection of the whole, and taking his pen, ink and paper instantly and eagerly wrote down the lines that are here preserved." (Coleridge, 1947)

Sir Walter Scott (Voronoff, 1941, p. 63), Leo Tolstoy (Voronoff, 1941, p. 63), Robert L. Stevenson (1947), and the Frenchman Rosny (Voronoff, 1941, p. 63) are a few of the novelists who have commented on their use of dreams in their artistic creations. Stevenson, for example, wrote much of Dr. Jekyll and Mr. Hyde from a series of dreams over a period of time.
Mozart (1952), Beethoven (in Shapero, 1946), and the Italian composer Tartini (Voronoff, 1941, p. 64) have all reportedly used dreams as the basis of some of their musical compositions. In a letter, Beethoven wrote:

Now during my dream journey, the following canon ... came into my head....I resumed my dream journey and ...in accordance with the laws of association of ideas, the same canon flashed across me....Awake, I held it fast...only permitting it to be changed into three parts. (in Shapero, 1946)

Schopenhauer (Voronoff, 1941, pp. 58, 59, 63), Nietzsche (Voronoff, 1941, pp. 58-59), and Descartes (McKellar, 1957, p. 121; Hutchinson, 1949, p. 30) have all reported the use of dreams in their philosophical work. Descartes seems to have encountered the basic notions of analytic geometry in a dream, and more strikingly "in a dream recorded by him as of November 10, 1619, an illumination came inducing him thenceforth to combine mathematics and philosophy into a new discipline." (Hutchinson, 1949, p. 30)

The mathematician Poincaré has often been cited as having developed a new class of mathematical operations (Fuchsian functions) in a dream-like state (Poincaré, 1908). And the French mathematician Condorcet reported that in dreams certain problems solved themselves so to speak and their corollaries came to mind (Voronoff, 1941, p. 63).
It has been reported that an archaeologist named Hilprecht found the solution to the problem of a Babylonian inscription during a dream (McKellar, 1957, p. 121).

In chemistry the most famous examples are those of Kekule and Bohr. Kekule discovered an important concept, the benzine ring, in modern organic chemistry in a dream-like state (McKellar, 1951, p. 121), and Bohr is reported to have conceptualized the model of the atom in a dream (Koestler, 1964).

Practical inventions reportedly have been developed in dreams. Thomas A. Edison (Porterfield, 1941, p. 94) used dreamlike states to aid him in his work, and Elias Howe (Koestler, 1964) apparently invented the sewing machine from a dream. And when a medical doctor had to pay ten dollars to a patient when she broke a tooth eating dry food he had prescribed, he dreamed about the process of making dry cereal flakes. The next morning he demonstrated the results in the hospital kitchen; and in later years, of course, this invention of a dream gained widespread use.
Armchair speculations.

Speculative associations relating creativity and dreams have been given from the time of Socrates (1947) to the present (Koestler, 1964, p. 178). Most of these speculations concern the nature of the dream. The Latin writer Petronius speaks in the Satyricon of the dreamer pursuing his waking interests while asleep. The military conqueror sees routed forces, lawyers plead cases in court, and misers gloat over hidden treasure. According to Petronius' view the content of the dream is concerned with the fulfillment of one's waking desires (Negroz, 1939, pp. 1-2). This view persists in Voltaire who writes, "I have known advocates who have pleaded in dreams, mathematicians who have sought to solve problems; and poets who have composed verses. I have made some myself which are very passable. It is therefore incontestable that constructive ideas occur in sleep, as well as when we are awake, which ideas as certainly come in spite of us." (Voltaire, 1947)

In modern times a similar relation was proposed in more sophisticated manner by Koestler (1964, p. 178): "(The dream) makes use of 'links' which while awake we 'would not dream' of using except where dream-logic intrudes into humour, discovery, and art."
Others who have commented on the similarity of the processes involved in creativity and dreaming include Emerson, Coleridge, Shelley (All in Megroz, 1939, pp. 80–88), Edward Carpenter (1947), H. Addington Bruce (1947), Harold Shapero (1952), Victor Hugo (1948), Weiss (1964), and Ullman (1964). A survey of eminent individuals

Bearing somewhat more scientific credibility than the foregoing literature is a survey by Hutchinson (1949). Through letters, comments, interviews, and questionnaires, information concerning about 250 eminent and manifestly creative individuals was gathered. Most of those the author had direct contact with admitted that they dreamed quite often about their work especially if it was exceptionally baffling and restrictive. He quotes a number of examples: (a) from an author: "'Then I am working on a book, I dream about it almost every night....Often I can see pages of words and can read them off in my sleep.'" (b) from an essayist: "'It seems as if problems settled themselves sometimes over night during sleep or dreams.'"; (c) from a poet: "'I have sometimes written a whole poem in my sleep.'"; and (d) from an inventor: "'Waking up ... I would suddenly have before me every minute detail of a complicated wiring diagram.'"

Hutchinson (1949) also reports a survey by Henri Fehr, a French mathematician. Of sixty-nine mathematicians who
answered his question concerning the solving of problems in
dreams fifty-one were affirmative and eighteen negative.

Creativity and states related to dreaming

Another approach that tenatively relates creativity and
dreaming is seen in the relationships that have been estab-
lished between creativity and psychological states similar
to the dream experience, specifically states of visual imagery
and the psychological experience under the influence of halluci-
nogenic substances.

Roe (1951) studied the use of imagery in a group of
sixty-four eminent research scientists who had made important
and original contributions in their respective fields. The
great majority of them reported a significant reliance on the
use of imagery in their thought processes. Only a very small
percentage reported a predominant reliance on imageless thought.

Gordon (1961) took a somewhat different approach. He
made tape recordings of sessions in which creative individuals
were working on problems, and at the same time reporting
verbally their mental processes. By reviewing tapes of pro-
ductive sessions he concluded, essentially, that conceptual
breakthroughs or illumination was almost always preceded by
and occurred in conjunction with a state of very vivid imagery.
In the two instances above there is the notion of the use of imagery as a factor in the act of creation. And to the extent that a state of imagery and the dream experience are related, so is the creative act (Lewin, 1969).

The efficacy of hallucinogens for stimulating creativity has long been noted. Poets and philosophers alike have implicated psychedelic agents such as cocaine, marijuana, or LSD as catalysts for their creative productions (Hutchinson, 1949, pp. 128-133). More recently, Krippner (1964) and Martin (1969) have commented on this relationship.

In a more experimental vein, Harman, McKim, Mogar, Fadiman, and Stolarof (1966) attempted to assess the effects of LSD-25 on creativity. They measure the effects of LSD in part by administering alternative forms of three creativity tests to the subjects several days before and then during the experimental session. Improvement in performance was statistically significant for all three creativity tests.

Thus, again, to the extent that the dream experience can be related to the psychological experience under certain drugs, there enters the possibility of a relationship between dreaming and creativity. A theoretical rationale for this has been provided in part by Fischer (1969).
Psychoanalytic theory relating dreams and creativity

Psychoanalytic thought has implicated the dream as an important source of creative potential. Tauber (1959, p. 8) wrote that "the preconscious ego of the dreamer thus allows a partial satisfaction in hallucinatory wish fulfillment, the dream."

De Becker (1968, pp. 103-140) remarked on the similarity of the processes involved in dreaming and creativity. And Havelka (1968, p. 69) wrote of the symbolic function of the dream: "It is a process of continuous discovery of new possibilities of meaning in a repeated rhythm of inward and outward oscillations." And later he wrote that the dream is indispensable for the formation of the creative act. Kris (1965a) wrote that "The study of the mechanisms of the dream have suggested that similar mechanisms play a part in the working of creative imagination, in the production of the work of art." He further clarified this point in relation to psychoanalytic theory in another article (1965b).

Hamilton (1969) attempted to establish a psychoanalytic relationship in part between the dreams of John Keats and his creative output in the form of poetry.

In most of the foregoing examples, the psychoanalytic rationale relating dreams and creative insight appears to be
thus: The function of the dream is to protect sleep by providing, in disguised form, an expression of instinctual desires. The fulfillment of these instinctual desires is accomplished in disguised form in the manifest content of the dream. And the manifest content of the dream is made up of so-called "day residues" from either the immediate or distant past. Now these day residues often contain elements of the individual's waking activities which he has developed over time through sublimation, repression, and other psychodynamic mechanisms in order to satisfy basic instinctual urges unacceptable in society. For example, an individual might sublimate a certain portion of his libidinal energy into artistic expression or scientific investigation, or some other professional endeavor. And problems encountered in these endeavors often take the form of day residues in dreams because they are reflections of libidinal impulses. This relationship allows the analyst to interpret the individual's dream. And it follows then that the artistic and scientific problems of waking activity require libidinal energy for their solution when encountered in dreams. Thus the release of libidinal energy in dreams often provides solutions to these problems.
The sleep laboratory

In view of the literature cited above it is somewhat surprising to find that in so far as the present author has been able to discover, there have been no attempts to use modern sleep and dream research techniques to study the relationship between creativity and dreaming.

The discovery by Aserinsky and Kleitman (1953) and confirmed by Dement and Kleitman (1957) and Goodenough, Shapiro, Holden and Steinschneider (1959) of a relationship between regularly recurring periods of rapid eye movements (REM) and reports of dreaming during periods of low voltage brain wave activity has led to a plethora of sleep and dream investigations utilizing electroencephalographic equipment in the last twenty years. Typically, various electrophysiological parameters (such as length and number of rapid eye movement periods (REMPS), density of rapid eye movements within such periods, and length of time spent in sleep stages other than REM) are measured in order to investigate the psychology and physiology of sleep and dreams and individual differences with respect to these parameters.

Thus, again it is surprising to note the lack of published studies in which attempts have been made to utilize these parameters in an investigation of creativity. Studies which
bear the closest relation to this purpose are those in which personality and behavioral correlates of dreaming and dream content have been made. Monroe (1967) found psychopathology to be related to REM time, albeit paradoxically. Rechtschaffen and Verdone (1964) found that scores on the Taylor Manifest Anxiety Scale were positively related to the proportion of the total sleep period spent in REM phases. And it has been found that chronic nonrecallers of dreams have less amounts of REM sleep yet more actual REMs than chronic recallers (Antrobus, Dement and Fisher, 1964). And there are studies which establish a relationship between field-independence-dependence and the content of dream reports (Cartwright, 1966; Baekeland, 1968).

However, all these studies bear only an implicit relation to the issue of creativity and dreams. That is, they are related only in so far as the characteristics discovered can be attributed to creative or noncreative individuals. The extent of this relationship between these studies and an investigation of creativity and dreams is discussed further and evaluated in Chapter IV.

The study of creativity related to dreams

It is similarly interesting to note that creativity
theoreticians and experimenters have neglected an examination of the relationship between creativity and dreaming. Articles and studies which are implicitly nearest to this issue are those which deal with creativity as a process and with cognitive abilities involved in that process.

Wallas (1926) characterized the process of creativity in terms of four stages, the third of which was called "illumination." The event of illumination or insight has been given a number of different names since then. For Maslow (1962) it was one of a variety of "peak experiences." MacKinnon (1964) called it the "transliminal experience." Rogers (1959) described it as an inner condition wherein one would "toy with ideas, colors, shapes, hypotheses...to think in terms of metaphors." And it is obviously this stage or this experience in the creative process to which the discoveries, inventions, poems, musical compositions, etc., reported earlier refer.

Thus if one were going to investigate the relationship between creativity and dreams, a logical place to begin would be to examine the similarities between creative abilities necessary for this stage or experience of "illumination" and certain characteristics of the dream experience. This,
then, was the main task of this study: namely, to select individuals identified through various tests as to level of creative abilities and to test for corresponding differences in dream reports gathered from these individuals.

It was decided then, in this study to attempt to select those creative abilities which could (a) theoretically or logically be related to the dream experience and (b) be related in the form of specific testable hypotheses to parameters associated with the sleep-dream cycle.

Ullman (1964) noted some features of dreams which are suggestive of the creative process. Two of these were:

a) the element of originality - the dreamer's rendezvous with his past, present, and future concerns in a highly idiosyncratic fashion.

b) the fact that the dream characteristically joins together two or more disparate elements into a new pattern or Gestalt that has both meaning and significance.

These two notions of originality and the joining together of disparate elements meshes nicely with Mednick's (1962) remote associations theory of creativity. Mednick defined the process of creative thinking as "the forming of associative elements into new combinations which either meet specified requirements or are in some way useful." (p. 221)
A specific hypothesis which (although not tested in the present study) might be generated from this theoretical juxtaposition of creativity and dreaming is as follows: Given that there are individual differences on a measure of creativity which is based on the formation of remote associations, these same individual differences will exist in terms of the remote associations in the manifest content of the respective dreams.

Another heuristic base comes from Guilford's (1956; 1959) conception of divergent thinking. In his conceptual model for the structure of intellect, he empirically derived a number of abilities which could be subsumed under the category of divergent thinking. Guilford (1963) wrote that "the most obvious aspects of creative thinking appear to depend upon the abilities to do divergent-productive thinking ... with the abilities of fluency, flexibility, elaboration, and redefinition playing significant roles." (Emphasis added.) Fluency relates to the quantity of production of words, ideas, phrases, etc. Flexibility refers to a shifting among psychological categories.

There are specific testable hypotheses relating these creative abilities of fluency and flexibility and certain parameters of the sleep-dream cycle. The derivation goes like
this: If the psychological processes involved in creativity and dreaming are similar, then the abilities of fluency and flexibility will be evident in both waking creative activity and in dreaming. More specifically, if an individual is determined to be creatively "fluent" in the production of ideas, then perhaps he would also present more fluent dream reports. For example, he might give longer dream reports in terms of number of words, or he might give a more detailed description of his dream experience. In terms of flexibility, a highly flexible individual might describe more shifts of settings or types of action in his dreams than a less flexible person.

Specific areas of examination.

Because of the dearth of experimental studies attacking the main issues relating creativity and dreaming, this study was conceived of as a tenative, pilot study. It would be virtually impossible for any one study to bear on all of the central issues, and thus this study was concerned primarily with gathering data which might be suggestive of the desirability and directions of further research.

The central questions asked in this investigation were: First, are the dream reports of high and low creatives discriminable, and second, in which ways or along which dimensions are they different? More specifically, with regards to the
second question, the dimensions to be examined for possible
differences included (a) fluency—in terms of simple word
counts of dream reports and in terms of the number of content
elements of the dream reports; (b) relative commonness or
uniqueness of the content of the dream reports; (c) the re-
lation of dream report content to waking concerns or problems;
(d) whether the dream report content appeared to deal with
past, present or future material; (e) how closely the dream
report content resembled waking reality; (f) whether the dream
report content was predominantly conceptual or perceptual;
and (g) the relative vividness or vagueness of the recall
of the dream experience.

Finally because of procedures followed as standard in the
sleep laboratory and out of curiosity, it was decided to
examine the differences in the electrophysiological parameters
commonly measured in sleep and dream studies.
There were three major steps involved in the completion of this study. The first included the selection of instruments and Ss, the second included subject participation in the sleep phase of the experiment, and the third included analysis of the data.

**Pre-sleep phase**

**Selection of creativity measures.** A salient issue which had to be dealt with at the very outset was the selection of the instruments used to identify different levels of creativity. Most purported tests of "creativity" have been subjected to severe criticisms on both rational and empirical grounds. Such problems include relatively low correlations among certain measures of creativity (Bower and Clark, 1968), the pervasive element of fluency in the measurement of creativity (Clark and Mirels, 1970), a satisfactory operationalization of creativity theory (Worthen and Clark, 1969). Other problems have been pointed out by McNemar (1964), Thorndike (1962), Wallach and Kogan (1965), Jackson and Messick (1965), and Yamamoto (1965).

Because of these problems, rather than relying solely on one measure of creativity it was decided to use several
instruments and attempt to select subjects who performed uniformly poorly or well on all or most of the instruments. This use of multiple criteria for subject selection and the extreme groups design is discussed further in Chapter IV.

The instruments used to establish subject selection criteria were chosen on two grounds: (a) certain theoretical and practical assumptions, and (b) the heuristic value in relation to the dream experience of the underlying theory of the instruments.

As discussed partially in Chapter I, the theoretical underpinnings of the various measures of creativity appear to have a significant relation to the process of dreaming in the case of Mednick's remote association theory (Mednick, 1962). Thus it was decided to use an instrument based on remote association theory. The operationalization of this theory has most often been in the form of the Remote Associates Test (RAT). However, after reviewing several studies in which the RAT as a measure of creativity was investigated, Worthen and Clark (1969) hypothesized that the theoretical position relating remote associations and creativity might not be well operationalized by the measure. "That is, the RAT may not be a defensible extension of Mednick's remote association theory." (p. 6) The authors proposed an alternative measure
of remote associational ability in the form of the Functionally Remote Associates Test (FRAT) and presented empirical data which suggested the FRAT to be superior to the RAT as a measure of creativity. Thus for the purposes of the present experiment it was decided to use the FRAT.

In the FRAT Ss are asked to find a fourth word which is related to three other words. For example, if the three words were "cave," "ball," and "Halloween," the correct response would be "bat."

The second theoretical base as discussed in Chapter I was Guilford's (1956, 1959) conception of the divergent thinking abilities of fluency and flexibility which were shown to bear at least a logical relation to certain aspects of the sleep-dream cycle. Fluency and flexibility have often been assessed by means of the brick uses test. In this test Ss are simply asked to list as many uses for a common brick of which they can think within a specified time limit. Since the brick uses test may be scored for fluency, flexibility, and unusualness of responses, its use in this study was indicated.

It was also decided to take two additional measures of fluency in order to obtain a different set of data which would separate the measure of fluency from flexibility and unusualness. For one measure Ss were asked to list as many round and edible objects that they could think of and in the second measure subjects were asked to simply list as many words as possible.
Both measures had specified time limits.

The entire battery of tests with a sleep questionnaire
is contained in Appendix A. It is exactly as presented to
Ss.

Administration, scoring, and results of creativity measures.
The battery of creativity tests and a sleep questionnaire were
administered to 423 undergraduate students of The Ohio State
University. Completion of the tests by the subjects partially
fulfilled an introductory psychology course requirement.
There was a total of twelve testing sessions administered
by the author to groups of Ss ranging in size from 26 to 45.
Each session lasted approximately forty-five minutes. The
order of individual test presentations always remained the same,
as did the time limits (See Appendix A, instructions to Ss).

The word fluency test, the round and edible objects test,
and the brick uses test were all scored for fluency by simply
totaling the number of acceptable responses; that is, responses
which fulfilled requirements contained in the instructions to
the Ss. The FRAT was scored according to a key (Worthen and
Clark, 1969). Only the keyed responses for the individual
items were scored as correct.

Individual S's brick uses test responses were given a
score for fluency, flexibility, and unusualness. The unusualness
score was derived by first listing the total number of different responses given by the 423 Ss. Then a count was made of the number of times that a particular response occurred in the total population of 5799 responses. Thus every response for every S was assigned a numerical value which ranged from one for the most common response to sixty-three for the unique responses. Then the values per response were totaled for each S and an unusualness score for each S was thus derived.

The author constructed a scoring system for flexibility by selecting categories of responses which seemed to unequivocally require a shift of psychological set. The categories selected are presented in Appendix B. Flexibility scores for Ss were then computed by counting the number of times in chronological order the S shifted from one category to another.

The means, ranges, and standard deviations of the scores for all the creativity test scores and the correlations among different test scores are presented in Appendix C. All tests were scored by the author.

Selection of subjects

An attempt was made to select Ss who scored in either the upper or lower 15% on three of the four categories of creativity measures. The four were (a) one of the three fluency measures; (b) the flexibility measure; (c) the unusualness of response measure; and (d) the remote associates measure, the FRAT. An attempt was
made to place ten Ss, five males and five females, in each group, i.e., a high and a low creative group, and to modify slightly the 15 percent requirement if and when necessary, for example, if preferred Ss were unavailable. Specific modifications are presented below and in Appendix D.

The tenatively selected Ss were contacted by telephone and asked to appear for an interview concerning possible participation in a psychology experiment. During the interview an explanation of the sleep phase of the experiment was made. Ss were not informed of the main purpose of the experiment other than to say that an attempt was being made to establish a relationship between the psychological processes involved in the original battery of tests and those theoretically involved in the process of dreaming. Subjects were not told that the experiment dealt with creativity. A request was then made for the Ss to volunteer, without pay, for this experiment. Only one of the tenatively selected high creative subjects declined. Six of the ten tenatively selected low creatives were unable to participate, one female and five males. Of these there were four outright refusals, one had dropped out of school, and one the experimenter was unable to contact.

Of the twenty Ss who eventually participated in the sleep phase of the experiment, fifteen fulfilled the original criterion completely and the remaining five closely approached it. All
subjects in the high creative group fulfilled the requirements. Because of the number of tentatively selected low creative subjects who were unable to participate, the eventual makeup of the low creative group consisted of five who fulfilled the requirements completely and five who fulfilled the requirements for two instead of three categories of creativity measures. These five subjects closely approached the criterion in that on one of the two remaining categories in which they did not meet the exact requirements, they did score in the lower 19%, 20%, 20%, 20%, and 27% respectively. There were, of course, highly significant differences between the two groups on all of the creativity measures. Appendix D presents the scores and corresponding upper and lower percentages of these twenty Ss.

Sleep laboratory phase

Pre-sleep phase. At least one day before each subject's first sleep session was to begin, he was given a tour of the sleep laboratory. Subjects were shown the EEG laboratory and the recording apparatus. It was explained that verbal communication was possible between the sleep rooms and the equipment room over an inter-com system, and that these conversations could be recorded on tape. All Ss were to sleep for two consecutive nights in the sleep laboratory approximately an hour before their usual sleep time. After Ss were prepared for bed, standard electrode attachments (Jasper, 1958; Rechtscheffen
and Kales, 1968) were made by either the E or four other techni-
cians. During electrode attachment Ss filled out a sleep
questionnaire and a consent form. On night one Ss were told
they would be awakened twice during the night and asked to
report whatever was going on in their minds.

Tape recorders were used to record dream reports. All
equipment—EEG machines and tape recorders—were located in a
room completely separate from the sleep rooms. Intercom
systems over which Ss gave dream reports connected the four
sleep rooms and the equipment room.

Sleep phase. On night one, an effort was made to awaken
each S for a dream report approximately five minutes after the
onset of his second REMP and ten minutes after the onset of
his third REMP. For three of the Ss in each group, however,
awakenings were not made in the proper periods. For the
three high creatives not awakened in the second and third REMPs
awakenings were made in REMPs one and two; one and three; and
three and four respectively. For the three low creatives not
awakened in the second and third REMPs, awakenings were made
in REMPs two and four; one and two; and three and four respec-
tively. All awakenings were made by calling the S by name over
the inter-com system. Each S was asked to wake up and when he
replied, E asked S to report what was going on in his mind at the time of awakening. Unstandardized follow-up questions were also asked. The entire interview was recorded on tape for all Ss. Tapes for three Ss, two low creatives and one high creative, were not obtained due to experimenter error.

On the second night Ss were allowed to sleep without experimental awakenings. On both nights each S's bed time was restricted to 450 minutes. After such time Ss were aroused and asked to report any additional dreams they may have had throughout the night. When this phase was completed, the electrodes were removed and Ss provided transportation to their homes or classes. After the first night Ss were asked not to take any naps during the day.

**Post-sleep phase**

**MMPIs.** After completion of the sleep phase, Minnesota Multiphasic Personality Inventories (MMPIs) were administered individually to all Ss at their own convenience. The completed tests were then given to two clinicians intimately familiar with the MMPI. They were asked to separate the tests equally into a high creative group and a low creative group.

**Transcription and analysis of dream reports.** Dream reports were re-recorded from the two tape recorders onto a
cassette recorder. From the cassettes the E typed out the
dream reports for each S.

There was a total of twenty-five high creative reports and
twenty-five low creative reports. Eighteen of the reports from
the high creative group were obtained from the first and second
experimental awakenings on night one. Sixteen low creative
reports were obtained similarly. The remaining low creative
reports consisted of five REMP awakenings on the morning of
night one; two REMP awakenings on the morning of night two;
one report on the morning of night one when ten minutes after
the final awakening S recalled a dream he had had during the
night; and finally, one report on the morning of night two
when S reported on a dream experienced on night one. The
remaining seven high creative reports consisted of three
from REMP awakenings on the morning of night one; one from
a morning awakening which occurred in Sleep Stage Two; two
reports from the morning of night one after the final awaken-
ing report Ss recalled a dream from earlier in the night; and
finally, one report obtained under similar circumstances to
the preceding one only on night two.

There was a total of five judges who performed the differ-
ent analyses (described below) of the dream reports. For the
discrimination analyses and rating scales two judges were used.
Both were graduate students in psychology who had taken a graduate level course on creativity. The order of presentation of the analyses and scales was randomized in order to minimize order effects.

For the fluency measure in terms of a simple word count a university undergraduate majoring in psychology was used as judge. For the separation of the dream report content into categories two graduate students were used as judges: one was a psychology major, the other in home economics. All five judges were unfamiliar with sleep and dream literature.

Following steps similar to those of Monroe, Rechtschaffen, Foulkes, and Jensen (1965) to separate REM and NREM (non REM) reports, two discrimination analyses were performed to determine whether the dream reports were discrimimable. In Discrimination Analysis One all fifty dream reports were judged. Just how many of the fifty reports were high creative or low creative was unknown to the judges. The reports were presented to the two judges who were asked to categorize each report as being from a high or a low creative subject. In the Discrimination Analysis Two an attempt was made to eliminate three possible sources of error variance. In the first instance subject production of dream reports might be affected by factors
which are unique to a given night. For instance in this study dream reports were obtained on the S's first night in a sleep laboratory and also, in some cases, on the second night when presumably the subjects had adapted to the new sleep setting.

A second possible source of error variance has been demonstrated by Verdone (1965), Hall and Van de Castle (1966), and Dohoff and Kamiya (1964) in terms of differences in the nature of the dream reports taken from earlier awakenings as opposed to later awakenings. Thirdly, there are sex differences in the content of dream reports as reported by Hall and Van de Castle (1966). And in the present study there were males and females in both groups. Also since it has been demonstrated that dream content varies with the menstrual cycle (Swanson and Foulkes, 1966), none of the female Ss participated in the sleep phase during menses.

Thus for the Discrimination Analysis Two dream reports were paired. In each pair there was a report from a high creative and a low creative, both reports were from members of the same sex, from approximately the same awakening (i.e., the first, second, or final experimental awakenings), and from the same night. Using these criteria seventeen pairings were made and presented to the two judges. For each pair they were asked to compare the reports and identify the high creative and the low creative report.
In order to determine along which dimensions the dream reports might differ three different types of measures were taken: word counts, ratings, and separation of the dream report content into categories.

A fluency measure in terms of word count was obtained by presenting the thirty-four dream reports obtained from the two standard nighttime REM awakenings to the judge. For each report he was asked to mark the end of the S's response to E's first question, namely, "what was going on in your mind just before I called your name?" The student was then asked to count the total number of words in the response barring successively redundant phrases. In such a manner, a fluency score was derived for each S for each dream report.

Six different rating scales (Appendix E) were applied to all fifty dream reports. The high and low creative reports were compared for each rating scale by each judge individually. Then mean scores between the two judges for each item was computed and the corresponding mean scores were used to compare the two groups on each scale.

Finally, for each of the dream reports the content elements were separated into three general categories. The dream reports obtained from the first and second awakenings were used. The first category was called External Objects. Included
Here were any and all physical objects mentioned in the dream reports such as tables, cars, people, etc. In the second category called **External Activity** the judges were instructed to include any type of movement mentioned in the dream reports be it physical activity on the part of the dreamer or anyone or anything else involved in the dream action. The third category was called **Internal Activity**. In this category was placed any expressed emotions or cognitive-type activity. Included here were such items as feeling, sensations of pain or pleasure, etc. and thinking, interpretations or evaluations of external events, reasons for doing things, memories, subjective descriptions, etc.

The two judges separated the elements of all thirty-four reports into these three categories and in addition identified a setting for each dream. A setting was defined as where, specifically, the dream experience was perceived as having took place.

A count was then made of the number of elements placed in each category. This number was taken as a score to be used in comparing the high and low creative groups on the different categories. This was done for each judge individually, then scores per subject were averaged between judges and the
resultant means were used to compare the two groups on the three different categories.

**Scoring of EEG records.** Records were scored according to procedures described in Rechtschaffen and Kales (1968).

First night records were scored by E, a novice to this task.

Second night records, (EEG baseline) records were scored by two experienced technicians of the sleep laboratory.

Inter-rater reliability is important in this task (Monroe, 1968), and a ninety percent scoring agreement between these two technicians had been demonstrated previously.

In addition to the usual parameters measured (e.g., total time spent in each of the different sleep stages, number of stage changes, etc.), the E took a count of the number of discrete rapid eye movements which occurred in REM time and also the number of epochs (i.e., pages of the EEG record) during REM time which contained bursts of alpha frequency waves lasting at least .5 sec. All records were scored blind with respect to the subject and his group, high or low creative.
CHAPTER III
RESULTS

**Discriminability of high and low creative dream reports**

The binomial distribution was used to test for statistical significance on the two discrimination analyses. In both cases the probabilities of making correct or incorrect judgments were the same. The percentages of correct judgments and the corresponding probabilities of occurrence are presented in Table One. As can be seen the results were very significant for both discrimination tasks. For Discrimination Analysis One the significance level was .045 while for Discrimination Analysis Two it was .015. In addition, it can be seen that accuracy of judgment increased from sixty-two percent to seventy-nine percent when the controls were made for sex of subject, time of night, and night.

In Discrimination Analysis One eighty-four percent of the errors consisted of high creative reports identified as low creative. And if only the thirty-four nighttime REMP awakenings are considered, ninety-two percent of the errors are high creative reports being incorrectly identified. This suggests that the judges may have had too high a standard for labeling reports as high creative. And further, that perhaps
### TABLE ONE

**Discrimination Analyses 1* and 2**

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Reports</th>
<th>Se</th>
<th>% Correct</th>
<th>% Agreement</th>
<th>Significance Level***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(n)</td>
<td>Judge A</td>
<td>Judge B</td>
<td>Between Judges</td>
</tr>
<tr>
<td>1*</td>
<td>50</td>
<td>17</td>
<td>64</td>
<td>60</td>
<td>62</td>
</tr>
<tr>
<td>2**</td>
<td>34</td>
<td>17</td>
<td>82</td>
<td>76</td>
<td>79</td>
</tr>
</tbody>
</table>

* Analysis 1 refers to the task in which the judges were asked to identify all reports as either high or low creative.

** Analysis 2 refers to the task in which reports were paired with controls for sex of subject, time of night, and night.

with a lowering of such standards might come improvement in correct judgments. Snyder's (1970) assertion that instead of most dreams being bizarre and unusual, the majority of dreams are rather dull, ordinary reflections of waking life provides a possible basis for the errors in judgment in Discrimination Analyses One and Two. Hartmann (1970) also comments on the "banality" of most dream reports.

**Dimensions of differences between high and low creative dream reports**

*Word counts.* Comparisons of the number of words contained in Ss' responses to the initial question of the dream report interviews are presented in Table Two. As can be seen there was a statistically significant difference between the two groups for the second dream report word count (p < .025) and for the two dream report word counts combined (p < .025). In all cases the mean word counts for the high creative reports was greater than that for the low creative reports.

*Categorization of dream report elements.* The mean number of elements in each category for both judges is presented in Table Three along with the average of both judges and the corresponding t- and p-values. There was a significant difference between the two groups for both the External Objects (p < .05)
TABLE TWO

Differences between High and Low Creative Groups on Word Counts in Dream Reports for Nights One and Two

<table>
<thead>
<tr>
<th>Fluency Variable</th>
<th>High Creative Group</th>
<th>Low Creative Group</th>
<th>Group Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Means</td>
<td>Standard Deviations</td>
<td>Means</td>
</tr>
<tr>
<td>Word Count</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dream Report 1</td>
<td>57.33</td>
<td>52.87</td>
<td>23.50</td>
</tr>
<tr>
<td>Word Count</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dream Report 2</td>
<td>94.55</td>
<td>80.42</td>
<td>33.37</td>
</tr>
<tr>
<td>Mean Word Count</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dream Reports 1-2/2</td>
<td>76.22</td>
<td>57.27</td>
<td>28.63</td>
</tr>
</tbody>
</table>

* p = .025
TABLE THREE

Results of Categorization of Content of Dream Reports
(N = 34)

Mean External Objects

<table>
<thead>
<tr>
<th>Judge A</th>
<th>Judge B</th>
<th>Average</th>
<th>t-score</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC**</td>
<td>LC***</td>
<td>HC</td>
<td>LC</td>
<td>3.16 1.75 3.16 1.75</td>
</tr>
</tbody>
</table>

Mean Internal Activities

<table>
<thead>
<tr>
<th>Judge A</th>
<th>Judge B</th>
<th>Average</th>
<th>t-score</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>LC</td>
<td>HC</td>
<td>LC</td>
<td>2.56 .38 2.22 .38</td>
</tr>
</tbody>
</table>

Mean External Activities

<table>
<thead>
<tr>
<th>Judge A</th>
<th>Judge B</th>
<th>Average</th>
<th>t-score</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>LC</td>
<td>HC</td>
<td>LC</td>
<td>2.22 1.06 2.00 .94</td>
</tr>
</tbody>
</table>

*t-scores were computed using the averages of Judges A and B as the individual scores.

**HC refers to High Creative

***LC refers to Low Creative
and Internal Activity categories (p .01). Borderline significance was obtained for the External Activity category (p .10). In all three cases the mean number of elements was greater for the high creative reports than the low creative reports.

**Dream settings.** Settings for the two groups of dream reports are presented in Table Four. Sixty percent of the known settings were identified as "home" for the low creative reports while only fourteen percent were such for the high creative reports. In addition, the remaining high creative settings seem more varied and unusual than the low creative reports.

**Rating scales.** Of the six rating scales applied to the dream reports only the Common-to-Unique rating produced significant results (p .003). The content of the high creative reports was rated significantly higher on the dimension of commonness to uniqueness than the content of the low creative reports. High and low creative group means for each judge individually and together along with the probability values from the tests conducted are presented on Table Five.

**Electrophysiological parameters**

There were no significant differences between the two groups on any of the sleep cycle parameters measured. These results with the respective means and standard deviations are


<table>
<thead>
<tr>
<th><strong>High Creative Reports</strong></th>
<th><strong>N</strong></th>
<th><strong>Low Creative Reports</strong></th>
<th><strong>N</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subway station</td>
<td>1</td>
<td>Stage play</td>
<td>1</td>
</tr>
<tr>
<td>Parking lot in Europe</td>
<td>1</td>
<td>Party</td>
<td>1</td>
</tr>
<tr>
<td>Furnace boiler room</td>
<td>1</td>
<td>Car</td>
<td>1</td>
</tr>
<tr>
<td>Army transport plane</td>
<td>1</td>
<td>Sleep lab</td>
<td>1</td>
</tr>
<tr>
<td>Boat</td>
<td>1</td>
<td>Home</td>
<td>6</td>
</tr>
<tr>
<td>Dormitory in private girl's school</td>
<td>1</td>
<td>Unknown</td>
<td>6</td>
</tr>
<tr>
<td>Clothing store</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside a university building</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public building (inside)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car (inside)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep Lab</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE FIVE

Results of Rating Scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Judge A</th>
<th>Judge B</th>
<th>Average</th>
<th>$z$-score***</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HC*</td>
<td>LC**</td>
<td>HC</td>
<td>LC</td>
<td></td>
</tr>
<tr>
<td>Commonness-Uniqueness</td>
<td>3.20</td>
<td>2.48</td>
<td>1.88</td>
<td>1.43</td>
<td>2.74</td>
</tr>
<tr>
<td>Probability of Occurrence</td>
<td>2.12</td>
<td>1.73</td>
<td>3.12</td>
<td>2.94</td>
<td>1.36</td>
</tr>
<tr>
<td>Conceptual-Perceptual</td>
<td>2.64</td>
<td>2.80</td>
<td>2.44</td>
<td>2.49</td>
<td>.39</td>
</tr>
<tr>
<td>Past-Future</td>
<td>1.14</td>
<td>1.11</td>
<td>1.51</td>
<td>1.39</td>
<td>.30</td>
</tr>
<tr>
<td>Relation to Making Concerns</td>
<td>3.01</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>0</td>
</tr>
<tr>
<td>Vagueness-Vividness</td>
<td>2.80</td>
<td>2.80</td>
<td>2.62</td>
<td>2.73</td>
<td>.16</td>
</tr>
</tbody>
</table>

* HC refers to High Creative

** LC refers to Low Creative

*** Based on the Mann-Whitney U-test as discussed in Hays, W. L., Statistics, Holt, Rinehart and Winston, New York, 1963. Individual scores used in the computations were the averaged ratings between Judges A and B.
presented on Tables Six and Seven.

**Sex differences**

Comparisons between high and low creative males and between high and low creative females were made for the largest differences in means on the electrophysiological parameters. There were no significant differences with one exception. This was on the length of the last REM. The low creative males had a significantly longer mean duration than the high creatives \((t(8)=2.51, p .05)\).

**MMPI results**

The two clinicians who separated the MMPIs into high and low creative groups were accurate fifty percent of the time. That is, half of the S's records they placed in each group were correctly placed. There were no significant differences between the two groups on any of the seventeen MMPI scales measured.
<table>
<thead>
<tr>
<th>Sleep variable</th>
<th>High Creative Group</th>
<th>Low Creative Group</th>
<th>Group Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Means</td>
<td>Standard Deviations</td>
<td>Means</td>
</tr>
<tr>
<td>Total sleep (min.)</td>
<td>431.9</td>
<td>16.9</td>
<td>427.4</td>
</tr>
<tr>
<td>Stage one sleep (min.)</td>
<td>16.7</td>
<td>3.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Stage one (% sleep time)</td>
<td>3.86</td>
<td>1.7</td>
<td>4.47</td>
</tr>
<tr>
<td>Stage two sleep (min.)</td>
<td>245.55</td>
<td>35.0</td>
<td>240.50</td>
</tr>
<tr>
<td>Stage two (% sleep time)</td>
<td>56.963</td>
<td>8.4</td>
<td>56.324</td>
</tr>
<tr>
<td>Stage three sleep (min.)</td>
<td>36.95</td>
<td>11.1</td>
<td>38.4</td>
</tr>
<tr>
<td>Stage three (% sleep time)</td>
<td>8.562</td>
<td>2.5</td>
<td>3.950</td>
</tr>
<tr>
<td>Stage four sleep (min.)</td>
<td>44.35</td>
<td>32.0</td>
<td>36.75</td>
</tr>
<tr>
<td>Stage four (% sleep time)</td>
<td>10.147</td>
<td>7.1</td>
<td>8.573</td>
</tr>
<tr>
<td>REMP sleep (min.)</td>
<td>88.30</td>
<td>12.7</td>
<td>92.35</td>
</tr>
<tr>
<td>REMP time (% sleep time)</td>
<td>20.459</td>
<td>2.9</td>
<td>21.685</td>
</tr>
<tr>
<td>Total REMPs</td>
<td>4.1</td>
<td>4.1</td>
<td>0</td>
</tr>
<tr>
<td>Sleep time to 1st REMP (min.)</td>
<td>95.4</td>
<td>31.5</td>
<td>93.8</td>
</tr>
<tr>
<td>Intercersed wakefulness (min.)</td>
<td>4.15</td>
<td>4.576</td>
<td>11.9</td>
</tr>
</tbody>
</table>
TABLE SEVEN

Differences between high and low creative groups on sleep-related variables for night two.

<table>
<thead>
<tr>
<th>Sleep Variable</th>
<th>High Creative Group</th>
<th>Low Creative Group</th>
<th>Group Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Means</td>
<td>Standard Deviations</td>
<td>Means</td>
</tr>
<tr>
<td>Body movements</td>
<td>31.20</td>
<td>14.34</td>
<td>28.30</td>
</tr>
<tr>
<td>Number of stage changes</td>
<td>91.80</td>
<td>17.39</td>
<td>93.10</td>
</tr>
<tr>
<td>Total REMs</td>
<td>589.70</td>
<td>237.94</td>
<td>511.50</td>
</tr>
<tr>
<td>REMs/Total REMP time (min.)</td>
<td>6.65</td>
<td>2.53</td>
<td>5.39</td>
</tr>
<tr>
<td>Total Alpha time (min.)</td>
<td>31.55</td>
<td>21.86</td>
<td>26.40</td>
</tr>
<tr>
<td>Sleep time from last REMP to awakening (min.)</td>
<td>16.65</td>
<td>22.34</td>
<td>29.00</td>
</tr>
<tr>
<td>Length of first REMP (min.)</td>
<td>9.95</td>
<td>9.69</td>
<td>14.35</td>
</tr>
<tr>
<td>Length of last REMP (min.)</td>
<td>26.90</td>
<td>13.55</td>
<td>38.05</td>
</tr>
<tr>
<td>Stage Two interruptions of REMP (min.)</td>
<td>5.35</td>
<td>4.61</td>
<td>3.85</td>
</tr>
<tr>
<td>Body movements during REMP</td>
<td>6.30</td>
<td>4.57</td>
<td>5.50</td>
</tr>
</tbody>
</table>
Conclusions and interpretations

Results from the discrimination analyses were interpreted to mean that dream reports obtained in a sleep laboratory setting from high and low creative subjects can be successfully discriminated in at least two circumstances: first, on the basis of just the content of the reports themselves, and second, when possible variance due to factors other than creativity are controlled. Controlling for such factors as sex of subject, time of night, and night apparently aided in the accuracy of judgments. There was an increase in accuracy of almost twenty percent from Discrimination Analysis One to Analysis Two. However, if one were to take into consideration that eight-four percent of the judgment errors made in Discrimination Analysis One were of the same type (i.e., labeling high creative reports as low creative) the possibility becomes apparent that perhaps the difference in percentage of accurate judgments between the two discrimination analyses is due not to the variance contributed by sex of subject, time of night, and night but instead due to a too high criterion on the part of the judges for labeling a report "high creative." If only half of the errors made in Discrimination Analysis One were due to this too high criterion, and such errors were corrected, the percentage of accurate judgments for Analyses One and Two would be about the same, i.e., about eight percent.
Given then that dream reports from high and low creative subjects are discriminable, the question next asked was in which ways the dream reports were different. The results clearly show that the high creative subjects presented more fluent dream reports not only in terms of the wordiness of the reports but also in terms of the content elements of the reports. These results could mean that first, the dream experiences of the high creative Ss were indeed more "creative" than those of the low creatives. That is, just as in waking life the subjects tend to differ in terms of psychological flexibility and in the production of remote associations and unusual responses, they also may tend to exhibit corresponding differential reflections of these processes in their dreams. Second, high creatives may be able to report more of their dream experiences because of the extent to which they are able to perceive and thus report internal events. Results of the present study in which content elements from three different categories and dream settings were demonstrably different for the two groups seem to show that it is more than simple verbal fluency which differentiates the dream reports of high and low creatives. High creatives may be reporting more because there is more to report, that is, their dreams are more complex, or because they are more attuned to or acceptant of their internal states. And indeed this later interpretation coincides with a theoretical discussion of creativity with an orientation to the personality of the individual (Rogers, 1959; Maslow, 1962; McKellar, 1957; Kris, 1965 a and b.).

With regard to the length of dream reports previous sleep
laboratory studies have found that depressed patients gave briefer
dream reports than two other clinical groups (Langa, 1966), while
Foulkes and Rechtschaffen (1964) reported that subjects whose MMPI
profiles indicated emotional disturbance gave reports of greater
length than those whose profiles did not. This last study was re-
plicated by Pivik and Foulkes (1966). Since in the present study
there were no significant differences between the two groups on
any of the MMPI scales, it appears reasonable to conclude that the
differences in dream report length were not due to differences in
emotional disturbance or psychopathology and that they were prob-
ably due to the cognitive traits reflected in the tasks utilized
to select the subjects.

With regard to the type of differences in dream report
content previous studies have found that field independents
(Witkin, 1962) have significantly more dream elements
(Baekeland, 1968) and more imaginative dreams than field
dependents (Cartwright, 1966). The relationship between
field-independence-dependence and creativity is somewhat
uncertain. Evidence was reviewed and hypotheses were suggested
by Bloomberg (1967). He suggested that "field independence is
a necessary, but not sufficient, condition for creativity.
Perhaps therefore, all creative persons are field independent,
while only some field independent persons are creative." If
such a relationship is valid one would expect high creatives to exhibit the same characteristics as field independents in relation to dream reports.

This, indeed, was the result in the present experiment. First, high creatives had significantly more dream elements in the present study as did field independents in the Baekeland (1968) study. And it might be noted that the procedure used in the determination of dream elements was very similar to the present experiment, the exception being that elements were not categorized in the previous study. Second, Cartwright (1966) found that the dream reports of field independents were rated more imaginative. Variables composing what she called a "Dreaming Pattern" included the Remote Associates Test, Imaginativeness of Dream Content, a Visual Imagery Flexibility Test and the Draw-A-Person (DAP) test scored on Witkin's Body Sophistication scale (Witkin, 1964). Subjects who exhibited this pattern she described as "more field independent...and a rich store of verbal associations which they use creatively in new combinations...and as good clear visual imagers who can manipulate and control their images in problem solving." The similarity between Cartwright's and the present studies is seen in the reliance on a remote associates measure and a flexibility measure to
identify subjects. And there is a similarity in the results of the two studies in that the dream reports of those subjects in the Cartwright study who conformed to the "Dreaming Pattern" were rated as more imaginative than those which did not, while in the present study the dream reports of the high creatives were rated as more unusual than those of the low creatives.

The result in the present study concerning differences in fluency does not mean, however, that high creative subjects necessarily have a better recall of their dream experience in terms of quality. For there were no significant differences on the rating scale for the vividness as opposed to the vagueness of recall where the judges were instructed to disregard the quantity of recall. And further, there were no significant differences in the total number of dreams from nighttime REM awakenings or in the reported frequency of home dreams. Put another way, from the above pattern it appears that high and low creatives will recall approximately the same number of dreams when asked to do so, and they will recall their dream experiences with relatively equal clarity. But the dream experiences of the high creatives may contain more information in terms of content elements and high creatives will certainly
report more information about their dream experiences than will the low creatives.

It also appears that the nature of the content of the dream reports is different in terms of the greater uniqueness of the high creative reports. Exactly which aspects of the dream reports or standards the raters chose to use to label one report as more unique than another one is not known. However, by examining Table Four on which is presented the list of dream settings for the two groups, the possibility arises that settings were indeed one of the standards. The larger number of home settings for the low creative reports together with the obviously unusual or at least interesting quality of the settings for the high creative reports certainly indicate differences in the nature of the content of the dream reports from high and low creative subjects.

Here one might speculate that perhaps the psychological processes of creativity are at work. The setting of the dream might serve as a basis for bringing together other elements, common or uncommon, into a unique whole or juxtaposition, which is a close approximation of Mednick's (1962) definition of creativity presented in Chapter I.
Procedural evaluation

There are methodological factors in the present experiment which should be considered in any interpretation of the results. One concerns the selection of subjects. Specifically, do the criteria used to select the high and low creative subjects contain confounds which might eliminate the possibility of making accurate conclusions? For example, perhaps the tests used for this study are not adequate tests of creativity. As developed in Chapter II, there is widespread disagreement concerning the measurement of creativity. Also, perhaps the use of a multiple criteria technique was improper without weighting scores on the different abilities represented in the different tests. For example, the use of this technique would be improper if remote associational ability were twice as important as fluency or flexibility in creative ability. Also, perhaps the use of an extreme groups design was improper. This would be true if the relationship between creativity and sleep-dream variables were nonlinear. Essentially, all of these methodological problems reflect on the uncertainty with which one must interpret the results.

An important possibility also to be considered here is that the subject selection procedure may have differentiated those with high and low intelligence rather than creativity. And
therefore that differences in sleep and dream parameters might be due to intelligence rather than creativity. Serving as a possible control for this factor there were no significant differences between the subject-reported grade point averages of the two groups. Nonlaboratory studies, related to the issue of intelligence and dreaming, report conflicting results. Williamson, Heckel, and Boblitt (1970) reported no significant differences between groups of high and low intelligence on reported frequency of home dream recall while Connor and Boblitt (1970) reported a positive correlation between the two variables. In both studies intelligence was assessed by the Shipley Institute of Living Scale and the procedures used to define different degrees of intelligence for statistical purposes were the same. Given these conflicting results, the relationship between intelligence and dream recall is unclear. Thus even with the nonsignificant difference in grade point averages between the two groups in the present study, given the ambiguity of the studies cited above and the absence of studies related directly to the issue of intelligence and sleep-dream parameters, one must still consider the possibility of intelligence being a confounding factor in this experiment.

A consideration of Clark and Kirels (1970) suggestion regarding the influence of the number of responses given on various measures of creativity was made. A tentative procedure for reducing
undue influence of the number of responses for measures taken on the brick uses test was developed in the later stages of this investigation. Fulfillment of subject selection criteria was essentially maintained with the use of these scoring adjustments.

Another methodological question concerns the extent to which one can accept the design of the sleep phase of the experiment in terms of the resultant electroencephalographic and dream report data.

Electroencephalographically, after sleeping for one night in a sleep laboratory and being awakened twice for dream reports, how closely does the sleep cycle on the second night represent a true EEG baseline? It has been demonstrated that from night to night an individual will spend a relatively stable proportion of his total sleep time in stage REM. However, the first night procedure used in the present study might be considered as REM deprivation in terms of awakening Ss before the termination of a REM period and in terms of depressed REM time usually associated with adaptation to the sleep laboratory.

First night laboratory effects have been found by Agnew, Webb, and Williams (1966), Mendels and Hawkins (1967), and Rechtschaffen and Verdone (1964). As noted by Baekland (1970) "first night effects include longer sleep latencies, increased
first REM period latencies, diminished REM sleep, more awakenings and time spent awake." (Emphasis added.) These adaptation effects are usually absent after the first night. In the three studies cited above there were no marked adaptation effects after the first night.

In terms of individual differences, Rechtschaffen and Verdine (1964) found that although their Ss did not differ markedly in their REMP times the differences which did exist were stable. That is, there were significant, reliable individual differences over four nights in the sleep laboratory. In terms of individual differences in the effects of REM deprivation, Cartwright, Monroe, and Palmer (1967) present data suggestive of reliable individual differences between Base Rate REM\% and Recovery Night REM\%. These data are consistent with those of the present study in which there were no significant differences between the high and low creative groups on change in REM\% from night one to night two. The rank order of Ss' REM percentages on nights one and two are almost identical as was the case in the Cartwright et. al. (1967) study.

The question might still be asked whether or not the laboratory setting and procedure might differentially affect high and low creative subjects because of their personality
differences to the extent of eliminating (or accentuating) actual differences. In answer to this question Foulkes (1966) has written that while there are individual differences in REM percent the variations are "sufficiently small that any potentially responsible personality factors could still play only a minimal role in the overall determination of amounts of REM dreaming." Depressive disorders have been associated with a reduction in REM percent (Mendels and Hawkins, 1967b and c; Snyder, Anderson, Bunney, Kupfer, Scott, and Wyatt, 1968; and Snyder, Scott, Karacan, and Anderson, 1968). Psychopathology evident in good and poor sleepers has been related to differences in REM percent (Monroe, 1967). And finally, differences have been found in REM percent between those who typically remember their dreams (recallers) and those who rarely do (nonrecallers) (Goodenough, Shapiro, Holden, and Steinschriber, 1959; Antrobus, Dement, and Fisher, 1964). The above studies represent a few instances where at least some minimal relations have been established between REM percent and waking behavioral or personality variables.

However, it should be remembered that in the present study there were no significant differences between the two groups
on any of the MMPI scales, the self-reported quality of sleep, or the frequency of home dreams recalled. Thus again, results from the present study appear to be consistent with previous literature. And it appears reasonable to assume that the electroencephalographic patterns exhibited by the subjects in this study are representative of their usual patterns.

The questions of individual differences and adaptation effects might also be asked with regard to the dream reports. For example, are dream reports taken on night one different from those taken on other nights. Lewis et. al. (1966) compared dream reports taken on nights one and two with those taken on nights three and four and concluded that their data confirmed an "individual consistency in the type of report given." That is, subjects who gave one type of report on nights one and two tended to give a similar type of report on nights three and four. And in a REM-deprivation study, Foulkes, Pivik, Ahrens, and Swanson (1966) reported that "REM compensating Ss (i.e., those with higher REM times following deprivation than following pseudodeprivation) did not differ significantly from REM noncompensating Ss in their distribution of relatively higher Df ratings (Dreamlike fantasy ratings of dream reports—W. S.) to deprivation or pseudo-deprivation nights." Thus with this evidence for an individual
consistency across different nights in the type of dream reports given, it seems reasonable to assume that in the present study the dream reports can be taken as representative of the subjects' "typical" dream reports.

It might also be noted that the agreement of three studies—Foulkes and Vogel (1965); Foulkes, Spear, and Symonds (1965), and Foulkes and Rechtschaffen (1964)—that maladaptive or pathological waking response was positively associated with dreamlike qualities of REM-sleep fantasy was obtained even though dream reports were gathered on night one in one experiment, over four nights in another experiment, and over two non-successive nights in the third experiment. Thus, again, it appears likely that reports gathered on different nights have minimal intrasubject variation.

Further research

Possible directions that future research might take include the following:

Dimensions of differences in dream reports. The full extent of the differences in the nature of the dream report content needs to be explored. To what extent do judges rely on simple word fluency for separating dream reports into high and low creative categories? What facets of the dream reports of high creatives are more unique and novel than the low
creatives? Are there differences other than fluency and uniqueness in the content of the dream reports? These are a few of the questions that could be investigated.

Problem solving aspects of dreams. In Chapter I much of the relationship between creativity and dreaming was established on the basis of anecdotal reports of problem solving in terms of creative insights in dreams. In the present study there was only one rating scale applied to this issue. A profitable avenue for investigating this further would be a long-term study of a few individuals with identifiable problems or concerns.

The problem solving aspect of dreams falls into the category of sleep and dream research in which various relationships between waking behavioral variables and dream content variables have been studied. Foulkes (1970) reported that in general two relationships have been considered: complementarity or continuity with present evidence greatly favoring the continuity hypothesis. For example dream reports from Ss with evidence of pathological response on standard personality inventories such as the MMPI are more vivid and bizarre than for other Ss (Foulkes and Rechtschaffen, 1964; Pivik and Foulkes, 1968). It also appears that if a drive is satiated
prior to sleep it will be reflected in less influence upon dream content. For example, Hauri (1966) reported that after six presleep hours of concentrated studying subjects had REM dreams less concerned with thinking and problem solving, and after six hours of presleep physical exercise subjects had less REM dreams containing physical activity. This relationship is consistent with the observation made by many of those cited in Chapter I that after working on a problem for a considerable length of time and then putting it aside, creative insights came either in dreams or in moments of relaxed reflection.

Kramer (1969) reported that events of the previous day (day residues) appeared in 25% to 50% of the dreams he examined. Van de Castle (1970) reported on an experiment in which 30% of the 50 lab dreams of a subject who was a sports car enthusiast contained references to sports cars, 36% of the 36 dreams of an avid football fan dealt with football activities, another subject had airplanes in 32% of his 34 dreams, while 23 percent of the lab dreams of another subject dealt with situations involving the color guard to which he belonged.

Thus it appears that waking interests may contribute significantly to nocturnal dream content. And experiments such as the above in which such issues as the incorporation
of presleep stimuli into nocturnal dreams are studied can be applied to the problem solving aspect of dreams.

A recent nonlaboratory experiment dealing directly with the issue of problem solving in dreams was described by Dement (1970). Three problems were presented to 500 students to be studied fifteen minutes before going to bed. In the morning they were to record any dreams recalled. Judges reported that of 1,148 attempts at problem solving, eighty-seven dreams were related to the problem, fifty-three directly and thirty-four indirectly. The problem was solved in a dream on seven occasions. Dement concluded that "We are convinced, however, that the dream solutions obtained in this experiment were valid examples of problem solving."

**Personality variables.** Creativity and dreaming were discussed primarily in terms of the cognitive aspects of each in this study. Given the large number of sleep laboratory studies investigating the relationships between personality and sleep and dreaming, a selection of high and low creative subjects in terms of their personality characteristics might contain more generality.

**Similarity of psychological processes of creativity and dreaming.** In this regard the question asked is, "To
what extent are the psychological processes which are at work in creativity also at work in the dream experience? This of course is the most general question of all and should be taken as subsuming all the preceding areas for further research. For an investigation of the preceding areas would begin to construct an answer to this last question.
References


Langs, R. J. Manifest dreams from three clinical groups. *Archives of General Psychiatry*, 1966, 14, 634-641.


Mendels, J. and Hawkins, D. R. Sleep and depression: A controlled EEG study. *Archives of General Psychiatry*, 1967, 16, 344. (b)

Mendels, J. and Hawkins, D. R. Sleep and depression: A follow-up study. *Archives of General Psychiatry*, 1967, 16, 536. (c)


Voronoff, S. V. From Cretin to Genius. New York Alliance Book Corporation, 1941.


On the following pages is contained the battery of creativity tests and sleep questionnaire as presented to the 423 undergraduate psychology students. The instructions preceding each test were read aloud by the experimenter as the students followed along. Time limits for the first three tests are given in the instructions. Thirty minutes were allowed on the FRAT. The order of presentation of tests was the same for all students.
Experiment DC-3

Experimenter: Wesley R. Sylvia

INTRODUCTION

There are five sections to this experiment. The first four sections consist of word games; the last section is a questionnaire. Do not begin any section until the experimenter instructs you to do so. Please make sure that all of the blanks below are filled in.

Name: ____________________________ (Last) __________ (First) __________ (MI) __________

Age: __________ Sex: __________

Instructor's Name: ________________________________

Time of Class: __________

Psychology 100 or 300? (Please circle the class in which you are enrolled.)
INSTRUCTIONS

Now I want to see how many different words you can make in one minute. Just any words will do, like "chair" and "happy." When I give the signal, you begin and write down as many words as you can think of as fast as you can. Don't worry about your spelling. Don't bother to number your answers. Just write as many words as you can until I tell you to stop.
INSTRUCTIONS

Now I want to see how many different, round and edible objects you can list in two and one-half minutes. For example, a hamburger and a pizza are both round and edible. When I give the signal you begin and write down as many round and edible objects as you can think of as fast as you can. Don't worry about spelling. Don't bother to number your answers. Just list as many round and edible objects as you can until I tell you to stop.
INSTRUCTIONS

Now I want to see how many different uses for the common brick you can think of in five minutes. For example, a brick might be used in building a house, and it might be used as a doorstop. When I give the signal you begin and write down as many uses as you can think of as fast as you can. Don't worry about your spelling. Don't bother to number your answers. Just write as many uses for the brick as you can until I tell you to stop.
NAME: _________________________________________________________

INSTRUCTIONS

In this test you are presented with three words and asked to find a fourth word which is related to all three. Write this word in the space to the right. (Note that the three words are not necessarily related to each other, but each of them is related in some way to the missing fourth word.)

For example, what word do you think is related to these items?

A. cave   ball   Halloween   ________

The answer in this case is "bat." bats live in caves; a bat is often associated with a ball; and a bat is one common Halloween symbol.

Here is another example:

B. cheese   cabin   honeymoon   ________

You should have written "cottage" in the space provided. "Cottage cheese"; a cottage is related closely, functionally, to a cabin; and many persons think of spending a honeymoon in a cottage.

Try these next two:

C. skin   seek   camouflage   ________

D. easy   concrete   nails   ________

The answers are at the bottom of this page.

Now turn this page over and try the groups of words on the next two pages. Many of these are not easy and you will have to think about some for awhile. If you have trouble with some groups of three, go on to the next and come back to them later.

The answers to C and D are: C. hide   D. hard
1. bitter honey lovable
2. interval cosmos vacuum
3. pin finger indicate
4. terminate whistle halt
5. nurse cloud colorless
6. coward taxi chicken
7. print current media
8. danger bull communist
9. endure straw final
10. tread fatigue rubber
11. male young mischievous
12. cards razor heal
13. garden wedding bee
14. line crooked ruler
15. spread popcorn cheese
16. angry traverse Jesus
17. soup may metal
18. contest face ugliness
19. commandment steeple school
20. dismount light striptease
21. breathe eagle humility
22. calendar palm courtship
23. canvas music beauty
24. ring nearby circle

GO ON TO THE NEXT PAGE
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>25. ring</td>
<td>nearby</td>
<td>circle</td>
<td></td>
</tr>
<tr>
<td>26. rules</td>
<td>amusement</td>
<td>plucky</td>
<td></td>
</tr>
<tr>
<td>27. log</td>
<td>green</td>
<td>fire</td>
<td></td>
</tr>
<tr>
<td>28. credit</td>
<td>bull</td>
<td>electricity</td>
<td></td>
</tr>
<tr>
<td>29. petite</td>
<td>hat</td>
<td>measure</td>
<td></td>
</tr>
<tr>
<td>30. breakfast</td>
<td>pigeon</td>
<td>crack</td>
<td></td>
</tr>
<tr>
<td>31. walk</td>
<td>mezzanine</td>
<td>flat</td>
<td></td>
</tr>
<tr>
<td>32. car</td>
<td>texas</td>
<td>water</td>
<td></td>
</tr>
<tr>
<td>33. notice</td>
<td>stamp</td>
<td>pole</td>
<td></td>
</tr>
<tr>
<td>34. net</td>
<td>fur</td>
<td>wash</td>
<td></td>
</tr>
<tr>
<td>35. sale</td>
<td>memorable</td>
<td>delivery</td>
<td></td>
</tr>
<tr>
<td>36. corridor</td>
<td>verse</td>
<td>route</td>
<td></td>
</tr>
<tr>
<td>37. freight</td>
<td>say</td>
<td>fast</td>
<td></td>
</tr>
<tr>
<td>38. normal</td>
<td>super</td>
<td>nude</td>
<td></td>
</tr>
</tbody>
</table>

STOP. DO NOT GO ON TO THE NEXT PAGE.
This page has been inserted to keep pagination correct.
The following questions and fill-in statements concern the characteristics of your sleep and dreaming behavior. Please supply the requested information as completely and as accurately as possible.

1. Usually (on the average) I sleep for ____ hours per night.
2. Usually (on the average) it takes me ____ minutes to fall asleep at night.
3. During the night I usually awaken from sleep ____ times before I get up for good in the morning.
4. Last night I slept for approximately ____ hours.
5. Last night it took me approximately ____ minutes to fall asleep.
6. Rate the following statement on the five-point scale provided below:

   "I would characterize myself as being a very good sleeper."

   Strongly Agree    Moderately Agree    Strongly Disagree
   1            2             3              4              5

7. Do you have any serious sleep difficulties or problems? For example, insomnia, sleep walking, or nightmares. (Circle your answer.)  
   Yes  No

PLEASE GO ON TO THE NEXT PAGE
APPENDIX A (CONT.)

8. Circle the letter of one of the following descriptions which best applies to the type of mental activity you usually experience when you attempt to fall asleep at night.

a. mostly thoughtlike activity, very few visual images.

b. both thoughtlike activity and visual images.

c. mostly visual images, very little thoughtlike activity.

d. very little of anything, that is, neither thoughtlike activity nor visual images.

9. Usually (on the average) I am able to recall (remember) ______ dreams per week, or ______ dreams per month.

10. Rate the following statement on the five-point scale provided below:

"I very rarely recall my dreams."

Strongly Agree       Moderately Agree       Strongly Disagree

1          2          3          4          5

11. This past week I recalled (remembered) approximately ______ dreams.

12. Can you recall any dreams you had last night? Circle your answer.

Yes       No

13. From the dreams you are able to recall do you usually remember them as being in black and white or in color? Circle your answer.

black and white       color

14. Have you ever had any unusual dream experiences, for example, finding the solution to a problem, foretelling a future event, etc.?

Yes       No

If the answer is "yes" please specify what type of experience.
APPENDIX B

CATEGORIES USED FOR THE FLEXIBILITY MEASURE BASED ON RESPONSES TO THE BRICK USES TEST

<table>
<thead>
<tr>
<th>I - STRUCTURES</th>
<th>II - WHOLE BRICK</th>
<th>III - PARTIAL BRICK</th>
<th>IV - PROP-SUPPORT</th>
<th>V - WEIGHT</th>
<th>VI - MOTION</th>
<th>VII - MISC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>Border-Line</td>
<td>Gravel-Cinders</td>
<td>Keep objects</td>
<td>Balance-Count-</td>
<td>Strike an object</td>
<td></td>
</tr>
<tr>
<td>Falls, Barriers</td>
<td>Holders (holes)</td>
<td>Write with</td>
<td>from rolling</td>
<td>erweight</td>
<td>Throw-Gane</td>
<td></td>
</tr>
<tr>
<td>Underneath</td>
<td>Measurement</td>
<td>Sculpt-chisel</td>
<td>Prop-leveler</td>
<td>Hold-weight</td>
<td>Tool</td>
<td></td>
</tr>
<tr>
<td>Fireplaces</td>
<td>Cover-Plug</td>
<td>Art-Decorations</td>
<td>Base</td>
<td>down</td>
<td>Noise maker</td>
<td></td>
</tr>
<tr>
<td>Container</td>
<td>Write on</td>
<td>Dust</td>
<td>Book-record</td>
<td>Exercise</td>
<td>Drop</td>
<td></td>
</tr>
<tr>
<td>Domestic Objects</td>
<td>Tool</td>
<td></td>
<td>Starting</td>
<td>Iron-Press</td>
<td>Extra weight</td>
<td>Wash clothes</td>
</tr>
<tr>
<td></td>
<td>Heat</td>
<td></td>
<td>block</td>
<td>Dive for</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Straight Edge Markers</td>
<td></td>
<td>Block moving</td>
<td>Extra weight</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXPLANATION: A response was labeled Category I if the brick were being used together with another brick to form some sort of structure such as a school, a wall, etc. Category II was employed if an isolated brick, such as to cover a hole, were being used and the requirements for Categories IV, V, and VI were not fulfilled. Responses were labeled Category III if only a part of the brick were being used such as in gravel, cinders, or dust. Category IV was used if the response appeared to emphasize the property of a brick as being a solid object capable of providing support to some other object. For example, a brick might be used to prop up a bed, keep a car from rolling, etc. Category V included responses which emphasized the property of the weight of the brick, for example, a paperweight, an exercise weight, a counterweight, etc. Category VI was applied if the brick were being put into motion for any purpose, such as striking another object, throwing, etc. Finally, responses which could not be placed in any of the first six categories were labelled Category VII.
APPENDIX C

Ranges, Means, and Standard Deviations of and Correlations among Creativity Measures

<table>
<thead>
<tr>
<th></th>
<th>FRAT</th>
<th>SHIFTS</th>
<th>UNUSUALNESS</th>
<th>B.U. FLU.</th>
<th>R&amp;E FLU.</th>
<th>WORD FLU.</th>
<th>RANGE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRAT</td>
<td>.10</td>
<td>.04</td>
<td>.05</td>
<td>.18</td>
<td>.07</td>
<td>4-28</td>
<td>17.19</td>
<td>5.24</td>
<td></td>
</tr>
<tr>
<td>FLEXIBILITY</td>
<td>.63</td>
<td>.63</td>
<td>.33</td>
<td>.23</td>
<td>0-19</td>
<td></td>
<td>7.48</td>
<td>3.44</td>
<td></td>
</tr>
<tr>
<td>UNUSUALNESS</td>
<td></td>
<td></td>
<td>.88</td>
<td>.44</td>
<td>32-1125</td>
<td>409.01</td>
<td></td>
<td>204.95</td>
<td></td>
</tr>
<tr>
<td>BRICK USES</td>
<td></td>
<td></td>
<td></td>
<td>.40</td>
<td>.18</td>
<td>3-27</td>
<td>13.64</td>
<td>4.62</td>
<td></td>
</tr>
<tr>
<td>TEST FLUENCY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROUND &amp; EDIBLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBJECTS FLUENCY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORD FLUENCY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX D

**RAW SCORES AND CORRESPONDING UPER (FOR HIGH CREATIVE SS) AND LOWER (FOR LOW CREATIVE SS) PERCENTAGES FOR INDIVIDUAL SUBJECTS, AND GROUP MEANS WITH CORRESPONDING PERCENTAGES ON THE CREATIVITY MEASURES**

### HIGH CREATIVE GROUP

<table>
<thead>
<tr>
<th>Measure</th>
<th>Males</th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>MEANS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRAT</td>
<td>Score:</td>
<td>25</td>
<td>25</td>
<td>27</td>
<td>22</td>
<td>20</td>
<td>24</td>
<td>24</td>
<td>27</td>
<td>27</td>
<td>24.8</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>19</td>
<td>13</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>FLEXIBILITY</td>
<td>Score:</td>
<td>12</td>
<td>14</td>
<td>10</td>
<td>13</td>
<td>12</td>
<td>13</td>
<td>19</td>
<td>16</td>
<td>11</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>11</td>
<td>5</td>
<td>25</td>
<td>8</td>
<td>11</td>
<td>8</td>
<td>19</td>
<td>16</td>
<td>12</td>
<td>8%</td>
</tr>
<tr>
<td>UNUSUALNESS</td>
<td>Score:</td>
<td>1040</td>
<td>825</td>
<td>697</td>
<td>781</td>
<td>762</td>
<td>801</td>
<td>744</td>
<td>623</td>
<td>796</td>
<td>798.9</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>14</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>BRICK USES</td>
<td>Score:</td>
<td>23</td>
<td>24</td>
<td>20</td>
<td>22</td>
<td>22</td>
<td>20</td>
<td>25</td>
<td>19</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>6</td>
<td>6</td>
<td>11</td>
<td>2</td>
<td>14</td>
<td>13</td>
<td>6%</td>
</tr>
<tr>
<td>TEST FLUENCY</td>
<td>Score:</td>
<td>21</td>
<td>15</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>18</td>
<td>22</td>
<td>22</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>1</td>
<td>3</td>
<td>25</td>
<td>6</td>
<td>5</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td>17%</td>
</tr>
<tr>
<td>HOUND &amp; EMBLEK</td>
<td>Score:</td>
<td>27</td>
<td>25</td>
<td>32</td>
<td>33</td>
<td>27</td>
<td>30</td>
<td>28</td>
<td>30</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>27</td>
<td>19</td>
<td>6</td>
<td>4</td>
<td>27</td>
<td>11</td>
<td>21</td>
<td>11</td>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>OBJECTS FLUENCY</td>
<td>Score:</td>
<td>27</td>
<td>25</td>
<td>32</td>
<td>33</td>
<td>27</td>
<td>30</td>
<td>28</td>
<td>30</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>27</td>
<td>19</td>
<td>6</td>
<td>4</td>
<td>27</td>
<td>11</td>
<td>21</td>
<td>11</td>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>WORD FLUENCY</td>
<td>Score:</td>
<td>27</td>
<td>25</td>
<td>32</td>
<td>33</td>
<td>27</td>
<td>30</td>
<td>28</td>
<td>30</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Up. %</td>
<td>27</td>
<td>19</td>
<td>6</td>
<td>4</td>
<td>27</td>
<td>11</td>
<td>21</td>
<td>11</td>
<td>1</td>
<td>49</td>
</tr>
</tbody>
</table>
### APPENDIX D (CONT.)

**LOW CREATIVE GROUP**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Subjects</th>
<th>Males</th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>MEANS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>FRAT</td>
<td>Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>17</td>
<td>7</td>
<td>5</td>
<td>11</td>
<td>12</td>
<td>14</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td>Low.%</td>
<td>13</td>
<td>9</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>5</td>
<td>1</td>
<td>13</td>
<td>17</td>
<td>24</td>
<td>13.5</td>
</tr>
<tr>
<td>FLEXIBILITY</td>
<td>Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>Low.%</td>
<td>20</td>
<td>39</td>
<td>20</td>
<td>20</td>
<td>12</td>
<td>12</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>UNUSUALNESS</td>
<td>Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/47</td>
<td>20/7</td>
<td>113</td>
<td>134</td>
<td>130</td>
<td>113</td>
<td>154</td>
<td>50</td>
<td>47</td>
<td>55</td>
<td>148.0</td>
</tr>
<tr>
<td></td>
<td>Low.%</td>
<td>46</td>
<td>19</td>
<td>5</td>
<td>8</td>
<td>13</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>BRICK USES</td>
<td>Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>13</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>12</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>Low.%</td>
<td>31</td>
<td>51</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>39</td>
<td>15</td>
<td>2</td>
<td>1</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>TEST FLUENCY</td>
<td>Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>5</td>
<td>10</td>
<td>14</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>Low.%</td>
<td>5</td>
<td>2</td>
<td>27</td>
<td>55</td>
<td>27</td>
<td>13</td>
<td>27</td>
<td>13</td>
<td>27</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>ROUND &amp; EDIBLE OBJECTS FLUENCY</td>
<td>Score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>28</td>
<td>16</td>
<td>24</td>
<td>14</td>
<td>20</td>
<td>16</td>
<td>12</td>
<td>18</td>
<td>36</td>
<td>24</td>
<td>22.1</td>
</tr>
<tr>
<td></td>
<td>Low.%</td>
<td>79</td>
<td>7</td>
<td>56</td>
<td>2</td>
<td>21</td>
<td>7</td>
<td>51</td>
<td>12</td>
<td>98</td>
<td>56</td>
<td>30</td>
</tr>
</tbody>
</table>
APPENDIX E

RATING SCALES

1. Does the dream content as a whole reflect common, everydayish material, or is it uncommon, unique, or novel?

<table>
<thead>
<tr>
<th>Common, Everydayish</th>
<th>Parts Common, Parts Unique</th>
<th>Novel, Uncommon, Unique</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

2. The following rating scale refers to the quality of recall of the dream without regard to amount of recall.

All of what is recalled is recalled dimly, vaguely, and unclearly. 1

Most of what is recalled is recalled dimly, vaguely and unclearly. 2

Some parts are recalled dimly and vaguely, while others are recalled vividly and clearly. 3

Most of what is recalled is recalled vividly and clearly. 4

All of what is recalled is recalled vividly and clearly. 5

3. To what extent does the dream content reflect a conceptual (thought-like) as opposed to perceptual (seeing, feeling, etc.) experience?

<table>
<thead>
<tr>
<th>Purely Conceptual</th>
<th>Parts Conceptual, Parts Perceptual</th>
<th>Predominantly Perceptual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>


4. To what extent might the dream reflect a waking concern or a waking problem of the dreamer?

<table>
<thead>
<tr>
<th>No Obvious Relation</th>
<th>Implicit Relation</th>
<th>Explicit Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

5. Is the dream content something that might be expected to occur in real life, or does the dream content reflect an experience very unlikely to occur in real life (in terms of natural laws)?

<table>
<thead>
<tr>
<th>Very Likely To Occur</th>
<th>Parts Likely To Occur</th>
<th>Very Unlikely To Occur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

6. Does the dream content appear to be predominately concerned with past, present, or future activity?

<table>
<thead>
<tr>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>