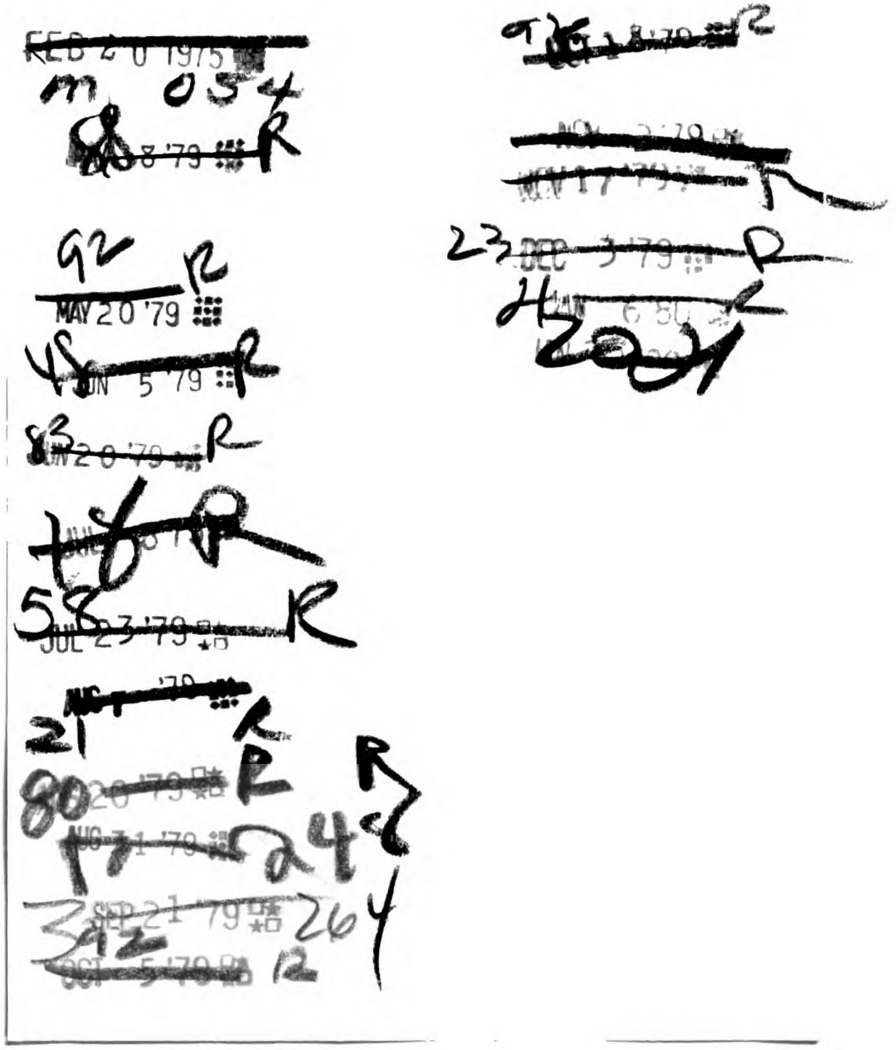
PERCEPTUAL AND COGNITIVE FACTORS IN CREATIVITY

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY
LORRAINE CAROL LEONOWICH
1972



ABSTRACT

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By

Lorraine Carol Leonowich

This study was undertaken to examine the role of relational cognition in creative thought and the functioning of the right hemisphere. Relational thought is defined as that mode of approach to the world which concerns itself with the patterned inter-relatedness of things and the generation of meaning structures based upon the dynamic patterns of unfolding in the world which serve to define the perceptual identity and symbolic meaning of objects and events. This is contrasted with an associational approach to cognition which emphasizes a link by link construction of abstracted concepts that is little dependent upon the direct, broadly ranging perceptual confrontation with the world which is necessary to the discernment of relational meaning. These ideas are discussed in the light of the perceptual theories of James Gibson and Ernest Schachtel, and the findings of

research in the areas of creativity and functional brain asymmetry.

It was hypothesized that high creatives and right hemisphere dominant persons, in contrast to low creatives and left hemisphere dominant persons, would exhibit the characteristics of relational thinkers. They were hypothesized to be sensitizers and superior in incidential learning (measured by means of an anagram solving task) under conditions in which the incidential cues were embedded in the environment of the room. They were expected to perform in a superior fashion on the concealed figures test and the sub-scales of an original test (the Word Preference Test) which were designed to reflect the use of and liking for relational thought styles. Right hemisphere dominance was expected to correlate with creativity and relational thought. The Barron Welsh Art Preference Scale and the Fitzgerald Openness to Experience Inquiry were used as measures of creativity. Hemisphere dominance was measured by means of the eye movement response described by P. Bakan and M. Day. Subjects were college undergraduates enrolled in introductory psychology courses. t tests, analyses of variance, appropriate correlation coefficients, the chi square and Fisher's exact tests were used to test the significance of results related to the hypotheses.

Both high creatives and right hemisphere dominant (left looking) persons were shown to be superior to low creatives and left hemisphere dominant (right looking) persons respectively in their ability to discern the principles of organization behind the word series in the word preference test. However, a strong case for the particularly relational quality of this ability was not made, except in the case of left lookers, who excelled specifically on the relational items. (Part of this failure was attributed to the nature of the word preference test, which needs further refinement.) High creatives and right hemisphere dominant persons were superior in their capacity to discern the existence of order, but again the relational character of the process was not clearly demonstrated. Some support for the hypothesized relational character of creative thought was found in the greater preference of high creatives for relational and sensory items (as opposed to associational items) on the word preference test, and in the ability of this test (a measure of the capacity to discern the inter-connectedness of things) to differentiate between high and low scorers on the Barron Welsh, a largely perceptual measure, and between left and right hemisphere dominance groups. High creatives did seem to benefit more than low creatives from the environmentally embedded incidental cues, and were significantly higher in sensitization; the predicted

differences were not found for the left vs. right looker comparison. The predicted differences in concealed figures performance were not found. Even though right hemisphere dominant persons were not found significantly superior on the Barron Welsh and Experience Inquiry, their performance on the word preference test (relative to that of left hemisphere dominant persons) did resemble that of high creatives.

Sex differences are discussed.

Approved _____
D. Donelson
1970

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Psychology

1972

ACKNOWLEDGMENTS

The author would like to acknowledge the patient guidance of (firstly and most particularly) Elaine Donelson, Andrew Barclay, and Ellen Strommen in the completion of this project, and to recognize the inspiring influence of Paul Bakan upon the initiation of this work.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Creation is not the invention of that which was not; it is the profound discrimination of that which is but previously went unenunciated. To know a thing profoundly is to discriminate it in the context of its world, in the patterns of its becoming, in its reaching beyond itself into the patterns of things other than self. It is to confront the other in its transcendence toward the world, in its existence for itself. To know creatively is not to know utilitously, to impose preconceived orders upon things whose weight and boundaries are defined in terms of goals and ends. It is to affirm a thing as it is; it is the power to empathically trace the patterns of being of the other beyond its physical boundaries and parts into the dynamic swirl of that which it does, of its becoming, its melting into the world at large by way of its participation in its patterned flows. To know in this way is to know relationally. The purpose of this thesis is to examine the role of relational perception and cognition in creative thought.

THE THEORY AND PROBLEM

Some of the theories that have been advanced to shed light upon the creative process (most notably Mednick's) have been peculiarly intellectual in cast, emphasizing cognitive processes which are largely verbal in character and failing to deal with the perceptual-imagerial end of the problem. This has been in spite of the fact that any creative production short of madness must remain within certain limits of concordance with the universally experienced world. The most valued products of creative genius tend to enhance, or point out the patterns of an order already implicit in the world, rather than to invent ex nihilo ranges of understanding which have little resemblance to the experience of ordinary men, should they be placed in the position to see. Indeed, it is the very universality of the meaning of a work of art, the broad ranging sweep of coherence which a scientific theory makes through the fragments of the world, that insures the worth of both the creator and the thing which he makes. The ability to perceive truly and profoundly and to vividly recall the things learned from these

world immersions must play an important role in the creative process.

The self reports of many highly gifted scientists and artists are filled with references to the peculiar perceptual style of the creative personality. Very striking in these accounts is the extent to which the critical elements in these persons' productions are drawn either from the concrete data of raw experience or from imagerial reconstructions of that experience. It is as though for them a thing derives its significance not from the accretion of associations which could be statically assigned to it, but from the pattern of its becoming in a world of other becomings. A thing is known most profoundly when it is known dynamically, in the shifting contextual patterns of its perceptual being, and it is from these resources that the stuff of art and creative scientific insight springs. Van Gogh observes that

> Art demands a persistent work . . . and a continuous observation. The feeling . . . for reality is more important than the feeling for pictures, at least it is more fertile and more vital . . . there is something . . . of what wood or shore or figure has told me, and it is not a tame or conventional language, proceeding less from nature itself than from a studied manner or system . . . people who do not in the first place wrestle with nature never succeed. . . . I think that if one has tried to follow . . . the masters, one finds them deep in reality. . . . I mean that their so-called creations will be seen by one in reality, if one has the same eyes. . . . It is looking at things for a long time that ripens you and gives you a deeper understanding (Van Gogh, 1967).

Einstein wrote in one of his letters,

> The words of the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The psychical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be voluntarily produced and combined. . . . The above mentioned elements are in my case of visual and some of muscular type.

Stephen Spender, the poet, writes: "For writing it would imply living my way through the imaged experience of all these ideas, which here are mere abstractions, and such an effort of imaginative experience requires a lifetime of patience and watching . . ."; and from D. H. Lawrence: "Art is a form of supremely delicate awareness and atonement--meaning at-oneness, the state of being at one with the object"; Dorothy Canfield: "I can write nothing if I cannot achieve these very definite, very complete visualizations of the scene" (Ghiselin, 1952).

However, the foremost theories of creativity take little note of this and largely confine their speculations and research to a verbal sphere which is far removed from the exigencies of creative perceptual and imagerial experience. Mednick's theory (Mednick, 1962), dependent as it is upon world-estranged verbal association hierarchies (which repeat the conditioned enshrined of the abstractly known and which link contextless, motionless fragments), and upon the invention of a principle of utility against which to judge and determine the creative, is antithetical in spirit to the position which is outlined in this paper.

This is not to deny that highly creative persons might be quite adept at producing unusual chains of verbal associations; it is to deny that the process of producing remote, chained verbal associations has a significant role to play in creative productions of any greater importance in the intellectual history of mankind than the activities of Madison Avenue.

The theoretical formulations with which most of the ideas in this paper are most closely akin are those of Schachtel (1959) and Gibson (1959). In his book, Metamorphosis, Schachtel discusses a style of perception, the allocentric mode, which he characterizes as essential to creative activity. In brief, allocentric perception can be characterized as contextual (relational) and dynamic, and as enhancing the perceiver's knowledge of the object taken as a thing which exists in its completeness only with respect to other things. Because it is open to the complexity of an object's potentiality for being, allocentric perception retains the capacity to return to the object again and again in a fresh discernment of its meaning. An object which is known allocentrically is known in its totality, and is affirmed in its independent being, in the complexity of all of its knowable characteristics and interactions with other objects. This is in contrast with the autocentric mode of knowing, which singles out only a limited range of characteristics of

the object, those concerned with its utility as a means of need fulfillment or those salient sensory characteristics which produce a feeling of pleasure or pain in the observor, and uses these to statically define the object and simplistically, exploitatively fixate its "meaning." The result is isolation and failure to grasp the complex web of interactions in which the object may engage. Since the activity of tracing out the patterns which an object makes in the world in the process of defining its dynamic existence, and equating or linking these patterns of relational movement with the patterns produced by other superficially distinct objects, appears to be involved in the creation of symbols, parallels, and allegorical themes in painting, literature, and even musical composition and scientific theory, it can be assumed that relational perception and cognition play a major role in the creative process. Here, the pattern of an object's becoming and the significance which it shares with the patterns of other objects is more crucial in its understanding than specifying the nature of its usefulness or giving a list of the sensory characteristics with which it assaults the observor, so long as this list does not serve to integrate the object with its surrounding world in a mutual elaboration of meaning. Certainly "usefulness" is no criterion for discriminating the creative from the mad (Mednick's claims to the contrary); but the ability to profoundly

discern and relate the fragments of the world, not associationistically but according to their shared patterns of unfolding in the world, is.

There is much in this which is similar to the approach taken in James Gibson's theory of perception. Gibson (1955) takes direct issue with those theorists who claim that perceptual learning takes place as the result of the association of previously meaningless and isolated fragments into an object whole, and who also assert that the perceiver becomes less and less involved with the stimulus field (which is in itself meaningless) and more dependent upon associational, world estranged, memory patterns as perceptual learning progresses. Instead, Gibson holds that the stimulus environment is fundamentally meaningful, that perceptual learning takes place as the result of a process of active differentiation of the pattern of meaning already inherent in the world, and that increased awareness and differentiation of the stimulus field accompanies perceptual learning. So meaning is found through a process of continuous reconfrontation with the stimulus, resulting in an increased ability to discern the stimulus in the context of its perceptual field, not in the acquistion of a complex of associations which abstract the object and make it unnecessary to confront it in all the detail of its phenomenal reality again. (According to the associational view, a glancing superficial look triggers the defining associational

pattern and allows the person to use the object without confronting it allocentrically.) An object's identity is established by way of the observed constancies in the relationships between its parts and in the dynamic patterns it traces out in the context of its perceptual surroundings. Previous discrimination of meaningful stimulus patterns facilitates the active discrimination of that pattern in future stimulus arrays. Profound awareness of an object is relational, temporal-dynamic, increasingly stimulus attuned, and complexly multi-modal.

Indeed, James and Eleanor Gibson (1955) have provided experimental evidence indicating that, in the initial stages of perceptual learning, before the object is adequately known, verbalizations reflect a process of seeing objects in isolation from one another, with each one subsumed under an abstract type which classifies its characteristics. The subjects in this study were given a sequential array of nonsense shapes from which they were to select the shapes which matched a stimulus shown to them at the start of the procedure. They were asked to verbally describe all the items of the series as they proceded, and a record was kept of these responses. This first stage involved the use of naming responses (nouns) such as "spiral," "figure 8," which seemed to reflect the incorporation of the experience into the abstractly associational store of general stimulus types, accompanied

by a lack of attention to the unique characteristics of the presently whelming perceptual field. However, as learning progressed and the subjects came to more fully know the objects, their verbal responses turned to relational adjectives and adverbs ("thinner," "more circular") and increased attention was paid to the things immediately at hand. In this final condition which marked the point at which the stimulus objects were first known in their unique identity, the characteristic patterns for one object were related to those of other objects, and the increasingly correct differentiation of the identify of one shape simultaneously implied an increased awareness of the identity of the other, because each was truly known only as it was integrated into the context of the rest of the perceiver's world. This process of increased object confrontation accompanied by the relational interdependence of object differentiation and definition appears essential to a truly accurate, insightful understanding of the world. Anything less, and particularly the use of hastily applied verbal categories in an avoidance of genuine contact with the world, appears to lead to over-simplification and stereotype. These fail to lead to a vision of the world in which one part illuminates, retraces, interacts with another part in a co-dependence of meaning. Perception in this last mode is auto-centric, object estranged, and invokes the imposition of

pre-established meanings upon a minimally recognized object. If used habitually, such a style of approach to the world could hardly be expected to lead to creative insights about the nature of things.

Evidence for the relevance of a relational style of perception to creativity and the inadequacies of verbal association approaches (i.e., Mednick and Guilford's notions of fluidity and unusualness) appears in several studies. Riegel, Riegel, and Levine (1966) have found that the notion that a generalized verbal associational fluency is the facilitating factor behind the productivity of HC's as determined by performance on the Fricke Creative Personality Scale is an over-simplification. Other organizing processes beyond the mere facile production of numerous associations appear to be involved, and under certain conditions, low creatives exhibit the associational superiority usually attributed to HC's. (The following abbreviations will be used throughout the text: HC = high creative; MC = middle creative; LC = low creative.) These researchers found that high creatives gave a larger number of different responses when asked to associate to the stimulus word only when the subject was asked to give logically related responses: superordinates (for example, giving a response of "fork" to the stimulus word "utensil"), coordinates ("train" to "bike"), subordinates ("convertible" to "car"), similars ("auto" to "car"), and contrasts

("foolishness" to "wisdom"). In contrast, low creatives gave a significantly larger number of associative responses when they were asked to name functions ("eat" for "fork"), parts ("handle" or "metal" for "fork") and attributes of the stimulus words ("maturity" for "wisdom"). The responses which are closest in spirit to relational functioning are the logical responses, since these involve drawing parallels between discrete objects on the basis of similarities in their patterns of relationship to the world. In contrast, the LC's were significantly superior in differentiating the parts of static things taken in isolation, and in listing them (such responses fell into the parts and attribute categories). They also were more adept in naming uses for things, a function which involves the imposition of a need determined category upon an object whose unrelated attributes and patterns of independent existence in the world are ignored. (This latter response type formed the "functions" category, and consisted in giving answers like "drive" for the stimulus "car"). Thus, a simple explanation of creativity in terms of habit strength and association hierarchies appears ill-founded; differences between the HC and LC groups appear to depend upon the type of task and the relationship between the associated elements. The worlds of high creative subjects are peopled with objects that extend beyond themselves and implicate other objects in

the definition of their meanings. Things don't stand alone, but are involved with one another in hierarchies of relationship and degrees of similar functioning. Such a world vision would seem to be the necessary precursor to symbolism and philosophical perspective. The cognitive style of low creatives seems to be in contrast more isolating and less integrative; there is some evidence that they conceive of things in more autocentric, need-confined terms.

Jacobson, et al. (1968) were unable to demonstrate any relationship between scores on the Remote Associates Test and the ability of S's to use the process of mediation in learning concepts whose solutions were themselves associations to members of an already memorized list of paired associates. Mednick had designed the RAT to reflect his theory of creativity, which was based upon the hypothesis that high creatives possessed flat verbal assocation hierarchies and were able to combine ideas into new forms by using a remote associate commonly appearing on two discrete hierarchies to combine the central elements of each into a new synthesis. The fact that high scorers on the RAT are not more adept at using the process of mediation in problem solving at least casts doubt upon the theory which attributes success on the RAT to processes involving verbal association and mediation. If the RAT can be assumed to have any correlation with creativity, such a finding also casts serious doubt upon the validity

of the use of theories of verbal association to explain the cognitive behavior of high creatives.

Using the RAT as a criterion measure for creativity, Mendelsohn and Griswald (1964) have demonstrated the superiority of HC's in incidental learning. The task Mendelsohn and Griswald used to measure incidental learning was an anagram task, which is peculiar in that the solution to the task is inherent in the task stimulus itself, and previous exposure to the stimulus pattern of the solution words in the incidental learning treatment could relationally mediate the differentiation of the anagram words in terms of their correct solution. A reasonably quickly solved anagram often seems to "spell" its solution automatically, in the very act in which the anagram is seen, without need of a laborious cognitive process in which the anagram is taken apart and re-synthesized, bit by bit, as the respondent associates to each pronounceable fragment until a word is formed. The HC's were superior in their performance on incidentally cued anagrams even though MC's and LC's were equally as likely as HC's to recall the incidental cues. Since verbally reportable memory for the incidental cues does not seem to be related to this form of learning, it is possible that the information so acquired is not in the form of traditional associationistic verbal bonds and is in fact fundamentally unverbalizable, thus exerting a subtle, seemingly "unconscious" influence upon behavior.

It is possible that this influence is primarily upon the perceptual process of attending to the stimuli themselves, determining the way in which the person differentiates his world and selects out patterns of meaning. For instance, previous incidental exposure to the form "triangle" might, according to this explanation, provoke a selective perceptual discrimination of that pattern of events which produces a notion of triangularity from the many possible types of sets of relationships between the parts of the stimulus world. Thus the probability that the subject would preferentially discriminate those relationships between parts of his stimulus world which fulfill the requirements of triangularity would be increased. If he is attending to verbal stimuli, the probability that he would discriminate those verbal elements which are the equivalents of the imaged triangle would similarly be increased, and he would come to scan the anagram in just the proper sequencing of letters so that they would come to spell the concept name. He need never begin a process of verbal association to the combinations which result from a conscious disjoining and joining of letters to solve the problem. Ready accessibility to the relational imagery of the past would aid in the differentiation of meaning from the present, and the resulting understanding would not be attenuated through the imposition of fragmentating verbal encasements upon a

reality which ought to be confronted directly as the fountainhead of all fresh knowledge.

William Paradowski (1967) has demonstrated that a sense of novelty enhances incidental learning. Contextual perception and the activation of remembered relational images, steeped in the varying contexts of past experiences, by an encounter with some pattern in a present which but partially echoes the past, should enhance the sense of novelty and hence increase incidental learning. The pattern of relationships which defines the object in its world is never completely constant from setting to setting, and the present never completely duplicates the past, so the possibility of combination and expansion of meaning arises. In contrast, an associationistic, abstracting, primarily verbal non-contextual approach to the world would be less sensitive to the variations imposed by time and circumstance, and would result in a diminished sense of novelty. Past and present would be collapsed into sameness, while attention was narrowed, learning reduced.

William C. Ward (1969) has found that highly creative children use the incidental cues in their perceptual environment as aids to problem solving; they do not use associative processes as a source of ideas nearly as much--almost all of their responses are based upon discoveries made in the world at hand. In this

study, the incidental stimuli consisted of objects and pictures scattered about the experiment room. The subjects were asked to name everything they could think of which would fit in a given descriptive category (for example, the category of all round objects). The room furnishings included things which were possible solutions to the task.

Ward's high creative subjects could be described as scanners, since they obviously explored the environment more than did the low creatives. Scanners tend to be sharpeners, persons sensitive to small differences between stimulus elements (Klein, 1958). Levelers, on the other hand, are less sensitive to such differences, and seem to be collapsing their variable perceptions into a few limited, abstracted categories (in a process which is analagous to that which is described in associational theories of perception and is reminiscent of the verbal and mathematical processes advocated by those scientific thinkers who distrust the role of perceptual imagery in thought and insist upon the natural superiority of disembodied, "abstract" reason). Now sharpeners tend to be sensitizers (Steele, 1961) who tend in turn to be subject to interference on the Stroop test. One would expect that people subject to a high degree of interference in the Stroop situation find themselves so because they are simultaneously processing several sets of cues, and are in a position to see several dimensions of order

in their mutually relational context. In the Stroop situation, this tendency would result in seeing a combination of verbal and color cues in contradictory relationships, creating a tension that would have to be resolved in favor of one dimension to the exclusion of the other and that would cause the subject to achieve a poorer time score as he tried to resolve the conflict. Predictably, Amster (1965) has found that subjects high in Stroop interference are also superior in incidental learning. The very attentiveness to the contextual situation which facilitates incidental learning and perhaps provides the raw substance of creative thought is debilatory on a task such as the Stroop, which requires a ready blocking out of the "irrelevant" part of the stimulus field.

Amster also found that subjects who were faster at reading the color words on the Stroop than at naming colors, and subjects who had a low threshold for tachistoscopically presented words, were poorer at incidental learning. This perhaps occurs because both these groups of subjects use an efficient, abstracting perceptual style which results in the imposition of prior established categories upon the world instead of the use of information which comes from a careful differentiation from that world. Judgments under such circumstances would be rather world-estranged. Such a perceptual-cognitive style, in its non-relational, contextless

focusing, and heavy reliance upon the process of fitting a stimulus into an abstract and over-learned category, results in an exaggerated leveling, a neglect of detail, and a high degree of stereotypy. The individuality of the object, as well as previously undiscovered patterns of its relationship to the world, are lost. Even though the Gibsonian perceiver does learn to differentiate particular patterns of relationship in the stimulus field with the aid of past experience, this does not lead to stereotypy because the patterns are discerned from, not imposed upon, the stimuli. In other words, the stimulus in its unique identity is primary.

Epstein and Arlinsky (1965) have found that syntactical verbal material is easier to learn than unsyntactical material only under intentional learning conditions, and not incidental. This finding suggests that material incidentally learned is not necessarily collapsed into the patterns of established cognitive schema, and hence can be absorbed non-prejudicially, even when it is found to conflict with the demands of old ideas. (It can be assumed that the unfamiliarity and unorthodox rule-defying nature of ungrammatical statements interfere with focal learning. If these characteristics do not effect incidental learning in a similar way, it can perhaps be concluded that an increased capacity for incidental learning would result in an increased capacity

for picking up discrepant, unorthodox information from the stimulus field.) So it appears that a relational, allocentric, stimulus affirming form of perception and cognition is more likely to facilitate creative productivity, and that incidental learning might be a special example of the results of such an orientation, adding in its turn to the dimensions in terms of which the world is subsequently discerned. Indeed, high creatives tend to produce Rorschach protocals which are rich in context; parts are integrated into interconnected wholes, and there is a profuse perception of movement (a capacity which Rorschach attributes to an ability to empathically identify with object, i.e., to internally repeat the world relationships of the other) [Rorschach, 1942; Rawls and Slack, 1963].

Since Bakan (1969b) has found that people who swing their eyes right when shifting from a mode of passive receptivity to one of active response (as occurs when they finish listening to a question and ready their reply) are subject to less interference on the Stroop test, this brings us to a consideration of the work which has been done in the field of brain asymmetry. In humans, right looking under such circumstances has been theoretically associated with a more rapid activation (hence dominance) of the left hemisphere of the brain, while left looking has been held to indicate right hemisphere dominance.

(Stimulation of the occipital lobes of either hemisphere in primates and man is accompanied by a contralateral swing of the eyes [Wagman, Krieger, and Bender, 1958].) The two hemispheres have been found to be quite different in the range and styles of their capacities, and the differences are directly related to the issues of creativity and relational cognition and perception discussed earlier. For instance, left lookers (right hemisphere dominant persons) have been found to be more susceptible to hypnosis; those susceptible to hypnosis are more subject to interference on the Stroop (Bakan, 1969a), and hence are possibly superior in incidental learning. Persons who are left lookers have a greater percentage of alpha content in their brain patterns (Bakan, 1969c); this is also true of the readily hypotizable and those who engage in meditation, and above average alpha production has recently been claimed as a phenomenon among artists, musicians and "introspective and intuitive" persons (Alpha Wave of the Future, 1971). The mode of consciousness in hypnotic and meditative states is often profoundly allocentric. Kasamatsu and Hirai (1969) cite personal reports which bring to light the object centered, goal suspensive nature of the meditative experience, to wit:

> The Zen masters reported to us that they had more clearly perceived each stimulus than in their normal waking state. . . . Each stimulus is accepted as stimulus itself and treated as such. One Zen master described such a state of mind as that of noticing every person on the street but of not looking back with emotional curiosity.

Huxley (Erickson, 1969) describes a state of "deep reflection" which he utilized in order to accomplish his writing and which was characterized by a profound progressive psychological withdrawal from externalities and a complete absorption (often accompanied by intense imagery) in the matter which was the focus of his work. Alpha waves are more prevalent over the right hemisphere of the brain than over the left (Bakan, 1969c) and in the brain wave patterns of practitioners of meditation. Hypnosis prone persons are characterized by deep imaginative involvement, rich subjective states, and an interest in the life of the mind (Bakan, 1969a). (Barron [1968] has found that high creatives have high intellectual values and broad, humanistic interests.) Left lookers have more humanistic interests and better imagery than right lookers (Bakan, 1971). The right hemisphere, dominant in most people during sleep (it is most responsive in terms of evoked potentials during this time [Giannitrapani, 1964]), has been implicated in the symbolism and imagery of dreams (Bakan, 1971). Thus, one would expect high creatives to be scanners, sharpeners, sensitizers, better in incidental learning, prone to Stroop interference, susceptible to hypnosis, left lookers, and to have distinct humanistic interests and a greater than average ability to generate alpha activity and hypnagogic imagery.

In his brain stimulation studies, Penfield (1963) has reported the finding that visual illusions of interpretation (involving a change in the intensity, speed, direction, size, and apparent distances of objects from the observor); illusions of recognition (a feeling that what is being observed is familiar, unreal, or strange); and visual flashbacks (an hallucinatory reliving of some past part of experience, often involving all the details of sensory consciousness at the time of the incident) all occur primarily in association with the electrial stimulation of the right hemisphere. The interpretative cortex appears to be an area which assists in the interpretation of present experience by means of a subconscious filtering through the matrix of past relationships. Penfield thinks it participates in the elaboration and alteration of concepts. It is interesting that the flashback experiences elicted from this region only center around what appears to be acts of allocentric watching and listening, which involve an active differentiation and accomodation of the facets of the world. They do not involve autocentric, automatic, or over-learned activities such as eating, sexual excitation, running, writing, or speaking. Most of these illusional experiences involve a vivid awareness of the full context of events, and are far more complete and intense than memory (closely resembling the imagerial revery experienced by many highly creative

people). It is also quite interesting that this hemisphere is the sole province for the reliving of visual experience. Schachtel (1959) has pointed out the paramount importance of vision in the development of allocentricity, in that vision mediates the ability to select out an object from the field, concentrate upon it, and explore it in a manner free of the demands of pleasure or need fulfillment. It is followed in this effectiveness by touch, another sense which, in its relational functioning in spacial perception, is associated with the right hemisphere. The visual illusions from the right hemisphere appear to involve alterations in the relationships between parts of the stimulus field. Thus there are changes in relative speed, intensity, size--all of which require comparisons and context. The blurred vision illusion, thought by Mullan and Penfield (1959) to be an alteration in the ability to concentrate, and resembling in its diffuse inability to differentiate objects the autocentric immersiveness of the new-born (at least as their world experience is described in psychoanalytic circles), is also associated with electrical intervention in the normal functioning of the right hemisphere. Part of the creative process involves a focusing as well as a free ranging over the possible dimensions of order (like a kaleidoscopic shifting of the fragments of the perceptual field), an intense degree of concentration upon the objects of

concern which are played upon from all angles and degrees of cognitive, sensual, and motor awareness, connected through the matrix of similar patterns of becoming with the meanings of other experiences, and so embellished and intensified. It is the coalescence of unverbalized patterns of relationship (for pre-mature verbalization, like pre-mature categorization of perception and untimely abstraction, dissects, narrows context, and stills the movement of becoming) that is the source of flexible, novel orders of meaning.

It is this "unconscious" consciousness that perhaps provides the content of language before it is spoken. It is the task of the perceiver then to engage in what Einstein called the "laborious" business of verbal elaboration to string out the meanings compacted in visual-spacial or kinesthetic forms which take on symbolic significance in the light of the remembered images of other forms which had spun themselves out in patterns which were similar. Eisensohn (1962) has observed a decrease in creative writing ability and Benton (1968) in the ability to interpret proverbs (which take their meanings from the relationships between their parts rather than from the strict identity of their parts after right hemisphere lesions). The ability to use abstract words which describe patterns of world relationships rather than concrete objects is also impaired (Eisensohn, 1962).

There is an abundance of other data from brain lesion studies pointing toward the relational activity of the right hemisphere. Milner (1968) has found that subjects with lesions in the right temporal lobe have difficulty remembering complex figures, where an especially high premium is placed upon discerning the relationship between the parts and matching this relational template against subsequent figures. Kimura (1964) has found that when melodic material is played into both ears, the melody going into the left ear (right hemisphere) is heard in preference to that fed into the right ear, and Milner (1962) has found that lesions in the anterior right temporal region lead to a loss in the ability to differentiate melodies. (Melodies are defined by the relationships between tones, not the strict identity of the tones themselves.) Right hemisphere lesioned persons have difficulty identifying meaningful sounds (a process which involves placing them in a context of experience to make them interpretable) even when hearing for pure tones (which are relationally meaningless) is adequate (Spreen, Benton, and Fincham, 1965). They have difficulty matching cubes of various sizes which they are asked to explore by using the faculty of touch (Weistein, 1962), and have difficulty performing a formboard after it has been rotated 180 degrees (Teuber, 1962), indicating that the forms have been identified in an associationistic, S-R

fashion whose image is shattered when the form is moved to a different orientation which yet retains the relational correspondence of the parts. Touch is in Schachtel's view a sense which is only secondary to vision in the development of object awareness, and matching objects on the basis of touch of course involves a cognizance of the relationship between the parts of the objects. A synthesis of the sequential stimulus inputs achieved by running the hands over the object into a coherent whole which is uniquely characterized by the proportion and angular orientation of its parts (which are relational considerations) provides a means of identifying the objects, and a comparison between the objects thus known makes possible an effort to match like with like. Teuber also found that the double Necker cube reversed itself only with difficulty for these persons. Both these last findings point to a disruption in the ability to deal with the relationships between the parts of a figure. Patients with right sided lesions copy things in a piecemeal, unplanful manner, as though the parts formed no overall patterns of coherence. Proportion, perspective, the arrangement of different parts of a drawing, are all defective (Hecaen, 1968), but the indication of a non-relational detail in the drawing is intact. In contrast, left hemisphere lesioned persons tend to over-simplify their drawings, losing part of their complexity, as though an abstracting process gone mad had

imposed its killing generalities upon the object. Using the Rorschach as a testing instrument, Hall, Hall, and Lavoie (1968) have reported remarkably similar findings; left hemisphere lesioned persons produce a disproportionate number of rejection and perplexity responses in an interpretative style which is overly self-critical, arid, and unimaginative; in contrast, patients with right hemisphere lesions produce protocols which are exaggeratedly expansive and undisciplined, achieving unusually high numbers of responses characterized by movement, color, F minus, and fabulizing. Hall, et al. conclude that these findings are the result of a pathological exaggeration of processes normally found in the respective hemispheres, and that the left hemisphere is the critic, the judge, the evaluator, while the right is the innovator, the phantasizer, the artist.

It has been found that injuries to the right hemisphere are connected with disturbances of "spacial thought," resulting in disruption of the ability to construct designs, to orient with respect to a plan or geographical map, and to describe and visualize familiar itineraries and places. Such abilities would require the relational integration of inputs from several distinct sensory modalities, for instance visual and kinesthetic cues. Semmes (1968) has pointed to evidence for a diffuse physiological organization of the right hemisphere (as

opposed to a focal one for the left) leading to a capacity for heteromodal organization, a convergence of unlike elements (gravitational cues, touch, kinesthetic and visual cues) to produce a single supramodal space. The diffuse organization perhaps plays a facilitating role in the combination of associationistically "remote" ideas through a discovery of a pattern of integration with the world which they share and which points to a common focus of meaning (just as the evidence from sight and feel can point to a common slant in the world), a role in the creative synthesis of a single pattern that subsumes a large number of previously unrelated observations, or in the discovery of common patterns of relationship to the world on the part of objects which are superficially different. In contrast, the left hemisphere would specialize in activities requiring the close integration of like units. Support can be found for this in the dominance of the left hemisphere in the intricate muscular coordination needed in active speech, and in the superiority of coordination for most persons in the right hand, as well as in the logical and critical faculties (requiring exacting comparisons against a logical standard) in which this hemisphere appears to specialize. (It is interesting to note Rokeach's finding [personal communication] that artists, while ranking intellectuality high in their hierarchy of central values, tend to rank logicality low.)

On the basis of what has been discussed, it is hypothesized that creativity is correlated with right hemisphere dominance. Both high creatives and right hemisphere dominant people will prefer and use a relational style of dealing with the world. They will be sensitizers rather than represssors, and will be superior in incidental learning and other measures which tap a relational, world attuned approach in perception and cognition. Left hemisphere dominant people, because of the dominance of that hemisphere in verbal functioning and conventional logic, and because of the characteristics found true of right lookers, would be less creative repressors who were poorer at incidental learning, and who used an associational approach in problem solving. Conventional tests and experimental procedures are used in investigating these hypotheses, as well as an original test designed to measure relational thinking and preference for the use of relational principles in cognitive organization. More specific hypotheses are given following the description of the procedures.

EXPERIMENTAL PROCEDURES

Subjects

The subjects were 96 students (46 males and 50 females) recruited from introductory psychology classes in return for extra credit points in their courses. All 96 participated in Part I of the study outlined below, and 49 of these same subjects (25 males and 24 females) returned 3-5 days later to complete Part II. Subjects who participated in Part I of the study were not required to return for Part II, and credits were awarded separately for the two parts.

Procedure and Instruments

Part I

In several group sessions, all subjects were administered the Barron Welsh Art Preference Scale, the Fitzgerald Openness to Experience Inquiry, and one of two forms of an original verbal test, "The Word Preference Test," designed to measure preference for and use of relational patterns in concept formation. Both the Barron Welsh and the Experience Inquiry have been shown to positively correlate with traits typical of high creatives.

Barron (1953b) has found that subjects who score highly on the Barron-Welsh Art Preference Test are more resistant to pressures to conform to group opinion, have wider interests, are more fluent (Barron, 1953a), impulsive, original, intellectual, artistic, cynical, esthetic, and feminine (for males) while low scorers are conforming, rigid, and control impulse by repression. The Barron Welsh has been found to successfully differentiate an artist population from a non-artist subject group; a study using a revised art scale correlating .85 with the complete Barron Welsh test has found that high scorers claim to be more complicated, individualistic, and rebellious, while low scorers are conservative and conventional; scores on the revised art scale are also related to recognized creativity in various fields (Barron and Welsh, 1952; Rosen, 1955). Reliability figures for the art scale range in the .90's (Welsh, 1959).

High scorers on the Fitzgerald Experience Inquiry give significantly more original responses than low scorers on a word association test and object sorting task; they exhibit a "looseness of repression" (as measured by the R scale of the MMPI), and describe themselves as artistic, complicated, individualistic, cynical, imaginative, impulsive, interests wide, energetic, and unconventional (for females), in contrast to the conventional, cautious, inhibited self-descriptions of low scorers (Fitzgerald,

1966). High male scorers on the Experience Inquiry had a sensitive inner life, preferred to work alone at artistic activities, and were at odds with their environment, while high scoring females saw themselves as outgoing, active, dominant, and open to new and varied contacts with their environment. No reliability data is available for the Fitzgerald test.

Because of their obvious relatedness to traits associated with creativity (Barron, 1968), both the Barron Welsh and the Experience Inquiry were selected as criterion measures of this characteristic. The Barron Welse particularly contains the kind of items--figural, perceptual, composed of patterns of varying degrees of interconnectedness and complexity, which can provide a sphere of exercise for a relational approach to the organization of perception; the more complicated figures, providing more extensive opportunities for the operation of this style, would be expected to be preferred by relational perceivers. It so happens that preference for the complexity integrated diagrams on this test also results in a high creativity score.

The Experience Inquiry was selected for yet another reason, for it contains a cluster of items which are strongly flavored with the characteristics of what might be regarded as right hemisphere functioning. This cluster includes items such as the following: "At times

I have focused on something so hard that I went into kind of a benumbed state of consciousness, or at other times into a state of extraordinary clam and serenity"; "I like to indulge in emotions and sensations with the feeling of just letting go"; "Sometimes I have had the impression that the walls or the ceiling were moving and changing size or state, even though I knew this was impossible"; "I can look at an object . . . for a long time, continuing to discover different things about it" (this has both relational significance and significance in light of the connection between right hemisphere stimulation and alterations in visual concentration); "I would like to get beyond the world of logic and reason and experience something new and different" (formalized, verbal logic has been associated with the functioning of the left hemisphere. although the right hemisphere is capable of a logic which is not dependent upon verbal formulazations); "At times I have actively stared at something familiar and had it become very strange before my eyes" (metamorphopsia-like, and perhaps related to the discovery of different dimensions of relationship within a fixed cluster of stimuli); "While lying in bed or reclining in a chair I sometimes find myself perceiving faces, objects, etc., in the shadows of the light or the design of the ceiling, etc."; "I have experienced moments of inspiration and creativity, when artistic expression, ideas, or the

solution to problems I had struggled with came to me with a special intensity and clarity"; "Solutions to problems or ideas for new projects come to me at times 'out of the blue'" (perhaps from non-verbal, "unconscious" sources); "I have been so strongly in love with someone that I somehow felt that my own self was fading and I was at one with the beloved person" (dissolution of body boundary, reminiscent of brain stimulation phenomena with the right hemisphere, traditional concepts of id functioning, as well as the results of some studies on the Rorschach protocols of dream deprived subjects (Lerner, 1966) and the reported experiences of persons in meditative and creative inspirational states); "It is often better to act upon one's feelings than upon a logically reasoned plan"; "At times the solution to a problem has suddenly occurred to me while I was engaged in an activity unrelated to the problem" (again perhaps the gift of an "unconscious" consciousness capable of independent styles of action and resident in the right hemisphere).

Both the Barron Welsh and the Experience Inquiry were used in this study because there is no satisfactory unitary measure of so complex and ill-defined a phenomenon as "creativity"; the contents of these tests are different in form, and as it turned out, not highly over-lapping in the area of the phenomenon which they cover (the correlation between scores on the Barron Welsh and the Experience

Inquiry was only .3 for this subject group). So both were used at once, sometimes singly and sometimes in combination when analyzing relationships with other data, and their correlations with other measures were expected to shift in pattern and elucidate different areas of the central problem. The Barron Welsh and the Experience Inquiry were not expected to be redundant, equivalent measures, or to be equally related to the complex of factors under consideration. The degree to which each would be useful was unknown, because neither had ever been used in the context of a theory of relational perception-cognition. However, no claims will be made about the meaning of their discovered differences, since the comparative nature of these two tests is not the focus of the current problem.

The word preference test was administered first with an open-ended time limit (subjects took from 25 minutes to one hour to complete the test), and was followed by the Barron Welsh and the Experience Inquiry.

A few words must be said about the word preference test. This consisted of a series of 81 items, each of which contained four words; in 63 of the items the first three words "went together" in some way which was specified by the fourth word. The remainder of the items were nonsense combinations. The format was quite similar to that of the Remote Associates Test with the answers supplied, and a number of RAT items (15) were incorporated

along with the ones which were original with the author. The remaining 18 items had no underlying principle of organization apparent to the author and represented nonsense combinations. The 63 meaningful combinations were equally divided among three principles of organization: associational, sensory or shared characteristic, and relational.

The associational grouping consisted of three words which were dynamically unrelated; their referents shared no patterns of interaction with the world, and each word did little to expand upon the meaning of the next. They represented disjunct objects, each of whose differentiation in terms of any pattern of interaction with the world did nothing to clarify the meaning of the other words. These were selected as a cognitive approximation to the process of seeing the world in terms of discrete elements upon which experientially false, verbal organizational principles are imposed with little regard for the complex identity of the elements themselves. Here the three words were subsumed under a fourth word which was a cliche verbal associate to the others, but which did not serve to unite them in any coherent pattern of meaning. The words in this grouping were examples of a process where concepts are united by means of the mediation of a verbal associate, but with regard to little else, forming a relatively meaningless combination. This kind of

combination would occur with considerable frequency if the Mednick theory of remote association and verbal mediation were taken in its pure sense, without the addition of further concepts. An example of this type of grouping would be: soda kilt butter Scotch. Scotch is a remote associate to each of the first three words. The impression is one of paradoxical combination and senseless fragmentation. However, a certain degree of associational fluency would be essential to seeing these words as constituting a defensible combination, however shallow its significance.

The second type of grouping, the sensory, was chosen as a verbal-cognitive analog of the process of taking objects in isolation from the world, differentiating their parts, and then combining the objects on the basis of an identity between one of these parts shared by each of the objects. No attention is paid to the potential which the objects have of transcending themselves toward a supramodal, integrating concept-space in which each acquires additional meaning because it is seen in the context of the other. The combination is based upon non-dynamic sensory characteristics which are separated from the total identity of the object. This isolated characteristic is the sole justification for utilizing the object in the combination, which is otherwise barren in meaning. An example of this type of grouping would be: frog money

lime green. An analagous example from everyday life would involve the exploitative use of a single characteristic of an object or person in order to fulfill a need state, in oblivion to the complex of his other characteristics and their dynamic interaction with the world. The object would not be allocentrically perceived but autocentrically used. The words are superficially related and cannot be subsumed into the same abstract category or symbolic form; they share only a common sensory sign, a particular characteristic which has no meaning other than its circumscribed identity, and they remain in the end very unsuccessfully combined. However, the solution of these items would require an object awareness which is one step beyond that involved in the associational items, and an ability to conjure up some imagerial, though non-relational, representation of the objects would be expected to be an asset to their solution.

The third type of grouping was the relational grouping. Here the definition of each word element added to the significance of the other word elements, and the elements either interacted in the synthesis of a central meaning or else repeated a common pattern of dynamic, self-defining unfolding. The elements form their significance as complete entities in the context of each other, and the order in which they participate is one which requires them to transcend themselves in dynamic interaction with

the other elements. The list elements make sense together, yet the whole of their sense is something more than can be gotten from a mere differentiation of their isolated parts. The combination is deeper and more profound than in any of the previous item types. Examples of relational items would be: apple innocence estrangement Eden; clocks mathematics music order.

On the word preference test, the subject was required to decide whether the words in the list went together for some reason, to identify the principle of their combination, and to rate the items on the amount of appeal they had on a 5 point scale ranging from "pleases me very much" to "pleases me very little."

This part of the experiment was designed to test the following hypotheses:

Hypothesis 1: It was expected that high creatives and left lookers would identify the principle of organization behind the lists with more success than low creatives and right lookers, respectively.

Hypothesis 2: High creatives and left lookers would detect the mere presence of order with greater accuracy than low creatives and right lookers (i.e., the answer "no principle exists in the organization of this list" would be used with greater discretion and mostly where it was appropriate.)

Hypothesis 3: The differences in the performance of high and low creatives, left and right lookers, were expected to be particularly great on the relational dimension, followed by the sensory and associational dimensions.

Hypothesis 4: High creatives and left lookers were expected to be more tolerant of the dissonance produced by the no principle items, expressing this by ranking these items as being less displeasing than the low creatives and right lookers found them.

(To see an object relationally in terms of its continuing evolution in the context of other objects is to be continually aware of paradox and dissonance and the potentiality these possess for expanding understanding.) They were expected to like the relational items most, followed by the sensory and associational, and to like the relational and sensory items significantly more than did the other subjects.

Part II

Subjects were run individually for this part of the experiment. The subjects reported to a room arranged so that the subject sat facing a blank wall and the experimenter from across an empty, symmetrical table. A tape recorder was situated above and behind the subject so that the session could be recorded for a possible analysis of differences in the grammatical structure of the speech of each of the subject types (i.e., differences in the

frequency of use of relational comparative adjectives, adverbs, and verbs as opposed to nouns and non-relational adjectives) without the subject becoming distracted by the machine. (It was later decided to omit the analysis of this recorded data.) The subject was asked to interpret ten proverbs which were read aloud one at a time by the experimenter. The direction of the subject's eye movement was noted and recorded immediately after the proverb was read and before the subject began his interpretative response. This was done according to a procedure described by Paul Bakan (1969a) and Merle Day (1964).

Embedded in the proverbs were words which were the solutions to an anagram task which was to immediately follow. There were two possible sets of proverbs, only one of which was read to each subject; the set which was read was alternated between subjects to control for the possibility that the words cued by one proverb set were inherently easier to solve as anagrams than the words which appeared in the unread "uncued" list. Uncued anagrams served as a base measure of general anagram solving ability. Subjects given proverb set A to interpret were not exposed to proverb set B, so the anagrams made up from set B were uncued for these subjects and measured unassisted anagram solving ability. Similarly, subjects read proverb set B had not heard proverb set A, and the anagrams derived from set A were uncued for these subjects.

An equal number of anagrams was made up from the words in each proverb set, and anagrams from each set were matched in number of letters and the scramble formula used to produce the anagram. This proverb interpreting session provided incidental cues which could not be differentiated from the room environment, but which theoretically served as perceptual system primers, increasing the likelihood that the anagrams so cued would be solved through the differentiation of their parts in the same order as they occurred in the cued words. Alternatively, it can be said that this type of cueing is dependent for its effect upon an alteration in verbal association hierarchies, increasing the probability that the cued words would enter the stream of association which preceded the solution of the anagram, if such an associational strategy were used in the solution of the problem. Superior performance on the proverb cued anagrams accompanied by non-response to the environmental cues (described below) would indicate a verbal-associationistic style in problem solving.

Immediately after the proverb interpreting session, subjects were asked to go to another room where an experimenter's aide administered the anagram test. The anagram test consisted of 30 items--10 of these had been incidentally cued in the proverb situation; the solutions of 10 others were embedded in the room itself, and the 10 remaining anagrams were uncued. Examples of each of the

anagram types appeared in a random order in the test (see Appendix A for a copy of the anagram test used). The purpose of this procedure was to determine whether creative young adults and left lookers exploited the stimulus situation of the present and used it in relational context with the task at hand to provide incidental cues for the solution of the problem. The cues embedded in the room consisted of an umbrella hanging on a hook on the wall, the word "stashed" in an announcement written in large letters on the blackboard, pretzels which the experimenter's aide munched, a container of coffee yogurt which he unloaded out of his lunch sack (cueing both "coffee" and "yogurt"), a ball of string against a blackboard ledge, one way observation mirrors to one side of the room, a movie screen hanging from the ceiling, and a stuffed mouse and jumping rope mixed in a group of toys which were seemingly casually spilling out of a cardboard box situated on a table in the corner of the room. The toys were placed in the same location and position for each subject, and were in plain view to the right and in front of him. Anagrams in each group type (proverb cued, environment cued, and uncued) were matched in that one member from each (having the same number of letters) was built on the same scramble system; ten different scramble systems were used in all (see Appendix A.) (A control group showed no significant differences in the level of

difficulty of any of the resulting sets of anagrams.) The subject was given eight minutes to solve the anagrams (preceded by a one minute delay to permit him to orient himself to the room).

This was followed by an administration of the Thurstone and Jeffry Closure Flexibility Test (Concealed Figure Test, chosen because the task involves finding common relational patterns in the abstract figures) and a 90 item T-F questionnaire containing the MMPI depression scale and a list of 40 items from the Byrne sensitizer-repressor scale, selected on the basis of their ability to discriminate between high and low scorers for a previous subject population. (This group had been divided into males and females; the items which were selected were those with the highest discrimination index for both sex groups.) The depression scale and sensitizer-repressor items appeared in the questionnaire in mixed random order.

There were several expected results from this part of the experimental procedure:

Hypothesis 5: High creatives and left lookers were expected to show a greater evidence of incidental learning. Moreover, they were expected to be most superior to low creatives and right and middle lookers in the environmentally cued anagrams.

This hypothesis is in contradiction to the Mendelsohn and Griswald contention that incidental learning in high creatives is mediated by associational processes (the formation of fluid associational links) and that low creatives pay more attention to "present environmental and self-produced stimulus configurations."

Hypothesis 6: High creatives and left lookers were expected to be superior in the Concealed Figures Test, since this test can be viewed as a measure of the ability to match a perceptual template based upon the defining relationships between the parts of the example figure with the patterns of relationship within the choice figures. The subject must be able to discriminate the critical relationships from the complex of other potential relationships in each of the complete figures.

Hypothesis 7: High creatives and left lookers were expected to be sensitizers, and low creatives and right lookers repressors.

Hypothesis 8: High creatives and left lookers were also hypothesized to score higher on the depression scale. Lesions in right hemisphere cortical areas have been associated with an increase in euphoria, and lesions in the left hemisphere with increased depression; the cortex has an inhibitory influence upon processes (like emotion) mediated by lower brain centers (Truex and Carpenter, 1969). Depression has often figured heavily in the lives of creative people.

Summary

It would perhaps be of benefit, in view of the complexity of this study, to give a summary of the measures in which a relational style of perception-cognition is expected to be helpful. People who are relational perceivers are expected to do better in incidental learning, especially under those conditions in which the solution to the focal problem task is simultaneously present with the problem in the environment of the room. (The proverb cueing of the anagram task is expected to have associational rather than relational characteristics, and is not expected to benefit these persons significantly more than it does the other subjects.) They are expected to excel in concealed figures solution (in so far as the relational aspects of this task can over-ride the confounding difficulty of ignoring the task-irrelevant aspects of the stimulus), and on the relational and sensory sub-tests of the word preference test. They are expected to prefer the relational and sensory to the associational items. They are expected to score significantly above average on the Barron Welsh and the Experience Inquiry, and to be more frequently left lookers. Since sensitization is correlated with incidental learning and may itself be a measure of the capacity to allow the current of one's life to be disturbed by and intermingled

with external influences, relational perceivers are expected to be sensitizers.

RESULTS

The following statistical tests were used in analyzing the data: Fisher's t test, an F ratio for the analysis of variance, the Pearson product moment and point biserial correlations, and Fisher's exact test. t tests were used to compare the hemisphere dominance, creativity, and sex sub-groups on variables related to the hypotheses. Where data plots appeared to reveal clusterings of subjects of the same sex, creativity level, or hemisphere dominance classification in particular areas of the graph (whose axes were determined by the mean of the total subject group on each of the plotted dependent variables), chi square tests were done to test the significance of the resulting cell frequencies, except where an expected cell frequency fell below an N of 5; in the latter case, Fisher's exact test was used as a more appropriate statistical measure in lieu of the chi square. The F test was done to test the effect of creativity (as determined by the Barron Welsh), hemisphere dominance, and sex upon each of the dependent variables; the Barron Welsh was chosen as the creativity criterion for one of the main effects of the F test

because of its characteristics as a non-verbal, perceptual measure and because of the suspected popularized content of the Experience Inquiry. (Students in one of the author's classes admitted to marking certain Experience Inquiry items in a positively scored direction solely because they felt that they "ought" to behave in a manner consistent with the content of the statements; in the present study, the Experience Inquiry did prove to be less related to the other variables than was the Barron Welsh.) The mechanics of running the computer program for the F-test were also facilitated by using only one creativity criterion.

Incidental Learning

Contrary to Hypothesis 5, there were no significant between group differences on the incidental learning measures (for either environment or proverb cued anagrams) when the subjects were divided according to their standing in either creativity (Barron Welsh and/or Experience Inquiry) or eye directionality (see Table 2). However, although they were not significant, between group differences were in the predicted direction for the high vs. low creative comparison, with high creatives performing better on the environment cued and proverb cued anagrams than did the low creatives.

The situation might be further illuminated if we look at the preferred styles of utilizing information

within each of the subject groups. ("Preference" is measured by the relative number of correctly solved anagrams cued by each of the incidental procedures.) This can be done by examining within group differences in the use of the proverb (verbal associationistic) as opposed to the environment (perceptual relational) cues in the anagram problems. We find that high creatives did significantly better on the environment cued anagrams than they did on the uncued anagrams (t test, $p<.05$). This significant difference was not found for the proverb cued vs. uncued anagram comparison among high creatives (although the difference here was in the same direction), nor was it found for the low creatives in either the environment cued vs. uncued, or proverb cued vs. uncued comparisons. So high creatives did seem to show a preference for the use of information gleaned from the sensory evidence of their phenomenal field, in that they significantly benefited from such cues, thus demonstrating what was suggested to be a relational approach in problem solving. This could not be said of low creatives. Hypothesis 5 receives partial support from this within group analysis for the creativity groups; it is not confirmed for the eye directionality groups. (The general tendency for subjects on the whole to perform better on the environmentally cued anagrams than they did on either the proverb cued (t test, $p<.05$) or the uncued anagrams

(t test, $p<.001$; see Table 2) might have been sufficiently strong to obscure between group differences).

Creativity, DBRS, Depression, Concealed Figures, and Hemisphere Dominance

As predicted in Hypothesis 7, high creatives (as determined by both the Experience Inquiry and the sum of the scores on the Barron Welsh and the Experience Inquiry) are higher in sensitization as measured by the Byrne Repression-Sensitization Scale than are low creatives (t test, $p<.05$, Table 2; the corresponding F test for the relationship between creativity and sensitization was not significant). For males, this relationship is also shown to be significant by a frequency analysis (chi square, $p<.025$; see Table 7); high creative males are more likely to be those who score higher on the Repression-Sensitization Scale than are low creative males.

Contrary to prediction (Hypothesis 7), left lookers are not significantly higher in sensitization than right or middle lookers. However, it was thought that the degree to which a subject exhibited either left or right hemisphere dominance might bear some relationship to the other variables, so a "strength of hemisphere dominance" score was computed by counting the number of times each subject's eyes swung in the direction used for determining his hemisphere dominance classification. This score could vary from 7 to 10, depending upon the number of times the subject's eyes moved either left or right in a series of

10 proverb interpretation trials. Middle lookers were not included in this analysis, since the notion of strength of dominance of a particular hemisphere would be of ambiguous meaning in their case. Using this procedure, it was found that there is a significant -.714 correlation between strength of right looking (left hemisphere dominance) and sensitization for males ($p<.05$, Table 6). The correlations for females ($r=-.010$) and for sexes combined ($r=-.424$) were not significant. The comparable correlations for strength of left looking (right hemisphere dominance) with sensitization are not significant but are consistently of opposite sign ($r=.466$ for males, $r=.210$ for females, $r=.351$ for sexes combined). Thus strength of right hemisphere dominance (left looking) might predispose one toward sensitization, while strength of left hemisphere dominance (right looking) is likely to predispose one toward the use of repression, as predicted, particularly if one is a male.

Neither high creatives nor left lookers scored higher than low creatives and right lookers respectively in depression (Hypothesis 8) or on the concealed figures test (Hypothesis 6). However, middle lookers of both sexes do significantly more poorly than left or right lookers on the concealed figures test (t test, $p<.025$ and $p<.05$; see Table 2. The F test for eye movement as a main effect was not significant.) The last difference had not been predicted.

Performance on the concealed figures test correlates .476, .300, and .380 with performance on environmental cued, proverb cued, and uncued anagrams respectively (all correlations are significant at $p<.01$; see Table 4). The highest correlation is with the hypothesized relational measure, the environment cued anagrams.

Word Preference Test and Creativity

As predicted in Hypotheses 1 and 2, high creative subjects (Barron Welsh) show a generally superior performance on the word preference test; high creative subjects are significantly superior to low creative subjects in the total number of correct principle identifications across all item types ($p<.05$, one tailed t test) and in their performance in identifying the principle behind the association items, when these are taken alone (t test, $p<.01$, see Table 2). The corresponding F tests for principle identifications were not significant. The correlation between the Barron Welsh and correct identification of the principle behind the association items was also significant ($p<.05$; Table 5).

As predicted in Hypothesis 2, high creatives were superior in order detection (omitting the "no order" response where it was inappropriate), specifically in the case of association, sensory, and relational items (t test, $p<.001$, .05, and .05 respectively), and generally across

all item types (t test, $p<.01$). The p level for the F ratio for creativity as a main effect upon seeing order in the association items was .053; it was .07 for the total of all item types). The superiority of high creatives in seeing order generally across all item types was also supported by a chi square analysis ($p<.025$, Table 7), and by the correlation coefficient between the Barron Welsh and the tendency to incorrectly use the "no order" response generally across all item types ($r=-.201$, $p<.05$), and specifically in the case of the association items ($r=-.226$, $p<.05$). Among female subjects, high creatives are less prone to the error of claiming no principle of organization behind sensory items (chi square, $p<.01$, see Table 7).

Interestingly, the word preference test does not significantly distinguish high and low scorers on the Fitzgerald Openness to Experience Inquiry, but does distinguish high and low performers on the Barron Welsh Art Preference Scale. The Experience Inquiry also distinguishes less between lookers than does the Barron Welsh. When these measures are combined, only the differences between high and low creatives in identifying the principle behind the association items, and in seeing order in the association items and across all items generally are preserved, and these are significant at the .05 level using a <u>one tailed</u> t test. So the predictive power of the word preference test is weakened when the

Experience Inquiry is used as a criterion measure of creativity.

However, Experience Inquiry scores are associated with some liking indices. The Experience Inquiry alone correlates significantly with the tendency to like associational and relational items ($p<.05$), and high creatives defined by the joint criterion like sensory and relational items significantly more than do low creatives, as predicted by Hypothesis 4 (t test, $p<.05$; F test not significant).

Word Preference Test and Hemisphere Dominance

Hypotheses 1 and 3 are partially supported in that left lookers have a higher average number of correct identifications of the organizational principle behind the relational items than do right lookers ($p<.05$, one tailed t test; F test not significant). This superiority was specific to relational items and was not shown for other item types. However, it should be noted that relational items are those presumed to be most central in the test as a measure of relational thinking. Since left lookers were expected to show their greatest superiority on the relational items, Hypothesis 3 gains some support from this finding.

Consistently with Hypothesis 2, right lookers commit a greater number of erroneous "no order"

attributions than either left or middle lookers, across all item types (t test, $p<.05$, Table 2) and on associational and relational items each considered separately ($p<.05$; $p<.01$, respectively). The F test for the main effect of eye movement upon failure to see order in the relational, associational, and over all item types had p values of .04, .09, and .07 respectively.

Left and middle lookers do not significantly differ from each other on any performance measure from the word preference test.

No evidence was found for the hypothesis dealing with differences in expressed liking for the word preference item types among the eye movement groups.

Relationship of Performance on the Word Preference Test to Anagram Performance

Overall performance in principle identification is correlated with performance on the environment cued and uncued anagrams ($r=.286$, $p<.05$; $r=.379$, $p<.01$ respectively; see Table 4). Ability to identify the principle behind the association items specifically is also related to performance on the environment cued ($r=.334$, $p<.01$) and uncued ($r=.481$, $p<.01$) anagrams. The patterns of correlation here are similar to those between performance on the concealed figures test and the anagrams, except that the correlation between performance on principle identification and the proverb cued anagrams is not significant,

whereas the correlation between concealed figures and proverb cued anagram performance is significant. The significance which this has for any conclusions concerning the relational character of the word preference, anagram, and concealed figures tasks will be discussed below.

Sex Differences

Incidental Learning

Female subjects appeared to make more use of the environmental cues in the incidental learning situation than did males; females more often fell above the mean in performance on the environment cued anagrams than did males (chi square, $p<.05$). Like high creative subjects, female subjects also did significantly better on the environment cued anagrams than they did on the uncued ones (t test, $p<.05$); this difference was not significant for males or for low creatives.

Word Preference Test

Females perform significantly better than males in correctly identifying the organizational principle behind the association items (t test, $p<.01$, see Table 2; the F test is significant, $p<.04$, see Table 3), and in the total number of correct principle identifications across all item types ($p<.001$; F test significant at the .02 level). Females are also less likely to incorrectly claim "no order" generally in all item types ($p<.05$; the F ratio

approaches significance at p=.06), and in the association items (p<.01; the F test is significant at the .02 level) and the sensory items (p<.05, F test not significant).

Creativity

Females scored significantly higher than males on the Barron Welsh (t test, p<.001).

Sex, Hemisphere Dominance, and Environmental Cueing

There appeared to be some fundamental differences between the sexes with respect to the effect of hemisphere dominance that warranted exploration, although no predictions had been made about such interactions. It seems that much of the difference between males and females in the use of environmental cues was due to the performance of female left lookers. (The hypothesized relational character of the incidental learning task had led to the expectancy that left lookers in general would be superior in the environmentally cued anagrams; this was not found to be the case.) Female left lookers were significantly superior to male left lookers in performance on the environment cued anagrams (t test, p<.01; F test not significant). A Fisher's exact test also showed a relationship between sex and performance on the environment cued anagrams for left lookers, significant at the .005 level (see Table 7); female left lookers were more often superior in solving the environment cued anagrams

than male left lookers. This sex difference was not found for either middle or right lookers. There was also a -.598 point biserial correlation ($p<.01$) between performance on the environment cued anagrams and sex for left lookers (where females were coded as "1," males as "2"); this significant correlation was not found for right lookers or the combined subject group. Indeed, there was a -.73 correlation between performance on the environment cued anagrams and strength of right hemisphere dominance for male left lookers, significant at the .05 level (see Table 6), perhaps indicating a contributing handicapping factor of right hemisphere dominance to the already inferior performance of males in the relational use of environmental cues in problem solving. The corresponding correlation for female left lookers was -.018. The combination of maleness and right hemisphere dominance seems to be particularly handicapping to the relational use of environmental cues.

Sex, Hemisphere Dominance, and Creativity

There does appear to be a positive relationship between strength of hemisphere dominance and creativity as measured by the Barron Welsh, particularly for male left lookers (right hemisphere dominant) and for female right lookers (left hemisphere dominant). For male left lookers the correlation between strength of right hemisphere dominance and creativity is .746, $p<.05$; the

correlation for female left lookers (r=.337) is not significant; however, the correlation for combined sexes remains significant (r=.493, $p<.05$). The correlation between strength of left hemisphere dominance and creativity is significant for right looking females (r=.738, $p<.05$), but the corresponding correlations for males (r=.214) and combined sexes (r=.453) are not significant.

Sex and Right Hemisphere Dominance

Even though male and female right and middle lookers are not statistically distinguishable on any measure (except in identifying the principle behind the association items on the word preference test, in which female right lookers are superior to male right lookers, t test, $p<.05$, F test for effect of eye movement x sex not significant; and in depression, in which female middle lookers score more highly, t test, $p<.02$, with the F for effect of sex x eye movement on depression significant at less than the .05 level, see Table 3), there are widespread differences between male and female left lookers. Female left lookers perform better than male left lookers on the concealed figures test (Fisher's exact test, $p<.025$, see Table 7), and in various aspects of the word preference test. Male left lookers are inferior to female left lookers in identifying the principle behind the sensory items (t test, $p<.05$, see Table 2), and in identifying

organizing principles generally ($p<.01$); they are more prone to erroneously claiming "no order" generally ($p<.05$), and in the association ($p<.05$) and sensory items ($p<.01$); the F ratios for the effect of sex x eye movement upon these measures were not significant. As mentioned previously, male left lookers were also inferior to female left lookers in incidental learning as measured by their performance on the environment cued anagrams, and were inferior to female left lookers on the Barron Welsh (this last difference, though a seemingly sizeable 6.25 points, was not significant).

There is a significant negative correlation between strength of left looking and the number of erroneous "no order" attributions in the associational category for left looking females only ($r=-.638$, $p<.05$, compared with $r=-.029$ for left looking males, see Table 6). The sizeable, though non-significant for this N (12), negative correlation between strength of right hemisphere dominance and the general indiscriminant use of the "no order" response ($r=-.541$), and the erroneous use of "no order" in the sensory ($r=-.319$) and relational ($r=-.489$) items which were found for left looking females, are reversed in direction for left looking males (r general incorrect use of "no order" = .242; r incorrect "no order" in sensory items = .353; r incorrect "no order" in relational items = .422). Although these correlations are not

significant, the pattern is remarkably consistent. The corresponding correlations for right lookers were essentially zero (except that strength of right looking correlated .43 with the erroneous use of "no order" in the relational category for females), and all were non-significant.

Since for males strength of left looking is related in a theoretically consistent manner to "personality" variables such as creativity measured by use of the Barron Welsh ($r=.746$, $p<.05$), and sensitization ($r=.466$, not significant), but is related in a direction opposite to that which would be expected for performance variables such as incidental learning and the word preference measures of the ability to perceive the ordered inter-relatedness of things, one would suspect that some sort of incompatability between what might be biologically determined personality propensities based upon the organization of these male left lookers' nervous systems and the characteristics demanded of them by their socially ascribed sex role might hamper what left looking males creatively do in the world. The pattern of correlations with strength of right hemisphere dominance is in a theoretically consistent direction for female left lookers across all of these measures (although only one of the correlations, that between strength of left looking and the number of

incorrect "no order" responses to association items, r=-.638, is significant at the .05 level).

SUMMARY OF RESULTS

The following can be said about the original hypotheses.

Part I

1. As predicted, both high creative (as determined by the Barron Welsh) and left looking (right hemisphere dominant) subjects showed superiority in identifying the principles behind the word preference lists when compared with low creatives and right lookers, respectively; this superiority was significant in the case of the association items for the high creative vs. low creative comparison, and in the case of the relational items for the left looker vs. right looker comparison. Although left lookers correctly identify more principles than middle lookers, the differences are not significant.

2. When the Barron Welsh is used as a criterion measure for creativity, high creatives use the "no order" response in the word preference test inappropriately significantly less often than do low creatives; this is true for all item types in the word preference test. High

creatives, determined on the basis of a summation of standard scores from both the Barron Welsh and the Experience Inquiry, were significantly superior to low creatives only in their general ability to see order and in their ability to see order in the association items.

Right lookers were significantly inferior to both left and middle lookers in their capacity to see order generally (total erroneous "no order" score) and their ability to see order in the association and relational item types. Left lookers use the "no order" response indiscriminantly less often than do middle lookers, but the differences are not significant.

3. For all subjects, the sensory items were the easiest (see Tables 1 and 2). We find this by either looking at the erroneous "no order" scores or the number of sensory items for which the subjects were able to come up with the keyed organizing principle. The sensory items were followed in difficulty by the association and relational items (except that in the relational items it was easier to see order, without specifying the nature of that order, than it was in the association items). So the subject groups were not distinguished by their ability to selectively handle one type of word preference item over another. Hypothesis 3 was therefore not confirmed.

4. High creatives (Experience Inquiry plus the Barron Welsh) were found to like the relational and sensory items significantly more than did the low creatives, as predicted. However, there were no significant differences between high and low creatives in their preferences for the items which had no underlying organization. The Experience Inquiry correlated significantly with liking for both relational and associational items, while for low creatives, a significant positive correlation was found between liking the sensory items and scoring well on the Barron Welsh and in incidental learning as measured by the environment cued anagrams.

The eye movement groups could not be distinguished on their relative degree of positive response to any word preference item type, and they did not show a significant preference for any of the item types, except that left and middle lookers significantly preferred sensory to associational items. Therefore it can be said that none of the predicted within group differences in liking for the items were found, except in the case of the predicted preference for sensory over associational items in the case of left and middle lookers. Generally, across all subjects, the sensory items were preferred most, followed by the relational and the associational, and the subject groups could not be distinguished on the basis of their preference rankings of these item types. However, the

predicted between group difference for high creative and low creative subjects in preference for the relational and sensory items was confirmed.

Part II

1. None of the predicted between group differences in incidental learning were found. However, high creatives seemed to display a preference for the use of cues embedded in the environment of the problem room, in that they performed in a significantly better fashion on the environment cued anagrams than they did on the uncued anagrams, whereas their performance on the proverb cued anagrams gave no evidence of having benefitted from an earlier exposure to the solution words in the proverb session, which would have been expected to have a facilitory effect upon the availability of associational cues. The predicted differences in incidental learning for the eye movement groups were not found.

2. High creatives were not significantly superior to low creatives on the concealed figures test, nor were left lookers superior to right lookers. However, left and right lookers were significantly superior to middle lookers, an unanticipated result.

3. High creatives are significantly higher in sensitization than low creatives, as predicted. The predicted differences in sensitization for eye movement groups were not found.

4. High creatives were not found to be significantly more depressed than low creatives. There were no significant differences in depression between the eye movement groups.

DISCUSSION

The Word Preference Measures in Relation to Creativity

Preference for Items

As predicted, high creatives (total score) did prefer the sensory and relational items significantly more than did the low creative subjects. The groups did not differ in their acceptance of the association items, which were the least liked of all item types for both groups. It is difficult to believe that high creatives would primarily use a cognitive strategy in problem solving which often yielded results which they and their less creative audience found dissatisfying. In the light of this finding, the hypothesis that creative insight is primarily the product of abstracted, verbal-associationistic processes seems highly implausible.

Principle Identification

High creatives (Barron Welsh and total score) were superior to low creatives in general principle identification on the word preference test and in the simple capacity to see order. However, the predicted patterns of

differences between high creatives and low creatives on the principle identification sub-scales of the word preference test were not found. Indeed, contrary to predictions, the principle identification task which most strongly differentiated between high and low creative groups was the associational one. Part of the reason for this might be found in the fact that the association items were the easiest ones for which to find an organizing principle (see Tables 1 and 2, Part II). The nature of the category itself was probably the most easily comprehensible. Even though the sensory items were not significantly easier than the associational ones, the relational items were quite difficult, and were solved significantly less often than either the sensory or associational items. In future research, item difficulty will be reduced and greater care taken in equating the difficulty of the kinds of items. Until this is done, the hypothesized differences between the cognitive styles of high and low creatives cannot have a fair test, and high creatives cannot be directly shown to have a greater facility in relational thought. On the basis of the present data, there is little reason to arrive at a conclusion that is anything other than the conventional assertion that high creatives differ from low creatives in the flatness of their association hierarchies, and their ability to associate with rapidity and fluidity. Perhaps a pictorial form of the test would

provide a means for making more elaborate distinctions between the cognitive functionings of high and low creatives. The verbal form may be too boring, too difficult, and too indirectly related to the presumed underlying phenomena of interest, which are mainly perceptual and imagerial in nature. This indirectness would be most acute in effect for the sensory and relational items. Thus, the verbal format may be most handicapping on those items, and particularly for those people in which we expect the hypothesized perceptual/cognitive style to be shown, high creatives. A future research attempt will be directed toward developing a pictorial version of the test.

Criterion Measures of Creativity

In the context of evaluating the effectiveness of the word preference test as a measure of basic variables related to creativity, one must consider again the problem of defining a suitable criterion measure of creativity and the related problem of method variance. More specifically, we are calling into question the current validity of the Experience Inquiry as a measure of the openness to experience assumed necessary for creative production. The items of this scale, though perhaps suitable for identifying deviant, "creative" beliefs and practices among the members of a college population a decade ago, now seem less capable of performing that function. The phenomena

they refer to have become so thoroughly engrained in current "pop culture" that one wonders about their suitability for a task of differentiating one group of the young from another. The range of scores on the Experience Inquiry (16-54) was noticeably smaller than that on the Barron Welsh (3-57) for this subject group.

The word preference test did differentiate between high and low scorers on the Barron Welsh, but not between high and low scorers on the Experience Inquiry. The Barron Welsh and the Experience Inquiry were correlated significantly but minimally, r=.3. When both measures were combined, the power of differentiation of the word preference test was reduced, and fewer scales yielded significant differences between high and low creatives than when the Barron Welsh was used as the sole criterion measure; the power of prediction of the capacity to see order was most effected. Using only the Barron Welsh as the criterion, every word preference sub-scale, with the exception of the ability to define the exact principle of organization behind the sensory and relational items, successfully differentiated between high and low creatives. Neither the Experience Inquiry nor the Barron Welsh significantly correlated with any measure other than the various sub-scales of the word preference test.

The Experience Inquiry, used alone as a criterion measure of creativity, was correlated with no word

preference measure other than those measuring liking for associational and relational items. The activity of approval requires less involvement of one's capacities than the process of recognizing and identifying the nature of orders. The Experience Inquiry does not seem to be able to predict a capacity for seeing and identifying orders, but merely the readiness to approve of patterned events whose structure may be only incompletely understood.

Adding the Barron Welsh standard scores to the Experience Inquiry standard scores and using the sum as an operational definition of creativity resulted in the finding that the high creatives liked the sensory and relational items significantly more than did the low creatives, as predicted. This prediction was not confirmed when either the Barron Welsh or the Experience Inquiry were used alone.

The word preference test can be characterized as a measure of the ability to relate things, to combine them in a way which is meaningful, and of the capcity to react favorably to such combinations. It can be said that creativity, as best we can define it, is positively related to both of these capacities. The nature of the mechanisms behind this ability to view one part of the world in the light of the other, and to combine the parts into a mutually illuminating whole and find joy in that, must go undefined because of the failure to get the

predicted within group differences in the number of correct principle identifications for each of the word preference test item types. However, the fact that the sub-scales of the word preference test most effectively predicted performance on the Barron Welsh, a largely perceptual measure of creativity which seemingly would provide ample opportunity for the appreciation of the interdependence of forms and the linking of images, is interesting. It would tend to leave the conclusion that purely associational factors were responsible for the creative ability of high performing subjects in doubt.

This capacity to discern a relationship between things, at least in the verbal tests used, appears to be present to a lesser degree in low creatives, right lookers, and males. Right lookers, when compared with left lookers, appear to have particular difficulty with the associational and relational items; males, compared with females, tend to have difficulty with the associational and sensory items; while low creatives, compared with high creatives, show inferior performance across all item types. This becomes theoretically interesting when considered in terms of the contrasting styles of analytical and relational thinking discussed in the introduction. We would define analytical thinking as the tendency to view the world in discrete parts, non-contextually, so that in problem solving the cues of the environment and similar patterns

in "irrelevant" stores of memory are ignored; intuition (which is based upon the correlation of unverbalized, incidentally encountered or remembered cues), is distrusted, and thought proceeds in a link by link fashion, discrete unit by discrete unit, like in the weaving of an associational chain based upon verbal conditioning rather than a sensory-like feel for the qualities of the elements or an understanding of the common dynamic form of inter-relationship with the world that they share. It is like the process of defining and combining objects or ideas on the basis of commonly shared static qualities, a like unit to like unit linking, instead of on the basis of a commonly held gestalt of interaction with the world. Analytical thought would be exemplified by an attempt to define a word such as "game" by enumerating all parts and types of its instance, relational thought by a realization of the infinity of the category; analytical thought by an emphasis upon the size or shape of a thing in classifying it, relational thought by an emphasis upon its function (not in terms of its potential for exploitative use but in terms of its pattern of dynamic unfolding and interaction with other things in the world).

It was my contention that the left hemisphere provided the analytical style, the right the relational, and that the right hemisphere provided the content behind the word stream generation of the left hemisphere. Words

stand for relational categories. A "dog" is a thing which does in a particular way, has a relationship with other beings which is quite particular, in addition to consisting of parts which maintain a particular pattern of relationship with respect to each other. A fifteen foot high dog is as much a dog as a chilhuahua, a long nosed one as a short nosed one; if we visited Saturn and found peculiar beings which in no way resembled earthly dogs but whose existence unfolded before our observing eyes in a particular dog-like fashion, we would be tempted to call these creatures "dogs." To characterize "dog" definitively in terms of enumerated instances (collie, terrier, beagle) or lists of discrete, associationistic, non-relational characteristics which all members of the class allegedly share (brown, short, big eared) is to engage in a thoroughly hopeless analytical task.

In light of this, it is peculiarly interesting that low creatives (Barron, 1968), right lookers (Bakan, 1971), and males (Bardwick, 1971) are less verbally fluent and hence perhaps have less access to the content providing image spinning activities of the right hemisphere. Males pride themselves on their "analytical" cognitive style and demonstrate it in their tendency to prefer less complex perceptual patterns (i.e., they have a tendency to prefer diagrams which portray an abstracted characteristic of an isolated object, rather than a complexly intersecting

display of many lines, and they have a tendency to respond less contextually ("field independence") in such tasks as the rod and frame). The inferiority of right lookers on association and relational items and of low creatives on all items is consistent with other data. Low creatives and males in my population are inferior in incidental learning; people who are inferior in incidental learning are less susceptible to interference on the Stroop test (i.e., they are readily able to "abstract" one characteristic of the visual display and respond to it alone), both of which characteristics point toward an "analytical," isolating style of perception and cognition where elements are dealt with per se rather than in the context of their interactions with things and the similarity of these patterns of interaction with those of other things. Because of the biological character of their dominant hemisphere, right lookers might show this weakness in relational thought on the relational items of the word preference test (which require them to extend ties of connectedness across entire scenes and systems of interaction). Males in our culture, taught to be spartan, single minded, and unfeeling, might demonstrate this isolating style in the sensory items, but there is some evidence that the preference for simple, non-contextual sensory input is evident in males from infancy (Kagan and Lewis, 1965), and so their thought style might be

determined by more than social convention. High creatives, left lookers, and females (who prefer from infancy more complex, multi-dimensional forms of sensory input) would then be expected to be relational thinkers. But again, the finding that the associational items (which are non-imagerial and non-relational) also differentiate between these groups cannot be easily explained within the context of this theory.

Anagram Performance

Performance on the anagram task was correlated with only two other measures, the concealed figures test and the general ability to identify the principles of organization behind the items on the word preference test, particularly the associational items. It was not correlated with creativity as measured by either the Barron Welsh or the Experience Inquiry, or with sensitization, as might be expected for an incidental learning task. The correlations were significant ($p<.01$) for the relationships between concealed figures performance and all conditions of anagram cueing (uncued, proverb cued, and environment cued). The correlations were also significant ($p<.01$) for the relationships between anagram performance and the above mentioned word preference test measures, but there were two exceptions--performance on the proverb cued anagrams did not correlate significantly with either general principle identification or the specific ability

to identify the principle of organization behind the association items on the word preference test. Clearly the capacity to pick up and utilize incidental cues from an immediately whelming perceptual environment and the ability to bring past learned incidental verbal cues (or the altered association hierarchies which result from them) to bear on a present problem situation are not altogether identical.

It would be convenient if we could ascribe the same underlying process, a non-verbal process of relational perception and cognition, to performance on all three of these measures, anagram solution, concealed figures, and principle identification. However, there is no significant correlation between performance on the concealed figures test and the word preference sub-scales that also correlate with anagram solution. That is, the measures which are correlated with anagram performance are not correlated with each other. A one-factor explanation is particularly strained in that the only word preference test measures correlated with anagram solution were the total principle identification score and the association principle identification score. The correlation of the association scale scores with anagram solution suggests a factor of verbal fluencey based upon the possession of flat association hiearchies, more than it suggests an underlying explanation built upon relational perception and cognition.

Thus, it seems likely that there are two kinds of factors involved in anagram solution. One factor is that of associational fluency, which accounts for the correlation between anagram performance and the association sub-scale, and because of this, perhaps also for the total principle identification score (to which the association sub-scale contributes.) The perceptual/relational factor would then account for the correlation between the concealed figures scores and anagram performance, as explained above. However, there remains one inconsistency. The associational and total principle identification scores do not correlate with performance on the proverb cued anagrams. These correlations would be expected if the relationship between the associational word preference scale and anagram solution were due to an underlying factor of associational fluency, and performance on the proverb cued anagrams were facilitated by that fluency.

SUMMARY AND CONCLUSIONS

1. High creatives use environmental cues to aid in problem solving and hence seem to be more attuned to their current perceptual world. They tend to be sensitizers. Their performance in principle identification and the perception of order in the word preference test is superior to that of low creatives, particularly in general ability to identify the principles of organization behind the items, especially the associational items, and in seeing the existence of order in all item types.

2. Females make greater use of environmental cues in problem solution than do males. They prefer stimulus complexity, scoring significantly more highly on the Barron Welsh than their male counterparts. They are superior to males in general verbal principle identification, particularly in the associational items, and in the perception of order in the word preference test. (The latter is true in all but the relational items, where the differences were not significant, though in the same direction.)

3. Female left lookers are superior to male left lookers in using environmental cues in problem solving, identifying the principles of organization in the word preference test (particularly the sensory items), and seeing order in the word preference items, particularly in the association and sensory items. Female left lookers are more often superior in concealed figures than are male left lookers.

4. There is a significant correlation between strength of hemisphere dominance and creativity for combined sexes among left lookers, and for male left lookers and female right lookers taken alone. There is a significant negative correlation between strength of left looking and failure to see order in the associational items of the word preference test for females only. There is a significant negative correlation between strength of left looking and using environmental cues for males only; male left lookers perform significantly more poorly on this incidental learning task than do female left lookers. There is a significant negative correlation between sensitization and strength of left hemisphere dominance (right looking) for males only (perhaps reflecting a harmony between their sex roles and biological capacities which either results in a relatively conflict free existence (and low scores in sensitivation) or in an exaggerated, mutually reinforcing

style of insensitivity and defensive denial toward experience which is emotion ridden and "irrational").

5. One would expect right lookers of both sexes and left looking males to be the least creative performers. Left looking tends to be correlated with inferior performance in incidental learning and on the word preference test for males; right looking is correlated with repression among males. Right lookers in general are significantly inferior on the word preference test, and male left lookers score about as poorly as right lookers on this. Female right lookers are significantly inferior to female left lookers in the capacity to see order in the word preference items. Except in the ability to identify the principle behind the association items (where right looking females are superior to males) there are no significant differences between right looking males and females. Right looking females would be expected to be less creative performers than left looking females, but the contradictory relationship between their sex role and biological capacities, which might be expected to add to the complexity of their life experience and might mediate the significant correlation between strength of right looking and creativity for them, would seem to give them an edge over right looking males in their potentiality for creative performance.

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APPENDICES

APPENDIX A

ANAGRAMS: INSTRUCTIONS, SCRAMBLE

SYSTEMS, CUEING, AND KEY

Instructions: Below you will see a series of puzzles called anagrams. Anagrams are mixed up words. Your job is to unscramble the words so that they make sense. For example, enwi can be unscrambled to spell "wine." There are no contractions, proper names or abbreviations which we wish you to find in these scrambles. You have 8 minutes for this.

	Anagrams	Scramble	Cueing
1.	honeug	632145	Proverb (set 1)
2.	lepertz	7316245	Environment
3.	nofruet	6213574	Proverb (set 2)
4.	tbeetr	412536	Proverb (sets 1&2)
5.	dsahret	4621357	Proverb (set 1)
6.	eawthdc	6213574	Proverb (set 1)
7.	fcoefe	412536	Environment
8.	eshece	562314	Uncued both groups
9.	glrnoli	7316245	Proverb (set 1)
10.	snadsed	1624753	Provert (set 2)
11.	setsdha	1624753	Environment
12.	hteet	51324	Proverb (set 2)
13.	ecerns	524361	Environment
14.	gtinrs	624531	Environment
15.	rrimros	4621357	Environment
16.	tgoyur	632145	Environment
17.	dsnglead	48712635	Proverb (set 2)
18.	ralumlbe	48712635	Environment
19.	enwsra	524361	Proverb (set 2)
20.	khnist	524361	Proverb (set 1)
21.	nujmigp	6213574	Environment
22.	duceont	7316245	Proverb (set 2)

	Anagrams	Scramble	Cueing
23.	rrowke	632145	Proverb (set 2)
24.	vtsheeai	48712635	Proverb (set 1)
25.	geewihd	4621357	Proverb (set 2)
26.	grahset	1624753	Proverb (set 1)
27.	emuos	51324	Environment
28.	erubrb	562314	Uncued both groups
29.	drenif	624531	Proverb (sets 1&2)
30.	yhpap	51324	Proverb (set 1)

*Anagrams cued by proverb set 1 were automatically uncued for subjects hearing proverb set 2. Proverb set 2 anagrams were likewise uncued for S's exposed to set 1.

Key:

1.	enough	16.	yogurt
2.	pretzel	17.	gladdens
3.	fortune	18.	umbrella
4.	better	19.	answer
5.	hardest	20.	thinks
6.	watched	21.	jumping
7.	coffee	22.	counted
8.	cheese	23.	worker
9.	rolling	24.	heaviest
10.	saddens	25.	weighed
11.	stashed	26.	gathers
12.	teeth	27.	mouse
13.	screen	28.	rubber
14.	string	29.	friend
15.	mirrors	30.	happy

APPENDIX B

THE EXPERIENCE INQUIRY

APPENDIX B

THE EXPERIENCE INQUIRY

E. T. Fitzgerald
University of California

Directions: This booklet contains 68 numbered statements. Please read each statement and decide whether it is true as applied to you or false as applied to you.

You are to make your answers on the answer sheets provided. If a statement is True as applied to you, place a check mark on the lines in the column headed T. If a statement if False as applied to you, place a check mark on the lines in the column headed F.

There are no right or wrong answers. The statements are about matters on which people often differ. The best answer is just your own opinion. Please answer TRUE or FALSE for every statement, even if you have to guess at some.

1. I am regarded by others as a person with a strong sense of humor.

2. Sometimes I wander off into my own thoughts while doing a routine task so that I actually forget that I am doing the task, and then find, a few minutes later, that I have completed it without even being aware of what I was doing.

3. At times I have carried on real conversations with another person while I was asleep (e.g., with someone who walked into my room).

4. Sometimes I have had the impression that the walls or the ceiling were moving and changing size or state, even though I knew that this was impossible.

5. When I am working, I find it distracting if the TV is on or if someone is talking in the room.

6. At times the solution to a problem has suddenly occurred to me while I was engaged in an activity unrelated to that problem.

7. At times I have focused on something so hard that I went into a kind of benumbed state of consciousness, or at other times into a state of extraordinary calm and serenity.

8. I can look at an object--a leaf, a stone, a flower--for a long time, continuing to discover different things about it.

9. I prefer Martin Luther King to Jonathan Winters.

10. I avoid sports and activities that are thrilling but in which there is some risk of physical injury.

11. I feel uncomfortable when I cannot make my ideas consistent.

12. It is possible that there are civilizations on other planets which are far more advanced than ours.

13. I avoid "putting people on" or doing things just to see the reactions of others.

14. People are intolerable who take "sacred" things in a light and humorous way.

15. One should be on guard against obscuring rational thought by beliefs in mystical experiences.

16. Sometimes I imagine what it would be like if the world were different, e.g., if there were no laws, if we could read each other's minds, etc.

17. I usually prefer to do things in tried ways rather than new and different ways.

18. It is possible that we had a previous existence of which we have no memory.

19. I would like to get beyond the world of logic and reason and experience something new and different.

20. At times I have actively stared at something familiar and had it become very strange before my eyes.

21. Whenever possible I avoid taking risks and experiencing things that are different from the usual.

22. While lying in bed or reclining in a chair I sometimes find myself perceiving faces, objects, etc. in the shadows of the light or the design of the ceiling, etc.

23. I think that things should be predictable and certain.

24. At times I see unusual relations between things.

25. It is possible that our sense organs (i.e., eyes, ears, etc.) do not bring us our most important information.

26. Poetry has little effect on me.

27. I prefer the standards of the scientist to those of the artist.

28. I like to indulge in emotions and sensations with the feeling of just "letting go."

29. I tend to see humor in awkward situations in which I sometimes find myself.

30. I would enjoy a contest in a carnival in which I had to break a pile of dishes.

31. I have never had a strange or weird experience.

32. I have had experiences which inspired me to write a poem or a story, or make up a humorous tale, or paint a picture.

33. I have had the experience of being caught up by music or dancing, becoming enraptured by it, and having it live and express itself through me so that I seemed to cease to be.

34. I am quick to see "double meanings" in things people are saying or in what I am reading.

35. I think that miracles are possible.

36. I think that our most intense experiences can be communicated in words to others.

37. If one concentrates hard enough, it is possible to influence the thoughts and behavior of other people.

38. Some people are capable of extrasensory perception.

39. I sometimes find myself seeing serious matters or important people in a comical light.

40. There have been times when I have been completely immersed in nature or in art and had a feeling of awe sweep over me so that I felt as if my whole state of consciousness was somehow temporarily altered.

41. I have experienced moments of inspiration and creativity, when artistic expression, ideas, or the solutions to problems I had struggled with came to me with a special intensity and clarity.

42. I prefer people who are predictable and dependable to those who are impulsive and changeable.

43. At times I have found a sort of fulfillment of myself in creating something, as in crafts, science, writing, art or music.

44. I usually try to understand my dreams.

45. It is not possible literally to read another person's mind.

46. I think that unidentified flying objects from outer space have in fact been sighted.

47. I would like to try parachute jumping.

48. At amusement parks I usually avoid roller-coasters, ferris wheels and similar "thrill rides."

49. I think that many people in our culture have had visions at some time or another.

50. There are things and events which cannot ultimately be explained logically.

51. Solutions to problems or ideas for new projects come to me at times "out of the blue."

52. Most things people laugh at are not really funny.

53. I enjoy "wild" parties.

54. I am often bored when left alone.

55. It would be fun to throw darts at a picture of someone I dislike.

56. I have been so strongly in love with someone that I somehow felt that my own self was fading and I was at one with the beloved person.

57. I have had the experience of doing some task in the middle of the night (e.g., jotting down a note, answering a phone call) with no memory the next morning of having done so.

58. If one concentrates hard enough it is possible to influence objects.

59. It is possible for the mind to leave the body and experience things at great distances, even in the past and in the future.

60. When solving a problem I allow myself to consider all possibilities even though some are unrealistic or absurd.

61. I have walked in my sleep at times.

62. It is sometimes right to hit someone who makes you angry.

63. I would prefer vacationing at a fashionable resort to sailing around the world, paddling down the Mississippi, or some similar activity.

64. It is immature and childish for adult persons to display emotion and behave impulsively.

65. Eventually everything will be explained by the laws of science.

66. It is often better to act upon one's feelings than upon a logically reasoned plan.

67. It is possible that the moon influences human behavior.

68. I find myself uncomfortable in the presence of unconventional or "peculiar" people.

APPENDIX C

WORD PREFERENCE TEST--COPIES OF FORMS 1 AND 2, WITH KEYED ANSWERS

APPENDIX C

WORD PREFERENCE TEST--COPIES OF

FORMS 1 AND 2, WITH KEYED ANSWERS

On the next few pages you will see a series of items, each of which consists of a list of four words. Some of these items contain words which seem to go with each other. They might go together for a reason which is different for different items. We think that there are three possible reasons for putting these words together, and have explained these below.

1. An associational grouping is one in which the words seem to share nothing with each other but the fact that each has a verbal assocation in common with each of the others. Besides the fact that the list members share a verbal associate, putting them together does not make much "sense." There is no obviously apparent reason for combining them for any purpose, and one would not expect to find them normally occurring together. One of the words in the list might be this shared associate. An example of this type of grouping would be: soda kilt butter Scotch.

2. A sensory, or shared characteristic, grouping is one in which the words seem to go together because their referents share a common sensory quality. One of the words in the list may state the nature of the quality or characteristic shared by other items in the list. (The words may or may not have a common verbal associate.) Otherwise there is no other meaning which these words share or contribute towards. An example of this type of grouping would be: frog money lime green

3. A relational grouping is one in which the referents noted by the stimulus words combine so as to mean something more than any list member taken alone or combined with any other list member. The meaning of the total list cannot be pointed to as part of, or completely included in, any one of the list elements. "The whole is more than the sum of its parts." The list members seem to "go together" in that each one adds to the meaning of the other when they are all considered together in the context of each other. One of the words (the summary concept) is the focal point in terms of which the other words take on a collective significance. The summary concept takes into account the nature of each of the list elements and meaningfully combines them.

The separate words "point to" or are integrated by the summary concept. An example of this type of grouping would be: clocks mathematics music order

4. It is possible that none of the above principles is involved in the grouping.

As you are reading the word series on the following pages, decide whether their members go together (make sense together, or share something in common), and mark yes or no in the column headed "go together?" Then indicate if the principle you see in the combination appears among those listed above. Mark 1 (for associational), 2 (for sensory), 3 (for relational), or 4 (for none of these) under the column which designates the category principle that you have selected. If you initially decided that the words did not go together, don't mark anything in the principle column. Next indicate how much you like each particular list of words by marking in a number in the appropriate box in the "like" column according to the following scheme.

1	2	3	4	5
If the list pleases you very much	If the list pleases you a little	If you are completely indifferent to the list	If the list displeases you a little	If the list displeases you very much

Please take your time and consider your choices carefully.

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
1. fruit navel licorice Pillsbury		No		
2. apple innocence estrangement Eden		Yes	Relational	
3. vampire sharks crocodiles teeth		Yes	Sensory	
4. tail arms ape hairy		Yes	Sensory	
5. vampire coal trees airplane		No		
6. note dive chair high		Yes	Sensory	
7. fruit flower abdomen fertility		Yes	Relational	
8. cabbage Revolution troika Russia		Yes	Relational	
9. bald screech emblem eagle		Yes	Relational	
10. cabbage oil soup engine		Yes	Association	
11. widow bite monkey spider		Yes	Association	
12. sky bald envy sea		No		

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
13. book bustle dive beans		No		
14. sweat exhaustion prize race		Yes	Relational	
15. hand seed brain cage		Yes	Association	
16. feet softly guard escape		Yes	Relational	
17. fire prophecy Wisemen star		Yes	Relational	
18. monkey daffodil glue truck		No		
19. sweat sail pretzels royal		No		
20. stove pepper fire hot		Yes	Sensory	
21. feet skunk armpit smell		Yes	Sensory	
22. sweat shoulder blood cold		Yes	Association	
23. class railroad girl working		Yes	Association	
24. kill honor regret war		Yes	Relational	
25. scout witch Nabisco letters		No		
26. kill kangaroo proof earth		No		
27. Southern console station comfort		Yes	Association	
28. class anxiety hallways school		Yes	Relational	
29. tail dog house cat		Yes	Association	
30. feet eat scare crow		Yes	Association	
31. soap shoe tissue soft		Yes	Sensory	
32. bruise violets grapes eggplant		Yes	Sensory	
33. brain seed teaser ball		Yes	Relational	
34. kill cavity electric-shock pain		Yes	Sensory	
35. lick sprinkle mines salt		Yes	Relational	
36. bass complex sleep deep		Yes	Sensory	
37. gas house troops station		Yes	Association	

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
38. plague ship house steam		Yes	Relational	
39. gish knock-out Irish well		No		
40. gas pillows aluminum rotate		No		
41. apple mag sky pie		Yes	Association	
42. class audience portrait faces		Yes	Sensory	
43. fire nylon down hose		Yes	Association	
44. vampire silence blackness night		Yes	Relational	
45. hand seed brain bird		Yes	Association	
46. class carpeted railroad drawer		No		
47. cabbage egg oil boiled		Yes	Association	
48. fruit candy cake sweet-taste		Yes	Sensory	
49. scout bald eye eagle		Yes	Association	
50. apple cherry strawberry red		Yes	Sensory	
51. mouse sharp blue cheese		Yes	Relational	
52. widow mother bride woman		Yes	Relational	
53. gas planets fire star		Yes	Relational	
54. walker main sweeper street		Yes	Association	
55. fish deep potatoes fried		Yes	Association	
56. fruit crazy bolt nut		Yes	Association	
57. feet cobweb breakfast field		No		
58. widow antiques pyramids old		Yes	Sensory	
59. tail oil wife snow		No		
60. hand plant gown bird		No		
61. coconut planets		No		
62. fish words unconscious poem		Yes	Relational	

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
63. cabbage skunk feet smell	Yes		Sensory	
64. widow groceries gown shines	No			
65. shopping washer picture window	Yes		Association	
66. hand pillow petal soft	Yes		Sensory	
67. scout bugle horses calvary	Yes		Relational	
68. apple geranium shortcake blue	No			
69. fish chrome dime silver	Yes		Sensory	
70. cabbage skunk green striped	Yes		Sensory	
71. vampire ball man bat	Yea		Association	
72. fire salt fools Tarot cards	No			
73. scout mailman soldier uniform	Yes		Sensory	
74. sweat ocean pretzels salty	Yes		Sensory	
75. bride mother June apple pie	Yes		Relational	
76. stove pepper iron salt	Yes		Sensory	
77. plague ship tail rat	Yes		Relational	
78. kill bliss jump joy	Yes		Association	
79. stop petty sneak thief	Yes		Relational	
80. habit pouch road tobacco	Yes		Association	
81. lead bricks water heavy	Yes		Sensory	

Form 2

On the next few pages you will see a series of items, each of which consists of a list of four words. Some of these items contain words which seem to go with each other. They might go together for a reason which is different for different items. We think that there are three possible reasons for putting these words together, and have explained these below.

1. An associational grouping is one in which the words seem to share nothing with each other but the fact that each has a verbal association in common with each of the others. Besides the fact that the list members share a verbal associate, putting them together does not make much "sense." There is no obviously apparent reason for combining them for any purpose, and one would not expect to find them normally occurring together. One of the words in the list might be this shared associate. An example of this type of grouping would be: soda kilt butter Scotch

2. A sensory, or shared characteristic, grouping is one in which the words seem to go together because their referents share a common sensory quality. One of the words in the list may state the nature of the quality or characteristic shared by other items in the list. (The words may or may not have a common verbal associate.) Otherwise there is no other meaning which these words share or contribute towards. An example of this type of grouping would be: frog money lime green

3. A relational grouping is one in which the referents noted by the stimulus words combine so as to mean something more than any list member taken alone or combined with any other list member. The meaning of the total list cannot be pointed to as part of, or completely included in, any one of the list elements. "The whole is more than the sum of its parts." The list members seem to "go together" in that each one adds to the meaning of the other when they are all considered together in the context of each other. One of the words (the summary concept) is the focal point in terms of which the other words take on a collective significance. The summary concept takes into account the nature of each of the list elements and meaningfully combines them. The separate words "point to" or are integrated by the summary concept. An example of this type of grouping would be: clocks mathematics music order

4. It is possible that none of the above principles is involved in the grouping.

As you are reading the word series on the following pages, decide whether their members go together (make sense together, or share something in common), and mark yes or no in the column headed "go together?" Then indicate if the principle you see in the combination appears among those listed above. Mark 1 (for associational), 2 (for sensory), 3 (for relational), or 4 (for none of these) under the column which designates the category principle that you have selected. If

you initially decided that the words did not go together, don't mark anything in the principle column. Next indicate how much you like each particular list of words by marking in a number in the appropriate box in the "like" column according to the following scheme.

1	2	3	4	5
If the list pleases you very much	If the list pleases you a little	If you are completely indifferent to the list	If the list displeases you a little	If the list displeases you very much

Please take your time and consider your choices carefully.

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
1. cheese mountains neutrality Switzerland	Yes		Relational	
2. scythe against wood grain	Yes		Association	
3. gold super gazer star	Yes		Association	
4. gold popsicle telescope paste	No			
5. cactus sun thirst desert	Yes		Relational	
6. bruise violets grapes eggplant	Yes		Sensory	
7. scalpel heal hand surgeon	Yes		Relational	
8. tree column soldiers clothes	Yes		Sensory	
9. chamber staff box music	Yes		Association	
10. gold ice jewels glitter	Yes		Sensory	
11. seed brain catalogue teaser	Yes		Association	
12. scythe record book lion	No			
13. buried stake blook vampire	Yes		Relational	
14. athletes web rabbit foot	Yes		Association	
15. tree column building tall	Yes		Sensory	
16. cheese blood music blue	Yes		Association	
17. birth camp lucky day	Yes		Association	
18. attack pearls chew teeth	Yes		Relational	

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
19. Communist rose sunset red	Yes		Sensory	
20. apple-blossom baby dawn beginning	Yes		Relational	
21. stars dishes greetings trees		No		
22. apple-blossom rattle milkman sour		No		
23. gas feathers aluminum lightness	Yes		Sensory	
24. apple-blossom strawberry-ice-cream lemonade pink	Yes		Sensory	
25. cheese vomit old-milk sour	Yes		Sensory	
26. tree serpent stump tongue	Yes		Relational	
27. buried tent hammer basketball		No		
28. cactus petunia fresh flower	Yes		Association	
29. stars seasons leaves time	Yes		Relational	
30. music apple strawberry-ice-cream engine		No		
31. tobacco terry-cloth pass reporter		No		
32. cheese orchestra bath radish		No		
33. Communist thoughts China Mao	Yes		Relational	
34. sea home stomach sick	Yes		Sensory	
35. scalpel bean paste owl		No		
36. buried chased abandoned afraid	Yes		Sensory	
37. cactus lot hammer red		No		
38. apple-blossom out part time	Yes		Association	
39. King Pope beauty-queen robe	Yes		Sensory	
40. birth apple consumption mortality	Yes		Relational	
41. cactus rose thorn prick	Yes		Sensory	
42. acorn birthday deep strip		No		

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
43. grapes forgetfulness sparkle wine	Yes		Relational	
44. cabbage slick year toes		No		
45. tree knowledge serpent fall	Yes		Relational	
46. skunk kings boiled cabbage	Yes		Association	
47. king stalk trainer lion	Yes		Relational	
48. tree asparagus column pillows		No		
49. buried doornail center dead	Yes		Association	
50. pot butterflies pump stomach	Yes		Relational	
51. strawberry-ice-cream lemonade cold sour	Yes		Sensory	
52. gas bananas pillows metal		No		
53. room Saturday salts bath	Yes		Relational	
54. seed brain hand bird	Yes		Association	
55. apple-blossom out spring house	Yes		Association	
56. chocolate fortune tin cookie	Yes		Relational	
57. Communish birthday landing party	Yes		Association	
58. board magic death black	Yes		Sensory	
59. envy golf beans green	Yes		Sensory	
60. tobacco golf newspaper father	Yes		Relational	
61. wicked bustle slicker city	Yes		Relational	
62. scythe sickle plow steel-gray	Yes		Sensory	
63. stars diamonds polished-silver sparkle	Yes		Sensory	
64. king list pay check	Yes		Association	
65. tobacco bacon barbecue smokey	Yes		Sensory	
66. grapes puss spoiled sour	Yes		Association	

	Go Together? Yes	No	Principle 1 2 3 4	Like 12345
67. tobacco gang rail road		Yes	Association	
68. tree scaly soldiers office		No		
69. grapes shy boat cat		No		
70. king boxing asparagus Vatican		No		
71. grapes violets bruise purple		Yes	Sensory	
72. cabbage egg oil boiled		Yes	Association	
73. birth motor tuberculosis early		No		
74. tree cat call house		Yes	Association	
75. birth blooming awakening emerging		Yes	Sensory	
76. scythe winter corpse death		Yes	Relational	
77. brain seed teaser ball		Yes	Relational	
78. hand seed brain cage		Yes	Association	
79. cherry time smell blossom		Yes	Relational	
80. inch deal peg square		Yes	Association	
81. lead bricks water heavy		Yes	Sensory	

APPENDIX D

TABLES

TABLE 1.—Means and Standard Deviations for All Subject Classifications, All Dependent Variables.[a]

S Classifications	Dependent Variables, $\bar{X}$'s, S.D.'s, and N's								Dependent Variables											
	Standard Measures				Anagrams				Principle Identification					Liking				Erroneous "No Order"			
	B.W.	E.I.	S.R.	Dep.	Conc.Fig.	Env.Q'd.	Prov.Q'd.	Uncued	Assn.	Sens.	Rel.	None	Tot.	Like Assn.	L.Sens.	L.Rel.	L.None	@Inc.B.	@Ass.B.	@Sens.B.	@Rel.B.
All S's																					
$\bar{X}$	27.77^{96}	35.91^{93}	18.53^{49}	21.06^{49}	66.78^{49}	3.10^{49}	2.56^{48}	2.24^{49}	9.80^{95}	9.55^{95}	7.62^{96}	15.59^{95}	42.59^{95}	2.80^{96}	2.57^{96}	2.66^{96}	3.18^{88}	11.60^{95}	5.23^{95}	2.46^{95}	3.90^{95}
S.D.	13.92	7.57	7.00	4.55	24.03	1.98	1.41	1.67	4.47	4.13	3.28	2.73	7.48	.43	.51	.44	.43	7.87	3.66	2.40	2.75
Sex																					
Females	32.02^{50}	36.70^{47}	20.20^{24}	21.92^{24}	71.92^{24}	3.58^{24}	2.70^{23}	2.33^{24}	11.06^{49}	10.12^{49}	8.10^{50}	15.71^{49}	45.06^{49}	2.83^{50}	2.53^{50}	2.71^{50}	3.23^{48}	9.59^{49}	4.20^{49}	1.92^{49}	3.47^{49}
S.D.	13.74	7.79	5.73	5.45	23.34	1.95	1.55	1.58	3.90	3.82	3.11	2.46	6.32	.49	.57	.42	.49	6.33	2.92	1.89	2.48
Males	23.15^{46}	35.11^{46}	16.92^{25}	20.24^{25}	61.84^{25}	2.64^{25}	2.44^{25}	2.16^{25}	8.46^{46}	8.93^{46}	7.11^{46}	15.46^{46}	39.96^{46}	2.78^{46}	2.62^{46}	2.61^{46}	3.12^{40}	13.74^{46}	6.33^{46}	3.04^{46}	4.37^{46}
S.D.	12.72	7.33	7.82	3.40	24.11	1.93	1.33	1.78	4.68	4.39	3.41	3.02	7.78	.37	.44	.45	.34	8.80	4.06	2.75	2.96
Eye Movement																					
Lft. Lookers	27.50^{20}	36.85^{20}	19.25^{20}	20.25^{20}	72.00^{20}	3.00^{20}	2.42^{19}	2.10^{20}	11.05^{20}	10.15^{20}	9.00^{20}	14.25^{20}	44.45^{20}	2.76^{20}	2.47^{20}	2.59^{20}	3.15^{18}	8.55^{20}	4.05^{20}	1.90^{20}	2.60^{20}
S.D.	12.63	7.40	7.93	4.49	23.60	1.92	1.26	1.33	4.29	3.72	3.15	3.82	7.08	.41	.46	.42	.45	9.23	4.10	2.79	2.95
Mid. Lookers	22.79^{14}	34.00^{14}	18.29^{14}	21.14^{14}	53.57^{14}	3.21^{14}	2.29^{14}	2.00^{14}	9.64^{14}	10.07^{14}	8.50^{14}	14.79^{14}	43.14^{14}	2.85^{14}	2.59^{14}	2.59^{14}	3.20^{12}	9.14^{14}	4.29^{14}	2.00^{14}	2.86^{14}
S.D.	14.03	9.81	6.73	4.44	23.23	1.64	1.27	2.00	5.20	5.62	4.01	2.46	7.94	.37	.45	.49	.46	4.90	2.27	1.66	1.79
Rt. Lookers	25.67^{15}	37.57^{14}	17.80^{15}	22.07^{15}	72.13^{15}	3.27^{15}	3.00^{15}	2.67^{15}	9.27^{15}	9.53^{15}	6.73	16.20^{15}	41.73^{15}	2.81^{15}	2.65^{15}	2.69^{15}	3.18^{14}	15.00^{15}	7.00^{15}	2.87^{15}	5.13^{15}
S.D.	15.06	7.41	6.27	4.83	21.89	2.43	1.69	1.76	3.60	3.98	3.58	2.57	6.96	.38	.53	.53	.35	6.29	3.70	2.07	2.13
Sex and Eye Movement																					
F. Lft. Lookers	30.00^{12}	36.17^{12}	19.25^{12}	20.17^{12}	79.50^{12}	3.92^{12}	2.73^{11}	2.58^{12}	12.67^{12}	11.50^{12}	9.25^{12}	14.75^{12}	48.17^{12}	2.75^{12}	2.38^{12}	2.61^{12}	3.24^{12}	4.67^{12}	2.33^{12}	$.583^{12}$	1.75^{12}
S.D.	13.86	6.49	6.96	5.17	20.55	1.88	1.19	1.38	3.68	2.78	2.86	3.57	4.09	.37	.52	.43	.46	6.00	2.74	1.17	2.30
M. Lft. Lookers	23.75^{8}	37.88^{8}	19.25^{8}	20.37^{8}	60.75^{8}	1.62^{5}	2.00^{8}	1.37^{8}	8.62^{8}	8.12^{8}	8.62^{8}	13.50^{8}	38.87^{8}	2.76^{8}	2.61^{8}	2.55^{8}	2.99^{6}	14.37^{8}	6.62^{8}	3.87^{8}	3.87^{8}
S.D.	10.21	8.97	9.74	3.58	24.63	.92	1.31	.92	4.17	4.19	3.70	4.31	7.10	.49	.36	.43	.41	10.47	4.60	3.40	3.48
F. Mid. Lookers	30.17^{6}	36.83^{6}	22.67^{6}	24.33^{6}	59.33^{6}	3.00^{6}	2.17^{6}	1.00^{6}	10.33^{6}	10.50^{6}	9.17^{6}	14.83^{6}	45.17^{6}	2.96^{6}	2.49^{6}	2.57^{6}	3.05^{5}	8.17^{6}	3.83^{6}	1.50^{6}	2.83^{6}
S.D.	7.49	11.20	4.27	4.03	15.11	1.79	1.84	1.10	4.72	5.10	4.58	.75	4.62	.38	.60	.52	.48	5.35	2.48	1.05	2.32
M. Mid. Lookers	17.25^{8}	31.87^{8}	15.00^{8}	18.75^{8}	49.25^{8}	3.12^{8}	2.37^{8}	2.75^{8}	9.12^{8}	9.75^{8}	8.00^{8}	14.75^{8}	41.62^{8}	2.77^{8}	2.67^{8}	2.61^{8}	3.30^{7}	9.87^{8}	4.62^{8}	2.37^{8}	2.87^{8}
S.D.	15.61	8.79	6.50	3.11	28.10	1.64	.74	2.25	5.79	6.32	3.78	3.28	9.78	.37	.32	.49	.45	4.76	2.20	2.00	1.46
F. Rt. Lookers	28.33^{6}	37.80^{5}	19.67^{6}	23.00^{6}	69.33^{6}	3.50^{6}	3.17^{6}	3.17^{6}	11.83^{6}	8.67^{6}	7.00^{6}	16.33^{6}	43.83^{6}	3.02^{6}	2.86^{6}	3.02^{6}	3.26^{6}	12.33^{6}	4.67^{6}	3.00^{6}	4.67^{6}
S.D.	16.81	10.45	4.03	6.78	31.84	2.43	1.94	1.72	2.23	3.98	3.74	2.34	7.55	.30	.40	.47	.53	2.42	1.97	1.79	1.03
M. Rt. Lookers	23.89^{9}	37.44^{9}	16.56^{9}	21.44^{9}	74.00^{9}	3.11^{9}	2.89^{9}	2.33^{9}	7.56^{9}	10.11^{9}	6.55^{9}	16.11^{9}	40.33^{9}	2.67^{9}	2.51^{9}	2.47^{9}	3.13^{8}	16.78^{9}	8.56^{9}	2.78^{9}	5.44^{9}
S.D.	14.54	5.88	7.37	3.32	13.96	2.57	1.62	1.80	7.56	4.11	3.68	2.85	6.61	.38	.58	.48	.16	7.53	3.84	2.33	2.65
Creativity																					
High Creat.[a]	37.46^{48}	40.65^{48}	20.37^{27}	20.96^{27}	70.48^{27}	3.37^{27}	2.74^{27}	2.22^{27}	10.49^{47}	9.81^{47}	7.87^{47}	15.15^{47}	43.36^{47}	2.72^{48}	2.44^{48}	2.56^{48}	3.16^{45}	10.15^{47}	4.55^{47}	2.15^{47}	3.45^{47}
S.D.	9.50	5.52	6.35	4.09	24.26	2.24	1.56	1.72	4.53	3.72	3.85	2.87	8.25	.53	.56	.49	.41	8.84	3.85	2.67	2.92
Low Creat.	17.51^{45}	30.87^{45}	12.27^{21}	21.27^{21}	62.52^{21}	2.71^{21}	2.35^{20}	2.29^{21}	8.82^{45}	9.47^{45}	7.31^{45}	15.93^{45}	41.53^{45}	2.89^{45}	2.68^{45}	2.76^{45}	3.22^{40}	12.96^{45}	5.98^{45}	2.71^{45}	4.27^{45}
S.D.	10.37	6.05	7.42	5.26	24.03	1.62	1.23	1.68	4.27	4.61	2.65	2.59	6.75	.30	.43	.37	.47	6.56	3.44	1.98	2.39

[a]The number in the upper right hand corner of each box represents the number of subjects used in each sub-group to calculate the mean for the group in that measure.

[a]Total standard scores, Barron Welsh and Experience Inquiry.

Key to Abbreviations:

S = Subject
S.D. = Standard Deviation
N = Number
B.W. = Barron Welsh Art Scale
E.I. = Experience Inquiry
S.R. = Sensitization-repression
Tot. = Total

DEP. = Depression
Conc.Fig. = Concealed Figures
Env.Q'd = Environment Cued Anagrams
Prov.Q'd = Proverb Cued Anagrams
Lft. = Left
Mid. = Middle
Rt. = Right
@ = "No Order" Response

F. = Female
M. = Male
Creat. = Creativity
Assn. = Association
Sens. = Sensory
Rel. = Relational
L. = Like
Inc. = Incorrect

TABLE 2.--Significant t-Test Comparisons, Differences in Means.

Part 1: Between Group Differences (Independent Samples)

Subject Classifications	Male vs. Female	Standard Measures					Anagrams			Principle Identification					Liking				Erroneous "No Order"			
	Sex	B.W.	E.I.	S.R.	DEP.	CONC.FIG.	ENV.Q'D	PROV.Q'D	UNCUED	ASSN.	SENS.	REL.	HOME	TOT. WD. PREF.	L.ASSN.	L.SENS.	L.REL.	L.HOME	TOT.INC.B	ASSN.CD.B	SENSCD.B	REL.CD.B
Creativity																						
H.Creat.Tot.-L.Creat.Tot.		.001	.001	.05						.05*						.05	.05		.05*	.05*		
H. Barron Welsh-L. Barron Welsh	.05	.001	.001							.01				.05*					.01	.001	.05	.05
H. Experience Inquiry-L. Experience Inquiry		.05	.001	.05																		
Sex																						
Female-Male		.001								.01				.001					.05	.01	.05	
Eye Movement																						
Left-Middle						.05																
Left-Right												.05*							.05	.05		.01
Middle-Right						.05													.05	.05		.01
Sex and Eye Movement																						
Female Lft.-Male Lft.							.01				.05			.01					.05	.05	.01	
Female Mid.-Male Mid.				.05	.02																	
Female Rt.-										.05												

TABLE 2.--Continued.

Part 2: Within Group Differences (Dependent Samples)

Dependent Variables	Subject Classification											
	Sex			Eye Movement			Creativity					
	Females	Males	AllS's	Left	Middle	Right	H.Tot.Creat.	L.Tot.Creat.	H.B.W.	L.B.W.	H.E.I.	L.E.I.
Anagrams												
Env.Q'd-Prov.Q'd			.05									
Env.Q'd-Uncued	.05		.001				.05		.05*		.05*	
Prov.Q'd-Uncued												
Principle Identification												
#Correct Assn.-Sensory												
Sensory-Relational	.01	.05	.001			.05	.05	.001	.01	.05	.05	.01
Assn.-Relational	.001	.001	.001			.05	.01	.05	.001		.05	.01
Liking												
Like Assn.-Like Sensory	.01		.05	.05*			.05	.05	.05	.01	.05*	.01

*One-tailed test.

Key to Abbreviations:

B.W. = Barron Welsh Art Scale
E.I. = Experience Inquiry
S.R. = Sensitization-repression
DEP. = Depression
Con.Fig. = Concealed Figures
Env.Q'd = Environment Cued Anagrams
Prov.Q'd = Proverb Cued Anagrams
Assn. = Association
Sens. = Sensory
Rel. = Relational
Tot.Wd.Pref. = Total Principle Identification Score, Word Preference Test
L. = Like
Inc. = Incorrect
B = "no order" Response
CD = Called
H. = high
L. = Low
Creat. = Creativity
Tot. = Total
Lft. = Left
Mid. = Middle
Rt. = Right
S's = Subjects

TABLE 3.--Analysis of Variance: Significance Levels for F Ratios With Probabilities Less Than P=.1.

Subject Variables Main Effects	Dependent Variables and Significance Levels of F's																			
	Exp.Inq.	SR	Depression	Env.Q's	Prov.Q'd	Uncued	Conc. Fig.	Assn.	Sens.	Relat.	None	Tot.Wd. Pref.	Like Assn.	Like Sens.	Like Relat.	Like None	Incor-rect B	Assn. Co.B	Sens. Co.B	Relat. Co.B
Creativity (High vs. Low)	.000052																.0711	.0537		
Eye Movement (Left, Middle, Right)																	.0753	.0940		.0404
Sex (Male, Female)			.0933					.0479				.0259	.0769		.0994		.0638	.0206		
Interactions																				
Eye Movement x Creativity			.0456							.0400		.0076								
Sex x Creativity												.0124								
Sex x Eye Movement			.0459			.0095														
Sex x Eye Movement x Creativity								.0879				.0105				.0837				

Key to Abbreviations:

Exp.Inq. = Experience Inquiry
S.R. = Sensitization-repression
Env.Q'd = Environment Cued Anagrams
Prov.Q'd = Proverb Cued Anagrams
Conc.Fig. = Concealed Figures
Assn. = Association
Sens. = Sensory
Relat. = Relational
Tot.Wd.Pref. = Total Principle Identification Score, Word Preference Test
B = "No Order" Response
CD. = Called

TABLE 4.--Pearson Correlations, All Subjects Who Attended Part II of the Procedure.

	Anag. Tot.	Env.Q'd	Prov.Q'd	Uncued	Conc.Fig.	#Correct Assn.	Relat.	Sens.	Tot. Correct
Anag. Tot.		.877	.740	.796	.496	.407	NS	NS	.368
Env.Q'd	49[a]		.488	.548	.476	.334	NS	NS	.286*
Prov.Q'd	48	48		.411	.300	NS	NS	NS	NS
Uncued	49	49	48		.380	.481	NS	NS	.379
Conc.Fig.	49	49	48	49		NS	NS	NS	NS
#CorrectAssn.	49	49	48	49	49		NS	NS	.689
Relational	49	49	48	49	49	95		NS	.432
Sensory	49	49	48	49	49	95	95		.596
Total Correct	49	49	48	49	49	95	95	95	

*Significant at the .05 level; all other correlations are significant at the .01 level. NS = not signiticant.

[a]Numbers below the diagonal of the matrix represent the N's upon which the correlations were based (Pearson's r).

Key to Abbreviations:

Anag.Tot. = Anagrams Total
Env.Q'd = Environment Cued Anagrams
Prov.Q'd = Proverb Cued Anagrams
Conc.Fig. = Concealed Figures Test
Assn. = Association
Relat. = Relational
Sens. = Sensory
Tot. = Total
N's = Numbers

TABLE 5.--Correlations, All Subjects Combined.

	Sex	Barron Welsh	Exp. Inq.	#Correct Assn.	Sensory	Relational	Total Correct	Like Assn.	Like Sensory	Like Relational	Total Incorrect B[2]	Assn. Called B	Sens. Called B	Relational Called B
Sex[1]		-.310	NS	-.263	NS	NS	-.336	NS	NS	NS	.266	.278	.249*	NS
Barron Welsh	96		.364	.227*	NS	NS	NS	NS	NS	NS	-.201*	-.226*	NS	NS
Exp.Inq.	93	93		NS	NS	NS	NS	+.219*	NS	+.206*	NS	NS	NS	NS
#Correct Assn.	95	95	92		NS	NS	.698	NS	NS	NS	-.492	-.595	-.356	-.306
Sensory	95	95	92	95		NS	.596	NS	NS	NS	-.259*	NS	-.371	NS
Relational	96	96	93	95	95		.432	NS	.309	.227*	-.348	-.245*	-.294	-.414
Total Correct	95	95	92	95	95	95		NS	NS	NS	-.438	-.416	-.455	-.302
Like Assn.	96	96	93	95	95	96	95		.511	.610	NS	NS	NS	NS
Like Sensory	96	96	93	95	95	96	95	96		.640	NS	NS	NS	NS
Like Relational	96	96	93	95	95	96	95	96	96		NS	NS	NS	NS
Incorrect B	95	95	92	95	95	95	95	95	95	95		.919	.866	.883
Assn. Called B	95	95	92	95	95	95	95	95	95	95	95		.690	.696
Sensory Called B	95	95	92	95	95	95	95	95	95	95	95	95		.687
Relational Called B	95	95	92	95	95	95	95	95	95	95	95	95	95	

[1] 1 = Female, 2 = Male; correlations here are point-biserial (all other correlations are Pearson's r).

[2] A "B" score occurred when subject asserted that a word series had no organizing principle by leaving the principle designation space blank. A high "B" score indicates the incapacity to see order.

*Significant at the .05 level; all other correlations are significant at the .01 level; NS = not significant (Pearson's r). Numbers below the diagonal indicate the N's upon which the correlations are based.

Key to Abbreviations:

Exp.Inq. = Experience Inquiry
Assn. = Association
Sens. = Sensory,
B = "No Order" Response
N's = Numbers

TABLE 6.--Correlations Between Strength of Hemisphere Dominance and Other Variables.

	Females	N	Males	N	Combined Sexes	N
Correlation Between Strength of Right Looking (Left Hemisphere Dominance) and:						
Environment Cued Anagrams	-.338	6	-.585	9	-.446	15
Sensitization-Repression	-.010	6	-.714*	9	-.424	15
Depression	+.292	6	+.513	9	+.331	15
Creativity (Barron Welsh)	+.738*	6	+.214	9	+.453	15
Total Number Incorrect B	+.093	6	-.080	9		
#Incorrect B, Association	-.107	6	-.101	9		
#Incorrect B, Sensory	.000	6	-.118	9		
#Incorrect B, Relational	+.430	6	+.026	9	+.145	15
Sex					+.184	15
Correlation Between Environment Cued Anagrams and Sex, Right Lookers Only					-.075	15
Correlation Between Strength of Left Looking (Right Hemisphere Dominance) and:						
Environment Cued Anagrams	-.018	12	-.729*	8	.000	20
Sensitization-Repression	+.210	12	+.466	8	+.351	20
Depression	+.372	12	+.447	8	+.373	20
Creativity (Barron Welsh)	+.337	12	+.746*	8	+.493*	20
Total Number Incorrect B	-.541	12	+.242	8	-.228	20
#Incorrect B, Association	-.638*	12	-.029	8	-.383	20
#Incorrect B, Sensory	-.319	12	+.353	8	-.059	20
#Incorrect B, Relational	-.489	12	+.422	8	-.125	20
Sex					-.231	20
Correlation Between Environment Cued Anagrams and Sex, Left Lookers Only					-.598**	20

*Significant at the .05 level.

**Significant at the .01 level.

Key to Abbreviations:

N = Number (of subjects)
B = "No Order" Response

TABLE 7.--Summary of Significant Four-Fold Frequency Analyses.

Variables[1]	Subjects	Significance Level		N
		Chi-Square Test	Fisher's Exact Test[2]	
Creativity and Assn. Cd. B.	All	.025 (χ^2 = 5.605)		95
Sens. Cd. B.	Females	.01 (χ^2 = 7.742)		49
Sensitization-Repression	Males		.05	25
Sex and Env.CuedAn.	All	.05 (χ^2 = 4.557)		49
Env.Cued An.	Left Lookers		.005	20
Con.Fig.	Left Lookers		.025	20

[1]All division for continuous variables are at the mean for the total subject group.

[2]Fisher's exact test was used whenever an expected cell frequency fell below acceptable limits (N = 5) for use of the chi-square test.

Key to Abbreviations:

N = Number (of Subjects)
Assn. = Association
Sens. = Sensory
Cd.B = Called "No Order"
Env.CuedAn. = Environment Cued Anagrams
Con.Fig = Concealed Figures Test