To the Graduate Council:

I am submitting herewith a dissertation written by Steven Robert Banks entitled "Creativity, Mental Imagery, and Cerebral Dominance." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Educational Psychology and Guidance.

Charles L. Thompson
Major Professor

We have read this dissertation
and recommend its acceptance:

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CREATIVITY, MENTAL IMAGERY, AND CEREBRAL DOMINANCE

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee, Knoxville

Steven Robert Banks

August 1980

ACKNOWLEDGEMENTS

Though there are many individuals to whom I am indebted for this work, my parents certainly are first and foremost. Their emotional and economic support have always been there, when needed. So to my parents, Robert and Phyllis Banks this work is truly dedicated. I would also like to express my gratitude to my brothers and sisters, whose intellectual stimulation provided the groundwork for this dissertation.

Many thanks must go to my chairperson, Dr. Charles L. Thompson. Without him I know that I would not have finished this research project. His counsel, throughout my doctoral program, was all that kept me going many a time. I now believe that everyone should have a Counseling Psychologist as their committee chairperson. I would like to thank the rest of my committee for bearing with me. Dr. Howard Pollio, Dr. Ohmer Milton, and Dr. Schuyler Huck, have all given me something I was never able to give myself: discipline.

For their special help with this project, I would like to express my gratitude to Denise Luker and Susie Piper. I would also like to thank the students and staff of Columbia State Community College for their time and support of this project. Again, thank you all.

S.R.B.

ABSTRACT

The present study was designed to explore the relationship between creative ability, mental imagery ability, and cerebral hemispheric dominance. The relationship between these three factors was measured by the administration of nine different tests.

Sixty-six undergraduate students enrolled in psychology courses at a small southern community college served as subjects. They received three tests of creative ability, three tests of mental imagery ability, and three tests of cerebral hemispheric dominance. A Latin square design was employed in administering the tests, in order to minimize any order effect.

It was hypothesized that positive, vivid, mental imagery would have a positive relationship with creative ability. It was also hypothesized that the use of the right cerebral hemisphere would have a positive relationship with creative ability. None of the correlations that measured the original hypotheses were found to be significant. It was demonstrated, however, that creative ability was positively related to the age of the subject. When the variable, age, was held constant, one of the tests that measured right cerebral dominance was found to have a significant relationship with creative ability.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

STATEMENT OF PROBLEM

Ornstein (1973) suggests that there are two basic cognitive processes in humans, that closely correspond to the Freudian distinction between primary process thought and secondary process thought. One such cognitive mode is lateralized in the right cerebral hemisphere and is characterized by pictorial, imaginative and creative thinking. The other mode of cognition is lateralized in the left hemisphere and is characterized by rational, verbal and logical thinking. However, Lashley (1952) disagrees with the viewpoint of lateralization of functioning, stating that the brain acts in a holistic fashion with little or no lateralization of any cognitive functions. Furthermore, little research has been completed concerning the lateralization of higher cognitive processes. Therefore, the present study was directed toward examining the conflicting theories regarding the lateralization of cognitive functioning, as well as attempting to fill in the present gap in empirical research.

Two subproblems stem from Ornstein's hypothesis. The first subproblem revolves around the question of whether the creative process is lateralized in one of the cerebral hemispheres. Dimond and Beaumont (1974) suggest that creative ability is almost exclusively lateralized in the

right hemisphere. However, Bogen and Bogen (1976) state that creative ability is dependent on integrating and coordinating the two cerebral hemispheres. Bogen and Bogen believe that both hemispheres are necessary for creative ability. Furthermore, no one has adequately studied the relationship between creative ability and hemispheric lateralization. Therefore, this researcher completed a study which evaluated the relationship between creative ability and lateralization of cognitive functions.

The second subproblem raised by Ornstein's hypothesis concerns the association made by Ornstein between mental imagery and creative ability. However, Ornstein does not make the distinction completely clear, as to the exact relationship between mental imagery and creative ability. Other theorists in this area (Barron, 1963; Koestler, 1965) flatly state that mental imagery is the essential cognitive process involved in creativity. Research on this problem was conducted by Khatena (1976), who showed a statistically significant relationship between autonomous imagery ability and creative ability. However, one of the test instruments used (Gordon Test of Visual Imagery Control) has questionable validity, as demonstrated in a study by Starker (1974). Therefore, this researcher utilized more valid test instruments in order to measure the relationship between mental imagery and creative ability.

Rationale

The essential reason for this study was to attempt to infer what kind of internal process occurs, that enables the individual to come up with a creative idea or creative product. The focus of this study was on the internal mental process of creation. One of the reasons for this study was to ascertain if the creative process is one of two basic processes of cognition. Another reason for this study was to evaluate the relationship between creative ability and the lateralization of cognitive functions in the cerebral hemispheres. If one cerebral hemisphere is used more in creative thinking, this finding might give researchers in this area a better clue as to the relationship between cognitive functioning and neural functioning. Another reason for this study was to examine the relationship between mental imagery and creative ability. If mental imagery is a cognitive process used in creative thinking, then this finding will help to explain the internal process of creativity.

The final reason for this study was to attempt to link, both empirically and theoretically, three concepts that have become increasingly important in the literature of psychology. Creativity, mental imagery, and cerebral dominance are three concepts that have generated a considerable body of research concerning the factors that make up these three concepts. If this study had indicated a link between all three of these concepts, then a considerable contribution would have been made toward further understanding of these concepts.

Conceptual Definitions

Creative ability: the ability to make a novel and appropriate response to a problem solving situation.

Mental imagery ability: the ability to produce mental pictures or experiences either by the perceptual memory system or by the imagination.

Cerebral dominance: the predominance of one hemisphere in certain cognitive processes as inferred by certain motoric responses.

Memory image: a single mental image, which was produced by the memory system and is a reproduction of an actual event.

Eye dominance: the predominant use of one eye in certain motoric responses, which indicates that the opposite hemisphere is being utilized.

Imagination: the process by which memory images are synthesized into qualitatively new creations.

Imaginary playmate: an imagined companion created by an individual in early childhood.

Eye-shifting: a motoric shift of the eyes which indicates that the hemisphere opposite of the directional shift of the eyes is being utilized.

Handedness: the hand most frequently used to deal with the environment, which indicates that the opposite hemisphere of that hand is being utilized.

Imagery vividness: the clarity and detail of the mental imagery.

Positive-vivid imagery: vivid imagery that is not hallucinatory or frightening in nature.

Operational Definitions

Creative ability: what the subject scores on the Barron-Welsh Art Scale, the Remote Associates Test and the Guilford Alternate Uses Test.

Imagery vividness: what the subject scores on the Betts Test of Mental Imagery.

Positive-vivid imagery: what the subject scores on the Positive-vivid factor of the Imaginal Processes Inventory.

Right handedness: that which is defined as right-handedness by the Beaumont (1974) scoring procedure for the Annett Handedness measure.

Non-right handedness: that which is defined as non-right handedness by the Beaumont (1974) scoring procedure for the Annett Handedness measure.

Right eye-shifting: the shifting of both eyes to the right a simple majority of the time, when the subject is presented with questions that Meskin and Singer (1974) define as calling for an extended memory search.

Left eye-shifting: the shifting of both eyes to the left a simple majority of the time, when the subject is presented with questions that Meskin and Singer (1974) define as calling for an extended memory search.

Imaginary playmate: an affirmative response, when the subject is asked: Did you every have an imaginary companion when you were a child?

Right eye dominance: the predominant use of the right eye, as indicated, by the subjects' responses to a measure of eye dominance.

Left eye dominance: the predominant use of the left eye, as indicated, by the subjects' responses to a measure of eye dominance.

Hypotheses

1. There will be a positive relationship between left eye dominance and creative ability.

2. There will be a positive relationship between left-eye shifting, when the subject is presented with a question calling for an extended memory search, and creative ability.

3. There will be a positive relationship between non-right handedness as measured by the Annett Handedness Questionaire, and creative ability.

4. There will be a positive relationship between having an imaginary playmate in early childhood and creative ability.

5. There will be a positive relationship between imagery vividness and creative ability.

6. There will be a positive relationship between the Positive-Vivid factor of the Imaginal Processes Inventory and creative ability.

Assumptions

1. The Alternate Uses Test is a reliable and valid measure of creative ability.

2. The Mednick Remote Associates Test is a reliable and valid measure of creative ability.

3. The Barron-Welsh Art Scale is a reliable and valid measure of creative ability.

4. Handedness, as measured by the Beaumont scoring procedure for the Annett Handedness Questionaire, is a reliable and valid measure of cerebral hemispheric involvement in certain cognitive processes.

5. Eye-shifting, when presented with a reflective question, is a reliable and valid measure of cerebral hemispheric involvement in certain cognitive processes.

6. Eye dominance is a valid and reliable measure of cerebral hemispheric involvement in certain cognitive processes.

7. The Imaginal Processes Inventory is a reliable and valid measure of mental imagery.

8. The Betts Test of Mental Imagery is a reliable and valid measure of mental imagery.

CHAPTER II

REVIEW OF THE LITERATURE

Creativity and Mental Imagery

As any researcher in the area of creativity soon discovers, the field is fraught with amibiguity. Even an accepted definition of creativity is lacking. One common theme, though, does run throughout a number of creativity theories, such as those of Barron (1963), Koestler (1965), and Ornstein (1973). This theme is the use of imagery or imagination in the creative process.

Barron (1963) makes this observation concerning the relationship between creativity and imagery:

> Our studies of the psychology of literary creation persuade us that ideas from the unconscious play a large role in furnishing the material out of which the work of art is made...What appears to happen is this: the censorship (of the unconscious) momentarily suspends its function and an unconscious idea passes into the preconscious. This idea at first seems vague and appears to have no relationship to other conscious content. Often it finds its first representation simply as a momentary visual or verbal image (p.228).

Koestler (1965) elaborates this theory of creativity by citing both poets and scientists, who have made their initial creative insights through the use of imagery. Koestler states that the internal mental activity of the creative individual is basically the same for both the artist and the scientist. In both cases the individual must use some type of mental imagery to realize the creative insight. The reason for this is that imagery activity enables the individual to combine and recombine various aspects of the problem, until the creator can develop the unique solution to the creative problem. According to Koestler, no other cognitive activity has the flexibility to approach the creative problem

from so many different persepectives.

One of the examples used by Koestler is a description by Einstein of his own internal creative process:

> The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The physical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be voluntarily reproduced and combined... Taken from a psychological viewpoint, this combinatory play seems to be an essential feature in productive thought--before there is any connection with logical construction in words or other kinds of signs which can be communicated to others (Einstein, 1949, p. 142).

Koestler believes that mental imagery ability is a more primitive form of mental activity than symbolic thought, in both a phylogenetic sense and an ontogenetic sense. In effect the rise of symbolic thought has forced mental imagery out of the consciousness of most adult memebers of Western culture. Therefore, Koestler claims that mental imagery is more common among primitive peoples and among children in Western culture. Creative individuals are those people who are able to make a return to this more primitive form of cognition and then to integrate it with their normal conscious forms of thought.

Koestler concludes:

> And we heard one testimony after another from great scientists, which show that in order to create they had to regress at times from the word to the picture-strip, from verbal symbolism to visual symbolism (Koestler, 1965, p. 173).

There is some research evidence to support Koestler's theory of imagery and creativity. The Doob (1964) study showed that there were significant differences in eidectic imagery ability (photographic memory) between the rural members of the Ibo tribe of Nigeria and the urban members. Almost half of the rural Ibos had eidectic imagery, while only

7 per cent of the urbanized members of the Ibo tribe had eidectic ability, with significant differences between children and adults. Almost no eidectic imagery ability was reported among the adult urban Ibos.

A study completed by Haber and Haber (1964) showed that school children of elementary age in the United States had significantly more eidectic imagery ability than did adults. Haber and Haber reported that 8 per cent of the children in their study had true eidectic ability, with over half of the children demonstrating some eidectic imagery. Haber and Haber contrasted this finding with the frequency of eidectic ability among American adults, which they reported as nearly zero in frequency.

Three empirical studies have supported Koestler's idea that there is a positive relationship between creative ability and the ability to use and integrate unconscious thought with conscious thought. Myden (1959) found significant differences between recognized creatives and noncreatives in their ability to use and integrate unconscious thought with conscious thought. Hersch (1962), also using Rorschach scores, found that the recognized creative individuals were significantly better able to use and integrate unconscious thought with conscious thought than were the noncreative individuals. Garwood (1964) showed a significant positive relationship between creative ability and the ability to integrate unconscious thought with conscious thought, as measured by the Thematic Apperception Test.

There have been two studies which have empirically measured the relationship between imagery ability and creative ability. Khatena (1975) found a positive relationship between a self-report scale of perceived creative ability and the ability to have spontaneous mental images, as measured by the Gordon Test of Imagery Control. Khatena (1976) again demonstrated a positive relationship between a test of creative ability and the ability to have spontaneous mental images, as measured by the Gordon Test of Imagery Control. As pointed out earlier, there is a methodological weakness in the Gordon Test of Imagery Control that has been indicated in a research study completed by Starker (1974). Starker found that the Gordon Test did not have any relationship with a number of other imagery tests, which purported to measure roughly the same variables. The problem with the Gordon Test apparently stems from the wording of the test questions. For example, the Gordon Test asks the subject to visualize certain scenes, such as a car in front of a garden gate. If the subject responds that they cannot visualize such a scene, their imagery is rated as being spontaneous or autonomous. As Richardson (1972) points out, such a reponse could just as easily indicate that the subject had a complete lack of mental imagery, rather than spontaneous imagery.

There have not been any studies completed that attempt to link imagery, imagination and creativity. There has been one study of imagination and creative ability. Schaefer (1969) demonstrated a positive relationship between having an imaginary playmate in early childhood and creative ability in adolescence. Schaefer measured creative ability by having the adolescents nominated for their creative writing ability. Having an imaginary playmate in early childhood was measured by a questionnaire.

Creativity and Cerebral Dominance

In the last thirty years there has been a growing controversy in neuropsychology over the question of lateralization of cerebral hemispheric functioning. Lateralization of cerebral functions simply means the splitting of cognitive functions between the two cerebral hemispheres. Some researchers, such as Lashley (1952), state that the brain functions as a whole with little or no lateralization of functioning. Other researchers, such as Dimond and Beaumont (1974) believe that nearly all cognitive functions are split between the two hemispheres.

Ornstein (1973) proposed a model of neuropsychology which stated that creative ability and imagery ability were both lateralized in the right cerebral hemisphere. Though Ornstein appears to associate creative ability with imagery ability, he does not clearly establish the relationship between these two variables in the manner that Koestler and Barron do.

On the other hand, Ornstein hypothesizes that there is a strong relationship between right cerebral hemispheric usage and creative ability. Ornstein states that the left cerebral hemisphere is basically oriented toward symbolic thinking, while the right hemisphere is intuitive, artistic and imagery oriented. Other researchers have also suggested this same, basic division of cognitive functioning between the two hemispheres (Eccles, 1973; Humphrey and Zangwill, 1951).

Sperry (1968) and Gazzangia (1965) completed research on the cognitive functioning of individuals who have had their corpus callosum, the connecting tissue between the two hemispheres, severed in a surgical operation to treat epilepsy. In both studies, it was demonstrated that most patients primarily used the left hemisphere for symbolic thinking and the right hemisphere for spatial tasks. Other studies measuring the electrical activity in the hemispheres of normal individuals have found contrary results. Ornstein (1978) obtained results indicating that the right hemisphere had greater electrical activity than the left hemisphere, when the individual was dealing with spatial tasks. Govins (1979) found no significant differences between the hemispheres in electrical activity, when the individual was dealing with spatial tasks.

Research on the relationship between creative ability and cerebral functioning indicates similar, contradictory results in the literature. Harnard (1972) conducted a correlational study between creative ability and lateral eye-shifting. Lateral eye-shifting is simply the way both eyes shift, when the subject is called upon to answer a question that requires an extended memory search. Penfield and Boldrey (1937) demonstrated that test animals, who had an occipital lobe electrically stimulated, would

tend to shift their eyes in the opposite direction from the stimulated occipital lobe. Bender (1964) demonstrated the same procedure on human subjects, during brain surgery. Harnard (1972) found a positive relationship between creative ability and left eye shifting. This finding would tend to indicate that the right hemisphere is predominantly involved in the creative process. However, Smith (1972) found no significant differences between eye-shifting and creative ability. Bakan (1978) concludes:

> Though many problems remain to be solved with respect to the relationship between creativity and the conjugate lateral eye movement typology, the evidence available certainly suggests that this promises to be a fruitful area of research (p. 175).

The basic research question in this area appears to be a neuro-physiological question: Do the cerebral hemispheres function as separate neural units or do they work as one, unified neural unit? Bogen and Bogen (1976) state that it is impossible to separate the cerebral hemispheres into separate neural units. The corpus callosum provides an abundant network of neural pathways which serve to coordinate and integrate all aspects of neural functioning. Bogen and Bogen agree that one hemisphere may tend to be primarily used in certain cognitive functions, such as the left hemisphere's apparent dominance in speech. However, they point out that the right hemisphere can often be trained to take over functions of the left hemisphere, when brain damage occurs in the left hemisphere. Other researchers such as Dimond and Beaumont (1974) believe that the two hemispheres generally function in a relatively independent fashion, with the corpus callosum simply serving to transfer information between the two hemispheres. According to Dimond and Beaumont, nearly all major cognitive processes are lateralized or

located in one cerebral hemisphere or the other, with virtually no duplication of functioning between the hemispheres.

Luria (1965) completed a research study on the composer Shebalin, which illustrates the question of cerebral functioning and creativity. Though only a case study, Luria's study dramatically points out the complexity of studying neural functioning. During the years between 1959 and 1963, Luria observed the cognitive functioning of the Russian composer Shebalin. This composer suffered two strokes in the left hemisphere in a five year period, with the last stroke occuring in 1959. After the second stroke, Shebalin was unable to speak and was unable to understand the speech of other people. However, Shebalin was able to continue his creative musical work without any decrease in its quality. As Luria (1965) observed about Shebalin:

> Over the course of three years we have had the opportunity of observing a patient who was an outstanding Russian composer, and who, after a vascular lesion of the speech zones of the left hemisphere (including the temporal lobe), while suffering from a severe and predominantly sensory aphasia, preserved his musical abilities, continued his creative work, and executed a number of outstanding compositions which were performed many times and with great success (p. 291).

Conceptual Framework

The best context in which to fit the present study is Ornstein's theory of creativity. This theory is an extension of the psychodynamic theory of creativity. Ornstein generally concurs with the major tenets of the Freudian viewpoint on creativity. The major extension which Ornstein makes about this theory of creativity is

made by giving a neurophysiological basis to the different processes involved in the psychodynamic theory.

There are two major processes involved in creativity, as well as all other types of cognition, according to the Freudian viewpoint. These two processes are termed the primary process and the secondary process. Primary process thought is almost exclusively unconscious and consists largely of biological impulses. These impulses are cognitively represented by mental imagery and are not bound by any logical or rational associations (Freud, 1900). An individual experiencing just primary process cognition would be unable to distinguish between their inner mental world and the external physical world. An example of this inability to distinguish between these two worlds occurs when the normal individual is in the dream state. In the dream state the individual experiences the dream, as if it were actually occurring in the external world.

In order to differentiate between the inner mental world and the external physical world, secondary process thought is developed. Secondary process thought is cognitively represented by language and other types of symbolic thought. Secondary process thought is also characterized by its orientation toward reality: what Freud (1900) termed the reality principle. This concept means that the principle guiding secondary process thought is to discover what will satisfy the basic biological needs in the external physical world. An example of the reality principle of secondary process thought occurs in the study of mirage phenomenon. A person suffering from extreme thirst in the desert

may see a mirage. This is an attempt by primary process thought to immediately satisfy a biological need, by creating an hallucination. However, secondary process thought will attempt to ascertain the reality of any phenomenon, through rationally investigating the phenomenon, in order to make sure that it is actually occurring in the external world and not in the imaginary internal world.

Creativity, according to this viewpoint,involves a regression from secondary process thought to primary process thought. This type of regression involves a suspension of the filtering and inhibiting mechanisms of secondary process thought, so that the individual can make a controlled return to primary process thought. Kris (1952) states that a creative insight has to occur at the primary process level, because of the fluidity and the flexibility of primary process thought. This fluidity and flexibility allows the primary process mode a much greater ability in finding a solution to the creative problem, than does the secondary process mode, which is bound by logical, analytical constraints.

The extension that Ornstein makes concerning the Freudian theory of creativity is in regard to the lateralization of primary process thought and secondary process thought. Primary process thought is lateralized in the right cerebral hemisphere, while secondary process thought is lateralized in the left cerebral hemisphere. The creative insight, therefore, always occurs in the right cerebral hemisphere.

Ornstein (1973) cites a case study that demonstrates the relationship between the cerebral hemispheres and Freud's dichotomy of primary process thought and secondary process thought. The individual discussed in the case study had her corpus callosum severed in a surgical procedure used to cure extreme cases of epilepsy. In effect, her two hemispheres were disconnected and could not exchange information.

> Sperry demonstrated the Freudian conflict that occurs when the right hemisphere gets emotional input that the verbal hemisphere does not. He showed a photograph of a nude woman, among a series of otherwise dull pictures, to the right hemisphere of a patient. At first the woman said that she saw nothing, but she immediately flushed, squirmed, and looked uncomfortable. Her conscious or verbal half was unaware of what had caused her emotional turmoil. All she knew was that something unusual was occurring in her body. Her words showed that the emotional reaction had been "unconscious" or unavailable to her language apparatus. Finally, she told Sperry that he had a very peculiar machine (Ornstein, 1973, p. 91).

CHAPTER III

METHOD

This study sought to explore the relationship between creative ability, mental imagery ability, and cerebral dominance. A description of the methodology involved is presented in the ensuing chapter.

Subjects

The subjects for the present study were sixty-six undergraduate students enrolled in classes offered by the Psychology Department of Columbia State Community College, Columbia, Tennessee. Subjects had the option of participating in this research study, in lieu of an equal number of hours toward participation in a required special interest project. Forty-eight of the subjects were female, while eighteen subjects were male. The age of the subjects ranged from eighteen to fifty-five. A copy of the informed consent statement is provided in Appendix A.

Instrumentation

1. Imaginary companion:

This measure was administered to the subject in a face-to-face interview with the experimenter. The subject was simply asked: Did you ever have an imaginary companion or play-mate, when you were a child? A frequency count was kept of the responses by the experimenter during the study.

2. Imaginal Processes Inventory (Singer and Antrobus, 1970):

This inventory required the subject to respond to 344 items. Each item was rated on a five point continuum. For example, on an

item measuring Daydream Frequency, the subject responded on a five point continuum, ranging from "infrequently" to "many different times during the day." The inventory consists of twenty-eight scales; twenty-two of which deal with imagery and daydreaming, while six scales deal with personality variables related to daydreaming.

Singer (1972) states that there are three major styles of imagery, that are measured by the Imaginal Processes Inventory. These three major styles are: The Positive-Vivid style, the Neurotic-Anxious Absorption style, and the Obsessional-Emotional style. Only those six scales which comprise the Positive-Vivid style were used in this study. Those six scales were Visual Imagery in Daydreaming; Absorption in Dadydreaming; Frequency of Daydreaming; Accpptance of Daydreaming; Future Orientation in Daydreaming; and Positive Reactions in Daydreaming.

All but one of the twenty-eight scales have twelve items to the scale. Cronbach's alpha, a measure of the internal consistency and reliability of each scale, was .75 or above for all but three of the scales. A majority of the scales had a reliability of .80 or better. Since factor analysis was used to determine the scales, validity was not reported. A verbatim copy of the scales used is provided in Appendix B.

3. Bett's Questionaire on Mental Imagery (Sheehan, 1967):

This test purports to measure the vividness of mental imagery. The subject was asked to imagine individual objects, such as a red automobile and then rate the vividness of the image. The subject rated

the image on a seven point scale, with a one indicating a perfectly clear image and seven indicating no image at all. This test contains thirty-five items, each of which the subject is asked to rate on a seven point scale. The Betts Questionnaire has a test-retest reliability of .72-.75 and an inter-item reliability, as measured by Cronbach's alpha, of .90-.94 (Westcott and Rosenstock, 1976). The determination of the validity of self-report questionnaires presents many problems. Since there is no adequate neurophysiological measure of the vividness of imagery an individual is experiencing, there can be no criterion-related method of validating the Betts test. However, the Betts test does have a positive relationship with a number of other self-report questionnaires that purport to measure the vividness of mental imagery (Rehm, 1973; Starker, 1974). A verbatim copy of this instrument is in Appendix C.

4. Annett's Handedness Questionnaire (Annett, 1970):

This is a twelve item questionnaire that attempts to assess the degree of handedness of the subject. There is a great deal of controversy in the field of neuropsychology as to the relationship between handedness and cerebral hemispheric usage. The problem centers around the degree to which handedness indicates hemispheric usage in certain cognitive and motoric processes. Dimond (1972) summarizes the conventional view of this relationship:

> The traditional view holds that the hemisphere which relates to the preferred hand is the one which predominates in its functions. Taken to the extreme, the argument holds that one hemisphere overshadows the functions of the other; it dominates and directs, whereas the other one is subordinate (p. 188).

The traditional view takes the position that there is a dominant hemisphere, that generally controls cognitive and expressive functions.

This concept of cerebral dominance appears to have some foundation with people who are clearly right handed. However, left handed people, who make up between 6 per cent and 10 per cent of the population (Groden, 1969), lack this division of neural functions. The same is true of people who are ambidextrous. With some left handed people and some people who are ambidextrous it is not possible to say that one hemisphere is truly dominant. All it is possible to say is that people who are left handed will tend to use the right hemisphere more in cognition.

In an attempt to control for this problem, Beaumont (1974) suggests a different scoring procedure for the Annett Handedness Questionnaire, than the one suggested in the manual. In the manual, handedness is determined by a simple majority of responses to items, such as which hand the subject uses to hammer, write letters, or deal cards. Beaumont suggests that subjects be classified as right handed when they check that they use their right hand on eight or more of the twelve items. All other subjects will be classified as being non-right handed.

The Beaumont (1974) scoring procedure for classifying individuals into either right handers or non-right handers was the procedure used in this study. Any subject, who checked that they use their right hand on eight or more of the twelve item test, was classified as being right handed. All other subjects were scored as being non-right handed.

Annett (1970) does not report overall reliability or validity scores for the Annett Handedness Test. However, as Beaumont (1974) points out, the only other handedness measure on the market does have demonstrated criterion-related validity to the Annett questionnaire. A verbatim copy of this measure is provided in Appendix D.

5. Eye dominance:

Many of the same problems that occur in the literature concerning hand dominance are also present in the literature concerning eye dominance. As with handedness, eye dominance can only be assumed to be associated with cerebral dominance.

As with handedness, the vast majority of individuals indicate a preference for the use of one eye, in activities that dictate the use of just one eye. Ninety three per cent of the population has a dominant eye in activities that call for monocular functioning (Rubin and Walls, 1969). Eighty per cent of those who have a dominant eye will have a right dominant eye. Most researchers in this area agree that the eye that is dominant in monocular activities will be the leading or sighting eye in binocular activities. The sighting eye is the eye that first focuses on the object in perceptual situations.

Though there are not any diagnostic procedures that are widely used to determine the dominant eye, Rubin and Walls (1969) recommend using a series of questions to delineate which eye is dominant in monocular activities. This researcher used a series of questions recommended by Rubin and Walls. A verbatim copy of these questions is provided in Appendix E.

6. Lateral eye-shifting:

This is another purpoted measure of hemispheric involvement in certain cognitive processes. In many respects, it is apparently a better measure of cerebral hemispheric involvement than eye dominance or handedness. The reason for this is that lateral eye-shifting is a direct and observable response. The assumptions that underlie handedness and eye dominance are

not necessary with eye-shifting. As Singer (1975) points out, when a subject shifts their eyes in a certain direction, in response to a question, the researcher has a documented cue as to what hemisphere is controlling the cognitive processes at that moment.

Bakan (1969) completed the first research in the area of lateral eye-shifting and its relationship to cognitive variables. Bakan demonstrated a positive, significant relationship between left eye-shifting and hypnotic susceptibility. The relationship between left eye-shifting and a self-report scale of image clarity approached significance (significant at .10 level).

Meskin and Singer (1974) criticized Bakan's study on the grounds that it did not use independent raters to judge the direction of the eye-shifting. Using independent judges with an inter-rater reliability of .87, Meskin and Singer (1974) replicated much of Bakan's study. These researchers used the Imaginal Processes Inventory and the Byrne Repression-Sensitization Scale in order to ascertain the degree of a personality variable termed inner attentiveness. Meskin and Singer (1974) define inner attentiveness as:

> A personality style characterized by considerable sensitivity to private affective, imagery or fantasy content (p.69).

Inner attentiveness correlated significantly with lateral eye-shifting. High inner attentive subjects were significantly more left eye-shifters. Low inner attentive subjects were significantly more right eye-shifters. Meskin and Singer also found a significant correlation between inner attentiveness and a self-report scale of imagery vividness. Again, those who scored as high inner attentives were significantly more likely to report highly vivid imagery. Unfortunately, there was no reported correlation for the relationship between vividness of imagery and lateral eye-shifting.

In devising a measure of lateral eye-shifting, this writer used questions devised by Meskin and Singer and Bakan, which called for an extended memory search by the subject. The reason for using this type of question is best answered by Meskin and Singer:

> Both groups (right eye-shifters and left eye-shifters) shifted in their directional preference more for extended search questions than for minimal search questions (p.70).

This writer used seven questions (Bakan used five, while Meskin and Singer used four). This researcher also used Meskin and Singer's research procedure in measuring the eye-shifting of the subjects. This procedure called for the experimenter to ask the stimulus questions in a face-to-face interview with the subject. A camera recorded the proceedings. Two independent judges later reviewed and rated the eye-shifting, as either left eye-shifts or right eye-shifts. The subjects were rated as having either left eye-shifting or right eye-shifting, based on the way they shifted a majority of the time. A verbatim copy of the stimulus questions are provided in Appendix F.

7. Remote Associates Test (Mednick and Mednick, 1967):

This is a thirty item test, designed to measure creative ability. Mednick has hypothesized that creative ability involves making associations between previously remote elements. An example of this type of creative problem solving would be Gutenberg's invention of the printing press. Gutenberg was able to mentally associate the letter seal with the mechanism of the wine press. He brought together two remote elements, which when combined, enabled Gutenberg to invent the printing press.

In an attempt to measure the ability to associate remote elements, Mednick has designed a test of word association ability. The subject is presented with three words and is asked to come up with a fourth word that can be logically associated with the three stimulus words. For example,

the subject is presented with the words: blue, rat and cottage. The correct answer or association would be cheese. Mednick claims that the answers are statistically unlikely associations.

Validity was assessed by a criterion-related method. The criterion for validity was two groups of nominated creatives: a group of twenty architecture students, nominated by their instructors for their creative ability and a group of forty-three graduate students in psychology, who were also nominated for their creativity. Validity for the architecture students was established at .70 and the validity for the psychology students was as .55 (Cronbach, 1970). Test-retest reliability was reported at .92 (Mednick, 1967).

A verbatim copy of the test booklet is provided in Appendix G.

8. Barron-Welsh Art Scale (Welsh, 1959):

This is an eighty-six item test of creative ability. This creativity test is based on research findings by the authors (Barron, 1952; Barron, 1953; Barron and Welsh, 1952), that creative artists tend to prefer geometric figures, which are comples, assymetrical and ambiguous. Although it is not completely clear as to why creative artists prefer complex and ambiguous figures, Barron (1963) hypothesizes that artists prefer figures and situations that are disordered. They prefer disorder because it allows them to bring their own kind of order to the figure or situation, instead of having to conform to ordering completed by someone else.

The test items range from simple geometric shapes to complex patterns. The subject simply indicates whether they like or dislike the figure. Test-retest reliability was reported at .80 (Wrightsman, Wrightsman, and Cook; 1964). Welsh gave the test to eleven different groups of nominated creative individuals from various professions, requiring a high degree of

creative ability. Though the following is not the best way to determine and report criterion-related validity, it is the way that Welsh presents his results (Welsh, 1975):

> For each of the groups discussed above, means on the BW Art Scale were higher on the average than the mean for people-in-general. In one assumes a 50-50 statistical probability for each difference falling in this direction, then the combined probability for all eleven groups having means higher than people-in-general is one chance in 2048 (p.239).

Though the Barron-Welsh Art Scale has not been validated to the degree that this researcher would prefer, it does remain as the only widely used nonverbal test of creative ability. A verbatim copy of this instrument is provided in Appendix H.

9. Alternate Uses Test (Christensen, Guilford, Merrifield, and Wilson, 1960):

This is a nine item test designed to measure creative ability. It is based on Guilford's Structure of Intellect model. This is a three dimensional model of intellectual abilities based on the factor analytic work completed by Guilford and his associates. There are a total of 120 different possible intellectual factors represented in the model. The three major dimensions are called operations, products, and contents. The operations dimension is the most important dimension for this study, since it includes the divergent production factors. The divergent production factors are the primary intellectual factors which constitute creative ability. Divergent production requires the individual to produce their own unique answers or solutions to a problem solving situation. Divergent production contrasts with convergent production,

which requires the individual to choose one correct answer or solution from a variety of possible answers or solutions. There are seventeen different divergent production factors in the Structure of Intellect model.

The Alternate Uses test purports to measure one of these seventeen divergent production factors: spontaneous semantic flexibility. The measurement of this factor is done by asking the subject to list unusual uses for nine common objects. Some of the objects listed by the test are: a rubber tire, a chair and a wooden pencil. The subject must list unusual uses for these objects and not the common uses. The test is timed and the subject must list as many possible uses for the objects within the twelve minute time period. The test is scored by simply counting the number of acceptable unusual uses for the nine listed objects.

Alternate forms reliability was listed at between .68 to .81 (Guilford, Merrifield, and Cox, 1961). Validity was established through a factor analysis completed by Guilford and his associates. A verbatim copy of this instrument is provided in Appendix I.

Procedure

A nine-by-nine Latin square design was used to determine the order of test presentations. The Latin square design was used to minimize any order effect, due to the order of the test presentations.

All the measures were paper and pencil tests, with the exception of the eye-shifting measure. The paper and pencil tests were administered in small group settings. The eye-shifting measure was administered by having the subjects taken individually to a videotape room, where they were asked the stimulus questions necessary for that measure.

Analysis of the Data

A correlation matrix was provided for all tests that were administered to this sample. The Pearson Product moment r, point biserial r and the phi correlation were used in computing this correlation matrix. The sex and the age of the subject were included in this analysis, in order to ascertain whether either of these two variables might be confounding the relationships in the matrix.

A factor matrix was also provided for all tests that were administered to this sample. The principal factors solution with a varimax rotation was used in obtaining this matrix. Age and sex were also included in this analysis.

Since age was demonstrated to have a significant relationship to one of the creativity tests, further analysis of the data was completed for a subsample of this study. This subsample was taken from the total sample, because they formed a relatively stable group with respect to age.

The correlation matrix for the stable age group included the use of the Pearson product moment r, point biserial r, and the phi correlation in computing this correlation matrix. The factor matrix for the stable age group was computed by the principal factors solution with a varimax rotation.

The inter-rater reliability for the eye-shifting measure was computed by using coefficient alpha.

CHAPTER IV

RESULTS

The following chapter presents the results of the present study in both a verbal manner and a statistical manner. The hypotheses, which were formulated at the outset of this study, are listed in this chapter as a guide for the reader. These hypotheses are:

1. There will be a positive relationship between left eye dominance and creative ability.

2. There will be a positive relationship between left-eye shifting and creative ability.

3. There will be a positive relationship between non-right handedness, as measured by the Annett Handedness Questionnaire, and creative ability.

4. There will be a positive relationship between having an imaginary playmate in early childhood and creative ability.

5. There will be a positive relationship between imagery vividness and creative ability.

6. There will be a positive relationship between the Positive-Vivid factor of the Imaginal Processes Inventory and creative ability.

Table 1 is a correlation matrix for all the variables presented to the total sample of sixty-six subjects. All positive correlations in this table are presented in the directionality of the hypotheses. For instance, the positive relationship between handedness and the Alternate Uses test in Table 1 is indicative of a positive relationship between non-right handedness and a creativity test. However, none of the correlations which measured the original hypotheses were significant. A number of

Table 1

Correlation Matrix for the Total Sample

	Eye Shifting	Handedness	Eye dominance	Alternate Uses	Remote Associates	Barron-Welsh	Betts Imagery	Playmate	IPI	Day. Freq.	Vividness of Vis.	Age	Sex
Eye-Shifting	1.0000	0.1389	-0.1314	0.0092	-0.1294	0.1187	-0.3288*	-0.0757	-0.2452*	-0.0689	-0.3765*	-0.0445	0.1329
Handedness	0.1389	1.0000	0.0416	0.1903	-0.0210	0.0986	-0.0772	0.2875*	0.0075	0.1362	-0.1745	-0.1867	-0.0642
Eye-dominance	-0.1314	0.0416	1.0000	0.1455	0.0249	-0.1574	-0.2359	0.2183	0.1436	0.0559	0.0269	0.0097	0.2433*
Alternate Uses	0.0092	0.1903	0.1455	1.0000	0.2461*	-0.2099	-0.1372	-0.0229	0.0279	-0.0455	0.0673	0.3323*	0.1888
Remote Associates	-0.1294	-0.0210	-0.0249	0.2461*	1.0000	-0.0965	0.0535	-0.0365	-0.0659	-0.1734	0.0226	0.2099	0.0457
Barron-Welsh	0.1187	0.0986	-0.1574	0.2099	-0.0965	1.0000	0.0704	0.0059	0.1024	0.1819	0.0237	-0.2721*	-0.0796
Betts Imagery	-0.3288*	-0.0772	-0.2359	-0.1372	0.0535	0.0704	1.0000	0.0119	0.1438	-0.1067	0.3274*	0.0886	0.0011
Playmate	-0.0757	0.2875*	0.2183	-0.0229	-0.0365	0.0059	0.0119	1.0000	0.0722	-0.0278	0.1469	-0.0218	-0.0404
IPI	-0.2452*	0.0075	0.1436	0.0279	-0.0659	0.1024	0.1438	0.0722	1.0000	0.5961*	0.6200*	-0.1406	0.0096
Day. Freq.	-0.0689	0.1362	0.0559	-0.0455	-0.1734	0.1819	-0.1067	-0.0278	0.5961*	1.0000	0.2516*	-0.3644*	-0.1134
Vividness of Vis.	-0.3765*	-0.1745	0.0269	0.0673	0.0226	0.0237	0.3274*	0.1469	0.6200*	0.2516*	1.0000	0.0463	0.0390
Age	-0.0445	-0.1867	0.0097	0.3325*	0.2099	-0.2721*	-0.0886	-0.0218	-0.1406	-0.3644*	0.0463	1.0000	0.1841
Sex	0.1329	-0.0642	0.2433*	0.1888	0.0457	-0.0796	0.0011	-0.0404	0.0096	-0.1134	0.0390	0.1841	1.0000

*$p < .05$

significant relationships were found in this matrix. As far as the study of creativity is concerned, the most important of these correlations is the highly significant relationship between age and the Alternate Uses test of creative ability. Age also had a positive relationship, which approached significance, with the Remote Associates test of creative ability. On the other hand, age did have a significant inverse relationship with the Frequency of Daydreaming subscale of the Imaginal Processes Inventory.

Another significant correlation was found between the Alternate Uses test and the Remote Associates test. The third creativity test, the Barron-Welsh, did not have a positive relationship with either of the other two creativity tests listed in Table 1.

Left eye-shifting had a significant inverse relationship with the Betts Test of Mental Imagery, which is the exact opposite of the viewpoint taken by Ornstein in regard to the lateralization of cognitive processes. Left eye-shifting also had a significant inverse correlation with the Imaginal Processes Inventory. In particular left eye-shifting had a highly significant inverse relationship with the Vividness oof Visual Imagery subscale of the IPI. Eye-shifting did not have a significant relationship with either handedness or eye dominance. There were no significant relationships among any of the measures of cerebral dominance.

There was a significant correlation found between the Betts Test of Mental Imagery and the Vividness of Visual Imagery subscale of the IPI. Having an imaginary playmate did not have a significant correlation with any of the other tests which measured imagery. Having an imaginary playmate did have a positive relationship with non-right handedness.

Table 2 presents a Factor matrix for the data presented in Table 1. This matrix was obtained on the basis of a principle factors solution rotated to simple solution on the basis of a Varimax rotation. The first factor in this matrix is heavily loaded with mental imagery variables. In particular, the first factor could be called a vividness of mental imagery factor. It should be noted that left eye-shifting (right cerebral dominance) had a fairly strong inverse loading on this factor. Factor 2 in this matrix also appears to be a mental imagery factor, but of a somewhat different nature than Factor 1. This factor is characterized by the frequency of mental imagery and in particular the frequency of daydreaming. Factor 3 could be called a verbal creativity factor, with the Alternate Uses test and the Remote Associates test loading on this factor. Age also had a strong loading on this factor. The Barron-Welsh test of nonverbal creative ability had a strong negative loading on this factor. Factor 4 would seem to be an eye dominance factor with no other variables loading very strongly on this factor. Factor 5 is the handedness factor with the variable imaginary playmate loading on this factor. Factor 6 is the left eye-shifting factor with no other variables loading very strongly on this factor. It should be noted that eye-shifting had a negative loading on the first factor, but a positive loading on the second factor. The negative loading indicates that right eye-shifting has a positive relationship with imagery vividness, while the positive loading indicates that left eye-shifting had little relationship with any other variable.

Table 2

Factor Matrix for the Total Sample

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
Eye-Shifting	-0.30079	-0.04239	-0.13801	-0.08799	0.03757	0.85227
Handedness	-0.16063	0.14042	0.00620	-0.07792	0.86254	0.06937
Eye Dominance	-0.03209	0.08551	0.06126	0.87727	0.11715	-0.05154
Alternate Uses	-0.01098	0.16163	0.72788	0.07085	0.17319	0.13278
Remote Associates	0.01592	-0.08835	0.36040	-0.06448	-0.00255	-0.09762
Barron-Welsh	0.07036	0.09984	-0.34056	-0.17642	0.09368	0.08861
Betts Imagery	0.41247	-0.18046	-0.08039	-0.24220	-0.00212	-0.25978
Playmate	0.14151	-0.08718	-0.07148	0.21556	0.38300	-0.05527
IPI	0.60547	0.55517	-0.07432	0.12246	0.03646	-0.04912
Day. Freq.	0.11883	0.90284	-0.25933	0.00252	0.03438	-0.02907
Vividness of Vis.	0.85553	0.17744	0.07859	0.04878	-0.03629	-0.11710
Age	0.03367	-0.23285	0.55991	0.06903	-0.16888	0.06628
Sex	0.08476	-0.07588	0.20848	0.24282	-0.06117	0.22516

Since the results presented in Table 1 and Table 2 indicated a significant relationship between age and the Alternate Uses test of creative ability, a further analysis of the data was undertaken, in order to control for the effects of age on creativity. For this further analysis, thirty-one subjects, who were between the ages of eighteen and twenty-one, were selected to form a subsample. These thirty-one subjects were selected because they formed a relatively stable subsample with respect to age. Separate analyses were run on these subjects, with the results presented in Table 3 and Table 4.

Table 3 presents the correlation matrix for all the variables presented to this subsample, which will hereafter be called the college age group. Two variables were not presented in Table 3. Eye dominance was not presented because the distribution was too negatively skewed. Age was not presented in view of the fact that all subjects were relatively similar in age.

The most significant finding, with respect to the hypotheses of this study, is the occurrence of a significant positive correlation between non-right handedness and the Alternate Uses test of creativity. Left eye-shifting (right hemispheric dominance) had a positive relationship, which approached significance, with the Alternate Uses test. Daydreaming frequency had a positive relationship with the Alternate Uses test, which also approached significance. There were, however, no significant correlations among any of the three creativity tests.

Table 3

Correlation Matrix for the College Age Group

	Eye Shifting	Handedness	Alternate Uses	Remote Associates	Barron-Welsh	Betts Imagery	Playmate	IPI	Day. Freq.	Vividness of Vis.	Sex
Eye Shifting	1.0000	0.1660	0.3401	-0.1427	0.0224	-0.5565*	-0.1600	-0.4185*	-0.2005	-0.5444*	0.2411
Handedness	0.1660	1.0000	0.3680*	-0.0993	-0.0608	-0.2716	0.3815*	-0.2905	0.0616	-0.4380*	-0.1789
Alternate Uses	0.3401	0.3680*	1.0000	-0.0555	-0.1660	-0.0496	-0.0471	0.0366	0.3449	-0.0651	0.0452
Remote Associates	-0.1427	-0.0993	-0.0555	1.0000	0.0985	0.0437	0.1064	-0.0308	0.1310	0.0227	0.2014
Barron-Welsh	0.0224	-0.0608	-0.1660	0.0985	1.0000	-0.1163	-0.2906	-0.0668	0.1679	-0.1157	0.0256
Betts Imagery	-0.5565*	-0.2716	-0.0496	0.0437	-0.1163	1.0000	0.0088	0.3478	-0.0747	0.5676*	-0.1454
Playmate	-0.1600	0.3815*	-0.0471	0.1064	-0.2906	0.0088	1.0000	-0.1115	-0.1585	-0.0706	-0.0651
IPI	-0.4185*	0.2905	0.0366	-0.0308	-0.0668	0.3478	-0.1115	1.0000	0.4309*	0.4930*	0.1044
Day. Freq.	-0.2005	0.0616	0.3449	0.1310	0.1679	-0.0747	-0.1585	0.4309	1.0000	0.1406	0.0030
Vividness of Vis.	-0.5444*	-0.4380*	-0.0651	0.0227	-0.1157	0.5676*	-0.0706	0.4930*	0.1406	1.0000	0.1013
Sex	0.2411	-0.1789	0.0452	-0.2014	0.0256	-0.1454	-0.0651	0.1044	0.0030	0.1013	1.0000

*$p < .05$

Table 4

Factor Matrix for the College Age Group

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
Eye-Shifting	0.71639	0.02301	0.12938	0.68330
Handedness	0.47419	0.29270	-0.64346	-0.10715
Alternate Uses	0.10023	0.55232	-0.26149	0.37538
Remote Association	-0.01459	0.02493	0.03990	-0.27960
Barron Welsh	0.19401	0.05593	0.42816	-0.23882
Betts Imagery	-0.66871	-0.10751	-0.10295	-0.08508
Playmate	0.03251	-0.09622	-0.54376	-0.15991
IPI	-0.60514	0.32055	0.14824	0.00751
Day. Freq.	-0.12567	0.90535	0.23658	-0.22585
Vividness of Vis	-0.82526	0.02504	0.08408	0.05289
Sex	-0.02442	0.02357	0.19258	0.34735

There was a significant inverse relationship between left eye-shifting and the Betts Test of Mental Imagery. There was also a significant inverse relationship between left eye-shifting and the Imaginal Processes Inventory. The Vividness of Visual Imagery subscale of the IPI had a significant inverse relationship with left eye-shifting.

Non-right handedness had a significant inverse relationship with the Vividness of Visual Imagery subscale of the IPI. Non-right handedness also had a significant relationship with having an imaginary playmate in early childhood. Handedness did not have a significant relationship with eye-shifting.

The Vividness of Visual Imagery subscale of the IPI had a highly significant positive relationship with the Betts Test of Mental Imagery. The Imaginal Processes Inventory and the Betts Test of Mental Imagery had a positive relationship, which approached significance.

The major differences between Table 1 and Table 2 appear to have occurred as a result of the variable, age, no longer being a factor in Table 2. In Table 1 the variable, age, appears to have confounded the effects of the Alternate Uses test of creative ability, particularly in its relationships with Daydreaming Frequency and eye-shifting. The correlation between handedness and the Alternate Uses test also increased sharply in Table 2, as compared to Table 1. The correlation between handedness and the Vividness of Visual Imagery subscale of the Imaginal Processes Inventory also dramatically increased in Table 2, when compared to Table 1.

Table 4 presents a Factor matrix for the college age group. The Factor matrix listed in Table 4 was obtained by the principle factors solution with a Varimax rotation.on all the variables presented to this subsample with the exception of age and eye dominance. Factor 1 of this matrix could be termed the vividness of mental imagery factor. The Betts Test of Mental Imagery and the Imaginal Processes Inventory both have strong loadings on this factor. The Vividness of Visual Imagery subscale had a very strong loading on this factor. Left eye-shifting and non-right handedness had inverse loadings with respect to the vividness of imagery variables in Factor 1. Factor 2 could be termed the Frequency of Daydreaming factor, since the Daydreaming variable has a very strong loading on this factor. The Alternate Uses Test has a strong loading on this factor. Factor 3 could be called the Handedness factor. As demonstrated in this factor non-right handedness has a positive relationship with having an imaginary playmate in early childhood. Both of these variables have strong loadings in the same direction on Factor 3. The Barron-Welsh had an inverse loading with respect to non-right handedness on this factor. Factor 4 is the eye-shifting factor. The Alternate Uses Test has a fairly strong loading on this factor.

The major differences between the factor analysis completed for the total sample and the factor analyis completed for the college age group subsample involve the handedness variable, the daydreaming

frequency variable, the eye-shifting variable, and the Alternate Uses test of creative ability. In Table 2 these variables tended to load on separate factors, while in Table 4 they were compressed into similar factors. In particular, dropping out the age variable, seems to have made the Daydream Frequency variable, the Alternate Uses variable, the handedness variable, and the Imaginal Processes Inventory variable, all load on Factor 2. Dropping out the eye dominance variable seems to have resulted in one less factor in the factor matrix.

Table 5 presents the inter-rater reliability coefficient for the two raters, who judged the eye-shifting responses for all of the subjects who participated in this study.

Table 5

Eye-shifting

VARIABLE RATED	r
Eye-Shifting	.83

CHAPTER V

DISCUSSION

The present study was designed to measure the relationship between creative ability, mental imagery ability and cerebral dominance. Certain hypotheses were formulated at the outset of the study. These hypotheses, with the findings which pertain to each of the hypotheses, are discussed in this section.

Hypotheses 1. There will be a positive relationship between left eye dominance and creative ability.

As the findings in all the tables listed in the Results Section indicate, there was not a positive relationship between left eye dominance and creative ability. However, the distribution of scores on the eye dominance measure may have been a factor in the lack of any positive relationship between left eye dominance and creative ability. Only nine out of sixty-six subjects in this study had left eye dominance. Statistically, at least fifteen subjects should have had left eye dominance if the sample was to accurately reflect the general population.

Any interpretation based on the results of such a poor distribution would have little external validity. A better distribution of eye dominance is needed before this hypotheses can be adequately explored.

Hypotheses 2. There will be a positive relationship between left eye-shifting and creative ability.

Though the correlation between left eye-shifting and creative ability did not reach significance in the total sample, it did approach significance when the age of the subjects was stable. In particular, the factor analysis completed for the stable age group showed that the Alternate Uses

creativity test and left eye-shifting had substantial loadings on the same factor: Factor 4.

The distribution of right eye-shifters versus left eye-shifters was not what other researchers have reported. Most studies have shown a roughly equal distribution or a slightly skewed distribution in the direction of right eye shifting. This study, in the total sample, clearly had a skewed distribution toward left eye-shifting. The stable age group also had a slight skewing toward left eye-shifting.

Though there is some reason to suspect a positive relationship between left eye-shifting and creative ability, the only safe conclusion that can be made from this study is that other research must be undertaken in order to establish the relationship between creative ability and left eye-shifting.

Some mention should be made of the serendipitous relationship between left eye-shifting and mental imagery. One of the strongest relationships found in this study was the inverse relationship between left eye-shifting and vividness of mental imagery. This relationship was significant when either the Imaginal Processes Inventory or the Betts Test of Mental Imagery was correlated with left eye-shifting. It was highly significant when the Vividness of Visual Imagery subscale of the IPI was correlated with left eye-shifting. This inverse relationship remained relatively stable across all age groups. It was also evident in the weightings of the two imagery test scores and the eye-shifting scores in the Factor Analysis. Both major imagery test and the eye-shifting measure had substantial loadings of Factor 1 in both Factor Analysis Tables listed in the Results section.

The findings of an inverse relationship between left eye-shifting and mental imagery is in complete opposition to the theories of Ornstein (1973) and Singer (1975). Both Singer and Ornstein state that individuals who demonstrate more right hemispheric functioning should have a greater use of mental imagery.

On the other hand, the finding of a negative relationship between imagery ability and right hemispheric usage has been implied by other researchers. A number of researchers have demonstrated a negative relationship between right hemispheric usage and performance on tests of visual and spatial abilities (Silverman et al, 1966; James et al, 1967; Levy, 1969).

What the present study appears to indicate is that it is not just spatial task functioning that is different, but the total act of perceiving that is different for those who have right hemispheric usage versus those who have left hemispheric usage.

Hypothesis 3. There will be a positive relationship between non-right handedness, as measured by the Annett Handedness Questionaire, and creative ability.

This hypothesis was not confirmed in the total sample. As stated previously, there was a significant, positive relationship between creative ability and age in the total sample. When the age of the subjects remained relatively stable, a significant, positive relationship between non-right handedness and creative ability was found. A somewhat similar relationship was also found in the loadings of handedness and the Alternate Uses Test on Factor 2 in the Factor Analysis Table for the stable age group.

The distribution of scores for handedness in the total sample was was not what has been reported by other researchers. Approximately 75 per cent of the general population is right handed, 15 per cent is ambidextrous, and 10 per cent is left handed. In the total sample only twelve subjects reported that they were non-right handed. This is a little short of the expected distribution. However, the college age group had eight individuals, who reported that they were non-right handed. This sample does reflect the expected distribution.

At first blush the results of the college age group would appear to provide support for the hypothesis that the right hemisphere is the hemisphere involved in the creative process. Non-right handedness and left eye-shifting did have a positive relationship with the Alternate Uses test of creativity. Certainly, one interpretation of these results could be that the creative process is lateralized in the right hemisphere. This interpretation would conform to Ornstein's theory that the right hemisphere is the creative hemisphere, while the left hemisphere is the analytical hemisphere.

However, there are a number of indications that left-handers and ambidextrals have little or no lateralization of neural functioning in the traditional sense of the concept. Zangwill (1960), Levy (1969), and Hecaen and Sauget (1971), all present evidence which indicates that left-handers and ambidextrals do not have clear cut lateralization of speech or other major cognitive functions. Though there are different conclusions that may be drawn from this research finding, one hypothesis is that left-handers and ambidextrals are more likely to use and integrate both cerebral hemispheres. Right-handers are more likely to use just the left hemisphere.

Bogen and Bogen (1976) hypothesize that the individual who is able to integrate both cerebral hemispheres will be more likely to be creative. Therefore, another interpretation of the results of this study would be that left-handers and ambidextrals are better able to use and integrate their cerebral hemispheres. The non-right handed group tends to utilize both cerebral hemispheres in dealing with problem solving situations. The right handed group tends to use just one hemisphere.

Hypothesis 4. There will be a positive relationship between having an imaginary playmate in early childhood and creative ability.

The present study did not demonstrate a positive relationship between having an imaginary playmate and creative ability. This finding does conflict with an earlier research finding by Schaefer (1969), which demonstrated a positive relationship between having an imaginary playmate in childhood and creative ability.

The distribution of subjects reporting to have had an imaginary companion was similar to what other researchers have recorded. Approximately 30 per cent of the subjects in the present study reported that they had an imaginary playmate in childhood. This finding adequately reflects the expected distribution of scores on this measure.

The only variable that had a significant, positive relationship with having an imaginary playmate was non-right handedness. This finding was the same across all age groups. Since mental imagery in general had an inverse relationship with left eye-shifting and non-right handedness the interpretation of the above result, concerning the imaginary companions, is beyond the grasp of this writer.

Hypothesis 5. There will be a positive relationship between imagery vividness and creative ability.

As the results in all the tables listed show, imagery vividness, as measured by the Betts Questionaire, did not have a positive relationship with creative ability. Since the distribution of test scores for imagery vividness was relatively normal, the interpretation of these results must be that this aspect of imagery ability does not contribute to the creative process.

These results somewhat contradict the theories of Koestler (1965) and Barron (1963), which were cited earlier in this study. Both theories state that the ability to visualize images, as well as the ability to combine images into new creations is the essential aspect of the creative process. The results of the present study indicate that the ability to vividly visualize images is not an essential aspect of the creative process.

Hypothesis 6. There will be a positive relationship between the Positive-Vivid factor of the Imaginal Processes Inventory and creative ability.

The results of the tests, which measured this factor, indicated that the Positive-Vivid factor did not have a positive relationship with creative ability. Since the distribution of scores for the Positive-Vivid factor was relatively normal, the interpretation of these results must be that this type of imagery ability does not make any measurable contribution to the creative process.

When the Positive-Vivid factor was broken down into its six subscales, there were still no positive relationships found in either the total sample or the stable age group. However, one of the six subscales, the Daydream

Frequency scale did approach significance in the stable age group. It also had a strong loading on the same factor, Factor 2, that the Alternate Uses Test loaded on in the Factor Analysis Table for the stable age group.

The Daydream Frequency scale is a measure of how often a person fantasizes and daydreams during their normal routine. There may be some relationship between how frequently one creates a daydream and how frequently one creates a solution to a problem solving situation.

The psychodynamic interpretation of the results of the relationship between Daydream Frequency and creative ability would revolve around the ability to integrate unconscious thinking with conscious thinking. A person who daydreams frequently would have little repression of their unconscious desires. Since they had little repression of unconscious material, this type of person supposedly would be better able to use and integrate their unconscious thinking processes with their conscious thinking processes. As stated previously in this study, there have been a number of studies which have demonstrated a positive relationship between creativity and the ability to use and integrate unconscious thought with conscious thought (Myden, 1959; Hersch, 1962; Garwood, 1964).

Suggestions for Further Research

The most potentially fruitful line of research suggested by this study would be to continue to examine the relationship between creative ability and handedness. A different sample, with a normal distribution of non-right handers versus right handers, is clearly needed before any definite conclusions can be made regarding the relationship between creativity and handedness. The age of the subjects would also need to be stable, since this clearly confounds the relationship between creativity and handedness.

The relationship between creativity and the age of the subject may be another area of research with some potential. This type of study would need a large sample of subjects with an age range that extended from early adulthood into old age. If a curvilinear relationship resulted from this type of study, the findings would help to establish the peak years for creative performance.

The relationship between eye-shifting and creativity may also be another area in which research is needed. Again, the age of the subjects would need to be stable for any results to be considered valid. The distribution of right eye-shifters versus left eye-shifters should be roughly equal in the sample for the study to be valid.

Though the relationship between imagery ability and creative ability did not turn out to be positive, there may be other types of imagery ability that do contribute to the creative process. Certainly, other areas of imagery ability should be explored to determine their relationship with creative ability, particularly daydreaming.

The relationship of cognitive functioning to neural functioning is one of the most crucial research questions in educational psychology and in psychology. In the research, there is a distinct lack of studies comparing handedness with various cognitive abilities. The human species is the only species which has demonstrated a definite hand preference. There must be some reason or event that has produced this phenomenon. In particular, most theorists in the area believe that the development of a complex language brought about the phenomenon of handedness in humans. However, no one has completed any cross-cultural studies of primitive, illiterate humans to ascertain if there are any handedness differences between primitive humans and the so called civilized humans.

In conducting further study in this area, the most useful test instruments would seem to be: The Alternate Uses test of creative ability; the Imaginal Processes Inventory; and the Annett Handedness questionaire. In the factor analyses conducted by this researcher, the communality of the above three tests was found to be consistently higher than the other tests in their respective areas.

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APPENDICES

APPENDIX A

INFORMED CONSENT FORM

This study intends to examine the relationship between creative ability, mental imagery, and cerebral hemispheric usage. Each subject in this study will be completing three tests of creative ability, three tests of mental imagery, and three tests of cerebral hemispheric usage. The total time spent in taking these tests will be approximately four hours. Only the experimenter will know the responses to these tests; the responses will be coded so that no subjects' responses can be identified by name.

There are no expected risks or discomforts, as a results of participation in this study. However, if any subject does experience any negative feeling from participation in this study, they are free to withdraw at any time without penalty. Any question that the subject has concerning the study will be answered by the experimenter at any time during the study.

This study may help those who participate to better understand their own mental processes and their interpersonal behavior. Under these conditions, the subject's signature on this form indicates their willingness and agreement to participate in this study.

Signature_____

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APPENDIX B

SUBSCALE KEYS

IMAGINAL PROCESSES INVENTORY

SCALE 1

DAYDREAMING FREQUENCY

Scale Item #	IPI #	Scoring Direction	Item
1	1	+	I daydream (infrequently - many different times during the day).
2	2	+	Daydreams or fantasies make up (no part - at least 50% of my waking thoughts).
3	3	+	As regards daydreaming I would characterize myself as someone (who never - an habitual daydreamer).
4	5	+	I recall or think over my daydreams (infrequently - many different times during the day).
5	6	+	When I am not paying close attention to my job, a book, or TV, I tend to be daydreaming (0% of the time - 75% of the time).
6	9	+	Instead of noticing people and events in the world around me, I will spend approximately (0% of my time - 50% of my time) lost in thought.
7	10	+	I daydream at work (or school) (infrequently - many different times during the day).
8	14	+	Recalling things from the past, thinking of the future, or imagining unusual kinds events occupies (0% - 50% of my waking day).
9	17	+	I lose myself in active daydreaming (infrequently - many different times during the day).
10	18	+	Whenever I have time on my hands I daydream (never....always).
11	20	+	When I am at a meeting or show that is not very interesting, I daydream rather than pay attention (never....always).
12	24	+	On a long bus or train ride I daydream (never...a great deal of the time).

SCALE 3

ABSORPTION IN DAYDREAMING

Scale Item #	IPI #	Scoring Direction	Item
1	127	-	My daydreams seldom repeat themselves
2	97	+	Some of my daydreams are so striking that I keep on thinking about them after they are over.
3	75	-	I seldom have the same daydream more than once.
4	62	+	I become so affected by my daydreams that they will subsequently determine my mood.
5	104	+	When a child, I would often create a great fantasy world for myself.
6	131	+	My imagination often goes around and around in the same circle.
7	42	+	During a daydream, I sometimes feel a very strong sense of excitement.
8	91	+	When I have an unusually enjoyable daydream, I try to prevent it from coming to an end.
9	35	+	As a child, I was a constant dreamer.
10	88	+	Sometimes my imagination keeps coming back to the same things over and over again, no matter how much I try to change the subject.
11	135	+	A daydream can completely change my mood.
12	38	+	If something is really on my mind, I often brood on it for hours on end.

SCALE 3 (cont'd)

ABSORPTION IN DAYDREAMING

Scale Item #	IPI #	Scoring Direction	Item
13	148	+	I often have the same daydream over and over again.
14	109	+	Sometimes a daydream will make me so upset that I feel like crying.
15	146	+	I often daydream about events that happened over a year ago.
16	119	+	Something that has happened during the day often goes over and over in my mind.
17	63	+	I tend to get pretty wrapped up in my daydreaming.
18	138	+	I feel very emotional during my daydreams.
19	151	+	Some of my daydreams are so powerful that I just can't take my attention away from them.
20	142	+	I often have some kind of emotional reaction to my daydreams which lasts for a long time afterward.

SCALE 4

ACCEPTANCE OF DAYDREAMING

Scale Item #	IPI #	Scoring Direction	Item
1	153	-	Daydreaming in an adult is really childish.
2	177	-	I feel badly about daydreaming because it may indicate a weakness in character.
3	189	+	A really original idea can sometimes develop from a really fantastic day-dream.
4	201	-	Daydreams are unreal and seldom come true.
5	213	-	I feel guilty about my daydreams.
6	223	-	Because daydreaming often takes me away from my work, I try to avoid it even when I have no specific task to complete.
7	234	-	The fewer daydreams one has, the more time there is to really "live."
8	246	-	Daydreams accomplish nothing more than a temporary escape and just avoid things that must be done.
9	256	-	Daydreaming never solves any problems.
10	268	+	Daydreaming is a common experience for great scientists and artists as well as for the average person.
11	165	+	Daydreaming is normal for adults as well as for adolescents and children.
12	280	+	I find my daydreams are worthwhile and interesting to me.

SCALE 5

POSITIVE REACTIONS IN DAYDREAMING

Scale Item #	IPI #	Scoring Direction	Item
1	27	+	I can be aroused and excited by a daydream.
2	30	+	A "happy" daydream helps me "snap out of" a spell of unhappiness.
3	40	+	My daydreams are often stimulating and rewarding.
4	48	+	My daydreams often cheer me up when I feel blue.
5	53	+	Sometimes a thrill goes up my spine as I reflect on a great amount of triumph and achievement.
6	68	+	I often relive happy or exciting experiences in my daydreams.
7	77	-	My daydreams often leave me with feelings of sadness.
8	82	+	A daydream can bring a smile to my face.
9	95	+	I usually feel content and quite excited after a daydream.
10	110	+	Daydreams are more likely to arouse pleasant than unpleasant emotions within me.
11	124	+	My daydreams often leave me with a warm, happy feeling.
12	140	+	My fantasies usually provide me with pleasant thoughts.

SCALE 7

VISUAL IMAGERY IN DAYDREAMS

Scale Item #	IPI #	Scoring Direction	Item
1	161	-	The "scenes" in my daydreams are sort of fuzzy and unclear.
2	173	+	I can see the people or things in my daydreams as if they were moving around.
3	185	+	I sometimes have a very clear, lifelike picture of what I am imagining.
4	197	+	I can often "see" a large number of things or people in my fantasies.
5	209	-	I do not really "see" the objects in a daydream.
6	220	+	My fantasies often consist of black-and-white or color images.
7	231	-	My daydreams are mostly made up of thoughts and feelings rather than visual images.
8	242	+	Visual scenes are an important part of my daydreams.
9	252	+	The "pictures in my mind" seem as clear as photographs.
10	264	-	The scenes of my daydreams are never longer than brief flashes.
11	276	+	The "scenes" in my daydreams are so vivid and clear to me that my eyes seem actually to follow them.
12	288	+	I can still remember scenes from recent daydreams.

SCALE 11

FUTURE IN DAYDREAMS

Scale Item #	IPI #	Scoring Direction	Item
1	154	+	Before going somewhere, I imagine the scene and what I will be doing.
2	166	+	I picture myself as I will be several years from now.
3	178	+	I am more likely to think about tomorrow than wonder about yesterday.
4	190	+	I think about how "the world of the future" will look.
5	202	-	I never plan where I'll be or what I'll be doing several years from now.
6	214	-	I do not think about what the future will be like.
7	224	+	I daydream about what is about to happen.
8	235	-	I seldom think about what I will be doing in the future.
9	299	+	My thoughts are of the future rather than of the past.
10	311	+	I daydream about what I would like to see happen in the future.
11	323	+	I find myself imagining what I will be doing a year from now.
12	334	+	I tend to daydream about the events of the coming weeks and months more than of the happenings of the past.

APPENDIX C

APPENDIX A

THE BETTS QMI VIVIDNESS OF IMAGERY SCALE

INSTRUCTIONS FOR DOING TEST:

The aim of this test is to determine the vividness of your imagery. The items of the test will bring cretain images to your mind. You are to rate the vividness of each image by reference to the accompanying rating scale, which is shown at the bottom of the page. For example, if your image is "vague and dim" you give it a rating of 5. Record your answer in the brackets provided after each item. Just write the appropriate number after each item. Before you turn to the items on the next page, familiarize yourself with the different categories on the rating scale. Throughout the test, refer to the rating scale when judging the vividness of each image.

PLEASE:
Do not turn to the next page until you have completed the items on the page you are doing, and do not turn back to check on other items you have done. Complete each page before moving on to the next page. Try to do each item separately independent of how you may have done other items.

The image aroused by an item of this test may be:

Perfectly clear and as vivid as the actual experience.....Rating 1

Very clear and comparable in vividness to the actual experience.....Rating 2

Moderately clear and vivid.....Rating 3

Not clear or vivid, but recognizable.....Rating 4

Vague and dim.....Rating 5

So vague and dim as to be hardly discernible.....Rating 6

No image present at all, you only "know" that you are thinking of the object.....Rating 7

EXAMPLE:

Consider an image which comes to your mind's eye of a red apple. If your visual image was moderately clear and vivid, you would check the rating scale and mark '3' in the brackets as follows:

ITEM

A red apple.....(3)

Now begin the test:

Think of some relative or friend whom you frequently see, considering carefully the picture that rises before your mind's eye. Classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

ITEM	RATING
1. The exact contour of face, head, shoulders, & body.....	( )
2. Characteristic poses of head, attitudes of body, etc...	( )
3. The precise carriage, length of step, etc. in walking..	( )
4. The different colours worn in some familiar costume....	( )

Think of seeing the following, considering carefully the picture which comes before your mind's eye; and classify the image suggested by the following question as indicated by the degree of clearness and vividness specified on the Rating Scale.

5. The sun as it is sinking below the horizon.....( )

Think of each of the following sounds, considering carefully the image which comes to your mind's ear, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

6. The whistle of a locomotive.....( )

7. The honk of an automobile.....( )

8. The mewing of a cat.....( )

9. The sound of escaping steam.....( )

10. The clapping of hands in applause.....( )

Think of "feeling" or touching each of the following, considering carefully the image which comes to your mind's touch, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

11. Sand.....( )

12. Linen.....( )

13. Fur.....( )

14. The prick of a pin.....( )

15. The warmth of a tepid bath.....( )

Think of performing each of the following acts, considering carefully the image which comes to your mind's arms, legs, lips, etc., and classify the images suggested as indicated by the degree of clearness and vividness specified on the Rating Scale.

16. Running upstairs.....( )

17. Springing across a gutter.....( )

18. Drawing a circle on paper.....( )

19. Reaching up to a high shelf.....( )

20. Kicking something out of your way.....( )

Think of tasting each of the following considering carefully the image which comes to your mind's mouth, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

21. Salt.....( )

22. Granulated (white) sugar.....( )

23. Oranges.....( )

24. Jelly.....( )

25. Your favorite soup.....( )

Think of smelling each of the following, considering carefully the image which comes to your mind's nose and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

26. An ill-ventilated room.....( )

27. Cooking cabbage.....( )

28. Roast beef.....( )

29. Fresh paint.....( )

30. New leather.....( )

Think of each of the following sensations, considering carefully the image which comes before your mind, and classify the images suggested as indicated by the degrees of clearness and vividness specified on the Rating Scale.

31. Fatigue.....( )

32. Hunger.....( )

33. A sore throat.....( )

34. Drowsiness.....( )

35. Repletion as from a very full meal.....( )

APPENDIX D

APPENDIX I

QUESTIONNAIRE 2

Handedness Research

NAME_____AGE_____ SEX_____

Were you one of twins, triplets at birth or were you single born?_____

*Please indicate which hand you habitually use for each of the following activities by writing R (for right), L(for left), E(for either).

Which hand do you use:

1. To write a letter legibly?_____
2. To throw a ball to hit a target?_____
3. To hold a racket in tennis, squash or badminton?_____
4. To hold a match whilst striking it?_____
5. To cut with scissors?_____
6. To guide a thread through the eye of a needle (or guide needle on to thread)?_____
7. At the top of a broom while sweeping?_____
8. At the top of a shovel when moving sand?_____
9. To deal playing cards?_____
10. To hammer a nail into wood?_____
11. To hold a toothbrush while cleaning your teeth?_____
12. To unscrew the lid of a jar?_____

If you use the RIGHT HAND FOR ALL OF THESE ACTIONS, are there any one-handed actions for which you use the LEFT HAND? Please record them here_____

_____

If you use the LEFT HAND FOR ALL OF THESE ACTIONS, are there any one-handed actions for which you use the RIGHT HAND? Please record them here_____

_____

APPENDIX E

EYE-SHIFTING MEASURE:

Stimulus Questions

1. What was your favorite toy in childhood?
2. What was the hair color of your first grade teacher?
3. How many letters in the word sociology?
4. What is your earliest childhood memory?
5. What was the color of your first bicycle?
6. What was your worst accident in childhood?
7. How many letters in the word anthropology?

APPENDIX F

EYE DOMINANCE MEASURE

1. What eye do you use when you look through a telescope?

2. What eye do you use when you aim a rifle?

3. What eye do you use when you look through a microscope?

APPENDIX G

REMOTE ASSOCIATES TEST

college • adult • form 1

Sarnoff A. Mednick
University of Michigan

BEFORE YOU PROCEED WITH THE TEST, FILL IN ALL THE INFORMATION CALLED FOR ON THE BACK OF THIS TEST BOOKLET.

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.

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

cookies sixteen heart .....

The answer in this case is "sweet." Cookies are sweet; sweet is part of the phrase "sweet sixteen" and part of the word "sweetheart."

Here is another example:

poke go molasses .....

You should have written "slow" in the space provided. "Slow poke," "go slow," "slow as molasses." As you can see, the fourth word may be related to the other three for various reasons.

Try these next two:

A. surprise line birthday ..... A.

B. base snow dance ..... B.

The answers are at the bottom of the page.

Now open the booklet and try the groups of words on the inside pages. Many of these items are not easy and you will have to think about some for a while. If you have trouble with some groups of three go on to the next and come back to them later. Give only one answer to each question. You will have 40 minutes.

The answers are: A. party; B. ball.

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1. stop	petty	sneak	_____	1
2. elephant	lapse	vivid	_____	2
3. lick	sprinkle	mines	_____	3
4. shopping	washer	picture	_____	4
5. stalk	trainer	king	_____	5
6. sea	home	stomach	_____	6
7. walker	main	sweeper	_____	7
8. mouse	sharp	blue	_____	8
9. envy	golf	beans	_____	9
10. board	magic	death	_____	10
11. athletes	web	rabbit	_____	11
12. pot	butterflies	pump	_____	12
13. bald	screech	emblem	_____	13
14. note	dive	chair	_____	14
15. cherry	time	smell	_____	15

16. Southern	console	station	_____ 16
17. chocolate	fortune	tin	_____ 17
18. bass	complex	sleep	_____ 18
19. wicked	bustle	slicker	_____ 19
20. skunk	kings	boiled	_____ 20
21. habit	pouch	Road	_____ 21
22. soap	shoe	tissue	_____ 22
23. blood	music	cheese	_____ 23
24. room	Saturday	salts	_____ 24
25. widow	bite	monkey	_____ 25
26. chamber	staff	box	_____ 26
27. inch	deal	peg	_____ 27
28. puss	spit	spoiled	_____ 28
29. jump	kill	bliss	_____ 29
30. sore	shoulder	sweat	_____ 30

APPENDIX H

Welsh Figure Preference Test

or the Barron–Welsh Art Scale

START HERE

DIRECTIONS: Be sure to fill in your name and other information requested. Then answer LIKE (L) or DON'T LIKE (D) for each drawing by making a heavy mark in the appropriate box, as in the example at right.

EXAMPLE ONLY

	1	2	3
L	■		
D			

NAME (Please print)

AGE

SEX

DATE

L	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D																														
L	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
D																														
L	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
D																														
L	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
D																														
L	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
D																														
L	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
D																														
L	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
D																														
L	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
D																														
L	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
D																														
L	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
D																														
L	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
D																														
L	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
D																														
L	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390
D																														
L	391	392	393	394	395	396	397	398	399	400																				
D																														

DO NOT MARK BELOW THIS LINE

DL ___ ___ BW ___ ___ RA ___ ___ MF ___ ___ NP ___ ___ CN ___ ___

RP ___ ___ CF ___ ___

RS + RC = RL

FS + FC = FH

SM CM

RS ___ RC ___ RL ___

FS ___ FC ___ FH ___

SM ___ CM ___

CO ___ ___ MV ___ ___ XN ___ ___

SH ___ ___ XM ___ ___ XX ___ ___

BK ___ ___ XF ___ ___ FG ___ ___

DT ___ ___ XC ___ ___ ___ ___ ___

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APPENDIX I

ALTERNATE USES
Form B

Paul R. Christensen, J. P. Guilford, Philip R. Merrifield and Robert C. Wilson

NAME _____ SEX: M ____ F ____ SCORES: I ____ II ____

Total _____

GROUP _____ DATE _____

In this test, you will be asked to consider some common objects. Each object has a common use, which will be stated. You are to list as many as six other uses for which the object or parts of the object could serve.

EXAMPLE:

Given: A NEWSPAPER (used for reading). You might think of the following other uses for a newspaper.

a. start a fire
b. wrap garbage
c. swat flies
d. stuffing to pack boxes
e. line drawers or shelves
f. make up a kidnap note

Notice that all of the uses listed are different from each other and different from the primary use of a newspaper. Each acceptable use must be different from others and from the common use.

Do not spend too much time on any one item. Write down those uses that occur to you and go on to the others in the same Part. You may return to the incomplete items in a Part if time for that Part permits.

There are two parts to this test, with three items per part. You will have 4 minutes for each part.

If you have any questions, ask them now.

STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

PART I

List as many as six possible uses for each of the following objects:

1. SHOE (used as footwear)

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

2. BUTTON (used to fasten things)

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

3. KEY (used to open a lock)

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

PART II

List as many as six possible uses for each of the following objects:

4. WOODEN PENCIL (used for writing)

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

5. AUTOMOBILE TIRE (used on the wheel of an automobile)

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

6. EYEGLASSES (used to improve vision)

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

APPENDIX J

TABLE 6

Means and Standard Deviations for the Total Sample

VARIABLE	MEAN	STANDARD DEV.	CASES
Eye-Shifting	1.6061	0.4924	66
Handedness	1.1818	0.3887	66
Eye Dominance	1.1364	0.3458	66
Alternate Uses	6.8030	2.9883	66
Remote Associates	12.9545	4.6324	66
Barron-Welsh	35.9545	16.2778	66
Betts Imagery	82.4545	24.8820	66
Playmate	1.6970	0.4631	66
IPI	272.1364	33.6954	66
Day. Freq.	37.1667	7.5561	66
Vividness of Vis.	38.6212	8.9507	66
Age	25.7879	8.7873	66
Sex	1.7273	0.4488	66

TABLE 7

Means and Standard Deviations for the College Age Group

VARIABLE	MEAN	STANDARD DEV.	CASES
Eye-Shifting	1.6129	0.4951	31
Handedness	1.2581	0.4448	31
Alternate Uses	5.9677	2.4964	31
Remote Associates	13.2903	4.0182	31
Barron-Welsh	40.3548	15.8210	31
Betts Imagery	77.4839	25.1408	31
Playmate	1.6774	0.4752	31
IPI	274.9677	30.6273	31
Day. Freq.	38.4839	7.4515	31
Visual Images	38.3226	9.1666	31
Sex	1.6452	0.4864	31

VITA

Steven Robert Banks was born at an early age in Elizabethton, Tennessee, on March 31, 1954. He began work on this dissertation shortly thereafter, finishing it on August 4, 1980. In between these two dates, his life has been filled with few interesting events that he wishes to confide at this time.

He attended public schools in Elizabethton, until his graduation from Elizabethton High School in June 1971. He immediately commenced work at the University of Tennessee, Knoxville and was graduated from that fine institution in August 1974. He then began work on a Master of Science in Educational Psychology in September of 1974, receiving the above degree in August 1975 from the University of Tennessee, Knoxville. He worked as a Guidance Counselor in the Johnson City, Tennessee school system for one year, before returning to the University of Tennessee for the third degree in September 1976. He worked on his doctorate for two years, before accepting a position at Columbia State Community College, Columbia, Tennessee. He completed the Doctor of Education degree in Educational Psychology and Guidance in August 1980, while still employed at Columbia State.