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Creativity, intelligence and cognitive controls.

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CREATIVITY, INTELLIGENCE AND COGNITIVE CONTROLS

by

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PREFACE

This study began on the happy coincidence of encountering Wallach and Kogan's book "Modes of Thinking in Young Children" while reading an article on cognitive controls. The possible relevance of cognitive controls to creativity immediately suggested itself. A survey of the literature indicated that considerable work had been done on the individual controls. Little investigation, however, had been conducted in regard to a) cognitive controls as a constellation b) their relationship to creativity and c) their functioning in children. This study was concerned with these three basic issues. Piaget's general epistomological model was adopted to encompass these issues in full realization that the end result might bear little relevance to his conception of it.

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ABSTRACT

This study was concerned with a) the individual's encounter with his environment and b) the dimensions by which the individual organizes this encounter. The theoretical perspective adopted was Piaget's conception of intelligence as involving adaptation and organization. The modes of the individual's adaptation considered were intelligence and creativity, while the dimensions organizing this encounter were the cognitive controls of field dependence-independence, constricted-flexible, focusing-scanning, tolerance for ambiguity, equivalence range and leveling-sharpening. It was hypothesized that a) high creative Ss would be characterized, in the extreme, by the following cognitive controls: field independence, tolerance for ambiguity, and scanning; b) no distinction would be demonstrated between high and low creative Ss on the following cognitive controls: constricted-flexible, equivalence range and leveling-sharpening.

The sample consisted of 60 boys from the fifth grade of elementary school. They were administered three measures of intelligence and three of creativity, and eight tests for cognitive controls: Embedded Figures Test, Stroop Colour-Word Test, Object Sorting Test, Category Width Test, Schematizing Test and two tests designed by the author for focusing-scanning and tolerance for ambiguity. The Ss were

divided into groups of 15 Ss in regard to whether they were high and/or low on creativity and intelligence; the relationship of each control to each group of Ss was then considered.

The hypotheses were confirmed in regard to the controls of focusing, constricted-flexible, and equivalence range. However, contrary to expectation, field independence and tolerance for ambiguity did not distinguish the high creative from the low creative Ss. The results for leveling-sharpening were conflicting, but there was indications that the high creative Ss tended to be sharpeners and the low creative Ss levelers. The results were discussed in the light of Piaget's theoretical conceptions.

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CHAPTER I

INTRODUCTION

Subsuming all consideration of cognition and perception is a basic epistemological problem - the relationship between the knower and the known. Of vital relevance to this issue is the investigation of individual consistencies in cognitive behavior. The premise involved is that "the wide range of behaviors with which an individual encounters reality may be encompassed by relatively few dimensions of organization (Gardner, Holzman, Klein, Linton, and Spence, 1959; p. 1)." This study is concerned with a) the individual's encounter with his environment and b) the dimensions organizing this encounter. The theoretical perspective which will be adopted in order to encompass these two aspects is Piaget's conception of intelligence. This conception involves the functional invariants of adaptation and organization.

For the purposes of this study, adaptation will be considered to involve two basic modes - the intelligent and the creative. In operational terms, intelligence is defined as that behavior demonstrated on conventional IQ tests. This definition is analogous to Guilford's conception of convergent thinking since this would appear to be the type

of thinking required on conventional IQ tests. Likewise, creativity is defined in terms of an individual's responses to specific creativity tasks. Performance on these tasks would appear to necessitate what Guilford conceived of as divergent thinking. In order to elucidate theoretically these two modes of intercourse with one's environment, the following will be considered under adaptation: a) assimilation and accommodation, b) autocentric and allocentric perception and c) creativity.

Empirically, this study is concerned with elucidating the relationship between the intelligent and the creative modes of adaptation. Specifically, this study is concerned with investigating the dimensions by which an individual organizes his encounter with his environment in relation to these modes of adaptation. The dimensions of organization have been termed cognitive controls. The assumption is that these cognitive controls will correlate with consistent patterns of thinking and thus that they will be related differentially to intelligence and creativity. In this first chapter, adaptation and then organization will be considered.

Adaptation

Assimilation and Accommodation

The intellectual process is conceived of by Piaget as an active interaction between the organism and the environment. "This interaction functions outwardly as adaptive

coping and inwardly as organization (Hunt, 1961; p. 111)." Adaptation and organization are thus conceived of as two complementary aspects of one process. Piaget sees adaptation as involving the further functional invariants of assimilation and accommodation.

> Assimilation here refers to the fact that every cognitive encounter with an environmental object necessarily involves some kind of cognitive structuring (or restructuring) of that object in accord with the nature of the organism's existing intellectual organization (Flavell, 1963; p. 48).

However, the knower must in some sense adapt himself to the special properties of the object.

> The essence of accommodation is precisely this process of adapting oneself to the variegated requirements or demands which the world of objects imposes on one (Flavell, 1963; p. 48).

These two processes are involved in all intellectual activity and intelligent adaptation to the environment is seen as an equilibrium between assimilation and accommodation. The equilibrium process thus involves bringing assimilation and accommodation into a balanced coordination. In a sense, assimilation and accommodation are always in a state of equilibrium, the crucial point is the degree of stability of this state. An unstable coordination is seen when one or other predominates as, for example, in imitation or play. Imitation is defined as the primacy of accommodation to external reality over assimilation, while play is termed the assimilation of external reality to pre-existing concepts. From a theoretical point of view, it is Piaget's

conception of play that is of particular interest, for the creative process is often interpreted in terms of play. Piaget contends that

> play manifests the peculiarity of a primacy of assimilation over accommodation which permits it to transform reality in its own manner without submitting that transformation to the criterion of objective fact (Piaget, 1966; p. 111).

He then goes on to stress that play becomes more and more adequately adapted to nature. It is in this latter sense that he speaks of play as diminishing with age. The essential property of play, as Piaget defines it, is thus the deformation and subordination of reality to the desires of the self. The issue of play and assimilation will be returned to when creativity is considered.

Autocentric and Allocentric Perception

One of the most prevalent assumptions of beliefs of "everyman" is that what he perceives through his senses is true, that is, it is in point of fact "reality". However, research carried out over the last several decades has demonstrated the complex, conflicting influences which determine not only "how" an individual perceives and understands the objects of his environment but also "what" he perceives. Considerable psychological energy has been invested in determining the conditions under which an individual more or less adequately relates to his environment. A perspective on this problem is Schachtel's (1959)

conception of autocentric (subject-centered) and allocentric (object-centered) perception.

For Schachtel, autocentric and allocentric perception are two basic modes of perception; he further distinguishes between primary and secondary autocentricity. In primary autocentricity there is no objectification; the sensory quality and the feelings of the individual are fused. Although this mode predominates in the infant and the young child, it fades in importance or relevance as a mode of perception and consequently is not of concern here. Secondary autocentricity, however, is crucial to this discussion of intelligence and creativity. Secondary autocentricity essentially is perceiving the objects of one's environment from the perspective of society's demands on what should be perceived. What this means is that in an individual whose perception is predominantly secondary autocentric, the primary feature is not of the perception of an object as it is in its own right but what the individual needs to perceive in terms of society's demands. The predominance of autocentric perception implies the slavish assimilation of percepts to fixed schemata, fixed perspectives of one's environment, and thus stifles any possibility for creative functioning. The point is that when secondary autocentricity predominates to the exclusion of allocentric perception, the result is stereotyped thinking and creativity becomes impossible.

Allocentric perception, on the other hand, involves an openness toward the objects of one's environment.

> the perceiver usually approaches or turns to the object actively and in doing so either opens himself toward it receptively, or figuratively or literally takes hold of it, tries to grasp it (Schachtel, 1959; p. 83).

From this, then, it is obvious that allocentric perception is necessary for the true encounter with objects which is vital to the creative process. This encounter with objects in allocentric perception appears to be Piaget's concept of accommodation. However, the creative process has been conceived of by some (Taylor, 1959) as involving play, which suggests Piaget's concept of assimilation. Consequently, a theoretical delineation of creativity is warranted at this point.

Creativity

Examination of the theoretical issues on creativity reveals two fundamental issues of primary concern. The first relates to the aforementioned discussion of play, that is, does the creative process involve a temporary suspension of logic in order to permit freer play of fantasy and imagination or is it a direct result of logical reasoning. The second issue is whether creativity is the exclusive property of the select few or rather is it characteristic of man in general.

In regard to the first problem, the opposing positions might be typified by Taylor (1959) and Harris (1959)

and perhaps also demonstrates the theoretical bias of the fields they represent. For Harris, a business executive concerned with creativity in marketing, the creative process is systematic and goal-directed with the only distinction between the genius and "everyman" being the speed with which the process is completed. For Taylor, a psychologist, "the rules of traditional logic are essentially a psychological straight-jacket for creative thought (Taylor, 1959; p. 53)". To him, the vital aspect of creative insight is unconscious play.

Wallas (1926) first described the four basic stages of the creative process. These are essentially the same as Taylor's and it is the latter's development which will be presented here. This delineation of creativity is adopted on the assumption that creativity is a function of individual differences in patterns of thinking and since individuals differ in these cognitive patterns, they will also differ in their ability to be creative. Taylor's four stages are exposure, incubation, illumination and execution.

During the exposure phase, the individual accumulates an abundance of information from his environment. The distinction between the creative and the non-creative individual during this stage is that the creative person is characterized by a "marked sensitivity to and voracious consumption of the environment which is most apparent in early years (Taylor, 1959; p. 62)". On the other hand, the non-creative individual quickly classifies all experiences

in terms of preconceived stereotypes. The distinction also becomes apparent when individuals are looked at in relation to the continuum of tolerance-intolerance for ambiguity. The creative individual is able to tolerate ambiguous perceptions of the world around him; the non-creative individual, however, only deals with those perceptions which are easy to understand or which do not cause conflict. The major point to be made for this stage is that if an individual is free not to incorporate all experience into predetermined structures, then there exists the possibility of a reorganization of the facts of experience which is the essence of creativity.

During the incubation phase, experiences are fluid enough that they do not become stereotyped, even though the creative person is aware of these stereotypes. Consequently if experiences are immediately stereotyped little incubation occurs.

The third or illumination phase is often referred to as the moment of insight, that is, when a new organization is achieved, beyond the original facts or previous stereotypes. For the non-creative individual there is no insight into anything new since he is not able to escape previous categories and new experiences have essentially no impact.

The final stage, execution, involves the communication of these subjective experiences into objective verbal or non-verbal forms. The manner in which they are

communicated will largely determine and often modify the original insight. It is during this stage that many creative insights may be lost due to an individual's inability or even unwillingness to communicate his experiences in an objective form which is meaningful to others. It is the product then which permits some objective evaluation of the degree of creativity involved. In this context, Jackson and Messick (1965) discuss four characteristics of a creative product. They are unusualness, appropriateness, transformation and condensation.

Unusualness refers to the infrequency of a response relative to norms and thereby provides a standard for making an evaluation of unusualness. However, unusualness is not sufficient as an evaluation of the creativeness of a product. It must also be distinguished from a product which is simply bizarre - hence the second characteristic of appropriateness. "It must make sense in the light of the demands of the situation and the desires of the producer (Jackson and Messick, 1965, p. 313)." Although a a product may possess the characteristic of unusualness and appropriateness, it may however vary considerably in the level of its quality as a creative product. However, a creative product must involve the transformation of material to overcome the constraints of conventional structures. The transformation power of the creative product is thus judged in the context of the constraints which it has to overcome. Creativity thus involves more than just improvements of pre-existing

forms; it means the production of new forms. In Jackson and Messick's view, the fourth criterion of a creative product is that of condensation. In their words:

> The condensation achieved by a creative product summarizes essences, and the summary may be expanded and interpreted in a multiplicity of ways - intellectually and affectively, in terms of image or idea. It may be interpreted differently by different viewers or by the same viewer on difference occasions. This multiplicity of interpretation and the extensiveness of the expansions generated by the condensation are an indication of its summary power, and an appraisal of summary power provides an important judgmental standard for the evaluation of creative condensation (Jackson & Messick, 1965; p. 320).

There are thus two ways, at least, of looking at creativity - from the point of view of process or in terms of products. Obviously, creativity as a process can not be observed directly but only inferred. However, light can be shed on the process if it can be demonstrated that creative Ss differ consistently from non-creative Ss in terms of cognitive controls. The implication or hypothetical assumption being adopted here is thus that individuals differing in terms of creativity will also demonstrate corresponding and consistent differences in cognitive controls. On the other side, the possibility of assessing creativity in terms of products can be provided through tests designed specifically to provide an opportunity for creative expression which can then be evaluated.

The above conception of the creative process can be integrated into the conceptual model adopted here.

Creativity could be viewed as involving a preponderance (at least in the initial stages) of assimilation, in a fashion analogous to Piaget's delineation of play. Perhaps this conception of creative play can be made more explicit if it is considered in the light of the following: Kris' notion of "regression in the service of the ego" (Kris, 1952); and b) Guilford's concept of "divergent thinking" (Guilford, 1956).

For Kris, the ability to relax ego function (regression) is central to creativity. What this means is that when an unconscious idea rises to consciousness, the ego suspends its censoring function mementarily, this involves a "disregard of external stringencies (Kris, 1952; p. 253)". The regard for external stringencies (normal ego function) is similar to accommodation in Piaget's system and also Schachtel's secondary autocentricity.

What divergent thinking involves for Guilford is the freedom to change direction of thinking.

> In convergent thinking there is usually one conclusion or answer that is regarded as unique, and thinking is channeled or controlled in the light of that answer. In divergent thinking, on the other hand, there is much searching, or going off in various directions (Guilford, 1956; p. 289).

What these two perspectives elaborate is basic distinctions between the non-creative and the creative individual. In the present conception, then, they delineate an individual who is able to play with his environment - who is not tied to conventional stereotyped lines of thought. However, as

stated earlier, what distinguishes the true creative product from phantasy is that it must be appropriate, in other words, it must involve some accommodation to the demands of "reality", which involves ego control. In Kris' view, the ego regression is only temporary; "one controlled by the ego which retains the function of establishing contact with the audience (Kris, 1952; p. 167)". This quotation suggests that creativity can be more fruitfully conceived of as a process involving both assimilation and accommodation. Creative individuals would at times be able to ignore conventional lines of thought and previous structures and then at other times be acutely aware of external objects. Thus the creative person is coneived of as an individual who in his cognitive functioning is able to move freely between assimilation and accommodation in the course of his adaptation with his environment. Finally Piaget states that the complement of adaptation is organization; creativity is distinguished from the ordinary intellectual process in that it involves a reorganization of the facts of experience into new schemata.

A theoretical perspective of intelligence and creativity has been presented, but their interrelationship needs to be made explicit. The perspective adopted here implies that conventional intelligence and creativity are distinct modes of thought. However, another feasible position is that creativity is based upon a general intelligence factor.

The position which appears to be becoming increasingly popular in some circles is that creativity is a separate aspect of intellectual functioning from "intelligence", defined as a score on a conventional IQ test. It has been contended that the creative aspect of intellectual functioning is not tapped by conventional tests (Guilford, 1950; Getzels & Jackson, 1962; and Torrance, 1963). Sigel (1963) describes conventional evaluations of intelligence as assessing only "the ability to see things as organized in conventional classes or units". Also there is the aforementioned distinction of Guilford (1959) between convergent and divergent thinking. However, several writers have questioned whether creativity is a distinct dimension. In support of this position is the fact that several studies have reported significant correlations between creativity and conventional intelligence. Richards, Cline and Needham (1954) obtained correlations between measures of intelligence and creativity which ranged between .20 and .41, while in the Meer and Stein study (1955), the range was between .06 and .54. Similarly, Thorndike (1963) and Marsh (1964) both factored the correlation table reported by Getzels and Jackson (1962, p. 20), but failed to obtain a highly loaded factor for creativity which was not substantially loaded by conventional intelligence tests.

Part of this disagreement is undoubtedly accounted for by the questionable validity of creativity measures,

particularly since what is involved is value judgments on which responses fit some criteria (Maltzman, 1960; Mednick, 1962; Taylor, 1964; Jackson & Messick, 1965). In addition, Wodtke (1964) has shown that creativity tests have low reliabilities. In an attempt to clarify this issue, Cropley (1965) carried out a factor analytic study employing six convergent tests and seven divergent tests. The results he obtained were two large factors defined by the convergent tests and the divergent tests, respectively. The factor matrix was orthogonally rotated and 81 percent of the variance of the first factor was defined by two IQ measures and academic average. However, although 85 percent of the variance of the second factor was accounted for by five creativity measures, 12.3 percent of its variance was defined by the previous three scores. Although oblique rotations reduced the loadings of the tests involving convergent processes, they still demonstrated that the second factor was partially dependent on convergent processes. Cropley interpretes the findings as supporting the notion that "conventional skills may provide the basis upon which creative productions rest (Cropley, 1966; p. 264)".

Wallach and Kogan (1965) adopt a view which is a cogent argument in favour of the position that there is a distinction between the intelligent and creative modes of cognitive functioning. They criticized previous studies such as those of Torrance and his associates and the

Guilford group on the grounds that imposing explicit or implicit time limits and a test-like atmosphere mediates against creative functioning, and the correlations reported simply indicate that the creativity measures employed to date are not appropriate, for the reason just indicated. This position also finds indirect support from the reported reliabilities of Wallach and Kogan (1965). Two of their creativity measures yielded correlations of .51 and .75, however all other correlations were between .87 and .93. Wodtke (1964) investigated the reliabilities of the Torrance test batteries, by test-retest with a two month interval. For the non-verbal creativity tests, the total score correlations (among children in grade five) ranged between .05 and .59, with a total non-verbal correlation of .64. For the verbal creativity tests, the total score correlations ranged between .43 and .66. The total verbal score correlation was .73 and the total creativity score correlation was .75. He also investigated the reliabilities for grades two, three and four; the reliabilities for these grades were generally lower than just outlined for grade five. The author points out that the low reliabilities were not a function of low interscorer agreement where the correlations ranged from .95 to .99 for total battery scores. Wodtke also correlated the creativity scores with the Lorge-Thorndike Group Intelligence test. For the total creativity score and the intelligence scores, the correlations ranged

between .36 and .46. This data would appear to lend support to the position of Wallach and Kogan (1965), however, the controversy is still far from settled and awaits more extensive investigation.

Piaget's concept of adaptation has been taken to be the theoretical construct encompassing all cognitive activity of which measures of intelligence and creativity delineate two major dimensions. This model also encompasses cognitive controls since they are the regulative functions organizing an individual's intercourse with the environment.

Organization

Adaptation, in relation to cognitive activity, expresses the manner in which an individual copes with his environment. However "every act of intelligence presumes some kind of intellectual structure, some sort of organization, within which it precedes (Flavell, 1963; p. 46)". As stated initially, the assumption adopted is that there is a wide range of behavior which can be encompassed by a few dimensions of organization, namely, cognitive controls. Cognitive controls are

> ... conceived of as slow-changing developmentally stabilized structures: a) they are relatively invariant over a given class of situations and intentions; b) they are operative despite the shifts in situational and behavioral contexts typical of cognitive activity from moment to moment (Gardner et al., 1959; p. 5).

Investigations of these controls have been carried out by Klein, Gardner, Holzman and their associates, centered at the Menninger clinic. The controls which they have delineated (some of which are given bi-polar names) are the following: constricted-flexible (Smith & Klein, 1953); scanning or focusing (Schlesinger, 1954); equivalence range (Gardner, 1953); tolerance for unrealistic experiences (Klein & Schlesinger, 1951); and leveling-sharpening (Klein & Holzman, 1950). Another cognitive control which will be dealt with in this study is that of field dependence-independence (Witkin, Lewis, Hertzman, Machover, Meissner, and Wapner, 1954).

In the view of Gardner and his associates, these controls become relatively autonomous during development and are shaped by both constitutional and experiental factors.

> ... they represent certain broad areas of ego organization that seem to be important to the individual's efforts to achieve his own particular style of adaptive organization to his world (Gardner, 1962; p. 185).

Studies carried out chiefly by the Menninger group have demonstrated that, in relation to each control and the specific tests purported to measure these controls, individuals differ consistently in these aspects of cognitive control. Each of these controls will be defined in turn.

Field dependence-independence encompasses an individual's ability to overcome the influence of the surrounding field or to separate an item from its context.

Witkin et al. (1962) state that people generally ranged on a continuum from field dependent to field independent. Those Ss toward the field dependent end of the continuum are characterized by a) general passivity in dealing with the environment, b) lack of self-awareness, and low self-esteem; whereas field independent Ss are characterized by a) activity in dealing with the environment, b) awareness of "inner life" and c) high self-esteem.

Constricted-Flexible Control delineates modes of reacting to contradictory and intrusive cues. When dealing with distracting stimuli, constricted Ss respond to the most dominant cues in the field and ignore the others. Flexible Ss, on the other hand, are most comfortable in situations involving contradictory cues and are able to ignore the most dominant stimulus if it is inappropriate.

Focusing-Scanning refers to the extent of attention deployment. The individual at the focusing end of the continuum constantly scans the stimulus field and is thus aware of relatively many aspects of the field, while the scanner is more restricted in his attention deployment.

Equivalence Range is concerned with individual differences in categorizing stimuli. Narrow equivalence range delineates the relative tendency to use many categories while in broad equivalence range, there is the tendency to use few all-inclusive categories or groupings.

Tolerance for Unrealistic Experiences concerns

an individual's willingness to accept perception at variance with conventional experience.

Leveling-Sharpening is concerned with modes of organizing a sequence of stimuli characterized by either a low level of articulation of new stimuli (leveling) or a high level of articulation (sharpening).

Concerning the genesis of these controls, the view taken is that they are shaped by both constitutional and experiential factors. To date no investigators have demonstrated that these controls have antecedants in particular life experiences and/or specific genetic factors as such. However, there are indications as to the developmental sequence, and some studies employing brain-damaged Ss have suggested, in part, the role of constitutional factors.

In regard to development, Witkin et al. (1962) have indicated that the normal course of development is from field dependent to more field independent. The development of this control and constricted-flexible have been explained in terms of Werner's organismic-developmental theory, with its emphasis on the increase of perceptual and cognitive differentiation with increasing maturity (Witkin et al., 1962; Commalli, Wapner, and Werner, 1962). Similarly, Santotefano and Paley (1964) suggested that the scanning end of the focusing-scanning continuum and constricted control are developmentally earlier since they

characterized the cognitive functioning of the youngest children. In regard to tolerance for unrealistic experiences (tolerance for ambiguity) Frenkel-Brunswick's (1949) delineation appears to attribute its development solely to experiential factors.

Three of the controls (field dependence-independence, focusing-scanning, and leveling-sharpening) have at least some major component of attention, the major dimensions of which might be delineated as a) momentary attention span, b) selective attention, c) sustained attention, and d) extensiveness of attention deployment (Gardner, 1966). In regard to momentary attention span, it is generally more limited in children than in adults and is severely limited in the brain-damaged individual. Impairment of selective attention is one of the most serious handicaps for the brain-damaged since an individual is unable to distinguish the essential from the non-essential. These individuals would be expected to be field dependent. Gardner (1964) suggests that the Embedded Figures Test(a measure of field dependence-independence) can be used as a criterion measure for selectiveness of attention. In regard to sustained attention, a defect in this aspect is rather widespread among the brain-damaged. The relationship extensiveness of attention deployment to cognitive controls is more directly evident. Gardner (1964) points out the great individual variations in extensiveness of focusing-scanning that people engage in before making

decisions about stimuli. Gardner (1966) suggests that the degree of focusing-scanning in children may be effected by the impulsivity of children in general and the still greater impulsivity so often characteristic of the brain-damaged child. The cognitive controls have been characterized as modes of intercourse with one's environment, but it is clear from the above that attention plays an important role in this intercourse and short-circuiting of attention can only reduce the clarity of experience.

The relevant research on each of the cognitive controls will be considered in turn.

Field Dependence-Independence

Witkin (1950) reported a study on "Individual Differences in Ease of Perceptions of Embedded Figures", in which he demonstrated that individuals differ reliably in their ability to extract an item from the field in which it appears. The criterion measure involved was the Embedded Figures Test (EFT), a set of drawings which Witkin adapted from the Gottschaldt figures. Witkin et al. (1954) reported individual differences in mode of orientation in that tilting-room-tilting-chair (TRTC) and the rod-and-frame (RFT) test. These various tests, but especially the EFT, have come to define a dimension of cognitive control which Witkin and his associates first termed field dependence-independence. In general, it seems to apply to situations that contain competing sets of cues, perceived by the S.

The term field independent was applied to those Ss who showed a ready capacity to differentiate objects from their backgrounds. On the other end of the continuum, field dependent Ss were those who demonstrated a realatively passive submission to the domination of the background, and were unable to keep an item separate from its context. Witkin (1960) reported the finding that "children tend to be field dependent early in their perceptual development and to become more field independent as they grow up." In regard to specific individuals, the findings were that a child who was relatively field independent at one age would show the same tendency at later ages. Individuals were also consistent across tests, i.e., a child who was field dependent on the EFT was apt also to be field dependent on the RFT and TRTC. Goodenough and Karp (1961), in their factorial study, obtained a factor which was loaded by correlations from three subtests on the WISC (block design, picture arrangement, and object assembly) and the EFT. This was interpreted by the authors as tending to

> support the Witkin hypothesis that relationships obtained in many studies between tests of field dependence and standard tests of intelligence stem, at least in part, from common requirements shared by measures of field dependence and of certain kinds of intellectual abilities (Goodenough & Karp, 1961; p. 245).

Witkin and his associates have broadened the concept of field dependence-independence. This concept grew out of the specific perceptual test already mentioned.

The authors, however, felt that styles of functioning tapped by these tests extend to intellectual functioning as well; they gathered convincing evidence to support the general applicability of this concept (Witkin et al., 1962). The terms that Witkin et al. (1962) have adopted to dichotomize cognitive functioning are those of global versus analytic. Thus, according to Faterson (1962), "for the relatively field dependent Ss, object and field tend to 'fuse', so that the separation called for by the task cannot easily be made". The field dependent Ss' cognitive functioning is thus said to be global. On the other hand, the field independent S can keep object and field separate and consequently his functioning is said to be analytic.

Klein, Gardner and their associates have also investigated field dependence-independence, employing Witkin's criterion tests - EFT and RFT. They have, however, felt that there are certain similarities between field dependence and constricted-flexible control. On the basis of their results, Gardner et al. (1959) include both dimensions under the concept of field articulation. However, a subsequent study (Gardner et al., 1960) failed to confirm the findings that they both load the same factor. Apparently, they have not revamped their interpretation on this point. Gardner (1962) obtained a factor which he labelled field articulation, however the correlations it included were from the EFT and RFT only and not from the measure for constricted-flexible control.

Gardner and Long (1961) found that the speed with which persons identify embedded figures is significantly related to the number of items correct in recall (word lists) under conditions of interference despite the administration of the Word Recall Test three years after the EFT. Employing Thurstone's Concealed Figures Test, as a criterion test for field articulation, Long (1962) found that Ss who had great difficulty finding the embedded figures learned or relearned more slowly and were less accurate on recall. Ss who could easily locate hidden figures were significantly superior on all learning and recall tasks. From the preceding, it can be seen that the field dependence-independence control principle has important implications for cognitive behavior.

Constricted-Flexible

In regard to the constricted-flexible control principle, the criterion measure that is most often employed is the Stroop Colour-Word Test (Stroop, 1936b). Over the last thirty years, considerable research has been carried out employing this test. In an extensive review of research dealing with the test to date, Jensen and Rohwer (1966) concluded that

> a) it yields highly reliable and stable measures of individual differences on what seems to be three quite simple and basic aspects of human performance; b) though there are reliable individual differences on each of the three time scores obtained from the Stroop test, the three scores maintain the same rank order of magnitude

> for all Ss (there was no single exception among over 400 Ss tested by the writers (Jensen & Rohwer, 1966; p. 36).

The Stroop test has been employed extensively in studies of cognitive behavior. It has been employed to delineate two types of cognitive behavior - a) sensorimotor versus conceptual dominance and b) automatization or constricted-flexible control. It has also been used to delineate types of individuals who differ in patterns of cognitive behavior - cumulatives, disassociatives and stabilizers.

The dimension of sensorimotor vs. conceptual dominance was defined by Broverman and Lazarus (1958). It is specified by the speed with which Ss can read the names of colours (W) vs. the colours (C) themselves. Those Ss who have a high C/W ratio were designated as sensorimotor dominant. Subjects were then said to have a stronger cognitive subsystem in the dominant aspect.

Broverman and Lazarus' basic premise was the cognitive subsystems have an inherent tendency to maintain their organizations. From this they derived the following two hypotheses:

> a) the stronger the tendency of a cognitive subsystem to maintain its organization, the less vulnerable to distraction are task performances involving that subsystem; and b) when two cognitive subsystems compete, the stronger subsystem tends to dominate cognition such that the S tends to emphasize cognitive operations associated with that subsystem (Broverman & Lazarus, 1958; p. 103).

After categorizing Ss in terms of cognitive dominance, they

were then given conceptual and sensorimotor tasks under neutral and interference conditions. The results obtained were that interference effects impaired performance less when the task involved the stronger cognitive system. Also, under interference, the Ss tended more to be oriented towards cognitive operations which were associated with the stronger cognitive subsystems.

The second dimension is automatization and constricted-flexible cognitive control. Automatization is the term employed by Broverman (1960a) for the tendency of certain acts to become automatic and require little conscious effort or attention. This concept is defined by the same Stroop scores as Klein (1954) and his associates' concept of constricted-flexible control and thus Broverman's studies provide independent evidence for this control.

Klein (1954) employed the Stroop in an investigation of need, but reference will be made to this study only as it demonstrates the cognitive control of constricted-flexible. He used the Stroop to define two extreme groups on interference-proneness. The technique employed was a standard usage of the test, i.e., Ss were required to read aloud the colours red, green, yellow, and blue which were printed in incongruent colour names. For example, if the word r-e-d appeared in blue ink, the S was required to read "blue". As is consistent with all the previous research, there were individual differences in terms of susceptibility to interference. Of particular interest here is the

differential performance of these Ss on another cognitive task. The test procedure which Klein (1954) investigated was size estimations.

In the size estimation task, the Ss are required to make judgments under two conditions - perception and memory. In the perceptual task, the S was required to adjust a variable circle of light until it appeared equal in size to a standard disc. The result of relevance here is that the two groups separated distinctly in the direction of error: the high-interference group markedly underestimated while the low-interference group overestimated the size of the variable circle of light in comparison with the standard. Also, the high-interference Ss performed with greater individual consistency than did the low-interference Ss. In the second condition (memory), both groups tended to overestimate, but the overestimation was significantly greater in the low-interference group. In reviewing the data on these two tests, Klein suggests that the constricted control Ss (those with a high interference score - CW) more thoroughly traversed the whole range of possible settings before coming to a decision. This group also had less individual variability. He concluded that this

> all seemed to point to a tightened or suppressive form of control, reflecting, perhaps determined efforts to keep judgments in line with whatever external sources of information, cues and anchors were available in the stimulus field (Klein, 1954).

The use of the term 'constricted' by Klein suggests that this mode of the control is detrimental - the less effective end of the continuum. However, if the creative process is conceived of as involving accommodation, then the creative individual could be expected at times to demonstrate constricted control - 'efforts to keep judgments in line with external sources of information'. This, then, is the theoretical conception of constricted-flexible control. The problem thus becomes to delineate operationally this control as it relates to cognitive behavior.

Loomis and Maskowitz (1958) investigated one feature of the constricted-flexible distinction suggested by Klein's work (1954); i.e., that the flexible and constricted attitudes would likely involve different ways of tolerating ambiguity. From their study, they concluded that when a stimulus contained competing, overlapping, contradictory elements, the flexibles would tend to integrate these elements, whereas the constrictors were more likely to keep the intrusive ambiguities separated as much as possible. Gardner and Long (1960e), in their test-retest, study, obtained a Pearson's r of .55 ($p < .001$) for the interference group.

Broverman defines cognitive style as "manifestations of different response probabilities or response strengths in certain types or classes of behavior (Broverman, 1960a; p. 167)". He investigated "cognitive style" as it relates to two different types of tasks, the first being situations

in which the task was novel, difficult or concentration-demanding. The second was one that was practiced to the point of being automatic. The previously discussed "conceptual versus" perceptual motor dominance" applies to the former, while "automatization" applies to the latter. All Ss were categorized as to which end of the continuum they fell on each of the two dimensions - conceptual vs. perceptual motor dominance and automatization. Four groups resulted; Ss who are

1) conceptual dominant (CD) & strong automatizers (SA)
2) conceptual dominant (CD) & weak automatizers (WA)
3) perceptual motor dominant (PMD) & strong automatizers (SA)
4) perceptual motor dominant (PMD) & weak automatizers (WA)

As predicted, the CD Ss were less impaired than the PMD Ss on the concentration-demanding conceptual task, with the reverse being true on the concentration-demanding perceptual motor task. On the automatic tasks, there was no significant differences between these Ss. Similarly, on the automatic task, there was less interference on the task relevant to the stronger cognitive style, however in this case the F test only reached the .08 level of significance. There was also no significant difference between SA and WA on the concentration-demanding tasks. Broverman's work is especially relevant since the work of Klein and his associates was generally on neutral tasks. Broverman, on the other hand, employed tasks which were carried out under distracting, interfering conditions, thus providing support for the more general

applicability of cognitive controls to behavior.

Focusing-Scanning

Schlesinger first proposed this cognitive control under the label of Focusing (Schlesinger, 1954). He defined it in the following manner: "... an underlying preference for experiencing the world in a narrow discriminating way, even when the task does not demand such an approach (Schlesinger, 1954; p. 356)." This conception of focusing, however, appears to have something in common with the cognitive control of tolerance for unrealistic experiences since he defines the opposite end of the continuum as including individuals who "would be less intent upon checking their inner experiences against some objective standard and would be more prone to accept them uncritically (Schlesinger, 1954; p. 356)". Adopting this as the basic dichotomy, he then administered tasks (size estimation and picture sorting) which he hypothesized would discriminate Ss on this control. The results obtained were in the predicted direction: i.e., those who performed well on the size-estimation task, performed poorly on a task which was antithetical to it, i.e., picture sorting. In a later study, which employed the size estimation test, Holzman (1957) concluded that "focusers experience not only foveal objects with greater vividness but they are simultaneously actively aware of many more incidental aspects of a field than non-focusers (Holzman, 1957; p. 388)". This lends support for

the hypothesis that this principle is a mode of reality contact.

In his discussion of some process components of the cognitive controls, Klein (1958) stated that

> A cognitive attitude which we now call 'scanning' ... shows a distinctive quality of attention deployment. In the scanning attitude, attention is broadly and intensively deployed. The scanner is aware of a broad array of background qualities of a stimulus field. His investment is intensively incorporative, characterized by a constant, close look (Klein, 1958; p. 88).

A further study by Gardner and Lohrenz (1961) provides support for this notion that the degree of attention to stimuli affects the amount of their mutual assimilation. They concluded that when an individual fixes his attention on stimuli, the percepts become so stabilized that "they are less susceptible to interaction with memories of related earlier experiences in the course of memory formation (Gardner & Lohrenz, 1961; p. 611)".

Gardner and Long (1962a) investigated individual differences in scanning behavior in a variety of size estimation tasks (one of the criterion tasks for this principle) and on the Rorschach. They found that the main difference between scanners and non-scanners appears to be in the amount of information that the individual demands from the environment before making a response. The individual who scans his environment extensively appears to be more concerned with making a right response, one that will be

accepted by others. An individual who engages in limited scanning appears more relaxed and less critical in his acceptance of his personal experiences.

Santotefano and Paley (1964) conducted a developmental study of scanning; they also employed a size estimation task. Their results suggested that scanning, defined as the deployment of attention in an unsystematic, disorderly manner, is the more rudimentary form of cognitive functioning on this control, since it characterized the functioning of the younger children.

In this study, the opposing ends of the continuum this control will be delineated as focusing and scanning, respectively. Focusers are those who deploy attention systematically and in an orderly fashion, whereas scanners deploy attention unsystematically. Focusers thus inspect the information contained in the stimulus field more efficiently than scanners.

Equivalence Range

In regard to the cognitive behavior circumscribed by this control principle, there are two general "approaches" to the problem. One is encompassed by the concept of category width, and the other is equivalence range. Whether the two are synonomous or not is unanswerable to date since the evidence is equivocal. However, each area will be delineated in turn.

The concept of equivalence range was first

proposed by Gardner (1953). Subjects were tested on five tasks, one an object sorting task and four tasks involving constancy and brightness judgments. The expectation was that their performances would reflect consistent individual differences in equivalence ranges. The results obtained supported this general hypothesis. At the extremes of the dimension, some Ss divided an assortment of objects into as many as 30 groups, while others had only four groups. Similarly, persons of narrow equivalence range were also more accurate on object matches in size-constancy tasks. This result was confirmed only for women in a further study (Gardner et al., 1959). Sloane (1959) demonstrated that this control principle is in evidence in a wide variety of categorizing tasks. A study by Clayton and Jackson (1961) suggested that broad equivalence range may be associated with overgeneralization. Also, Gardner and Long's study (1960e) on the stability of cognitive controls yielded a test-retest r of .75 for the object sorting test. Finally, Gardner and Schoen (1962) and Sloane, Garlow and Jackson (1962) have shown that equivalence range behavior is highly consistent across a variety of stimulus domains.

Turning to category width, Bruner and Rodriquez (1956) initially demonstrated that Ss reveal marked individual consistency in the range or width of their categories. Pettigrew (1958) composed a Category-Width scale (C-W) which correlated +.57 ($p < .01$) with Bruner and Rodriquez's laboratory procedures. He concludes that his findings support

the interpretation that an individual's category width is his typical equivalence range for classifying objects. He also argues that category width also taps a "risk-taking" dimension, that broad categorizers are those who are willing to accept Type I errors and tolerate negative instances. Wallach and Caron (1959), Bruner and Tajfel (1961) and Tajfel, Richardson and Everstine (1964) all developed laboratory procedures which required the Ss to make judgments of the number of instances which would be admitted to a particular class of stimuli. In these studies, narrow categorizers were reflected by their higher rejection rates for categories, whereas broad categorizers had high rates of acceptance. Bruner and Tajfel (1961) also found that narrow categorizers tended to be more sensitive to change in the stimulus environment. The C-W test (Pettigrew, 1958) correlated positively with the Wallach and Caron (1959) procedure in the latter's study.

In regard to the possible interrelationships between these two concepts - category width and equivalence range, as mentioned earlier, the evidence is equivocal. Sloane, Garlow and Jackson (1963) reported that the two are independent of each other. Those Ss who are broad in equivalence range on object sorting tasks (where categories derive from the S) do not necessarily also achieve broad band width scores on categorizing tasks (in which the categories are inherent in the tasks). On the other hand, Gardner and Schoen (1962), in their factorial study, obtained

a strong factor which was heavily loaded with correlations from tests purported to measure, independently, equivalence range and category width.

Tolerance for Unrealistic Experiences

The Menninger group's work on this control principle began with a study by Klein and Schlesinger (1951) on perceptual attitudes toward instability. These attitudes were experimentally defined by Rorschach responses and in the experience of apparent movement; these attitudes were resistance and tolerance for instability. Their hypothesis was that "one expression of this attitude is the degree to which 'reality testing' rigidly requires the holding on to forms as they are known to be, refusing to tamper with reality as given (Klein & Schlesinger, 1951; p. 301)". Subjects were apportioned, from Rorschach test scores, into two groups (form-labile and form-bound). The result obtained was that the groups differed significantly in qualitative and quantitative responses to the apparent movement test, with the range being restricted in the form-bound group. Also, the general attitudes of ease of projection on the one hand and reluctance to do so on the other were quite evident. Klein, Gardner and Schlesinger (1962) conducted a study in which many measures, which they felt were indicative of tolerance for unrealistic experiences, were factor-analyzed. Three factors resulted which accounted for 51% of the variance. The first factor (21% of the variance)

they interpreted in terms of tolerance for experiences that are at variance with conventional reality. The second factor (16% of the variance) they interpreted as representing leveling-sharpening, while the third represented responses to a specific test.

Other investigators have been carrying out research under the label of "tolerance for ambiguity". This concept has been defined as "a tendency to resort to black-white solutions, to arrive at premature closure as to valuative aspects, often at the neglect of reality (Frenkel-Brunswick, 1949; p. 115)". The research under "tolerance for ambiguity" is concerned with an individual's response to stimulus ambiguity, while the research labelled "tolerance for unrealistic experiences" appears to be concerned with situational ambiguity. It can be hypothesized that unrealistic experiences is a special case of stimulus ambiguity. However, this relationship awaits further theoretical elaboration and investigation.

Tasks designed to measure intolerance for ambiguity have been mostly of the figure recognition variety. There are two types; the first usually consists of a set of cards (or slots with a pull-tab). The first card of the series has only a few elements of a design and successive cards have more and more elements, culminating in the final card with the complete design (Levitt, 1953; Smock, 1955). This technique has been termed the Decision Location Test (Levitt, 1953). Another technique, employed by Draguns and

Multari (1961) was to photograph a drawing with the objective moved successively out of focus.

Some studies have attempted to amplify the notion of intolerance for ambiguity by investigating a) the response characteristics of ethnocentric as compared to non-ethnocentric Ss; and b) its relationship to the experience of anxiety. The rational for the former was Frenkel-Brunswick's suggestion that intolerance for ambiguity is the crucial variable in the ethnocentric personality. A number of studies (Block & Block, 1951; Brown, 1953; Levitt, 1953; O'Connor, 1952; and Rokeach, 1948) have supported this notion. In regard to the second line of research, it has been postulated theoretically that "intolerance for ambiguity arises from the emotional conflict and intensity of anxiety experienced during the socialization process (Smock, 1957; p. 27)". There is little direct support for this; however, Smock in his studies has provided indirect support by demonstrating a relationship between experimentally induced anxiety and intolerance for ambiguity (Smock, 1955a, & b).

The research referred to above is more personality oriented and is tangential to the primary concern here, i.e., tolerance for ambiguity as a stable characteristic of an individual's cognitive behavior. More directly related to the present study is that of Loomis and Moskowitz (1958). They investigated the relationship between stimulus ambiguity and flexible-constricted control; they concluded that the

latter control appears to be more meaningful than the dimension of tolerance for ambiguity in differentiating individuals' responses to ambiguity.

On the assumption that an individual's response to stimulus ambiguity has more generality than "tolerance for unrealistic experiences", this study will be concerned with the former. More specifically, tolerance-intolerance for ambiguity is defined in terms of an individual's tendency to reach premature closure.

> The S's choice is then between extending the exploration of the picture - i.e., to use Piaget's terms, accommodating himself to its emerging properties - or cutting this search short by assimilating the percept to the objects of his previous experience (Draguns & Multari, 1961; p. 548).

Leveling-Sharpening

The leveling-sharpening control principle and its criterion test, the Schematizing test, were first presented by Holzman and Klein (1951). They postulated that "one basis for understanding these differences (individual differences in response to changing stimuli) was through perceptual attitudes of 'leveling' and 'assimilation' or of 'differentiation' and 'contrast' (Holzman & Klein, 1951; p. 257)". On the basis of their study, they concluded that these perceptual attitudes would be stable within individuals and would be predictive of personality tendencies.

> Sharpening refers to a propensity to maximize stimulus differences, an attunement to small gradients of difference between figure and ground. People who level tend to minimize such differences and to prefer the experience of sameness to that of difference (Holzman, 1954; p. 376).

Many additional studies were carried out on the relevance of leveling-sharpening to other aspects of behavior. In a study of serial behavior patterns, Smith & Klein (1953) also employed the Schematizing test. In point of fact, they were investigating the relationship of leveling-sharpening to constricted-flexible control, since the measures of serial behavior patterns were obtained from the Stroop Colour-Word Test. They distinguished three types of individuals on the basis of their performance on the Stroop. The scoring procedure consistent of measuring an S's performance time on the CW card five times, i.e., after every twenty responses. The resultant five time scores form some kind of pattern for each S. Smith and Klein termed the three main patterns as follows: cumulative, disassociative and stabilized.

> The Disassociatives' curve rises and falls discontinuously; this is claimed to reflect a faltering of attention required in the process of isolating the relevant stimulus. The Cumulatives curve tends toward increasingly slower reading time over the five time scores; these Ss show continuously aggregating difficulty throughout the performance. The Stabilizers' curve maintains an even course, remaining more or less horizontal over the five time scores; these Ss are most adequate to the interference task (Jensen & Rohwer, 1966; p. 71).

Smith and Klein (1953) investigated the relationship of these response patterns to what has come to be the criterion test for leveling-sharpening, i.e., the Schematizing test. They found that cumulatives tended to show a delayed sensitivity to change; disassociatives showed exaggerated sensitivity to change; although sensitivity to change was more refined for stabilizers, changes become more cautious after an initially exaggerated expectation. On the Gottschaldt figures, which relate to field dependence-independence, cumulatives recognized few embedded figures within the time limit, whereas disassociatives quickly recognized Gottschaldt figures, as did the stabilizers.

Holzman (1954) investigated the relationship of leveling-sharpening to visual, auditory and kinesthetic time error. He found that levelers showed significantly greater time error in all three modalities than sharpeners. In addition, he discovered there was a tendency for an individual S to respond consistently in the three modalities. The former finding was consistent with an earlier result obtained by Holzman and Klein (1954) investigating only visual time error.

Gardner et al. (1959) found a relationship, for female Ss, between leveling-sharpening and responses to a free-association test. In this latter test, Ss were asked to say everything that came to their minds for three minutes after hearing first the word "dry" and then the word "house". The levelers showed a) more blocking (difficulty in responding)

and b) greater difficulty in finding new situations (distinct responses). Presumably, this would be due to longstanding susceptibility to assimilation effects, i.e., new experiences and memory traces of related earlier experiences interact or "assimilate" thus blurring the perception of the new stimuli. Similarly, Holzman and Gardner (1959) found that Ss who were levelers on a neutral psychophysical task relied chiefly on repression as a defense mechanism. This finding also replicates one by Gardner et al. (1959). Gardner and Long (1960) did a reliability study on leveling-sharpening and the correlations obtained "offer support for the assumption that cognitive controls, as measured by these procedures, are relatively enduring features of cognitive organization (Gardner and Long, 1960; p. 486)".

The Menninger group went on to investigate the possible relations of leveling-sharpening to learning. Gardner and Long (1960) investigated the relationship between this control and serial learning. In their study, the sharpeners tended to give more responses but they made fewer errors. In the case of backward errors (i.e., repeating earlier items later in the test), they made significantly fewer than did the levelers. In their discussion, they hypothesized that

> ... Leveling-Sharpening may have still greater effects on learning when the rote-learning features of memory-drum experiments do not obtain, e.g. when learning occurs in single encounters with sequences of stimuli the person experiences as similar. Under the circumstances, memory is more "representational", less motor-habitual, and may be shaped

> more completely by the consistent individual differences in assimilation observed here and in earlier studies of leveling-sharpening (Gardner & Long, 1960; p. 184).

In another study, Gardner and Lohrenz (1962) found that a folk tale undergoes much more simplification and alteration in serial reproductions by levelers than in serial reproductions by sharpeners, supporting the assumption that levelers are more susceptible to assimilation effects.

In addition to the studies reviewed for the individual controls, a factor analytic study (Gardner et al., 1959) was carried out to test the interrelationships among these controls with a single group. They administered a number of tests, previously demonstrated as indicative of the control principles in question, to thirty male and thirty female Ss. There was, however, some variation between and within groups - in age, occupation, education, and even in one important case, the tests administered. The results obtained were that all five hypothesized controls were confirmed, however, only for one sex; factors representing the control principles of leveling-sharpening, equivalence range and field articulation appeared in the female sample. The field articulation principle, in the female sample, appeared to be a combination of the constricted-flexible control and field dependent-independence. In the male sample, factors representing the control principles of tolerance for unrealistic experiences and scanning appeared. Gardner et al., point out that these results are probably

more apparent than real, since gross sex differences were not apparent in previous studies of these controls.

The two independent factors obtained in the male sample account for only twenty percent of the total variance. Similarly, in the female sample, the three factors interpreted accounted for only thirty five percent of the variance. On the one hand, these results could be taken as somewhat limited support for the independence of the five control factors. On the other hand, the interpretation could be that the failure to replicate across factors reflects sex differences in terms of preferred cognitive controls. However, several methodological shortcomings have vital bearing on both interpretations. For one thing, the sample sizes (thirty in each group) were quite small for a factor analytic study; in this context, it is striking that all the hypothesized factors were confirmed for at least one sex. In addition, gross sex differences were not apparent in previous studies of the control principles. In regard to the cognitive control principle of field dependence-independence, the study by Witkin et al. (1954) explored sex differences more adequately and found men more consistent than women, which is directly contradictory to the findings obtained in the Gardner et al. study (1959). Another look at the factors obtained from the male sample is thus relevant at this point. The only factors which were interpreted were factor I (scanning - 12.3% of the variance) and factor IV (tolerance

for unrealistic experiences - 7.5% of the variance). However, three other factors appeared (II, III, V) accounting for 7.2, 6.7, and 5.9 percent of the variance, respectively. The authors felt that factor II could not be interpreted, while factor III resembled some aspects of field dependence-independence and factor V seemed to represent constricted-flexible control and other aspects of field dependence-independence. The important point, however, is that eight men did not return to take one of the tests for field dependence-independence, and they were quite different in their performance on other tests, from the rest of the sample who did return. On the Embedded Figures Test and the Stroop Colour-Word Test, they came out as more dependent and constricted, respectively, than did the rest of the sample. Thus the correlations between the three tests which were to form the core of one factor did not appear in the male sample. Because of this apparent artifact, the two factors were not interpreted.

On the basis of the studies reviewed above, Klein, Gardner, Holzman and their associates feel justified in stating that they have demonstrated the existence of five independent cognitive controls. However, there are many problems which this position glosses over. The most basic one being that the research on these controls is yet twoo small to justify this conclusion, (with the exception of Witkin's field dependence-independence) and the research on

these controls has been carried out almost exclusively by the Menninger group, i.e., no extensive confirmation has been supplied from independent studies.

The basic criticisms of their methodology comes out in their major validation study (Gardner et al., 1959). As mentioned earlier, they used too few Ss and the two groups were quite different. The result was that a separate analysis was performed on each group, consequently the factor analysis was carried out with an N of only 30. The significance of the factor loadings obtained is thus suspect. In addition to this basic defect, they also used too few criterion measures for the hypothesized factors (only two for each control, except constricted-flexible which had four). Also, they derived several scores from each test which often were not independent and thus likely contributed to some of the high factor loadings obtained.

A further problem which has implications for all the other studies carried out is that the criterion measures are not independent. That is to say, one test which is supposed to be the criterion test for one control was also found to load other factors as well, casting doubt on the independence of the controls. Obviously, until pure criterion tasks are developed the justification for calling them independent controls is tenuous. The fact that in specific studies Ss separated cleanly in terms of individual differences can with some validity be interpreted as performance

differences specific to the tasks and not necessarily characteristic of stable modes of cognitive behavior. However, despite the limitations and difficulties outlined, the writer agrees with Messick's (1961) conclusion that "they are suggestive of dimensions of consistent individual differences of such potential importance for a comprehensive treatment of cognitive and personality organization that their implications should be considered seriously and further research and refinement of measurement encouraged (Messick, 1961; p. 108)".

"Modes of coordination with reality" is the foundation of the present study and is of particular importance in understanding cognitive controls. It is important to stress that these controls are not defined solely in terms of physical specifications of different tasks. The main concern is the generality of the controls - "the range of situations which pose similar adaptive requirements and similar situational characteristics (Gardner et al., 1959; p. 14)". Thus a control principle represents the various ways in which an individual adapts to his environment when the situation allows him the option of employing a certain control in a preferred way. Two implications underlie this position - one is that antecedent conditions are crucial for understanding these controls, and secondly that an individual can vary with respect to any one control. The premise, however, is that a particular individual engages

in more or less scanning or more or less leveling behavior consistently. To iterate, a basic assumption of this study is that the cognitive controls are crucial to an understanding of the creative process since it too is a mode of coordination with reality. The point then is to spell out relationships between operational descriptions of cognitive controls and the adaptation model.

It was postualted that what would characterize creative behavior would be a process involving both assimilation and accommodation. Assimilation would involve an openness to the environment, voracious consumption of environmental stimuli and a freedom from conventional structures. Accommodation would involve an acute awareness of conventional structures. The creative individual is one who can freely modify stimuli to suit his own purposes (assimilate) but also respond to the demands of external 'realtiy' (accommodate).

The possible relationship of two controls to creativity appears fairly straight forward; these are focusing and tolerance for ambiguity. Openness to the environment would seem to imply an active perusing of the objects about one (focusing) and tolerance for ambiguity involves a freedom to accept ideas that deviate from the conventional. However, the possible relationships of other controls is not clear. Gardner and Schoen (1962) suggest that under certain conditions "high conceptual differentiation (narrow equival-

ence range) and extreme sharpening in combination could lead to minimal assimilation, low conceptual differentiation and leveling to maximal assimilation." Thus the implication is that several combinations of these controls may be facilitative of creative behavior. However, the various studies by Gardner, Holzman and his associates suggest that those Ss with narrow equivalence range (high in conceptual differentiation) are more rigid and intolerant of change in perceptual schemas once formed. Also the incubation phase was characterized by fluid experiences such that they do not become stereotyped; it is postulated, in this context then, that this requires that an individual demonstrate the cognitive control of sharpening. The resoning is that in levelers experiences lose their individuality resulting in extreme assimilation to previous schemata, i.e., stereotyping. It is postulated that constricted-flexible will not be discriminating because in the present definition of the creative process, both ends of the continuum are at times highly adaptive to creative functioning. Finally, in regard to field dependence-independence, it would appear, from its definition, that the ideal mode of relating with the environment appears to be the tendency toward field independence.

Statement of the Problem

This study is concerned with an individual's adaptive encounter with his environment by investigating what

are considered to be two basic modes of this encounter - intelligence and creativity. These modes of adaptation are investigated in the light of cognitive controls which are taken to be the dimensions organizing an individual's encounter with his environment. Previous investigations on cognitive controls have tended to a) concentrate on individual controls and b) employed adults as Ss. Also very little has been done in regard to their relevance to creativity. Consequently, the purpose of this study is to investigate the cognitive characteristics of the creative process in children in the light of cognitive controls. A subsidiary purpose is to replicate some of the results obtained by Wallach and Kogan (1965). They presented evidence for the distinction between intelligence and creativity and also presented partial evidence for the relevance of cognitive controls to creativity. In addition, an attempt is made to integrate the theoretical delineations of creativity and cognitive controls with Pieaget's concept of intelligence. The expected relationship of each control to creativity and intelligence will be presented in turn.

In the cognitive control of field dependence-independence, the more field independent Ss were considered to be those Ss who were able to overcome the influence of the surrounding field and separate an item from its context. Consequently, since this would appear to be the most adaptive end of the continuum, it is expected that high creative Ss

will be characterized by field independence. However, as pointed out previously (p. 22), earlier studies have demonstrated a relationship between field independence and intelligence. Consequently, it is expected that the high creative-high intelligent Ss will tend to be the more field independend and the low creative-low intelligent Ss the more field dependent.

The cognitive control of constricted-flexible delineates modes of reacting to contradictory and intrusive cues from the environment. From the theoretical delineation (pp. 25-37), it would appear that either end of the continuum would be adaptive for creative functioning. Consequently, for this control it is expected that the null hypothesis would be confirmed and no relationship to creativity demonstrated. Theoretically, the constricted end of the continuum would appear to be more related to intelligent (convergent) functioning than the flexible end. Thus, it is expected that high intelligent Ss will tend to be constricted. The moderating effects that creativity might have in relation to intelligence and this control are not known, although from the above it would be expected that there will be no interaction effects.

For the focusing-scanning control, the most adaptive end of the continuum would appear to be the focusing end since, in the present definition, it is assumed to be the most efficient in acquiring information from the environment.

Thus, it is expected that the high creative Ss will tend to be the focusers. Since high intelligence would be facilitative of adaptive intercourse with one's environment, it would be expected to have a moderating effect on focusing-scanning. Thus, it is expected that the high creative-high intelligent Ss will occupy the focusing end and the low creative-low intelligent the scanning end of the continuum.

The cognitive control of tolerance for ambiguity, in the present definition, involves the ability to resist premature closuer. This would appear to involve the freedom not to converge on the accepted solution. This freedom is essential to creative functioning. Thus it is expected that the high creative Ss will tend to be characterized by tolerance for ambiguity and the low creative Ss by intolerance for ambiguity. The possible moderating effects of intelligence are not known.

In regard to the control of equivalence range, either end of the continuum appears to be at times appropriate for the intercourse with one's environment involved in creative functioning. Thus it is expected that for this control the null hypothesis will be confirmed and no relationship to creativity demonstrated. This expected finding was previously obtained in the study by Wallach and Kogan (1965). In their study, the number of objects score for equivalence range demonstrated no relationship to creativity or intelligence.

The theoretical delineation of leveling-sharpening indicated that leveling (assimilation of stimuli) leads to stereotyping. Consequently, it is proposed that high creative Ss would tend to be sharpeners. Since it is expected that high intelligent Ss could more easily resist assimilation than low intelligent Ss, it is suggested that the high creative-high intelligent Ss will tend to occupy the sharpening end of the continuum and the low intelligent-low creative, the leveling end of the continuum.

CHAPTER II

METHODOLOGY AND PROCEDURE

Experimental Sample

The Ss employed in this study were sixty boys in the fifth grade of elementary school. It was intended that they be between their tenth and eleventh birthdays, however to obtain sufficient Ss several boys who were chosen turned eleven shortly before or during the testing. The mean age of the boys was 10.63 with a standard deviation of 5.13 months calculated from the middle of the testing period. All Ss were from four Roman Catholic elementary schools in the same suburban area. No other selection factors were taken into account. Boys at this age level were chosen primarily because of the author's interest in investigating creativity in children, and secondly because the creativity tasks employed had previously been employed only with this age sample (Wallach & Kogan, 1965).

Testing Materials

The tests employed in this study were a) three measures of intelligence (the comprehension, vocabulary, and block design subscales from the Wechsler Intelligence Scale for Children); b) three measures of creativity (Alternate

Uses, Similarities, and Pattern Meanings - Wallach & Kogan, 1965); and c) seven measures of cognitive controls (Embedded Figures Test, Stroop Colour-Word Test, Object Sorting Test, Category-Width Test, the Schematizing Test and two measures designed by the author - focusing-scanning and tolerance for ambiguity).

The administration and scoring of the intelligence measures followed the general procedure set down in the WISC manual (Wechsler, 1949). These scales were chosen because of their higher (relative to other subscales) correlations with the full scale IQ. The correlations for comprehension, vocabulary and block design with the full scale score (for 10½ year old) were .69, .83 and .64, respectively (Wechsler, 1949). For the same group, reported reliabilities were .73, .91 and .87 respectively. The raw scores for the three measures were converted to standard scores and then summed to yield an IQ index score for each S.

The three creativity tasks are presented in Appendix A. The first, Alternate Uses, asks the child to generate possible uses for a verbally specified object, e.g. newspaper. The Similarities task involves generating possible similarities between two verbally specified objects. Finally in the third task, Pattern Meanings, the child is asked to generate possible meanings or interpretations for each of a number of abstract visual designs. Also, the child is requested to consider the drawing as a whole in giving

his response. The originators of these tasks (Wallach & Kogan, 1965) derived two scores for each task: a) number of unique responses and b) the total number of responses produced by the child. Table 1 presents the Spearman-Brown split-half reliability coefficients reported by Wallach and Kogan (1965) for these scores.

TABLE 1

Spearman-Brown Split-Half Reliability Coefficients for the Six Creativity Variables (N = 151)

Alternate Uses - uniqueness	.87
Alternate Uses - number	.93
Similarities - uniqueness	.87
Similarities - number	.93
Pattern Meanings - uniqueness	.88
Pattern Meanings - number	.93

Turning to validity, it is obvious that this is a crucial problem which has not been adequately solved in relation to studies of this nature. Outside assessment of the creative ability of these Ss would involve the kind of detailed clinical and biographical study of each child that is impossible to carry out in practice. In addition, there was insufficient material from the Ss' performances in school to employ any indices from this area. At present, then, the most that can be done to facilitate the validity of the tasks is to see that the assessment of the Ss' creative

ability is consistent with the theoretical delineation of what constitutes a creative response.

In this light, then, two additional scores were added (appropriateness and transformation) consistent with the delineation of a creative product in chapter one. The instructions on which the scoring of the responses was based are presented in Appendix B.

The four scores (total number - henceforth termed flexibility, uniqueness, appropriateness, and transformation) were then summed to hield a total score for each test. These raw scores were then converted to standard scores and summed to yield a creativity index score for each S. In addition, each of the original scores were summed across tests to yield total scores on flexibility, uniqueness, appropriateness and transformation.

Embedded Figures Test (Field Dependence-Independence)

The standard form of this test was established by Witkin (1950); it consists of eight simple figures and twenty-four complex figures. These figures were the original Gottschaldt figures which Witkin made more difficult by adding colours to all but one. The object of this test is for the S to find the simple figure which is embedded in the complex one. In this study a short form of the test was employed (Jackson, 1956), which consists of 12 out of the 24 complex figures. The correlations between the shortened and full scale EFT reported by Jackson (1956) were in the mid-

ninties for several groups of subjects. The score on this test is simply the total time required to complete the task. A high score is assumed to represent the field dependent end and a low score the field independent end of the continuum.

Stroop Colour-Word Test (Constricted-Flexible)

There is no standard version of the Stroop test with respect to either the materials, the administration, or the scoring. The original test (Stroop, 1935b) consisted of three cards: a word card (W), a colour-card (C) and a colour-word card (C-W). The W card consisted of the words red, blue, green, brown, and purple arranged in a 10 x 10 matrix and printed in black ink on a white card. The C card consisted of colour patches in place of the words on the W card. Finally, on the C-W card, the 10 x 10 matrix consisted of the words of the five colours employed printed in an incongruous colour, e.g., the word red would be printed in blue ink. On this card each colour name appears an equal number of times in each of the four other colours. However, the exact size of the cards, the size or shape of the colour patches or their spacing were not specified. Many other forms have since been employed which were simple variations on the basic format employed by Stroop. Jensen & Rohwer (1966) on the basis of their review of the various techniques employed concluded that any version of this test should a) avoid the appearance of doublets of the same colour or word in immediate succession; b) require a different sequence

of responses on each of the cards to avoid sequential practice effects from one card to another; c) have every colour (and every word) follow every other colour an equal number of times.

The form adopted in this study incorporated the characteristic elements in previous versions of this test plus the suggestions listed above. There were three cards, W, C, C-W. The word cards W and C-W were printed in upper-case letters, double-spaced and in a 10 x 10 matrix. The C card consisted of colours which were the same size as a six letter word printed in upper-case letters. The test was slightly modified, however, in that on the C-W card instead of the words being printed in an incongruous colour, they were printed in black and bounded with a border of an incongruous colour.

The basic scores on the Stroop are time measures for the three cards, thus W, C and CW. A great many scores have been derived from these three. However, Jensen (1965), in his factor analysis of this test obtained three factors on which two of the basic scores and some of the derived scores emerge as almost independent measures of a particular factor. The first factor obtained was that of colour difficulty and was unambiguously represented by C/(C+W). The second factor was interference and the score CW-C was the purest measure of this factor and consequently was employed here. A high score on this factor is indicative of con-

striction, while a low score represents flexibility. The third factor was a speed factor. The basic time score W was the only "pure" measure of this factor. Thus the five scores were adopted for this study: W, C, CW, CW-C, and C/(C+W). The correlations reported by Jensen (1965) for these measures are presented in tables 2 and 3.

TABLE 2

Spearman-Brown Test-Retest Reliability Coefficients for W, C, CW, CW-C and C/(C+W) (N = 436)

W - (Reading Time on W card)	.88
C - (Reading Time on C card)	.79
CW - (Reading Time on CW card)	.71
CW-C - (interference score)	.48
C/(C+W) - (colour difficulty)	.72

TABLE 3

Spearman-Brown Reliability Coefficients for 10 administrations for W, C, CW, CW-C, and C/(C+W) (N=50)

W	.86
C	.86
CW	.84
CW-C	.56
C/(C+W)	.77

Focusing-Scanning

In the theoretical delineation of focusing-scanning it was stated that what basically distinguishes

focusers from scanners is the extent of systematic deployment of attention and the resultant efficiency in absorbing information from the environment. In the present writer's view the adequate assessment of this control "per se" would involve the tracking of eye-movement in each S. However, this task was beyond the scope of the present study. On the assumption that efficiency in deployment of attention results in more information being received, the experimenter devised a simple procedure to test this control. It consisted of having the Ss observe an array of 15 objects for 15 seconds, and then recount as many of them as they could remember. The objects employed were from the Kahn Test of Symbol Arrangement. Two main scores were derived: a) the number of objects and b) errors - a high score on number of objects and a low score on errors being indicative of focusing. However, the number of objects recounted may be more a function of short term memory than of the cognitive control of focusing-scanning. To somewhat obviate this limitation points were assigned on a fixed scale of increasing distance from the centre of the array of objects. The reasoning being that a focuser (by definition) since he scans the stimulus field more systematically and efficiently, will tend to recount more objects on the periphery than a scanner. Thus Ss with a high score presumably are focusers. This test may or may not correlate highly with the measures for focusing-scanning employed previously. To attempt some validation of this procedure, two forms of the test were administered

to the Ss. Form A, with a wide spread array, by definition of this control, should inhibit the performance of scanners, while on form B, with a tight array of objects hypothetically there should be less distinction between focusers and scanners.

Object Sorting Test (Equivalence Range)

The Object Sorting Test employed in this study was Wallach and Kogan's (1965) adaptation of the Clayton and Jackson (1961) Object-Sorting Test, which consisted of fifty familiar objects. In its present form, it is made up of fifty line drawings of the same objects. The pictures were laid out in five rows of ten pictures and each S was asked to arrange the cards in groups. Upon completion of the grouping task, the S was questioned about the reasons for the particular groups formed. The scores which were derived from this procedure are a) conceptual differentiation score, which is the number of groups containing two or more objects; b) the compartmentalization score, which is the number of objects left ungrouped; and c) percentage of pairs, groups containing only two objects. Narrow equivalence range is indicated by a high conceptual differentiation score and broad equivalence range by a low score. An index of internal consistency obviously could not be obtained for this measure. However, Sloane, Gorlow, and Jackson (1963) reported a correlation of .75 between alternate forms of this test. The versions they employed were group-administ-

ered paper-and-pencil tasks and were given to adults, but r's of .55 and .53 with the individually administered object sorting test of Gardner (1953) were obtained. For the conceptual differentiation score, Gardner and Long (1960) reported a correlation of .75 ($p < .001$).

The reasons for the groupings were scored according to the scoring system outlined by Oliver and Hornsby (1966). There are two main divisions to this system; a) the characteristics used as the basis of equivalence (the five modes being perceptual, functional, affective, nominal, and fiat equivalence), and b) the structure of the groupings (superordinate, complexive, and thematic). Percentage scores were computed for all these measures. The instructions given to the judges for scoring this test are presented in Appendix C.

Category Width Test

The procedure employed for this control was that devised by Wallach and Caron (1959) which they adapted for children from the Pettigrew (1958) category-width test. The task is presented as a guessing game and consists of twelve questions, which are presented in Appendix D. The score on this test was obtained by keying both parts of each item 1, 2, 3, or 4 representing responses that are least to most discrepant from the central tendency provided for each item. The twenty-four values were then summed to yield a total score. Wallach and Kogan (1965) obtained an

odd-even reliability coefficient of .76. Finally, a high score on this test is indicative of a preference for broad band widths and a small score reflects a preference for narrow band widths.

Tolerance for Ambiguity

As stated in chapter one, tolerance for ambiguity is defined specifically in terms of the tendency to premature closure. The task for measuring this control was designed by the experimenter and is similar to the experimental ambiguity task reported by Smock (1954). The task required each S to organize partially structured stimuli into a complete picture or design in order to obtain the correct response. Each S was administered six series of 10 cards. Each series represents a successively more clearly delineated picture. The stimuli employed in this study were a) a goat, b) a car, c) a butterfly, d) a man, e) an engine, and f) a giraffe. Drawing F is presented in Appendix E. Prior to the administration of each series five possible answers were presented to the S, one of which was the correct response. The list was left exposed throughout the series. This precaution was adopted in an attempt to rule out memory as an important variable. Also, a five card sample series (flower) was presented to familiarize the S with the task. Four scores were recorded: a) mean trial of first response; b) mean trial of first correct response; c) mean trial on which correct response stabilizes (either the second response

of a string of only correct responses, or the first correct response which was not followed by any erroneous responses); d) number of response changes before score C. The criterion response for this task is score A; scores B and C were included but are not directly relevant. These scores were included because Smock (1957) and Draguns and Multari (1961) reported a significant correlation between intelligence and the first correct response. Levitt's (1953) score for intolerance for ambiguity (in a similar procedure) was the number of responses other than "don't know" made prior to the point of clear perception. Consequently, score D was included as possibly another and different measure or aspect of intolerance for ambiguity.

Schematizing Test (Leveling-Sharpening)

This test requires an S to make size judgments on a succession of 150 squares of light which gradually increase in size. There are fourteen squares in the test ranging in size from 1.3 to 13.7. The squares were projected on a screen in a dark room. At the beginning of the test, the five smallest squares were presented, first in sequence and then twice in random order. The smallest square was then dropped and a larger square than any of the first five was added without interrupting the sequence of presentation. In this manner, by successively adding the next largest and dropping the smallest square, the range of squares was traversed. Two scores were computed for this test, a) percent-

age ranking accuracy and b) mean percentage increment error. The percentage ranking accuracy score was obtained by dividing the number of stimuli correctly ranked by the maximum number (150). If two or more stimuli were judged the same size within a sub-series, they were given 1/2 the accuracy credit they would obtain if they were not tied and were properly ranked - so long as they appeared at the appropriate place in the ranking. The mean percentage increment error score was obtained by subtracting the average actual increase in size from the judgments of size of each S. Five increment values were obtained (ignoring sign) which were then averaged to obtain an increment error score for each S. A high score on percentage ranking accuracy is assumed to represent the sharpening end of the continuum, while a low score is assumed to represent the leveling end. On the mean percentage increment error scores, a small value is assumed to represent the sharpening end and a large value the leveling end of the continuum.

Gardner and Long (1960) reported a test-retest reliability coefficient of .52 ($p < .001$) for percentage accuracy and .36 ($p < .05$) for mean percentage increment error. Reliabilities for this test would be expected to be low since the task necessitates that the S be naive. Consequently, on the retest some Ss would be aware of the nature of the task and their performance would improve - become more accurate.

Procedure

Initially, the boys were told that the experimenter was simply interested in playing a few games with them. During the first session with each S, a few minutes was spent in an attempt to put the S at ease, and then the instructions for the first task was given. The instructions for all tests are presented in Appendix F.

All tests were administered individually except the Band-Width Test and the Schematizing Test and these were administered together upon completion of the individual tested to groups of six to nine Ss. The Object Sorting Test, one of the focusing-scanning tests and the Stroop Colour-Word Test were administered during the first session as they could most easily be presented as a game. The other tests were then administered, the primary concern being that each experimental session last no longer than forty-five minutes. The IQ tests were administered after the creativity tasks so that the stress generated by these tests would not spread to the creativity tasks. Thus for most Ss the experimental time consisted of six sessions of approximately a half hour each, which were spread over a two month period. However, since the attempt to generate a game-like atmosphere, no time limit was imposed for the creativity, tasks, except in the case of two Ss who continued responding for an inordinately long period of time (ten minutes per question) in which case the experimenter suggested that these Ss go on to

the next item.

Previous researchers had administered the Schematizing test in total darkness, with the Ss (adults) being supplied with desk lamps or pen flashlights which were turned on by each S to record their judgments. However, since children were employed in this study and to simplify the procedure, the test was administered in semi-darkness. Thus there was enough light in the room for the Ss to record their judgments but also the room was dark enough for the squares to be clearly visible. In addition, on the suggestion of Gardner (1967) the test was terminated after judgment 90.

The focusing-scanning test (A) was administered twice to an additional group of Ss to test the reliability of this procedure. The two sessions were three weeks apart. In addition, the tolerance for ambiguity test was administered to these Ss. Half of the test was administered during the first session and half during the subsequent session.

Three graduate students in psychology scored the responses to the creativity tasks and the reasons for the Object Sorting Test. The instructions for scoring was given to the three judges in a group, then a complete set of the responses was given to each judge and they were asked to score the responses independently.

CHAPTER III

PRESENTATION AND ANALYSIS OF RESULTS

The reliabilities of the procedures designed by the experimenter (focusing-scanning and tolerance for ambiguity) and the inter-scorer percentage agreements for the creativity tasks and Object Sorting Test were determined first. The test-retest reliability coefficients for focusing-scanning and the split-half reliability coefficients for tolerance for ambiguity are presented in table 4.

TABLE 4

Reliability Coefficients for Focusing-Scanning and Tolerance for Ambiguity (N=30)

Focusing-Scanning	
Number of Objects	75
Differential Score	64
Tolerance for Ambiguity	
Mean First Response	82
Mean Number of Response Changes	42

The number of objects and mean first response are the scores of primary interest and fairly high reliabilities were obtained. Percentage agreement between judges for Alternate Uses, Similarities, Pattern Meanings and Object Sorting

Test are presented in Table 5.

TABLE 5

Percentage Agreement between judges for Alternate Uses (AU), Similarities (Sim), Pattern Meanings (PM), and Object Sorting Test (OST)

Test	Judges	Score		
		Uniqueness	Appropriateness	Transformation
AU	1, 2 & 3	65	51	22
	2 of 3	100	98	86
	1 & 2	85	73	66
Sim	1, 2 & 3	65	62	30
	2 of 3	100	100	100
	1 & 2	84	71	70
PM	1, 2 & 3	74	66	26
	2 of 3	94	97	83
	1 & 2	90	75	67
OST	1, 2 & 3		75	
	2 of 3		97	

The inter-scorer reliability obtained between all three judges was quite low. However, the higher percentage of agreement between judges one and two indicates that a large portion of the disagreement was accounted for by judge three. This was particularly evident for the transformation score, where judge three consistently awarded a higher score than

judges one and two. However, a very high percentage of agreement was obtained when the criterion was taken to be agreement between any two of the three judges. Consequently, for purposes of scoring, when at least two judges agreed on a score, that score was assigned for the response. For the creativity tasks, when all three disagreed, the lowest (most conservative score) was assigned. No score was assigned for the Object Sorting Test, since there was no justification for accepting one over another.

The intercorrelations among and between the creativity and intelligence measures will now be considered. The intercorrelations among the creativity measures for the sample of sixty boys are presented in table 6.

TABLE 6

Intercorrelations among Creativity Measures - Alternate Uses (AU), Similarities (Sim) Pattern Meanings (PM), Flexibility (Flex), Uniqueness (Unip), Appropriateness (Approp), Transformation (Trans) and Creativity Index (N=60)

	AU	Sim	PM	Flex	Uniq	Approp	Trans
Sim	56						
PM	62	76					
Flex	73	89	91				
Uniq	76	88	94	96			
Approp	74	80	85	88	91		
Trans	77	85	94	95	99	92	
Creativity Index	72	87	83	91	93	86	92

The intercorrelations among the creativity measures are very high, with most of the correlations being above .80.

The intercorrelations among the intelligence measures are presented in table 7.

TABLE 7

Intercorrelations among Intelligence Measures

	Comprehension	Vocabulary	Block Design
Vocabulary	49		
Block Design	-18	25	
I.Q. Index	64	76	58

The intercorrelations among the three intelligence measures are not as high as would be desirable. Although their correlations with the IQ index score are only slightly less than that reported by Wechsler (1949) between these three tests and the Full Scale I.Q., the disparity among the scores casts doubt on the validity of the intelligence dimension.

Turning now to the relationship between intelligence and creativity, the intercorrelations between the various measures are presented in table 8. The intercorrelations obtained are generally not significant. However, the correlations between vocabulary and all the creativity scores except similarities and pattern meanings were significant

beyond the .05 level. Thus, although the correlations are generally in agreement with Wallach and Kogan (1965), they are not unambiguously definitive of two distinct modes of behavior because of the significant correlations with vocabulary.

TABLE 8

Intercorrelations between Creativity and Intelligence Measures (N = 60)

	AU	Sim	PM	Flex	Unip	Approp	Trans	Creat. Index
Comprehension	15	11	07	14	11	05	12	11
Vocabulary	40**	20	22	26*	28*	30*	29*	31*
Block Design	03	06	10	05	09	10	08	12
IQ Index Score	25	17	18	21	22	20	22	25

* - .05 level of significance
** - .01 level of significance

The relationships between creativity and intelligence and the various cognitive controls can now be considered. The sixty Ss were divided into four groups on the basis of their creativity index score and the IQ index score. Table 9 presents the number of Ss in each cell when the split on both variables is on the median. The expected relative orthogonality of creativity and intelligence was not borne out by the actual distribution of Ss obtained on

the median split. However, to obtain equal cells, the Ss were first split into high and low on creativity and then within each creativity group, the Ss were further split into high and low on intelligence, thus yielding 15 Ss per cell.

TABLE 9

Median Split for Intelligence and Creativity

		Creativity	
		High	Low
Intelligence	High	19	11
	Low	9	21

For the high creativity Ss, the range of scores on the creativity index score was from -.50 to +13.48, while the range for the low creativity Ss was from -.63 to -3.16. Within the high creativity group, the high intelligence scores ranged between +.52 and +2.73. For the low intelligence scores, the range was from +.42 to -3.23. Within the low creativity Ss, the high intelligence scores ranged from -.49 to +5.15, while the low intelligences were between -.69 and -3.51. The IQ index score and the creativity index scores are presented in Appendix G.

Twenty-nine scores were computed from the eight tests administered to the sixty Ss. These scores are presented in table 10. As delineated in Chapter II, the scores

TABLE 10

Scores derived from the Cognitive Control Tests

	Score	Test
1	Total Time (FD-I)	Embedded Figures
2	W	Stroop Colour-Word
3	C	
4	CW	
5	CW - C	
6	C/(C+W)	
7	Number of Objects (F-SA)	Focusing-Scanning A
8	Errors	
9	Differential Score	
10	Number of Objects (F-SB)	Focusing-Scanning B
11	Errors	
12	Differential Score	
13	Number of Groups (E-R)	Object Sorting Test
14	Number of Singles (N of S)	
15	Percentage Pairs	
16	Band Width (B-W)	Category Width Test
17	Mean First Response (MFR)	Tolerance for Ambiguity
18	Mean First Correct Response	
19	Mean Trial Correct Response Stabilizers	
20	Number of Response Changes Before Score 19	
21	Percentage Ranking Accuracy	Schematizing Test
22	Percentage Increment Error	
23	Percentage Perceptible	Object Sorting Test
24	Percentage Functional	
25	Percentage Nominal	
26	Percentage Fiat Equivalence	
27	Percentage Superordinate Grouping	
28	Percentage Complexive Grouping	
29	Percentage Thematic Grouping	

most directly relevant to the present study are 1, 5, 7, 9, 10, 12, 13, 14, 16, 17, 20, 21, and 22. The other scores

are not directly relevant, since they are not measures of cognitive control. For each of the relevant scores, the means, standard deviations and a 2 x 2 analysis of variance was computed for the four groups and each score was correlated with every other score. The intercorrelations for all scores are presented in Appendix H, while the means, standard deviations and analyses of variance for the remaining scores (not directly relevant) are presented in Appendix I.

Before considering each control individually, the intercorrelations for the total sample will be considered. The intercorrelations for the scores most directly related to cognitive control are presented in table 11. Except for two correlations, all those reported in table 11 as significant are for scores within tests or between two versions of the same test. For example, the four scores for focusing-scanning A and B were significantly related. Similarly, the trial of first response and the number of response changes scores for tolerance for ambiguity were significantly negatively correlated. Finally, the two scores derived from the Schematizing test were also significantly negatively correlated, as expected from the definition of the scores. Outside of these within-test correlations, the only other significant correlations were negative ones between field dependence-independence (FD-I) and Focusing-Scanning A and B (F-SA and F-SB). The relationship that seemed to be indicated was a tendency for field dependence to be inversely

related to focusing. Very low correlations were obtained between all other controls. The individual controls will now be considered.

Field Dependence-Independence

The means and the analysis of variance for total time on the Embedded Figures Test for the four groups are presented in table 12. The standard deviations for the groups are reported in parentheses below the means. It is clear from table 12 that in this study the field dependent Ss were those Ss who were either high creative-low intelligent (HC-LI) or low creative-high intelligent (LC-HI). The mean score for the low creative-low intelligent Ss (LC-LI) indicated that these Ss tended to be field dependent (high scores). Finally, the high creative-high intelligent Ss (HC-HI) tended to achieve scores mid-way between the two ends of the dependent-independent continuum. The analysis of variance yielded no significant effect for either creativity or intelligence, however there was a significant interaction between creativity and intelligence for field dependence-independence which was significant beyond the .05 level.

TABLE 11

Intercorrelations of Scores Most Directly Indicative of Cognitive Controls

		1	5	7	9	10	12	13	14	16	17	20	21
5	CW-C	-24											
7	F-SA	-17	-08										
9	Diff	-18	-03	96**									
10	F-SB	-45**	15	42**	44**								
12	Diff S	-33**	04	35**	38**	92**							
13	E-R	14	-02	-02	-03	15	23						
14	N of S	-02	-14	-24	-21	04	04	13					
16	B-W	-06	-17	-20	-15	02	03	-14	11				
17	MFR	22	-01	00	-03	-03	08	25	-10	-08			
20	NRC	-10	02	-09	-06	11	10	-08	24	10	-51**		
21	PRA	05	21	-06	-07	01	01	-05	04	-14	05	-17	
22	PIE	03	03	-18	-15	-25	-21	09	05	15	09	07	-48**

** .01 level of significance

TABLE 12

Means for Total Time on the Embedded Figures Test for the Four Groups (N = 60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	1488.80 (427.40)	1290.53 (414.00)	1389.67 (432.27)
	Low	1303.07 (584.49)	1720.00 (594.62)	1511.53 (625.35)
	High + Low	1395.93 (520.36)	1505.27 (555.51)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	180400.00	1	180400.00	.65
Intelligence	223900.00	1	223900.00	.80
Interaction	1418000.00	1	1418000.00	5.08**
Within Cells	15620000.00	56	278946.43	

** F .95 (1. 56) = 4.02

Constricted-Flexible

The means and analysis of variance for the CW-C score on the Stroop Colour-Word Test for the four groups are presented in table 13.

TABLE 13

Means for CW-C score on the Stroop Colour-Word Test for the four groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	62.27 (33.37)	64.33 (23.79)	63.30 (29.00)
	Low	56.73 (23.54)	53.67 (24.12)	55.20 (23.88)
	High + Low	59.50 (29.01)	59.00 (24.54)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	150.60	1	150.60	.24
Intelligence	1069.00	1	1069.00	1.69
Interaction	122.00	1	122.00	.19
Within Cells	35370.00	56	631.61	

* F .90 (1,56) = 2.78

For this control, it was found that HI Ss obtained higher CW-C scores (tended to be more constricted) than did the low intelligent (LI) Ss. However, this effect was not significant and no relationship to creativity was demonstrated.

The intercorrelations between field dependence-independence and constricted-flexible within each group of Ss are presented in table 14. As demonstrated in table 14, a significant relationship was obtained between field dependence-independence and constricted-flexible for HC-HI and LC-HI Ss. The LC-HI Ss appeared to be the most field independent and the most constricted. This correlation was significant beyond the .05 level. The HC-HI Ss, however, tended to be constricted and in the middle range on field dependence-independence. No other correlations were significant.

Focusing-Scanning

The means and analysis of variance for the "number of objects" score on the Focusing-Scanning A test are presented in table 15. As demonstrated by the means in table 15, the high creative Ss tended to recount more objects than did the low creative Ss, thus by the definition of this control, would be termed focusers. In addition, the HI Ss tended to be focusers and the LI Ss scanners. The analysis of variance yielded a significant effect at the .01 level for creativity; however, the effect for intelligence only

TABLE 14

Intercorrelations between Field Dependence-Independence and Constricted-Flexible for the four groups

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	-56*	54*	-11
	Low	-30	-39	-35
	High + Low	-38	-09	

* .05 level of significance

reached .10 level of significance. No significant interaction was demonstrated. In the extreme, then, the HC-HI Ss tended to be the focusers and the LC-LI Ss the scanners. Table 16 presents the means and analysis of variance for the differential score on Focusing-Scanning A for the four groups.

TABLE 15

Means for the number of objects score on the Focusing-Scanning A Test for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	9.00 (2.25)	7.80 (2.01)	8.40 (2.22)
	Low	8.33 (1.81)	6.67 (1.74)	7.50 (1.96)
	High + Low	8.67 (2.07)	7.23 (1.96)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	30.00	1	30.00	7.46***
Intelligence	12.14	1	12.14	2.94*
Interaction	.80	1	.80	.00
Within Cells	231.00	56	4.13	

* F.90 (1, 56) = 2.78
*** F.99 (1, 56) = 7.13

TABLE 16

Means for the Differential score on the Focusing-Scanning A Test for the Four Groups (N = 60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	20.60 (5.17)	18.47 (4.63)	19.53 (5.02)
	Low	19.40 (4.14)	15.60 (3.76)	17.50 (4.39)
	High + Low	20.00 (4.73)	17.03 (4.45)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	131.90	1	131.90	6.20**
Intelligence	61.97	1	61.97	2.91*
Interaction	10.33	1	10.33	.49
Within Cells	1191.00	56	21.27	

* $F_{.90}(1, 56) = 2.78$
** $F_{.95}(1, 56) = 4.02$

Although slightly less significant, the differential score demonstrated the same relationship to creativity and intelligence as did the number of objects score. In the extreme, the HC-HI Ss tended to be focusers and the LC-LI

Ss scanners. The intercorrelations between focusing-scanning A (number of objects) and field dependence-independence and constricted-flexible within each group are presented in table 17.

TABLE 17

Intercorrelations between Focusing-Scanning A (number of objects) and Field Dependence-Independence (FD-I) and Constricted-Flexible (C-F)

			CREATIVITY		
			High	Low	High + Low
INTELLIGENCE	High	FD-I	11	-37	-05
		C-F	-40	-10	-28
	Low	FD-I	-17	-05	-24
		C-F	06	15	12
	High + Low	FD-I	-01	-28	
		C-F	-21	08	

In regard to the correlations between Focusing-Scanning A and Field Dependence-Independence and Constricted-Flexible no significant relationships were indicated.

The means and analysis of variance for the number of objects score on the Focusing-Scanning B test are presented in table 18.

TABLE 18

Means for Number of Objects score on the Focusing-Scanning B test for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	9.07 (1.65)	8.13 (1.54)	8.60 (1.67)
	Low	8.73 (1.61)	7.13 (2.03)	7.93 (1.99)
	High	8.90 (1.64)	7.63 (1.87)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	24.12	1	24.12	7.63***
Intelligence	6.67	1	6.67	2.11
Interaction	1.62	1	1.62	.51

* $F_{.90}(1,56) = 2.78$
*** $F_{.99}(1,56) = 7.1$

Focusing-scanning B demonstrates the same relationship to creativity and intelligence as Focusing-Scanning A. On the continuum from focusing to scanning, the Ss fall in the same progression - HC-HI, HC-LI, LC-HI, and LC-LI. Once

again the effect for creativity, on the analysis of variance, was significant beyond the .01 level. There was a tendency for an effect for intelligence but this did not reach significance. As previously demonstrated with focusing-scanning A, then, (see table 16) the focusers tended to be the high creative Ss, while the scanners tended to be the low creative Ss. The means and analysis of variance for the differential score on focusing-scanning B are presented in table 19.

As was pointed out previously (see table 11), the "number of objects" score and the "differential score" for focusing-scanning B were highly correlated. However, the effect for creativity for the latter score was considerably less significant than that for the number of objects score. For the number of objects score, the effect for creativity was significant beyond the .01 level, while for the differential score it was only significant at the .10 level. The creativity effect on the latter score was also less significant than the same differential score for focusing-scanning A; the significance levels were .10 and .05, respectively. Thus the anticipated (see p. 58) differential effect between focusing-scanning A and B was obtained. As indicated (on p. 58) focusing-scanning B was less discriminating than focusing-scanning A. The intercorrelations between focusing-scanning B (number of objects) and Field Dependence-Independence, Constricted-Flexible, and Focusing-Scanning A (F-SA) are presented in table 20.

TABLE 19

Means for the Differential Score on the Focusing-Scanning B Test for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	21.20 (4.21)	18.93 (4.06)	20.07 (4.29)
	Low	19.87 (3.26)	17.67 (5.37)	18.77 (4.58)
	High + Low	20.52 (3.83)	18.30 (4.80)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	74.76	1	74.76	3.81*
Intelligence	25.34	1	25.34	1.29
Interaction	.06	1	.06	.00
Within Cells	1099.00	56	19.63	

*$F_{.90}$ (1,56) = 2.78

Although the total correlation between Focusing-Scanning A and B was significant, among the subgroups this correlation was significant only for the LI group. Similarly, although there was a significant negative correlation between

TABLE 20

Intercorrelations between Focusing-Scanning A and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), and Focusing-Scanning A (F-SA)

			CREATIVITY		
			High	Low	High + Low
INTELLIGENCE	High	FD-I	-15	-43	-20
		C-F	24	-34	00
		F-SA	20	33	31
	Low	FD-I	-53*	-50	-58**
		C-F	48	06	25
		F-SA	46	30	48**
	High + Low	FD-I	-34	-53**	
		C-F	34	-04	
		F-SA	32	36	

* .05 level of significance
** .01 level of significance

focusing-scanning B and field dependence-independence for the total sample, within groups a significant correlation was found only for the LC and LI groups.

Object Sorting Test

The means for the "number of groups" score (equivalence range) for the four groups are presented in table 21. This table suggests that the HI Ss tended to have a broader equivalence range than LI Ss, however this effect was not significant and no relationship with creativity

TABLE 21

Means for the Number of Groups score (Equivalence Range) for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	11.40 (3.99)	11.67 (5.20)	11.53 (4.64)
	Low	12.13 (5.24)	13.93 (4.46)	13.03 (4.95)
	High + Low	11.77 (4.67)	12.80 (4.98)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	16.01	1	16.01	.67
Intelligence	33.74	1	33.74	1.41
Interaction	8.10	1	8.10	.34
Within Cells	1343.00	56	23.98	

* $F_{.90}(1,56) = 2.78$

was evidenced. Table 22 presents the intercorrelations between this control and those previously presented. Most of the correlations between equivalence range and the three previously presented controls were not significant. However,

TABLE 22

Intercorrelations between Equivalence Range (number of groups) and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), and Focusing-Scanning A and B (F-SA & F-SB)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE				
High	FD-I	09	18	13
	C-F	-10	36	11
	F-SA	-07	-01	-04
	F-SB	26	19	20
Low	FD-I	-24	42	12
	C-F	35	-61*	25
	F-SA	13	23	48**
	F-SB	48	09	17
High	FD-I	-13	36	
	C-F	10	-14	
	F-SA	02	02	
	F-SB	37	06	

* .05 level of significance
** .01 level of significance

for LC-LI Ss there was a negative correlation between narrow equivalence range (high number of groups) and flexible control which was significant beyond the .02 level. There was also a significant relationship for the LI Ss between scanning (focusing-scanning A) and narrow equivalence range.

The means for the "number of singles" score and the analysis of variance for the four groups are presented in table 23.

TABLE 23

Means for the Number of Singles Score on the Object Sorting Test for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	4.73 (2.60)	5.87 (5.18)	5.30 (4.14)
	Low	4.47 (4.98)	7.30 (6.19)	6.23 (5.83)
	High + Low	4.70 (3.97)	6.83 (5.79)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	68.22	1	68.22	2.65
Intelligence	13.07	1	13.07	.51
Interaction	15.01	1	15.01	.58
Within Cells	1439.00	56	25.70	

* $F_{.90}(1,56) = 2.78$

Table 23 demonstrates that the LC Ss tended to leave the largest number of objects ungrouped on the Object Sorting Test, with the LC-LI Ss, as a group, leaving the most objects ungrouped. This effect for creativity in regard to the

number of singles score was just short of significance at the .10 level. No other significant relationships were demonstrated by the analysis of variance.

The intercorrelations between the number of singles score and the previously presented cognitive controls of field dependence-independence, constricted-flexible, focusing-scanning A, focusing-scanning B and number of groups are presented in table 24. The only relationship between the number of singles score and the aforementioned controls was with constricted-flexible. The relationship indicated, beyond the .05 level of significance for the LC-HI Ss, was that a high number of singles on the Object Sorting Test was negatively correlated with constricted control. That is to say, a high number of singles was associated with a low constricted score (toward the flexible end of the continuum).

The means and the analysis of variance for the score on the Band Width Test for the four groups was presented in table 25. The results obtained demonstrated no significant effects for either creativity or intelligence. The intercorrelations between band width and the four previously discussed controls are presented in table 26. Although no effect was demonstrated for creativity and intelligence in regard to band width, several significant correlation with other controls were obtained. First of all, for the LC-HI Ss, a relationship with number of singles significant beyond the .01 level was obtained. That is to say, among these Ss

TABLE 24

Intercorrelations between Number of Singles and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), Focusing-Scanning A (F-SA), Focusing-Scanning B (F-SB), and Equivalence Range (E-R)

			CREATIVITY		
			High	Low	High + Low
INTELLIGENCE	High	FD-I	-29	-24	-27
		C-F	32	-57*	-17
		F-SA	-24	-19	-22
		F-SB	-20	49	19
		E-R	08	02	04
	Low	FD-I	-17	12	08
		C-F	-04	-10	-10
		F-SA	-14	-14	-23
		F-SB	00	18	-01
		E-R	24	04	18
	High + Low	FD-I	-19	05	
		C-F	10	-34	
		F-SA	-16	-21	
		F-SB	-07	24	
		E-R	19	06	

* .05 level of significance

there was a tendency for a high number of singles on the Object Sorting Test to be associated with broad band width on the Category Width Test. In addition, a negative correltation between flexible control and band width was obtained. The number of singles score across HI (both HC and LC) correlated with Band Width significantly; this relationship did not obtain for the LI Ss. An additional finding was that

TABLE 25

Means on Band Width for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	64.27 (10.51)	66.00 (11.52)	65.13 (11.06)
	Low	66.93 (8.21)	63.67 (13.54)	65.30 (11.32)
	High + Low	65.60 (9.52)	64.83 (12.63)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	8.82	1	8.82	.07
Intelligence	.42	1	.42	.00
Interaction	93.69	1	93.69	.71
Within Cells	7386.00	56	131.89	

* $F_{.90}(1,56) = 2.78$

for the Lc Ss as a group, there was a significant negative relationship between constricted-flexible and band width. The final finding for this test was a significant relationship between band width and field independence for HI Ss. The implications of these several correlations with band

TABLE 26

Intercorrelations between Band-Width and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), Focusing-Scanning A (F-SA), Focusing-Scanning B (F-SB), and Equivalence Range (E-R) and Number of Singles (N of S)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE				
High	FD-I	-41	-41	-42*
	C-F	14	-61*	-19
	F-SA	-24	-06	-17
	F-SB	-15	37	08
	E-R	11	-41	-19
	N of S	-21	73**	43*
Low	FD-I	-08	44	18
	C-F	04	-31	-16
	F-SA	-16	-47	-24
	F-SB	-18	-05	-03
	E-R	-53*	25	-09
	N of S	-47	12	-10
High + Low	FD-I	-25	08	
	C-F	09	-42*	
	F-SA	-23	-22	
	F-SB	-18	13	
	E-R	-19	-10	
	N of S	-33	36	

* .05 level of significance
** .01 level of significance

width is ambiguous since there is no distinction between the four groups on band width.

Tolerance for Ambiguity

The means and the analysis of variance for the

trials of first response on the tolerance for ambiguity test for the four groups are presented in table 27. The analysis of variance demonstrated no significant relationships between trial of first response and creativity or intelligence.

The means and analysis of variance for the number of response changes on the tolerance for ambiguity for the four groups are presented in table 28. Once again, for this score on the tolerance for ambiguity test, no significant effects were demonstrated for either creativity or intelligence.

The intercorrelations between tolerance for ambiguity (trial of first response) and field dependence-independence, constricted-flexible, focusing-scanning A, focusing-scanning B, equivalence-range (number of objects), number of singles, and band-width are presented in table 29. The only relationship evidenced between tolerance for ambiguity and the previous scores was with field independence for HI-LC Ss which was significant beyond the .01 level. The HI-LC Ss were the most field independent as a group and this was significantly (.01 level) correlated with their scores on the tolerance for ambiguity test.

Schematizing Test

The means for the "percentage ranking accuracy" score on the Schematizing test for the four groups are presented in table 30. For this score, a significant effect beyond the .10 level was obtained for intelligence: that is,

TABLE 27

Means for Trials of First Response on Tolerance for Ambiguity for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	1.97 (1.17)	1.80 (1.15)	1.89 (1.16)
	Low	1.70 (1.25)	2.87 (1.28)	1.94 (1.29)
	High + Low	1.84 (1.22)	1.99 (1.23)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	.37	1	.37	.24
Intelligence	.05	1	.05	.00
Interaction	1.63	1	1.63	1.04
Within Cells	88.02	56	1.57	

*$F_{.90}(1,56) = 2.78$

TABLE 28

The Means for Number of Response Changes on Tolerance for Ambiguity for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	9.40 (5.59)	9.13 (3.12)	9.27 (4.53)
	Low	9.93 (4.68)	8.60 (6.39)	9.27 (5.64)
	High + Low	9.67 (5.17)	8.87 (5.03)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	9.64	1	9.64	.35
Intelligence	4.24	1	4.24	.15
Interaction	.001	1	.00	.00
Within Cells	1544.00	56	27.57	

*$F_{.90}$ (1,56) = 2.78

TABLE 29

Intercorrelations between Tolerance for Ambiguity (trials of first response) and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), Focusing-Scanning A & B (F-SA & F-SB), Equivalence Range (E-R), Number of Singles (No of S) and Band Width (B-W)

			CREATIVITY		
			High	Low	High + Low
INTELLIGENCE	High	FD-I	07	70**	38
		C-F	16	33	11
		F-SA	08	-23	-04
		F-SB	37	-39	03
		E-R	19	43	32
		NofS	10	01	03
		B-W	-22	-41	-32
	Low	FD-I	13	-02	11
		C-F	-08	-40	-25
		F-SA	28	02	05
		F-SB	-08	07	-07
		E-R	03	32	19
		NofS	-01	-43	-18
		B-W	08	22	13
	High + Low	FD-I	12	29	
		C-F	06	-09	
		F-SA	19	-15	
		F-SB	15	-15	
		E-R	09	40	
		NofS	03	21	
		B-W	-10	-06	

** .01 level of significance

TABLE 30

The Means for Percentage Ranking Accuracy on the Schematizing Test for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	48.67 (28.17)	34.60 (23.04)	41.63 (26.68)
	Low	29.93 (21.95)	28.73 (21.46)	29.33 (21.71)
	High + Low	39.30 (26.93)	31.67 (22.46)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	880.50	1	880.50	1.46
Intelligence	2270.00	1	2270.00	3.76*
Interaction	619.00	1	619.00	1.01
Within Cells	33790.00	56	603.39	

*$F_{.90}$ (1,56) = 2.78

the HI Ss demonstrated greater ranking accuracy (sharpening) than did the LI Ss. There was no significant effect for creativity, although the HC-HI group demonstrated the

most sharpening. The intercorrelations between this score and the previous ones are presented in table 31; very few significant correlations were found. Among LC-HI Ss, there was a negative correlation significant beyond the .05 level between band width and sharpening. In addition, for HI Ss there was a significant relationship between this score and the tolerance for ambiguity score. Turning to the mean percentage increment error score on the Schematizing test, table 32 presents the means for this score for the four groups.

For percentage increment error, a significant effect for creativity was obtained beyond the .05 level, and also a significant effect for intelligence was obtained beyond the .10 level. On this score, it was demonstrated that HC Ss tended to be sharpeners; among this HC group the HI Ss tended to be more sharpeners than the LI Ss. Conversely, LC-LI Ss occupied the extreme end as levelers. The intercorrelations between percentage increment error and all previously discussed scores are presented in table 33. The major result evidenced between this score and previous ones was an inverse relationship between percentage ranking accuracy and percentage increment error; both scores derived from the Schematizing Test. This finding was expected from the definition of the two scores. In addition, however, a positive relationship between leveling and band width was once again demonstrated for HI-LC Ss.

TABLE 31

Intercorrelations between Leveling-Sharpening (percentage ranking accuracy) and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), Focusing-Scanning A and B (F-SA & F-SB), Equivalence Range (E-R), Number of Singles (NofS), Band Width (B-W), and Tolerance for Ambiguity (TFA)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE				
High	FD-I	18	27	27
	C-F	-03	34	10
	F-SA	-21	-03	-05
	F-SB	-31	-20	-17
	E-R	-12	24	06
	NofS	07	-23	-14
	B-W	00	-56*	-27
	TFA	34	45	39*
Low	FD-I	-10	-04	-08
	C-F	48	14	18
	F-SA	-27	-22	-23
	F-SB	40	-13	11
	E-R	07	-29	-10
	NofS	21	32	25
	B-W	-01	04	02
	TFA	-19	-41	-30
High + Low	FD-I	10	03	
	C-F	17	27	
	F-SA	-16	-07	
	F-SB	03	-12	
	E-R	-04	-03	
	NofS	13	04	
	B-W	-05	-23	
	TFA	13	-01	

* .05 level of significance

TABLE 32

Means for Percentage Increment Error on the Schematizing Test for the Four Groups (N=60)

		CREATIVITY		
		High	Low	High + Low
INTELLIGENCE	High	39.20 (17.25)	52.33 (19.11)	45.77 (19.36)
	Low	49.87 (17.37)	56.40 (11.62)	53.13 (15.14)
	High + Low	44.53 (18.12)	54.37 (15.95)	

ANALYSIS OF VARIANCE

Source	SS	df	MS	F
Creativity	1449.00	1	1449.00	4.95**
Intelligence	815.90	1	815.90	2.79*
Interaction	160.10	1	160.10	.55
Within Cells	16390.00	56	292.68	

* $F_{.90}(1,56) = 2.78$
** $F_{.95}(1,56) = 4.02$

TABLE 33

Intercorrelations between Percentage Increment Error and Field Dependence-Independence (FD-I), Constricted-Flexible (C-F), Focusing-Scanning A & B (F-SA & F-SB), Equivalence Range (E-R), Number of Singles (NofS), Band Width (B-W), Tolerance for Ambiguity (TFA), and Percentage Ranking Accuracy (PRA)

			CREATIVITY		
			High	Low	High + Low
INTELLIGENCE	High	FD-I	-16	07	-15
		C-F	14	-20	01
		F-SA	-34	-09	-29
		F-SB	03	-13	-14
		E-R	31	07	17
		NofS	-09	37	25
		B-W	49	38	43*
		TFA	-30	09	-11
		PRA	-36	-60*	-52**
	Low	FD-I	00	17	14
		C-F	27	05	31
		F-SA	20	17	-21
		F-SB	-27	-25	-31
		E-R	-06	-18	-06
		NofS	-07	-47	-17
		B-W	-04	-29	-18
		TFA	37	22	33
		PRA	-48	-21	-36
	High + Low	FD-I	-12	12	
		C-F	16	-13	
		F-SA	-14	-04	
		F-SB	-14	-20	
		E-R	12	01	
		NofS	-07	04	
		B-W	28	08	
		TFA	01	15	
		PRA	-47**	-46*	

* .05 level of significance
**.01 level of significance

In addition to the individual analysis performed for each control, a three-way analysis of variance with repeated measures was performed for creativity and intelligence and eight cognitive control scores. The scores employed were a) total time (field dependence-independence); b) CW-C (constricted-flexible); c & d) number of objects A and B (focusing-scanning); e) number of groups (equivalence range); f) band width; g) trial of first response (tolerance for ambiguity); and h) percentage ranking accuracy (leveling-sharpening). This analysis of variance is presented in table 34. Outside of the expected effect for cognitive controls, no significant effects for creativity or intelligence were indicated.

In regard to the additional scores obtained from the tests administered, they were not directly relevant to cognitive controls and thus are presented in Appendices G and H. Briefly, however, the results from these scores will be mentioned. From the Stroop test, three main time scores (W, C, CW) exhibited the same effect for intelligence as did the CW-C score; the CW score did reach significance at the .10 level. What was indicated was that the HI Ss consistently (but not always significantly) took longer time to perform this task than did LI Ss. For the complexive and thematic grouping scores on the Object Sorting test, significant effects were demonstrated beyond the .10 and .05 levels, respectively. For complexive grouping, the HC Ss

TABLE 34

Analysis of Variance for Creativity, Intelligence and Cognitive Controls

Source	SS	df	MS	F
Between Subj.	2156027.80	31	69549.28	
A (creativity)	18348.41	1	18348.41	.26
B (intelligence)	19363.69	1	19363.69	.28
AB	179602.91	1	179602.91	2.59
Subj. w. groups (error between)	1938712.80	28	69239.74	
Within Subj.	122112170.00	448	27257.18	
C (cognitive controls)	106617170.00	7	15231024.29	58.41***
AC	161920.00	7	23139.99	.09
BC	206710.00	7	29530.00	.11
ABC	1240500.00	7	177214.28	.67
C x subj. w. groups	108226300.00	420	257681.67	

*** $F_{.99}$ (7, 420) = 2.64

employed this category significantly more than did the LC Ss, while for the thematic grouping score the HI employed it more often than did the LI Ss. With regard to the rest of the scores computed, no significant relationships between either creativity or intelligence and any of the other cognitive control scores were demonstrated.

CHAPTER IV

DISCUSSION OF RESULTS

Reliability Measures

In regard to the reliability measures for the tasks designed by the author, the correlations were fairly high, especially for the scores of primary interest. This would suggest confidence in their indication of a consistent feature of cognitive behavior. For the focusing-scanning procedures, the fat that even higher correlations obtained in the main sample between focusing-scanning A and B reaffirms this conclusion. For tolerance for ambiguity however, examination of the range of scores indicates that most of the Ss responded on the first trial. This would suggest that the task was too easy. Consequently, the test-retest correlations for this task were spuriously high and the task itself was non-discriminating.

Creativity and Intelligence Dimensions

The findings for the creativity measures indicate that they were strongly intercorrelated. They are generally as high as those reported by Wallach and Kogan (1965); in both studies all correlations were above .50 with the majority being above .80. These findings lend support to

the view that there is a consistent dimension of cognitive behavior upon which individuals may be distinguished. They also cut across a possible verbal vs. visual distinction, since Pattern Meanings correlated highly with Alternate Uses and Similarities. As stated previously (P. 69), the correlations among the intelligence measures (although significant) were quite low. Consequently, any possible significant effects would be expected to be attentuated by the reduced validity of the IQ index score.

The intercorrelations between creativity and intelligence were generally non-significant and might appear to support Wallach and Kogan's (1965) conclusion that there is a distinction between the intelligent and creative modes of functioning, at least for the grade school population. However, the vocabulary test wich was the only test which correlated significantly with the creativity scores, was also the test which correlated most highly with the IQ index score. This finding was even more significant when considered in regard to the actual median split for creativity and intelligence, where the Ss tended to be grouped into HC-HI and LC-LI. Thus the expected relative orthogonality of intelligence and creativity was not borne out by the actual distribution of the Ss obtained on the median split. This could be due to the inadequacy of the intelligence measures. However, an equally plausible interpretation is that the two measures are not orthogonal. Thus the evidence

would not appear to support the position adopted by Wallach and Kogan (1965) - that there is a distinction between the intelligent and the creative modes of cognitive functioning.

Expected Results Reconsidered

In this study, it was expected that the following relationships would obtain:

a) high creative-high intelligent Ss would be the more field independent with the low creative-low intelligent Ss being the more field dependent;

b) for the cognitive control of constricted-flexible, it was proposed that no relationship to creativity and intelligence would be demonstrated;

c) the high creative-high intelligent Ss would occupy the focusing end and the low creative-low intelligent Ss the scanning end of the continuum;

d) the high creative Ss would be characterized by tolerance for ambiguity;

e) for the cognitive control of equivalence range, it was predicted that no relationship to creativity and intelligence would be obtained;

f) the high creative Ss would be characterized by sharpening.

With these postulated results in mind, each control will be considered in turn.

Field Dependence-Independence

The implication from the theoretical delineation of field dependence-independence (p. 20) was that field independence was basically the more adaptive end of the continuum. Consequently, it was postulated that field independence would be characteristic of creative Ss. However, the expectation for this control was essentially not confirmed. The most field independent Ss (achieving the lowest scores on the Embedded Figures Test) tended to be the LC-HI Ss rather than the HC Ss. The Ss most expected to be field independent, i.e., the HC-HI Ss, tended to fall in the middle range of the continuum. The LC-LI Ss were the only ones which tended to be field dependent in this study. There was a significant interaction for creativity and intelligence on field dependence-independence, but it was difficult to interpret. In this study, the test did not discriminate between high and low creative Ss.

Constricted-Flexible

It was predicted initially (p. 48) that this control would not distinguish between HC and LC Ss since both ends of the continuum can be adaptive for creative modes of functioning. The results obtained confirmed this hypothesis. In fact, the means for the CW-C scores on the Stroop Colour-Word Test for these two groups were essentially identical. There was, however, a slight tendency for the HI Ss to be more constricted (longer time scores) than

the LI Ss. In terms of Klein's conception of this control, HI Ss, more than LI Ss, would be characterized by greater efforts to keep judgments in line with external sources of information.

Focusing-Scanning

The basic theoretical position adopted in regard to this control was that efficiency in deployment of attention (focusing) would result in more information being received. In addition, it was postulated, on theoretical grounds, that creative Ss would be more open to the environment and more active in perusing the environment. Consequently, it was expected that creative Ss would demonstrate the focusing end of the continuum. This was confirmed at a high level of confidence. It was found that the high creative-high intelligent Ss were focusers and that the low creative-low intelligent Ss were scanners.

In addition to the major hypothesis above, it was contended (p. 57) that focusing-scanning B would discriminate less clearly between these two creativity groups than would focusing-scanning A. The reasoning was that for focusing-scanning B, with the narrow array of objects, systematic attention would be less crucial. It was found that on both focusing-scanning A and B (on the number of objects recounted score) the high creative Ss were significantly more efficient, i.e. able to recount more objects. However, on the differential scores which assigned more

weight to objects on the periphery, this effect was less significant for focusing-scanning B. On this test, the objects were tightly bunched and could almost be taken in at a glance. With the wide spread array on focusing-scanning A, however, an individual had to be more systematic to perceive all the objects in the time allowed. Consequently, the operation of the focusing end of this control was not as crucial on the focusing-scanning B as on focusing-scanning A. The finding of a less significant relationship for the former test supported this argument.

Equivalence Range

For this control, it was predicted that no distinction within creativity would be evidenced since either end of the continuum could be facilitative of creative functioning. This was confirmed; there was no significant effect for creativity. There was also no significant effect for intelligence in relation to this control. These findings were confirmed not only for the score of primary interest, i.e. number of objects score, but also for the number of singles score on the Object Sorting Test and the band width score on the Category-Width Test.

Tolerance for Ambiguity

It was expected that this control would be crucial in distinguishing between high and low creative Ss since tolerance for ambiguity involves a freedom to accept ideas

that deviate from the conventional (and of which the tendency to premature closure is a crucial aspect). Thus, it was predicated that the high creative Ss would tend to be more tolerant of ambiguity than the LC Ss. This expectation was not confirmed and little relationship to other controls was demonstrated. From these results, two conclusions could be drawn: a) either it is not relevant to the creative process, or b) the test does not assess what it was intended to measure. As mentioned previously (p. 105) the evidence suggests that the test was, indeed, non-discriminating.

Leveling-Sharpening

The theoretical delineation of this control stressed that the assimilation of successive stimuli (leveling) leads to stereotyping which is antithetical to creative functioning. Consequently, it was suggested that creative Ss would be characterized by sharpening - i.e., able to keep successive stimuli distinct. In regard to this expected results, the findings obtained were somewhat conflicting. On the percentage ranking accuracy score on the Schematizing test, there was no significant effect for creativity, although there was one for intelligence. Thus the HC-HI and the LC-HI groups were the sharpeners. However, a significant effect for creativity was obtained for the percentage increment error score. On the basis of this score, the HC Ss tended to be the sharpeners and the LC Ss the levelers.

Having summarized the findings regarding each control, the implications in terms of characteristics of cognitive behavior for the four groups can not be considered. The HC-HI and then the LC-LI groups will be considered first since this was the actual median plit obtained and the most basic distinction.

The HC-HI Ss were found to be most clearly focusers and sharpeners, but also occupied the middle range on field dependence-indpendence and tended to be slightly constricted. On this basis, they might be said to be a) efficient in acquiring information from the environment when that is demanded of them; b) able to keep successive stimul distinct; c) fairly able to separate an item from its context; and, d) somewhat concerned with keeping judgments in line with external sources of information. The characteristics just outlined appear to suggest a highly adaptive mode of encounter with the environment. These controls suggest the ability to readily "accommodate", in Piaget's definition of the term. However, it is suggested here that since these Ss were not extreme on the field dependence-independence and constricted-flexible controls, they are not bound to accommodation and thus can "assimilate" at will. In other words, it is felt that this finding generally supports the position adopted: that the creative process is characterized by the ability to move freely between assimilation and accommodation. In line with the concept of equilibrium mentioned previously (p. 2), the

creative process would thus be characterized by a flexible and stable equilibrium in which assimilation and accommodation predominate as the situation demands. The adaptive functioning of the non-creative individual could thus be characterized as a rigid equilibrium.

Turning to the LC-LI group, the control features demonstrated were field dependence, flexibility, scanning and leveling. These Ss could thus be described as a) unable to keep an item separate from its context; b) ignoring competing and conflicting elements; c) inefficient in surveying their stimulus field; and, d) assimilating successive elements to each other. In contrast to the HC-HI group, these Ss appear to be unable to accommodate adequately to the demands of external objects. They tend to assimilate predominantly and can not always accommodate when the situation demands.

Turning to the HC-LI Ss, as might be expected, the results are somewhat conflicting. In terms of their performance on the controls, they appear to be characterized by field independence, focusing, and leveling on one score but in the middle range on another. The first two controls would describe them as able to keep an item separate from its context, and efficient in acquiring information from the environment, thus in this respect being similar to the HC-HI group. However, the tendency to be levelers suggests that this group is more strongly influenced by a situation which encourages assimilation (Schema-

tizing test) - they appear as less able to keep successive stimuli distinct. This suggests reduced ability to move between assimilation and accommodation. However, since the leveling-sharpening control appears to be in part a function of intelligence, it is suggested that the findings offer preliminary support for the hypothesis that creativity is subsumed under a general intelligence factor.

The LC-HI Ss were found to be characterized by field independence and scanning. As a group they appear characterized by the ability to keep an item separate from its context, but they inadequately survey the information contained in their environment. These Ss would appear to be concerned with accurate perception but not able to handle diverse elements and thus assimilate stimuli rather than deal with conflicting information. It is suggested here that for these Ss, the equilibrium between assimilation and accommodation is too rigid and the flexible adaptation to one's environment as is required for creative functioning is thus rendered difficult.

In general the distinction between high creative and low creative Ss has been portrayed above as involving stability and instability of equilibrium. A stable equilibrium, thus, delineates the ability of the individual to move between assimilation and accommodation in his encounter with the world of objects. Perhaps further light can be shed on this process when it is viewed from the perspective

of Schachtel's conception of secondary autocentric and allocentric perception. The basic and most important distinction between these two modes of perception is the openness with which an individual perceives the objects of his experience, or the lack thereof. In secondary autocentric perception, the perspective from which an individual perceives objects is narrowed and closed such that his experience of objects is only from the perspective of his particular social group. This perception is truly convergent in Guilford's conception of the term.

Allocentric perception, on the other hand, involves an openness to the world such that it is possible for the individual to perceive many more objects and more variegated aspects of these objects. Only when one's perspectives are thus broadened to perceive many objects is creativity possible.

The importance of this exposition for the present study is that the cognitive controls that characterize the HC-HI Ss seem also descriptive of allocentric perception. As a group, these Ss appear more able to perceive objects veridically than, for example, the LC-LI Ss. The two most relevant control characteristics would appear to be focusing and sharpening. That is, these Ss are more able to perceive a variety of objects in the environment and also more able to keep a succession of object perceptions distinct.

On the other hand, the characteristics of the

LC-LI Ss (p. 114) suggest what is described as secondary autocentric perception. These Ss are unable to perceive an object as it is, but rather tend to confuse it with its context, ignore conflicting elements, or assimilate it to previous perceptions.

In regard to the HC-LI group, they did not appear able to preceive consistently in an allocentric fashion. What seems involved is that a basic level of intelligence is required. Below this minimum Ss are only able to perceive the conventional aspects of an object. Possibly, when the stimulus situation is simple, these Ss would be expected to perceive in an allocentric fashion. However, as the stimuli become more complex, they must increasingly fall back on conventional structures.

The dominance of scanning in the LC-HI group suggests that these Ss survey inadequately the information from the environment. They are also intelligent enough to perceive quickly the most accepted point of view. They are however, not able to look any further. In contra-distinction to the HC-LI Ss, it is not that allocentric perception is beyond their basic intellectual capacity. These Ss remain at the secondary autocentric level of perception for reasons other than intellectual capacity, such as for example, needs or problems of adjustment etc. It is for these reasons then that they are described as being unable to go beyond the conventional, accepted point of view.

The limitations of this study and proposals for continued research. This investigation was primarily an exploratory one, intended to examine the relevance of cognitive controls (consistent patterns of cognitive behavior) to creative thinking. As such, it has two primary deficits: a) insufficient range and b) insufficient number of Ss. The former refers to the point that the sample was too homogeneous. These two deficits undoubtedly played a large role in the low correlations obtained. However, an increase of Ss alone would not necessarily result in a more heterogeneous sample. What is undoubtedly needed before any clear conclusions can be drawn in regard to the interrelationships of creativity, intelligence and cognitive controls, is a major study cutting across such selection factors as age, sex and socio-economic status.

A limitation, in this latter regard, is the nature of the criterion tests adopted for intelligence and creativity. Both groups of tests depend heavily on verbal fluency. Thus the tasks themselves were biased in favour of middle class children. Children from a lower socioeconomic level could be severely handicapped simply because of insufficient verbal skills. Thus the range of applicability of this study is limited, reinforcing the need for a study cutting across socioeconomic status.

An additional major deficit in this investigation was the intelligence measures chosen. The correlations obtained (p. 69) do not warrant confidence in accepting the

IQ index score obtained as a valid measure of intelligence. This would appear to be a major source of error and a likely consequence would be an obscuring of the true picture. Consequently, any further investigation should involve a larger and more diverse number of measures of intelligence.

In regard to the measures adopted for the cognitive control measures, several lines of investigation suggest themselves. Although the Embedded Figures Test (field dependence-independence), the Object Sorting Test (equivalence range) and the Schematizing test (leveling-sharpening) appear fairly clearly delineated, the picture in regard to the other three tests appears less clear, and considerable uncertainty remains as to their usefullness. Although the main time scores for the Stroop Colour-Word Test (W, C, CW) appear fairly stable (see p. 56), the derived score (CW-C) for constricted-flexible, in an extensive investigation (Jensen, 1965), did not produce high reliabilities and its continued employment is of dubious value.

For the tolerance for ambiguity task, the major correction that it was felt this investigation suggested was that the successive increase in stimulus value of the cards must be more rigidly controlled, thus yielding sets of cards of equal difficulty. The technique employed by Multari (1961), i.e. photographing a picture with the objective moved successively out of fucus suggests itself as a possible appraoch. In any case, the theoretical delineation in chapter one (see pp. 35-38) suggests that this

variable is crucial and consequently any future study must first of all establish some valid measure for this control.

The most promising indication for future research comes from the focusing-scanning task. This test yielded the most significant results and appears to touch upon a crucial aspect of an individual's encounter with his environment.

The form of this test which would most directly measure this control would involve some kind of apparatus through which the S's eye movements could be tracked. In addition, this study suggests that the extent of the array of objects (size and number involved) is also a crucial element. Thus, one possible line of investigation would be alternate forms of the test in which the number of objects would be varied.

The test could also take the form of actual objects, slides projected on a screen, or a three-dimensional array. All these areas should be investigated to establish the generality of this control, and also the most fruitful measure of it.

From the author's point of view, the course that would seem best to follow at first would be an apparatus which would permit the experimenter to photograph or track the S's eye movements while the S was looking at various slides which could be varied as to number and spread of the objects. Possible relations to leveling-sharpening also

seem indicated. An additional line of research could be an investigation which objects the S looks at and later recounts to the experimenter - possible relations to personality could be investigated.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study was concerned with a) the individual's encounter with his environment and b) the dimensions organizing this encounter. The theoretical perspective adopted was Piaget's conception of intelligence as involving adaptation and organization. The modes of the individual's adaptation considered were intelligence and creativity, while the dimensions organizing this encounter were the cognitive controls of field dependence-independence, constricted-flexible, focusing-scanning, tolerance for ambiguity, equivalence range, and leveling-sharpening. It was hypothesized that a) high creative Ss would be characterized, in the extreme, by the following cognitive controls: field independence, tolerance for ambiguity, and scanning; and b) no distinction would be demonstrated between high and low creative Ss on the following cognitive controls: constricted-flexible, equivalence range, and leveling-sharpening.

The sample consisted of 60 boys from the fifth grade of elementary school. They were administered three measures of intelligence and three of creativity, and eight tests for cognitive controls: Embedded Figures Test, Stroop

Colour-Word Test, Object Sorting Test, Category-Width Test, Schematizing Test and two tests designed by the author for focusing-scanning and tolerance for ambiguity. The Ss were split into high and low on creativity and within each group they were further subdivided into high and low on intelligence, thus yielding a 2 x 2 contingency table with 15 Ss per cell. Within each cell, the means, standard deviations were computed and an analysis of variance for each control was calculated.

The statistical analysis revealed that the hypotheses were confirmed in regard to the controls of focusing, constricted-flexible and equivalence range. That is, the high creative Ss tended to be focusers and the low creative Ss scanners and that the controls of constricted-flexible and equivalence range did not discriminate between these two groups of Ss. However, contrary to expectation, field independence and tolerance for ambiguity did not distinguish between high and low creative Ss. In regard to tolerance for ambiguity, however, the results were spurious since the test did not adequately assess this control. For leveling-sharpening, the results were conflicting, but there were indications that the high creative Ss tended to be sharpeners and the low creative Ss levelers.

In conclusion, it is felt that this study has indicated some important features of the creative process in the obtained tendency for creative Ss to be focusers

(efficient in surveying the information contained in a stimulus field) and sharpeners (able to keep stimuli distinct). It is also felt that continued research on this area is warranted, particularly with a wide range of Ss taking into account such selection factors as age, sex, education and socio-economic level.

APPENDIX A

Creativity Tasks

Alternate Uses

1. Tell me all the different ways you could use a newspaper.
2. Tell me all the different ways you could use a knife.
3. Tell me all the different ways you could use an automobile tire - either the tube of the outer part.
4. Tell me all the different ways you could use a cork.
5. Tell me all the different ways you could use a shoe.
6. Tell me all the different ways you could use a button - the kind that is used on clothing.
7. Tell me all the different ways you could use a key - the kind that is used in doors.
8. Tell me all the different ways you could use a chair.

Similarities

1. Tell me all the ways in which a potato and a carrot are alike.
2. Tell me all the ways in which a cat and a mouse are alike.
3. Tell me all the ways in which a train and a tractor are alike.
4. Tell me all the ways in which milk and meat are alike.
5. Tell me all the ways in which a grocery store and a restaurant are alike.
6. Tell me all the ways in which a violin and a piano are alike.
7. Tell me all the ways in which a radio and a telephone are alike.

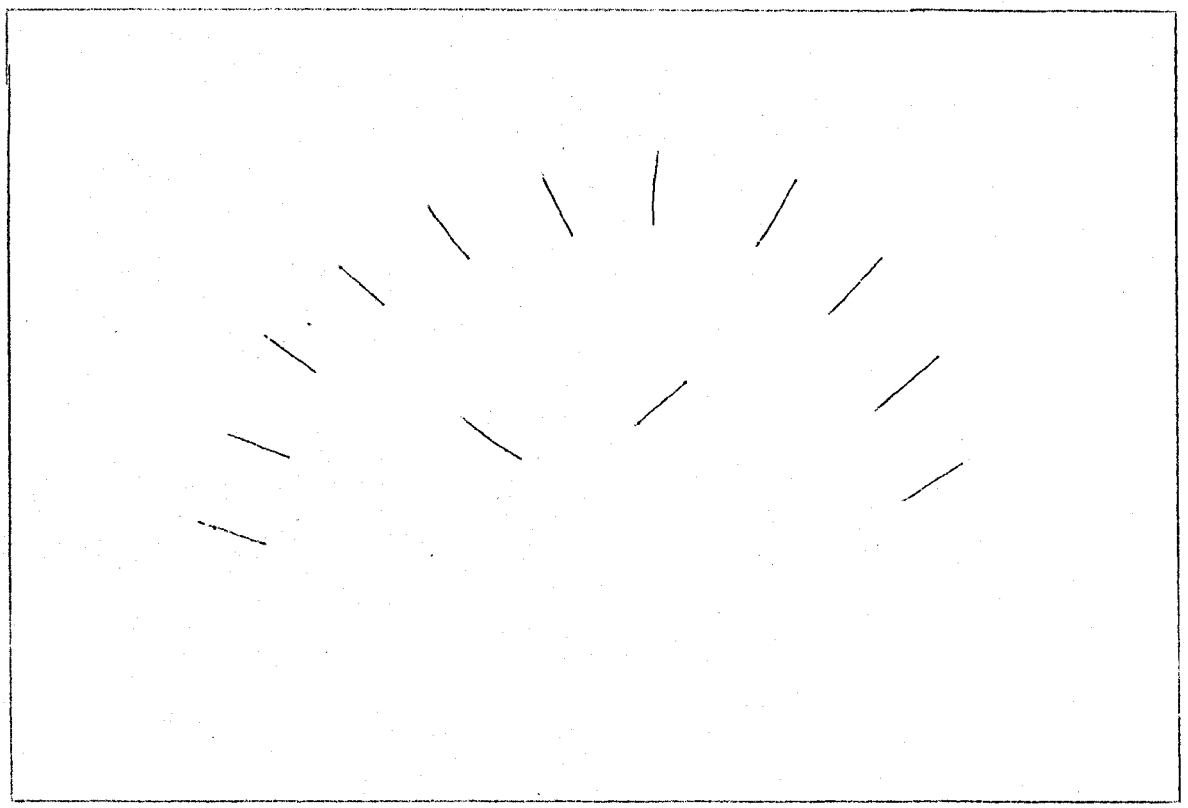
8. Tell me all the ways in which a watch and a typewriter are alike.

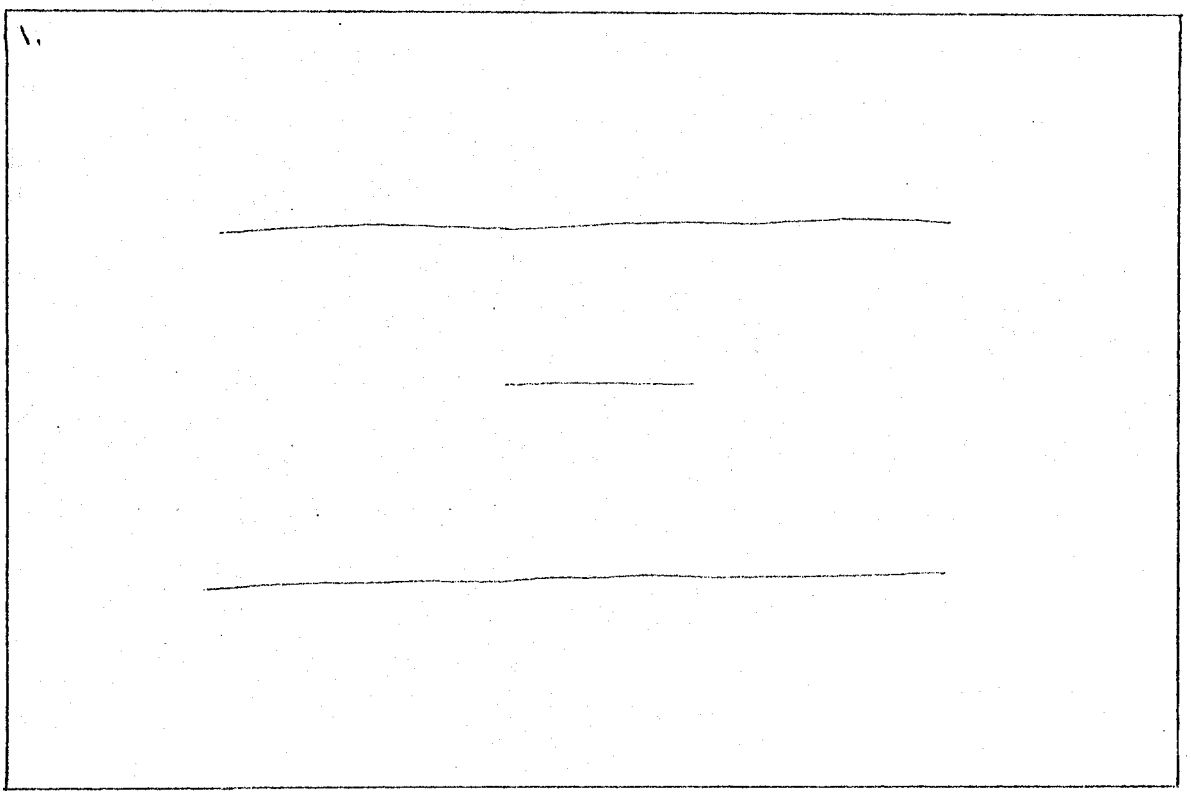
9. Tell me all the ways in which a curtain and a rug are alike.

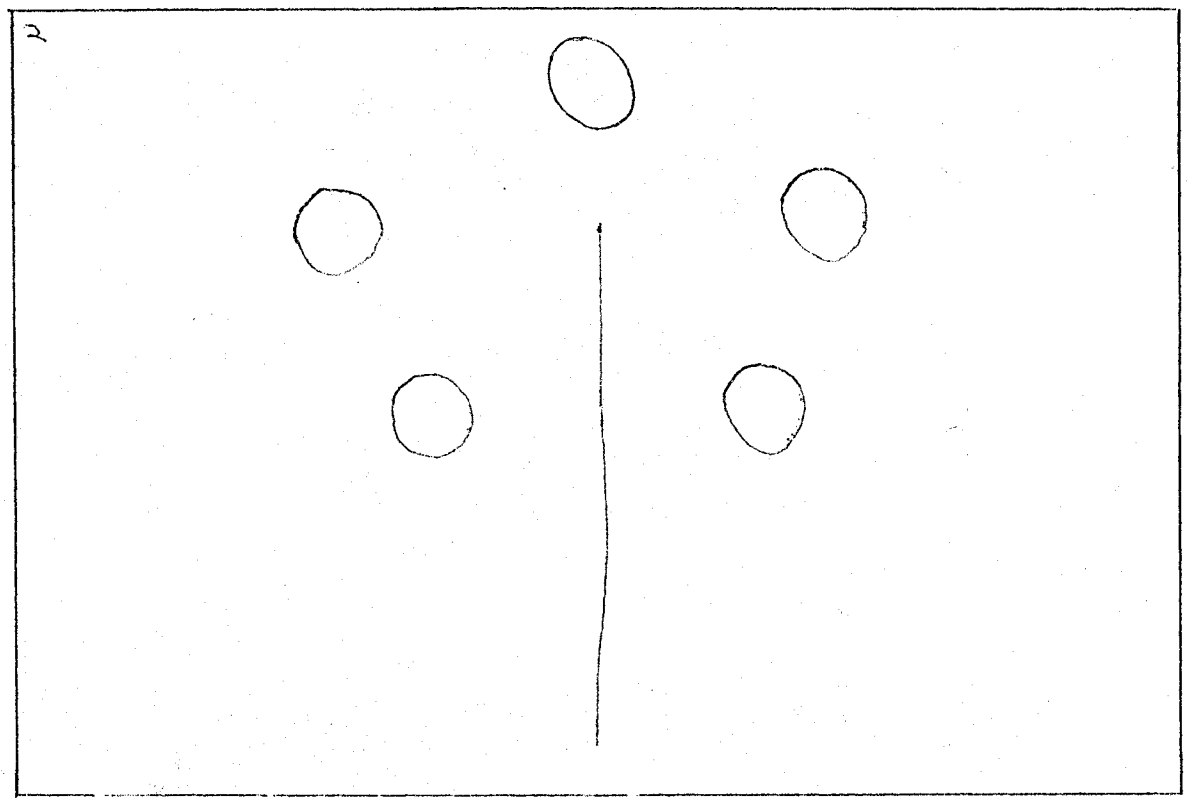
10. Tell me all the ways in which a desk and a table are alike.

Pattern Meanings

Example Card







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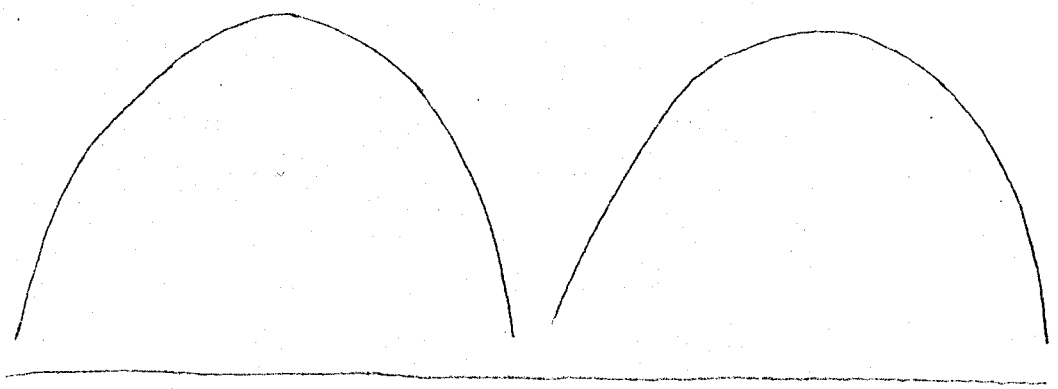

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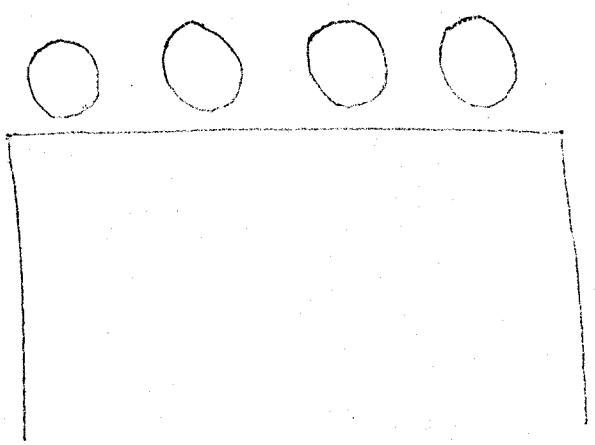
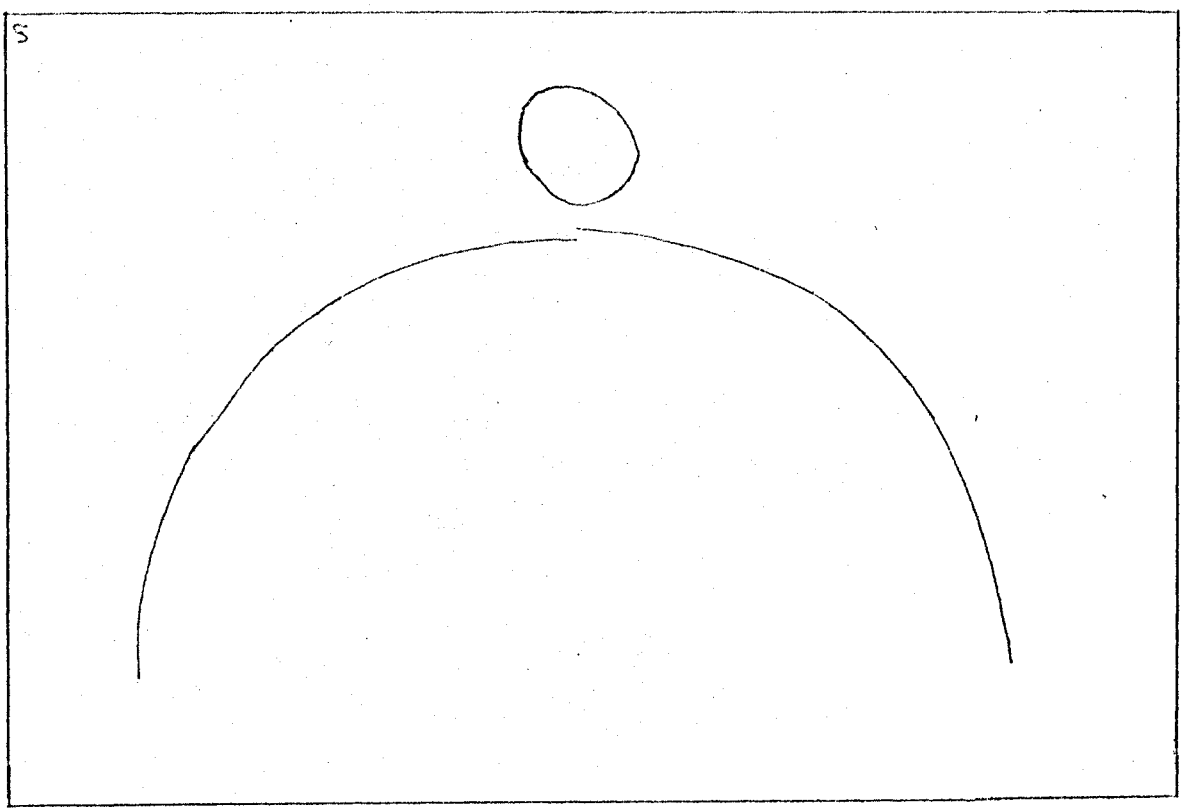
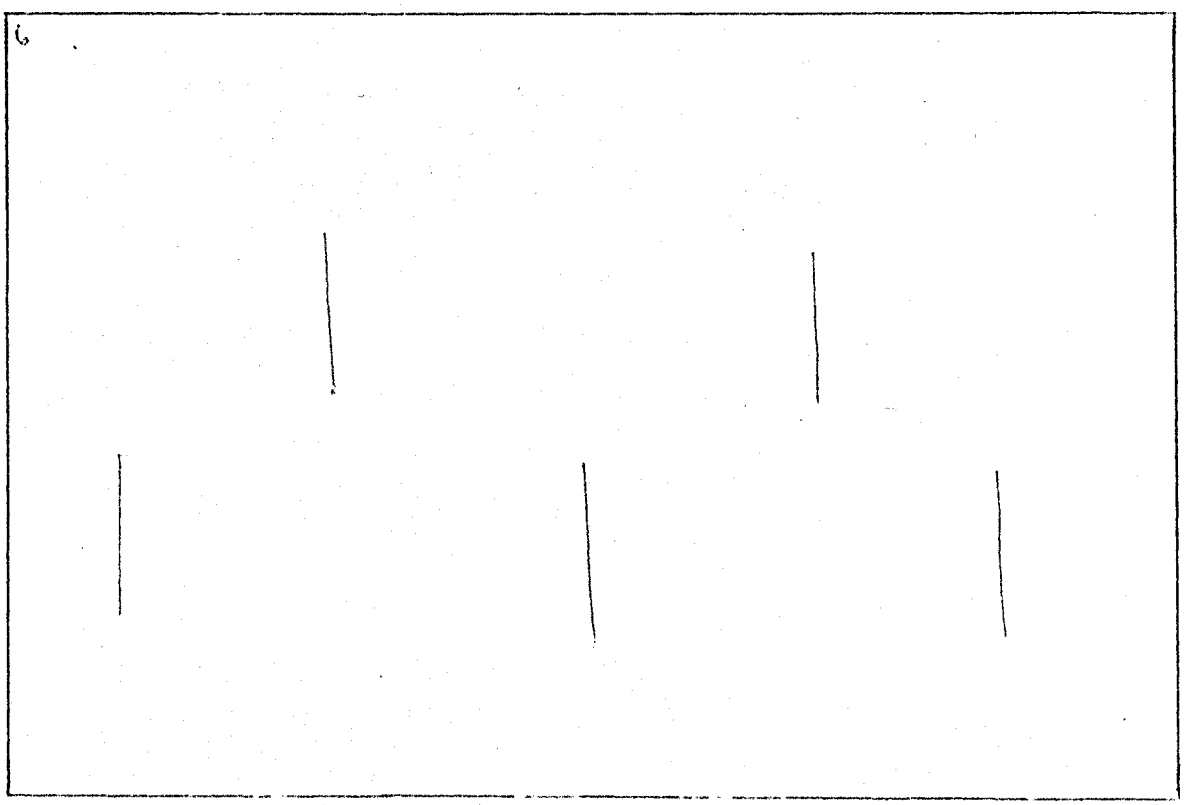
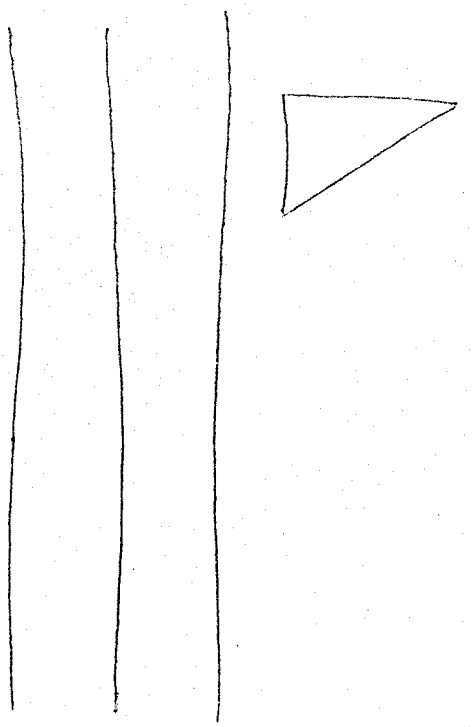






7.



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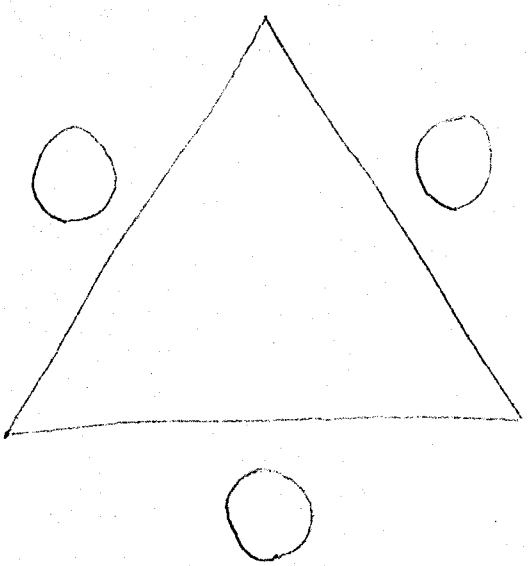


APPENDIX B

Instructions for Creativity Tasks

You are asked to evaluate the responses on the basis of the following three categories:

a) uniqueness
b) appropriateness
c) transformation

For the first two categories the judgment will be all or nothing, that is the response is given either a score of 1 or 0.

Uniqueness

Uniqueness is defined only in reference to the total reponses of this sample.

A score of 0 is given for any response which has been given to the same item by more than one S. You will also have to decide on the equivalence of similar responses. Equivalent responses are not judged unique and within one S's responses to one item, equivalent responses are assessed as one response. For example, on the "Alternate Uses" - in response to "Tell me all the different ways in which you can use a newspaper", any response that implies "read" is equivalent to "read" and is thus only scored once.

A score of 1 is given to any response which is given by only one S; that is, it occurs only once in response to any question and is not equivalent to any other response.

Appropriateness

A score of 0 is assigned to any response which is judged inappropriate or arbitrary in terms of the question asked. Unusualness of usuage is not a question but only whether the object can be used as described - in which case it is given a score of 1. To be appropriate, a response on the Pattern Meanings must include all the lines on the card.

Transformation

The final category is concerned with products

that are considered to be both unusual and appropriate but which vary in terms of their level of creative excellence. To take this aspect into consideration you will have to judge the Ss' responses in terms of their transcendence of conventional restraints. Only those responses which were judged unique and appropriate are considered for this category.

Responses in this category must involve a transformation of material or ideas to overcome conventional constraints.

The transformation power of a response is judged relative to the strength and nature of the constraints that are transcended. Transformation involves more than just unusualness, it involves a radical shift in approach to a subject or in handling the material. Thus, for example, on the Pattern Meanings transformations are not merely improvements on the existing drawings - rather, they involve the creation of new forms which include the exisitng drawings as a relevant detail. On this basis, a response is given a score of 1, 2, or 3.

APPENDIX C

Instructions for Object Sorting Test

The scoring for this test is divided into two main categories.

The first category considers the bases on which the pictures are judged to be the "same". Five modes can be distinguished: perceptible, functinnal, affective, nominal and fiat equivalence.

1) Perceptible: The child may render the items equivalent on the basis of immediate phenomenal qualities such as colour, size, shape or on the basis of position in time or space.

Perceptible Intrinsic	They are _____. (Adjective: "... both yellow.")
	They have_____. (Noun: "... writing on them.")
Perceptible Extrinsic	They are (preposition)_____. (position in time or space: "... all in a house).

2) Functional: The child may base equivalence on the use or function of the items, considering either what they do or what can be done to them.

Functional Intrinsic	They _____. (Verb" "... make noise.")
Functional Extrinsic	You _____ them. (Verb: "... can turn them on.")

3) Affective: The child may render the items equivalent on the basis of the emotion they arouse or of his evaluation of them.

Affective	You _____ them. (Value or internal state: "like them both.")
	They are _____. (Adjective indicating value: "... very important.")

4) Nominal: The child may group the items by giving a name that exists ready-made in the language.

Nominal	They are (or are not) _____. (Noun: "... both fruit.")

5) Fiat Equivalence: The child may merely state that the items are alike or are the same without giving any further information as to the basis of his grouping, even when he is prodded.

Fiat Equivalence	"A" is (or is not) "B" (Like, similar to, the same as, and so forth: "They are the same thing, really.")

The second category is according to the structure or syntax of the groupings formed. Three general grouping structures are distinguished: superordinate, complexive and thematic.

1) Superordinate groupings are constructed on the basis of a common feature characterizing the items included in a g group or class. Any array of items has a number of common characteristics, any one or combination of which can serve as the criterion for their inclusion in a group. Thus, for example, banana, peach and potato can be placed in a superordinate grouping because, "They all have skins", or "they are all food", or because, "they all can be bought at a store", and so forth.

General Superordinate	This construction consists of stating a common characteristic of the items in the group. For example, bell and horn are "both things that make noise".
Itemized Superordinate	Itemization may be added to superordinate groupings such that, while the items have a generalized property that joins them, the basis on which each item qualifies is explicitly stated. For example, "Bell makes noise, horn makes noise too, bell says ding-dong, horn says doo-doo.

2) Complexive structures are formed by using attributes of an array so as to form local rather than universal rules for grouping. This general pattern is ullustrated by five maneuvers for forming complexes:

Collections	The complex consists of finding complementary or somehow contrasting or otherwise related properties that all things have, but not in tying them

together in terms of attributes that are shared. For example, "Bell is black, horn is brown, telephone is blue, radio is red." Or, "newspaper you can read, book you can read, telephone you get messages over, radio you get messages over, and horn you can blow".

Edge Matchings — This complex consists in forming associative links between neighboring items. A chain of items is formed by tying the items together in linked pairs. For example, "Banana and peach are both yellow, peach and potato are both round, potato and meat are served together, milk and meat both come from cows." There is no consistency in the attribute or characteristic by which one link of the chain is joined with the one that precedes and the one that follows.

Key Rings — The key-ring complex consists in taking an item and linking all the others to it by choosing attributes that form relations between the central item and each of the others. For example, "Painting - well, one thing is a newspaper has got some painting on it, a book has got some black printing on it, a radio and a telephone have painting on them and a horn - well, there's a little painting on it, and a bell is also the colour of paints." Or, "germs are in bananas, peach, potato, meat, milk, water and air".

Associations — In the associations complex the child links two items and then uses the bond between these items as a nucleus for adding other items. For example, "Bell and horn are music things, when you dial a telephone it's music a little". Or, "Bell, horn, telephone and radio make noises, if you fold back a newspaper, then it will crackle and make a noise."

Multiple Groupings — This complex consists of the formation of several subgroupings. For example, "a telephone is like a radio - I know that. A horn and a bell make sounds, but I don't know about a newspaper". The list is thus segmented into several groups, and the gaps between them are not bridged.

3) Thematic groupings are formed on the basis of how the itmes fit in a sentence or story of a thema. The construction of the thematic groupings, in fact, most often depends on a sentence for tying items together. The sentence carries the story or thematic line: "The little boy was eating a banana on the way to the store to buy some peaches and potatoes".

APPENDIX D

Category-Width Test

1) Most birds fly at the speed of about 17 miles per hour.
   a) How fast does the fastest bird fly?
      1. 30 miles per hour
      2. 21 miles per hour
      3. 60 miles per hour
      4. 18 miles per hour
   b) How slow does the slowest bird fly?
      1. 15 miles per hour
      2. 5 miles per hour
      3. 10 miles per hour
      4. 2 miles per hour

2) Most whales are about 65 feet long.
   a) How long is the longest whale?
      1. 69 feet
      2. 150 feet
      3. 76 feet
      4. 90 feet
   b) How short is the shortest whale?
      1. 37 feet
      2. 8 feet
      3. 51 feet
      4. 58 feet

3) Usually about 58 ships arrive in New York harbour every day.
   a) What do you guess is the largest number of ships ever to arrive in New York city harbour in one day?
      1. 102 ships
      2. 65 ships
      3. 74 ships
      4. 60 ships
   b) What do you guess is the smallest number of ships ever to arrive in New York city harbour in one day?
      1. 5 ships
      2. 49 ships
      3. 38 ships
      4. 18 ships

4) Most dogs are about 3 1/2 feet long.
   a) How long is the longest dog?
      1. 4 1/2 feet
      2. 4 feet
      3. 5 1/2 feet
      4. 6 1/2 feet

b) How short is the shortest dog?
1. 1 foot
2. 1/2 foot
3. 2 1/2 feet
4. 2 feet

5) Most cars are able to go about 90 miles per hour.
a) How fast will the fastest car go?
1. 213 miles per hour
2. 95 miles per hour
3. 394 miles per hour
4. 132 miles per hour
b) How slow will the slowest car go?
1. 3 miles per hour
2. 18 miles per hour
3. 9 miles per hour
4. 1/2 mile per hour

6) Most roads are about 18 feet wide.
a) How wide is the widest road?
1. 51 feet
2. 27 feet
3. 20 feet
4. 36 feet
b) How narrow is the narrowest road?
1. 16 feet
2. 7 feet
3. 2 feet
4. 11 feet

7) Most states have about 4 million people in them.
a) How many million people are there in the largest state?
1. 5 million
2. 15 million
3. 8 million
4. 30 million
b) How many million people are there in the smallest state?
1. 1 million
2. 2 million
3. 1/8 million
4. 3 million

8) Most buildings are about 50 feet high.
a) How high is the tallest building?
1. 421 feet
2. 1253 feet
3. 157 feet
4. 63 feet

b) How short is the shortest building?
1. 40 feet
2. 6 feet
3. 29 feet
4. 17 feet

9) Most windows are about 34 inches wide.
a) How wide is the widest window?
1. 110 inches
2. 36 inches
3. 43 inches
4. 57 inches
b) How narrow is the narrowest window?
1. 3 inches
2. 21 inches
3. 12 inches
4. 28 inches

10) Most sailboats go about 9 miles per hour.
a) How fast will the fastest sailboat go?
1. 22 miles per hour
2. 39 miles per hour
3. 11 miles per hour
4. 14 miles per hour
b) How slow will the slowest sailboat go?
1. 7 miles per hour
2. 8 1/2 miles per hour
3. 6 miles per hour
4. 4 1/2 miles per hour

11) Every year about 300 new schoolbooks are written.
a) What is the largest number of schoolbooks written in one year?
1. 524 books
2. 330 books
3. 392 books
4. 980 books
b) What is the smallest number of schoolbooks written in one year?
1. 94 books
2. 25 books
3. 9 books
4. 180 books

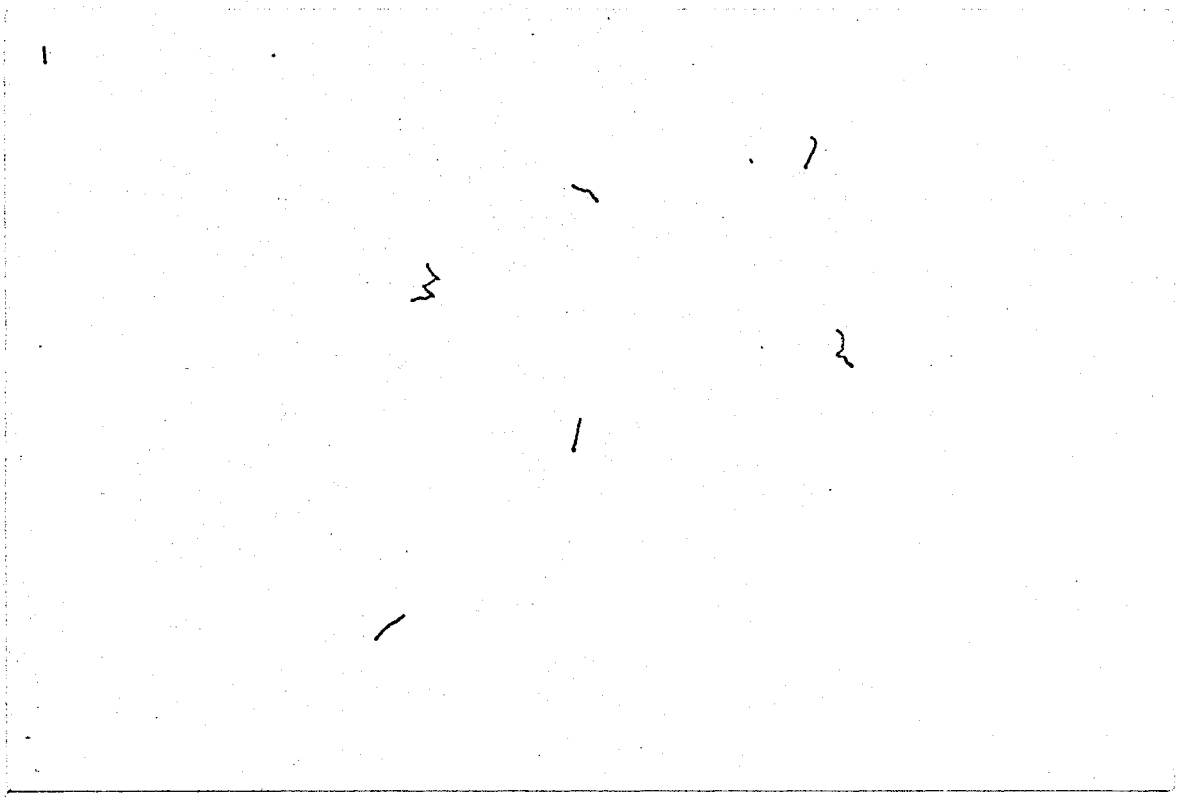
12) Most people spend about 55 minutes out of a whole day eating meals.
a) What is the longest time anyone spends eating meals in a whole day?
1. 60 minutes
2. 105 minutes
3. 240 minutes
4. 73 minutes

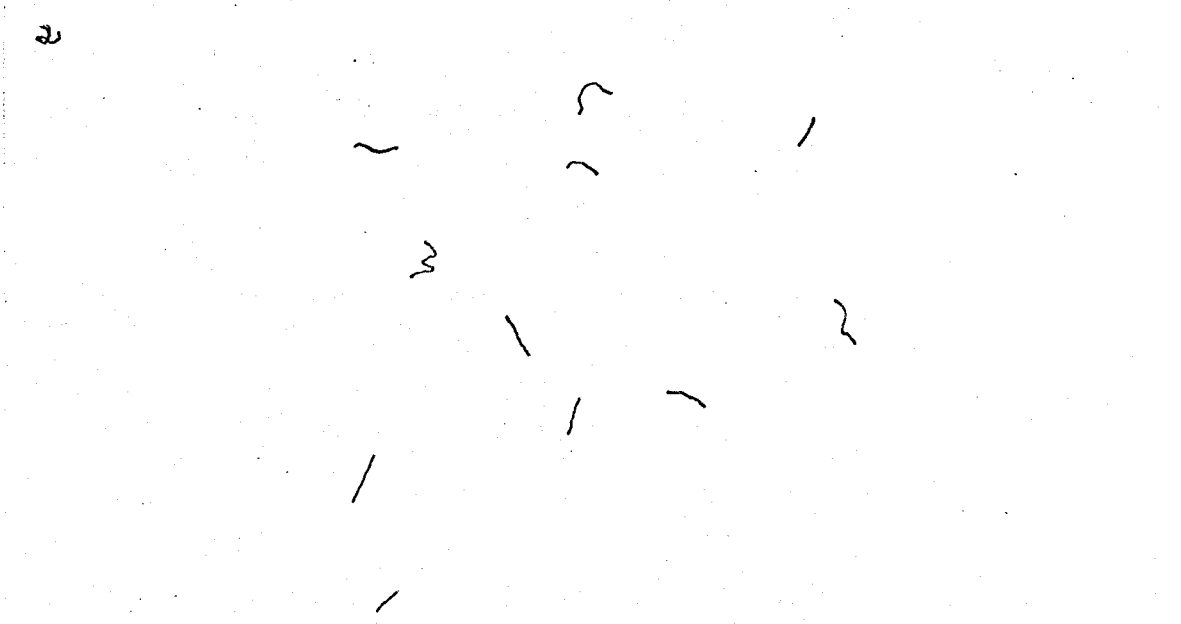
b) What is the shortest time anyone spends eating meals in a whole day?

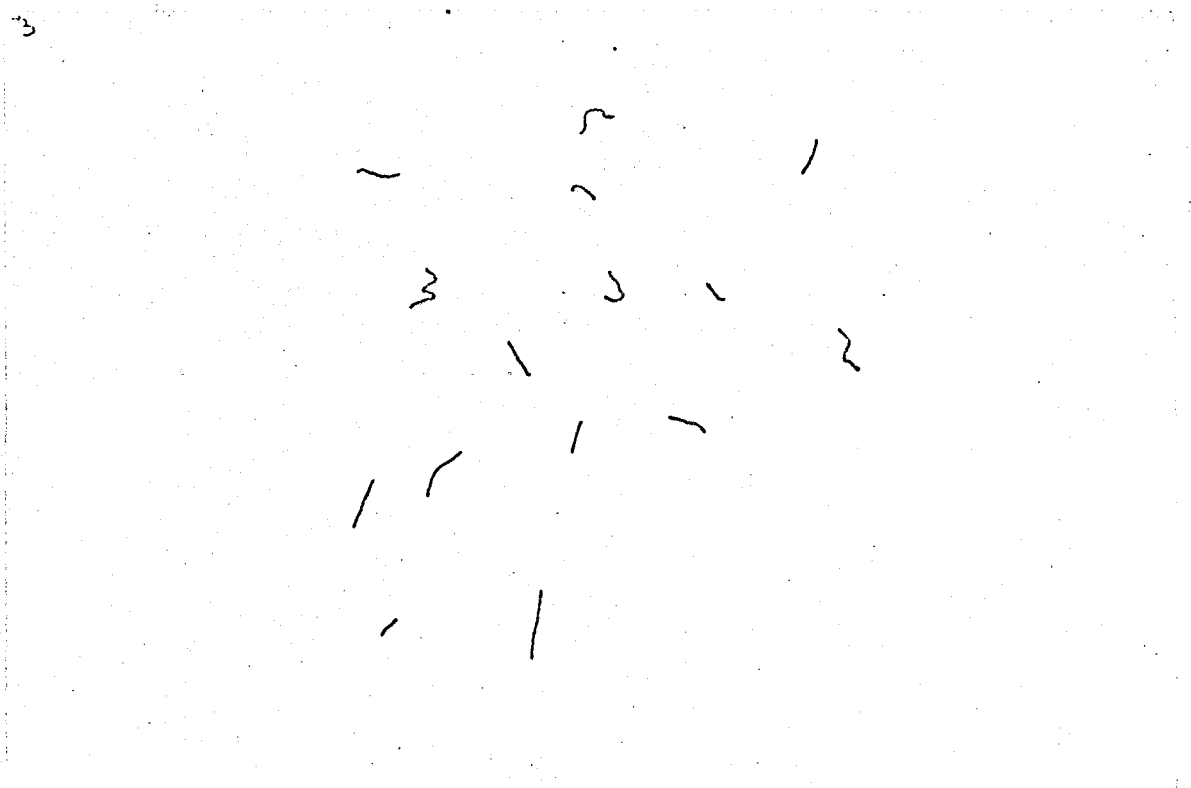
1. 3 minutes
2. 29 minutes
3. 47 minutes
4. 11 minutes

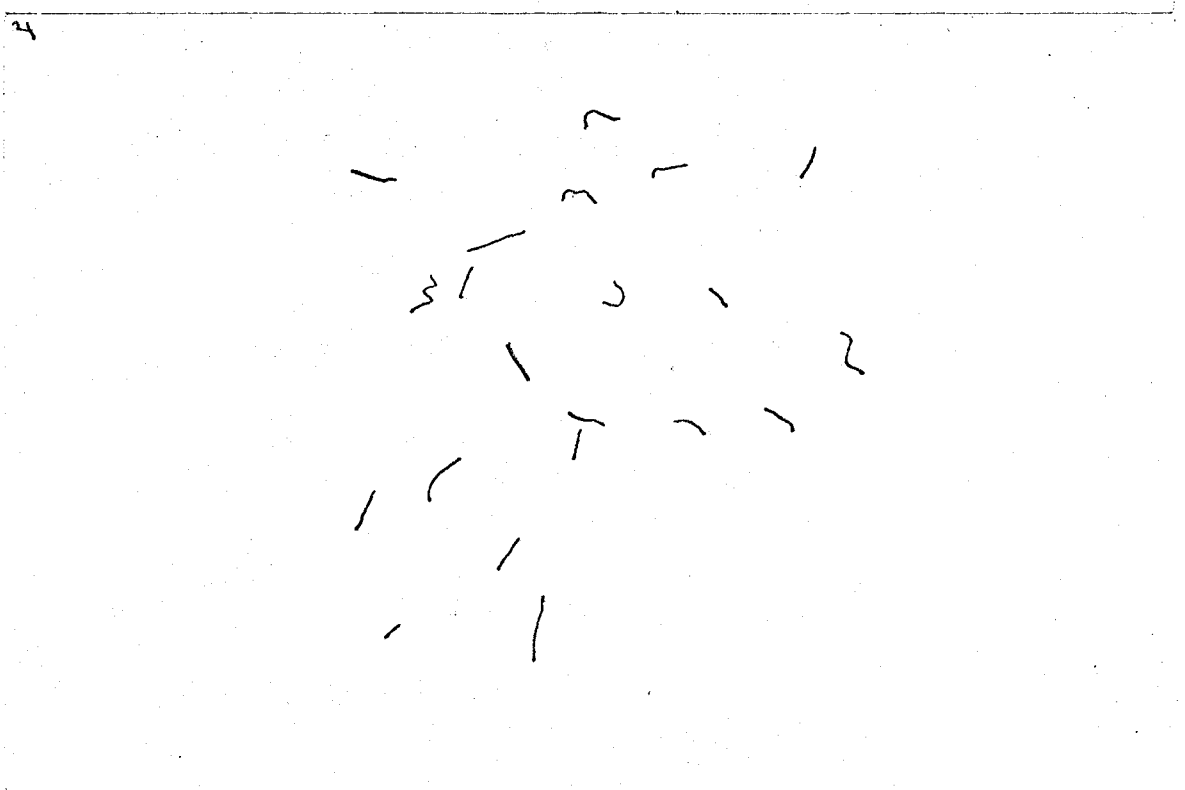
APPENDIX E

Tolerance for Ambiguity Test - Series F: Giraffe









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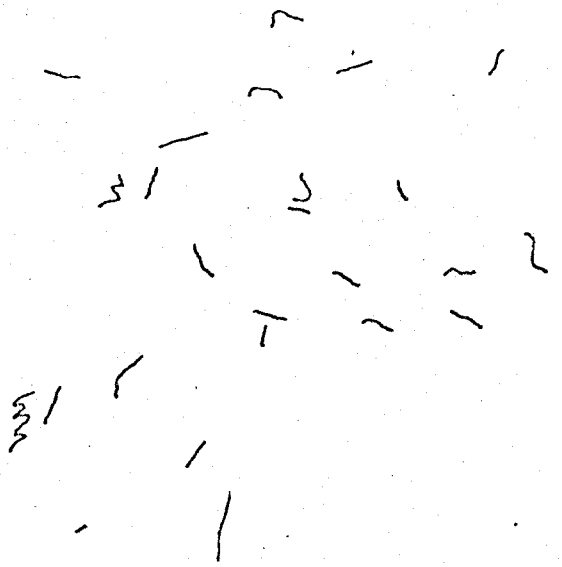
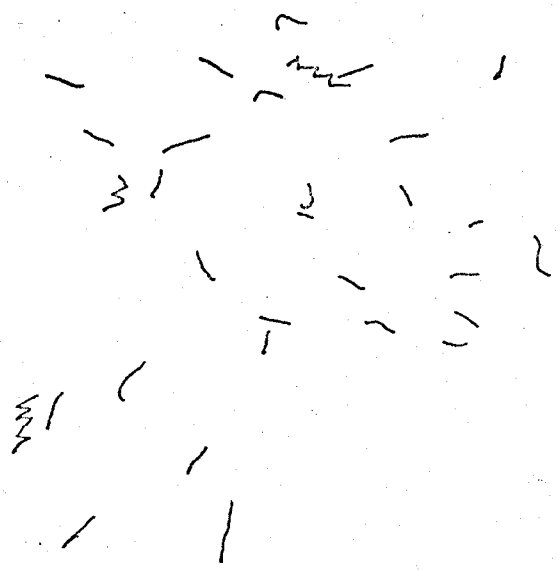
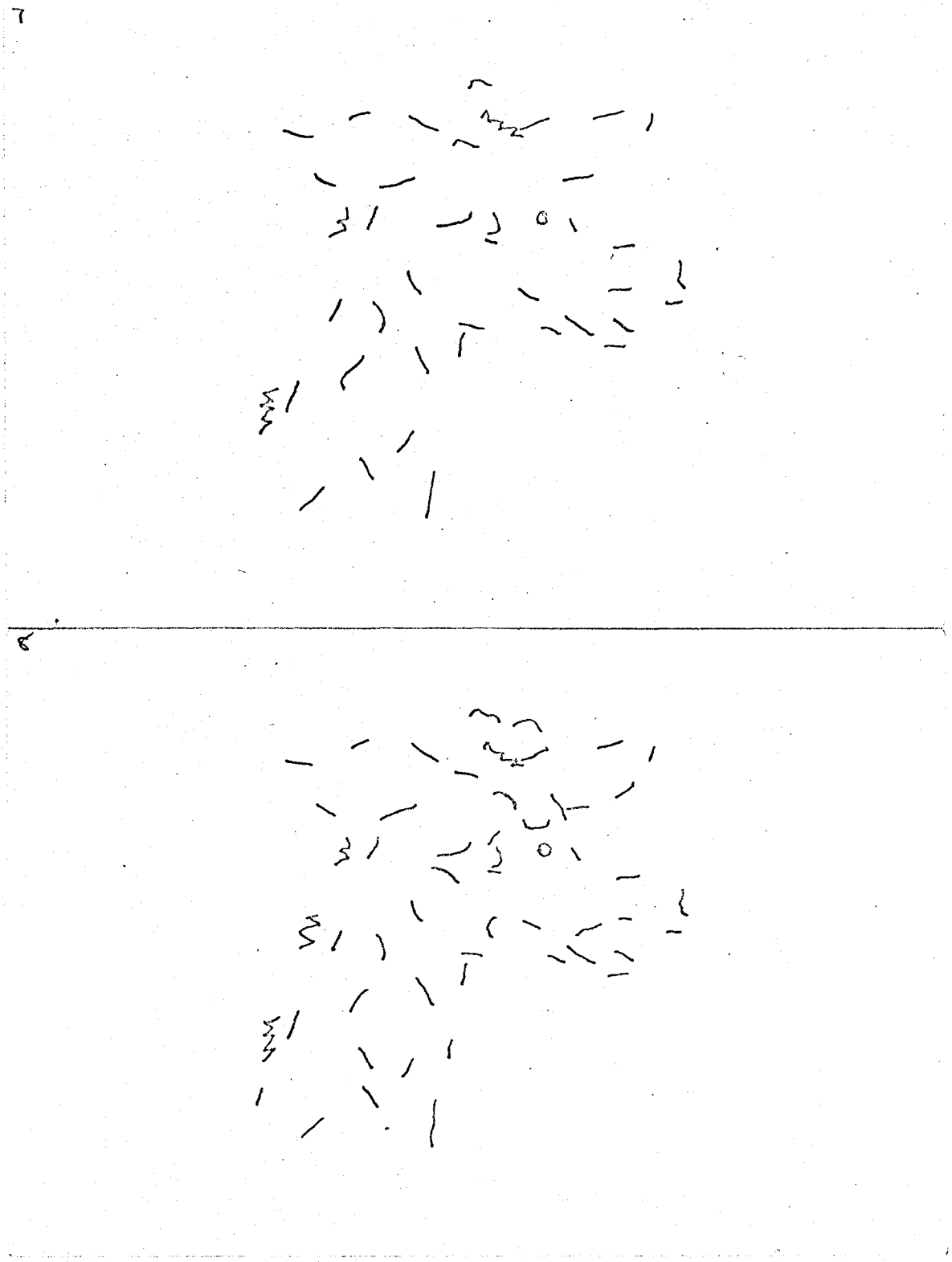


6





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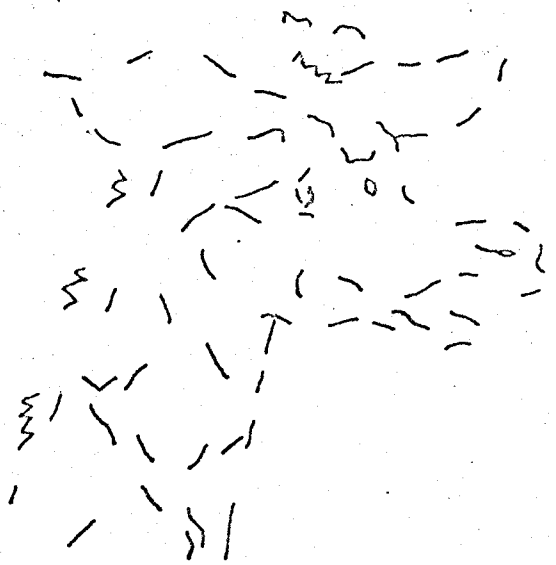
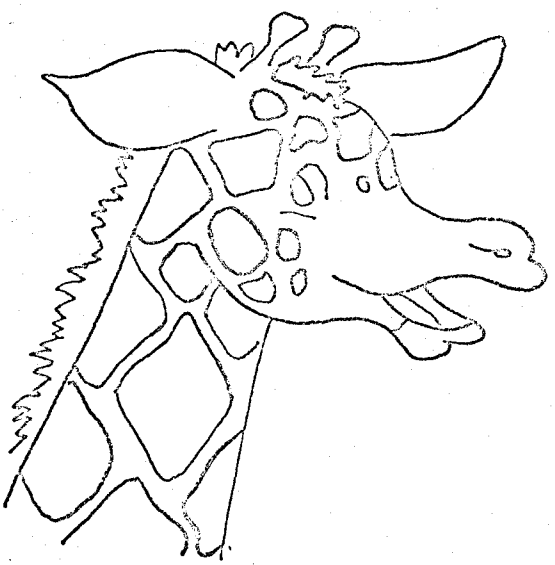


10



APPENDIX F

Instructions for Creativity & Cognition Tasks

Alternate Uses

Now, in this game, I am going to name an object - any kind of object, like a light bulb or the floor, - and it will be your job to tell me lots of different ways that the object could be used. Any object can be used in a lot of different ways. For example, think about string. What are some of the ways you can think of that you might use string. (The experimenter lets the child try.) Yes, those are fine. I was thinking that you could use string to attach to a fish hook, to jump rope, to sew with, to hang clothes on, and to pull shades. (The experimenter varies his suggestions so as not to duplicate any the child has provided.) There are lots more too, and yours were very good examples. I can see that you already understand how we play this game. So let's begin now. And remember, think of all the different ways you could use the object that I name. Here we go.

Similarities

In this game I am going to name two objects, and I will want you to think of all the ways that these two objects are alike. I might name any two objects - like door and chair. But whatever I say, it will be your job to think of all the ways that the two objects are alike. For example, tell me all the ways that an apple and an orange are alike. (The child then responds.) That's very good. You've already said a lot of things that I was thinking of. I guess you could also say that they are both round, and they are both sweet. They both have seeds; they both are fruits; they both have skins; they both grow on trees - things like that. Yours were very fine too. (The experimenter's suggestions are varied so as not to include any which the child has given.) Do you see how we play the game? (If the child indicates clear understanding already, the last sentence is replaced by - I can see that you already know how to play this game.) Well, let's begin now, and remember, each time I name two objects, you name as many ways as you can that these two objects are alike.

Pattern Meanings

Here's a game where you can really feel free to use your imagination. In this game I am going to show you some drawings. After looking at each one, I want you to

tell me all the things you think each complete drawing can be. Here is an example - you can turn it any way you'd like to. (The experimenter gives the example card to the child.) What could this be? (The child is encouaged to try some suggestions.) Yes, those are fine. Some other kinds of things I was thinking of were the rising sun, a porcupine, eyelashes, a brush, a carnation, and probably there are lots of other things too. And yours were very good examples too. (The experimenter's particular suggestions are varied so as not to include any given by the child.) I can see that you already know how we play this game. So let's begin now.

Embedded Figures Test

We have another game to play now and it is like one in the Sunday papers where, for example, a hidden animal must be found in a picture.

(present P-1 for 15 seconds) Does this remind you of anything.

(present P for 10 seconds) Learn this figure carefully because you will have to find it in the figure you just looked at.

(present P-1) Locate the simple figure. (When S locates it - have him trace it with a finger.)

This is the way the game will be played. I will show you a complex figure and then the simple figure. You will have to find the simple figure in the complex one. The simple figure will always be present in the complicated one and will always be right side up. If you forget the simple figure, you may ask to see it again (in which case turn over the complex figure and stop the clock, but do not return it to zero.) There may be some additional lines crossing the simple figure when it is in the complex figure.

Stroop Colour-Word Test

W Card

This page consists of names of colours. I'd like you to read the page out loud as fast and as accurately as you can, For instance, read this top line (the S reads the practice line). Now, when I turn the page, start reading as fast and as accurately as possible.

C Card

Now I am going to show you another page consisting of colours. I want you to name the colours as fast and as accurately as possible. To make sure that you have the colour names correct, read the practice line. Now when I give the signal, start reading as accurately and as fast as possible.

C-W Card

This is a different kind of page. It consists of colour names surrounded by different colours. For instance, the word red may be surrounded by the colour blue; you are to read the colour and ignore the word. I want you to read the colours off as fast and as accurately as possible. Try the practice line. Now remember, at my signal read the colours off as quickly and as accurately as possible, ignoring the words.

Focusing-Scanning

I have a game here that I want you to play for me. I am going to show you a group of objects that are spread out under this cloth. You will look at them for 15 seconds. Then I will cover them up again and I want you to tell me as many as you can.

Object Sorting Test

Now let's play the picture game. While I spread these pictures out for you I'll name them off so that we will be sure to agree on what each object is. (The experimenter sets down five rows of ten pictures each before the S , naming each as it is put down. The same initial arrangement is used for each child.) Now your job is to look the pictures over and then put all the pictures that seem to belong together in groups. The groups may be large or small, any size you want as long as the pictures in each group belong together for a reason. There aren't any right or wrong answers in this game. Every time I play it with someone the groups turn out differently. So you see, any way you feel like making the groups is fine, as long as you have some reason for it. Once you make the groups you can add to them or change them, and if there are any pictures left over at the end that don't seem to fit into any of your groups, you can just leave them separately. Do you see how we play the game? Good. Now take your time, there's no need to hurry. And remember that your groups can be all different sizes. OK, go ahead.

Category-Width Test

This game asks you to guess about a lot of things in our world. For instance, if you knew that most grown-up men in the world are around 5 feet 7 inches tall, you might guess that the tallest man in the world is 7 feet tall or 8 feet tall. And you might guess that the shortest man in the world is 4 feet tall or only 3 feet tall. In this game you get a chance to guess about things like that. Why don't you begin reading now, and circle your guesses for each of the th ngs printed below. Take your time, and ask me any

questions you want about things that aren't clear to you.

Tolerance for Ambiguity

The game that we are going to play now is made up of sets of 10 cards. The first card of the 10 has only a few lines of a complete picture; but each following card gives you a few more hints - a few more lines - as to what this picture looks like. Here is a list of names, one of these is the picture. I will leave the list out so you can see it. Remember there is only one picture in each set of cards. You don't have to guess on any card if you don't want to, but the object of the game is to see how soon you can tell what the picture looks like. You may look at each card as long as you wish. Here is a practice set of five cards. Remember, the idea of this game is to see how few cards you need to decide what the picture is.

(After the first response) We will go through the rest of the cards and if you want to change your answer you can.

Do you see how we play this game? OK, we will begin now. Here is the list, read it over first.

Schematizing Test

We wish to see how well you can judge the size of squares. We're going to show you a number of squares on the screen and we want you to tell us how big they are.

The squares may range anywhere between 1 inch nnd 18 inches. This doesn't mean you'll necessarily get a square which is 1 inch or 18 inches, though you may. But the squares will always be somewhere within this range. (The 1 inch square and the 18 inch square are exposed now for about 5 seconds each.)

We will show them to you again.

You will see 150 squares during the course of the hour, and you have 150 numbered spaces on your sheet. Write your estimation of the size of each square in its own numbered space. Thus for square number 1 record its size in inches next to number 1, etc.

Don't go back over your judgments to change them, In changing them you are more likely to be inaccurate. Please don't compare your estimates with anyone or make any comment during the hour. Make your judgments independently. Now to remind you once again of the range in which the squares fall, we will show you agin the smaller and the larger ends of the range.

In estimating the sizes of tge squares, you may use whole numbers, factions, or decimals, dependeing on how the squares look to you. The choice is entirely yours.

Now we are ready to begin. You will see each of the following squares for only a few seconds. Look at it

all the time it is on the screen and make your estimation when it disappears. The next square you see will be number 1.

APPENDIX G

1) IQ Index Scores (N=60)

1.64	5.15	.62	- .22
1.65	-1.54	-2.33	2.73
1.25	1.35	2.33	-1.31
-1.30	-2.13	.93	.53
1.45	.70	- .08	- .90
-3.23	- .20	-1.28	- .30
- .93	1.34	.31	1.22
-1.79	-2.49	3.63	- .98
-1.70	1.03	- .08	.28
.02	3.54	-1.83	- .41
.82	-1.40	-2.21	-3.31
-1.69	-3.51	- .29	-2.32
-1.89	1.51	- .09	- .69
.52	.38	- .82	- .49
.00	.42	.13	- .30

2) Creativity Index Scores

2.52	-2.41	1.26	.85
.13	2.00	-1.52	13.48
.00	.12	-1.06	-2.30
-2.32	-1.40	6.44	1.30
.15	.27	.29	-2.25
1.17	-1.68	-0.36	-1.81
-0.63	-0.25	-0.30	-1.39
-1.38	-1.77	.95	-1.50
-0.31	-1.17	-1.47	-1.98
-0.80	-1.15	.82	- .16
1.41	-1.46	- .67	-2.34
-0.46	-1.95	1.11	-1.21
0.07	-0.50	-1.65	-1.40
1.30	-3.16	- .65	-1.47
-1.35	.53	.35	9.05

APPENDIX H

1) Intercorrelations among all scores for the total sample (N=60)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	3	38	39	40
1	Comprehension																																								
2	Vocabulary	49																																							
3	Block Design	-19	25																																						
4	IQ Index Score	65	77	58																																					
5	Alternate Uses	16	41	04	26																																				
6	Similarities	11	20	06	17	57																																			
7	Pattern Meanings	08	22	11	19	63	76																																		
8	Flexibility	15	27	05	21	73	90	91																																	
9	Uniqueness	12	28	09	22	74	88	94	96																																
10	Appropriateness	06	30	10	20	73	81	85	88	92																															
11	Transformation	12	29	08	23	76	86	95	95	99	92																														
12	Creativity Index Score	11	31	13	25	77	88	84	91	93	87	92																													
13	Total Time RPI	13	-19	-49	-31	-04	-03	-04	-04	-04	-07	-03	-04																												
14	W score	05	02	-01	04	02	-09	-16	-10	-11	-14	-13	-09	-19																											
15	C score	-06	-03	01	-05	-03	-16	-23	-22	-17	-21	-19	-13	-17	49																										
16	CW score	-07	04	10	02	-04	-15	-24	-22	-20	-19	-20	-18	-30	53	77																									
17	CW-C	-12	-08	06	-07	02	-06	-13	-09	-10	-07	-11	-09	-24	41	50	88																								
18	C/(C+W)	-09	-15	10	-01	01	00	-01	-01	-01	-02	-01	01	-12	-74	44	25	29																							
19	Number of Objects A	11	36	24	35	41	39	53	48	49	48	50	49	-17	-04	-21	-16	-08	06																						
20	Errors A	13	19	03	17	33	30	45	39	46	36	46	36	-09	-05	-03	-07	-09	03	31																					
21	Differential Score A	10	41	25	36	42	37	49	44	46	48	47	47	-18	-07	-24	-12	-03	03	96	26																				
22	Number of Objects B	07	25	26	31	20	16	22	26	18	22	18	20	-45	-03	-14	07	14	02	42	-04	44																			
23	Errors B	04	16	-13	01	07	06	-03	01	03	00	02	00	-10	06	-02	09	04	-44	-07	22	-06	10																		
24	Differential Score B	09	24	16	25	16	11	17	20	13	17	13	14	-33	-08	-23	00	04	-21	35	-11	38	92	17																	
25	Number of Groups	-18	-10	-24	-29	-07	-15	-14	-15	-15	-13	-14	-15	14	03	-07	-05	-01	-23	-02	-20	-03	15	12	23																
26	Number of Singles	-03	-12	05	-01	-25	-20	-20	-25	-23	-15	-23	-24	-02	-13	-23	-18	-14	04	-24	-19	-21	04	-21	04	13															
27	Percentage Pairs	-20	-08	-12	-21	-05	-16	-15	-16	-15	-10	-14	-15	08	04	-07	-05	-01	-11	04	-14	01	24	01	28	87	34														
28	Band Width	-02	09	19	15	12	07	-01	01	08	06	07	11	-06	-14	-04	-07	-17	-25	-20	09	-15	02	25	03	-16	11	-16													
29	Mean First Response	05	09	-16	-04	-16	-15	-19	-18	-21	-24	-22	-14	22	18	04	08	-01	-38	00	09	-03	-03	27	05	25	-10	21	-08												
30	Mean First Cor. Resp.	12	-13	-28	-15	-24	03	-09	-06	-08	-16	-11	-06	43	05	00	-17	-19	-22	-22	-01	-31	-21	01	-08	01	11	03	-04	30											
31	Trial Cor. Response Stabilities	14	-15	-16	-07	-05	-01	-01	-01	-01	-08	-03	04	29	12	01	-12	-17	-14	-17	-12	-21	-06	-19	02	06	24	09	02	37	65										
32	Number of Response Changes	12	-03	04	09	11	01	10	09	09	06	10	08	-10	-16	-12	-07	02	11	-09	-11	-06	11	-20	10	-08	24	-06	10	-51	-19	27									
33	Backing Accuracy	25	08	-01	16	-02	02	-01	-04	-02	06	-02	-07	05	-06	15	19	21	13	-06	-07	-07	01	01	01	-05	04	-02	-14	05	-02	-06	-17								
34	Increment Error	-20	-03	05	-10	-21	-26	-35	-31	-30	-33	-31	-24	03	18	14	14	03	-05	-18	08	-15	-25	08	-21	09	05	17	15	09	13	02	07	-48							
35	Perceptible	34	00	-11	12	-08	01	-01	-01	-02	-07	-05	03	02	14	06	12	08	-07	-12	-03	-12	-11	-17	-14	-32	-26	-39	-01	04	-01	03	-06	23	-29						
36	Functional	-21	-18	16	-05	06	00	-09	02	-04	03	-04	00	-11	-05	06	05	07	16	-01	01	-01	23	-11	24	38	13	45	-01	08	02	03	00	-02	13	-38					
37	Nominal	-11	10	-03	-05	00	-06	08	-03	04	02	04	-06	08	-09	-10	-16	-11	-11	-08	-02	08	-12	26	-12	-08	13	-06	01	-09	-01	-03	03	-15	12	-50	-59				
38	Plot Equivalence	11	08	02	11	06	16	04	09	10	09	09	11	12	08	13	08	04	05	10	12	12	06	05	08	07	-12	03	09	-09	01	-13	03	20	12	-10	07	-1			
39	Superordinate Grouping	-06	00	-04	-06	-11	00	07	01	02	04	01	-03	-02	-18	-04	02	06	06	13	-07	20	01	05	04	-15	07	-06	-03	-10	-14	-04	04	18	-15	-07	-20	3	-05		
40	Complexive Grouping	-10	-17	01	-12	11	07	03	05	07	04	07	09	06	10	17	05	-02	08	-12	16	-19	-06	06	-12	-02	-05	-11	07	02	09	02	-11	-11	00	03	09	-1	04	-74	
41	Thematic	14	08	05	14	04	-05	-12	-07	-08	-10	-07	-03	-01	16	-03	-03	-04	-12	-12	-01	-18	03	-07	03	24	-04	19	-03	17	16	10	01	-04	20	85	24	-2	-01	-88	36

2) Intercorrelations among scores on cognitive control tests for high creativity Ss. HI Ss are below the median and LI Ss are above the median (N=15)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1		-.32	-.16	-.33	-.30	.08	-.17	-.30	-.31	-.53	-.60	-.32	-.24	-.17	-.25	-.08	.13	.39	.26	.04	-.10	.00	.39	.09	-.43	.08	-.33	.24	.36
2	-.40		.37	.39	.29	-.21	-.01	.38	.01	.02	.39	.05	.24	-.08	.48	-.11	.44	.38	.38	-.29	-.11	.55	.12	-.14	.12	.21	.29	-.35	-.11
3	-.60	.71	.	.77	.41	.82	-.36	.25	-.26	.08	.46	-.07	-.10	-.23	.03	.11	-.07	-.03	-.21	-.14	.06	.19	-.11	-.31	.43	.46	-.07	.24	-.13
4	-.64	.62	.80	.	.89	.54	-.09	.01	.07	.38	.55	.19	.12	-.15	.26	.12	-.08	-.22	-.18	.04	.33	.34	-.32	-.14	.47	.55	.25	-.16	-.17
5	-.56	.46	.57	.95	.	.21	.08	-.23	.21	.48	.44	.35	.35	-.04	.45	.04	-.09	-.24	-.09	.18	.48	.27	-.36	.09	.26	.60	.39	-.40	-.12
6	-.30	-.20	.54	.33	.18		-.40	.02	-.33	.05	.22	-.11	-.27	-.70	-.30	.12	-.36	-.24	-.46	.06	.10	-.10	-.13	-.24	.33	.33	-.29	.49	-.01
7	.10	-.06	-.45	-.45	-.40	-.53		-.16	.95	.46	.08	.36	.13	-.14	.06	-.16	.28	-.19	-.04	-.33	-.27	.20	-.06	-.27	.39	-.34	.32	-.34	-.10
8	.37	-.20	-.32	-.29	-.24	-.21	.37		-.09	-.41	.14	-.34	-.50	.06	-.34	.37	.10	.27	.47	.02	-.41	.36	.06	-.33	.35	-.34	.20	-.10	-.27
9	.06	-.07	-.44	-.36	-.28	-.51	.97	.32		.57	.19	.43	.14	-.03	.12	-.07	.24	-.34	-.08	-.32	-.15	.18	-.22	-.22	.47	-.28	.41	-.40	-.21
10	-.15	.16	-.13	.12	.24	-.45	.20	-.10	.26		.61	.92	.48	-.01	.37	-.18	-.08	-.65	-.63	-.14	.40	-.27	-.18	-.04	.25	.21	.39	-.36	-.25
11	.03	.00	.00	.06	.05	.01	-.39	.33	-.30	-.20		.51	.16	-.18	.12	.27	.11	-.33	-.31	-.28	.14	.00	-.05	-.39	.50	.19	.26	-.15	-.32
12	-.14	.16	-.11	.12	.24	-.42	.20	-.22	.27	.97	-.29		.54	.07	.46	-.29	.00	-.54	-.57	-.21	.50	-.39	.02	.09	-.04	.26	.38	-.40	-.19
13	.09	.36	.08	-.06	-.11	-.33	-.07	.06	-.14	.26	.09	.26		.24	.87	-.53	.03	-.08	-.01	.13	.07	-.06	-.30	.38	-.21	.55	.02	-.17	.16
14	-.29	.57	.48	.42	.32	-.01	-.24	-.08	-.36	-.20	-.12	-.21	.09		.35	-.47	-.01	.01	.16	.17	.21	-.07	-.39	.37	-.08	-.04	.26	-.22	-.22
15	.07	.29	-.01	-.12	-.13	-.37	.05	.00	-.02	.26	-.06	.26	.93	.12		-.55	.23	.16	.15	-.09	.25	.05	-.35	.49	-.25	.62	.20	-.34	.09
16	-.41	.04	.39	.24	.14	.44	-.24	.30	-.18	-.15	.58	-.22	.11	-.21	-.02		.08	-.21	.06	-.02	-.01	-.04	.19	-.44	.36	-.19	.06	.08	-.35
17	.07	.28	.10	.16	.16	-.17	.08	.14	.03	.37	-.16	.25	.19	.10	.08	-.22		.42	.47	-.62	-.19	.37	.10	-.15	.13	-.15	.15	-.20	-.05
18	.31	.03	-.01	-.18	-.24	-.03	.05	.13	-.09	.16	-.29	.10	-.22	.18	-.30	-.37	.51		.72	-.15	-.28	.33	.12	.22	-.38	.12	-.14	-.02	.41
19	.03	.10	-.06	-.18	-.21	-.21	.13	-.05	-.02	.40	-.28	.40	.33	.10	.17	-.28	.46	.56		.14	-.43	.37	.02	.11	-.12	-.01	.10	-.24	.15
20	.02	-.42	-.38	-.26	-.15	-.04	-.05	-.20	.00	.10	.15	.21	.09	-.30	.13	-.03	-.65	-.41	.09		.04	.04	-.04	.23	-.20	.18	.04	-.11	.08
21	.18	.07	.39	.12	-.03	.51	-.21	-.01	-.31	-.31	-.36	-.33	-.12	.07	-.18	.00	.34	.54	.09	-.59		-.48	.00	.34	-.29	.40	.43	-.41	-.26
22	-.16	.17	.15	.17	.14	.01	-.34	.04	-.26	.03	.72	-.03	.31	-.09	-.35	.49	-.30	-.42	-.36	.30	-.36		-.17	-.15	.34	-.17	.00	-.09	.20
23	.22	-.27	-.10	.19	.30	.21	-.17	.12	-.14	-.32	-.03	-.35	-.28	-.12	-.35	-.10	.32	-.07	-.21	-.32	.35	-.42		-.48	-.19	-.13	.23	-.21	-.29
24	-.25	.43	.21	.02	-.07	-.28	-.05	.09	-.08	.42	.33	.34	.72	-.01	.59	.49	.18	-.07	.30	-.07	-.20	.45	-.54		-.75	.29	-.21	-.03	.61
25	-.06	-.15	-.11	-.26	-.30	.04	.20	-.23	.16	-.04	-.29	.05	-.34	.20	-.17	-.35	-.51	.18	.10	.47	-.25	-.04	-.61	-.30		-.22	.23	.03	-.54
26	.29	.09	.08	-.04	-.10	.05	.00	.22	.07	-.01	.25	-.01	.04	-.28	.03	.27	-.22	.02	-.38	-.02	.25	.50	-.21	.10	-.06		.08	-.12	.08
27	.06	-.18	-.07	-.08	-.07	.11	.19	-.42	.27	-.01	-.47	.16	-.33	-.29	-.34	-.24	-.30	-.14	-.09	.16	.02	-.58	.16	-.40	.20	-.05		-.93	-.70
28	-.13	.37	.14	.23	.25	-.25	-.18	.42	-.26	-.07	.49	-.21	.21	.53	.13	.19	.24	.14	.10	-.22	-.06	.37	-.02	.31	-.26	.06	-.80		.43
29	-.03	-.03	.00	-.06	-.07	.03	-.21	.28	-.29	.05	.31	-.10	.34	.12	.39	.20	.31	.16	.17	-.07	.03	.53	-.20	.37	-.11	-.08	-.92	.52	

3) Intercorrelations among scores on cognitive control tests for low creative Ss. HI Ss are below the median and LI Ss are above the median (N=15)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1		-.29	-.23	-.42	-.39	-.20	-.05	-.17	.07	-.50	-.13	-.40	.42	.12	.29	.44	-.02	.40	.18	-.21	-.04	.17	-.24	-.24	.40	.00	.01	.20	-.17
2	.21		.62	.71	.47	.09	.21	.14	.07	-.19	.03	-.24	-.16	-.41	-.18	-.25	.08	-.22	-.16	.04	-.45	.20	.08	.11	-.16	.00	-.15	-.22	.01
3	.50	.21		.78	.40	.47	-.10	.14	-.29	-.30	-.23	-.42	-.44	-.48	-.47	-.22	-.23	.01	.05	.10	-.31	.27	.31	.33	-.60	.00	.08	.35	-.28
4	.53	.41	.79		.79	.32	-.03	.25	-.12	-.09	-.09	-.17	-.59	-.48	-.61	-.17	-.11	-.27	-.22	.12	-.12	.27	.39	.52	-.72	.00	.15	-.04	-.28
5	.54	.35	.59	.83		.55	.15	.13	.15	.06	-.40	-.16	-.61	-.10	-.48	-.31	-.40	-.59	-.40	.18	.14	.05	.16	.47	-.53	.00	.33	-.28	-.38
6	.15	-.82	.38	.07	.06		.21	.03	.10	.02	-.78	-.39	-.52	.18	-.19	-.54	-.76	-.33	-.12	.21	.01	.00	.08	.33	-.30	.00	.39	.22	-.48
7	-.37	-.42	-.26	-.13	-.10	-.22		.47	.94	.30	.06	.20	.23	-.14	.43	-.47	.02	-.06	-.54	-.31	-.22	.17	-.60	.35	.10	.00	-.06	-.06	.03
8	-.02	-.29	-.09	.05	.13	.24	.58		.35	.22	.29	.19	.04	-.29	.21	-.08	.32	-.13	-.58	-.34	-.24	.47	-.32	.80	-.48	.00	-.14	.12	.07
9	-.29	-.42	-.26	-.15	-.18	.19	.94	.43		.21	.00	.18	.26	-.07	.39	-.45	.06	-.09	-.52	-.31	-.05	.14	-.61	.29	.16	.00	-.02	-.18	.02
10	-.43	-.35	-.53	-.30	-.34	-.02	.33	-.02	.39		.32	.88	.09	.18	.33	-.05	.07	-.01	-.19	.11	-.13	-.23	-.42	.31	-.04	.00	-.37	.17	.39
11	.48	.05	-.03	.19	.35	-.05	-.04	.23	-.08	-.36		.62	.35	-.36	.15	.45	.64	.32	-.09	-.26	-.11	.08	-.12	-.03	.06	.00	-.30	-.03	.36
12	-.40	-.43	-.50	-.34	-.33	.11	.41	.00	.44	.96	-.37		.21	.02	.30	.09	.36	.21	-.08	.04	-.01	-.12	-.34	.19	.01	.00	-.49	.05	.55
13	.18	-.13	.39	.46	.36	.38	-.01	-.25	-.02	.19	-.18	.26		.04	.82	.25	.32	.10	-.22	-.41	-.29	-.18	-.41	-.29	.32	.00	-.57	.17	.53
14	-.24	-.21	-.32	-.40	-.57	-.03	-.19	-.44	-.16	.49	-.09	.46	.02		.31	.12	-.43	-.19	.33	.66	.32	-.47	-.32	-.24	.37	.00	-.09	.02	.15
15	.00	-.17	.28	.37	.20	.32	.01	-.24	-.04	.42	-.18	.43	.87	.39		.00	.08	-.01	-.28	-.24	-.27	-.09	-.65	-.09	.50	.00	-.59	.15	.60
16	-.41	-.23	-.41	-.62	-.61	-.08	-.06	-.36	-.01	.37	-.26	.33	-.41	.73	-.08		.22	.31	.23	.08	.04	-.29	.07	-.19	.09	.00	-.16	.21	.04
17	.70	.06	.54	.48	.33	.29	-.23	-.05	-.29	-.39	.29	-.35	.43	.01	.37	-.41		.38	.04	-.39	-.41	.22	-.19	.11	.03	.00	-.31	-.09	.34
18	.47	.27	.12	.10	-.05	-.13	-.45	-.23	-.48	-.12	.05	-.19	.00	.34	.05	.02	.65		.62	.01	-.27	.19	-.08	-.09	.15	.00	-.21	.41	.08
19	.53	.25	.22	.17	.08	-.08	-.40	-.24	-.34	.11	-.14	.08	.10	.31	.22	.14	.51	.74		.61	-.02	-.13	.16	-.41	.23	.00	-.04	.28	.01
20	-.19	.01	-.13	-.12	-.13	-.13	.26	.09	.33	.41	-.49	.37	-.03	.12	.09	.43	-.39	-.27	.22		.31	-.37	.10	-.10	-.04	.00	-.13	.07	.11
21	.27	-.12	.18	.34	.34	.21	-.03	.32	-.15	-.20	.55	-.27	.24	-.23	.22	-.36	.45	-.06	-.22	-.59		-.21	.37	-.19	-.11	.00	.23	-.40	-.06
22	.01	.22	.30	.08	-.20	-.04	-.09	-.28	-.07	-.13	-.32	-.06	.07	.37	.17	.38	.09	.23	.25	.47	-.60		-.20	.40	-.17	.00	.22	-.03	-.25
23	-.14	.56	-.16	-.02	-.17	-.64	-.30	-.03	-.24	-.05	-.37	-.21	-.25	-.18	-.28	-.11	-.10	.21	.23	.16	-.14	-.04		-.17	-.50	.00	.14	-.02	-.12
24	-.13	-.52	.04	-.10	-.13	.53	.06	-.24	.09	.41	-.28	.47	.68	.36	.72	.04	.24	-.01	.20	-.03	.05	-.07	-.29		-.76	.00	-.10	.31	-.08
25	.25	-.00	.10	.13	.27	.05	.08	.31	.00	-.34	.61	-.30	-.41	-.15	-.38	.04	-.10	-.15	-.34	-.15	.21	.01	-.50	-.65		.00	.04	-.25	.10
26	.09	-.06	.13	.35	.33	.15	.56	.26	.49	.15	-.06	.20	.22	-.15	.22	-.12	.28	.14	.21	.25	-.18	.14	-.10	.12	-.12		.00	.00	.00
27	-.01	-.37	.16	.15	.09	.34	.35	.31	.41	.18	.27	.11	-.27	.04	-.05	.18	-.19	-.36	-.18	.02	.20	-.18	-.45	-.10	.48	.07		-.31	-.91
28	.28	.30	-.01	.02	.11	-.18	-.48	.05	-.63	-.33	.10	-.31	.08	-.10	-.03	-.37	.50	.61	.34	-.41	.29	-.18	.41	.02	-.26	-.13	-.71		-.01
29	.04	.33	-.10	-.10	-.03	-.29	-.32	-.36	-.36	-.19	-.28	-.10	.36	-.07	.11	-.18	.19	.29	.17	.03	-.24	.22	.37	.16	-.49	-.03	-.99	.62	

4) Intercorrelations among scores on cognitive control tests. HC Ss are below the median and LC Ss are above the median (N=30)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1		-09	-04	-17	-09	-16	-28	-19	-21	-53	11	-41	36	05	22	08	29	48	39	-21	03	12	-24	-17	36	-03	11	15	-14
2	-30		39	54	41	-16	-13	-10	-18	-21	03	-30	-16	-30	-20	-22	05	04	03	03	-22	19	42	-27	-08	-02	-33	16	31
3	-30	59		77	48	44	-12	06	-21	-33	-16	-43	-09	-43	-15	-27	05	02	07	04	-08	24	19	20	-31	10	06	16	-08
4	-42	56	79		82	27	01	21	-03	-08	01	-18	-13	-46	-17	-32	09	-17	-13	06	13	11	22	21	-34	26	02	03	-03
5	-38	42	51	93		40	08	18	04	-04	-07	-19	-14	-34	-16	-42	-09	-36	-23	08	27	-13	02	16	-15	26	05	-01	-03
6	-04	-17	68	42	20		21	10	14	04	-58	-25	-24	10	-06	-39	-48	-27	-15	16	07	-03	-10	34	-19	07	15	07	-19
7	-01	-02	-36	-28	-21	-43		57	94	36	00	31	02	-20	11	-22	-15	-33	-51	-08	-07	-04	-33	18	05	45	14	-27	-11
8	-01	-02	-10	-20	-24	-11	13		44	16	23	13	-18	-39	-12	-18	07	-24	-44	-14	11	-07	-09	19	-06	24	12	10	-16
9	-10	-03	-33	-18	-09	-39	96	14		35	-05	32	01	-16	05	-17	-16	-37	-47	-04	-05	-04	-28	16	02	42	18	-41	-14
10	-34	12	-01	23	34	-17	32	-25	40		04	90	06	24	28	13	-15	-13	-14	19	-12	-20	-15	34	-20	14	-05	-06	08
11	-42	10	16	20	18	09	-18	25	-08	21		23	10	-24	00	15	49	20	-09	-32	19	-13	-25	-15	32	-05	12	04	-09
12	-19	15	-05	17	29	-24	28	-36	36	94	05		19	16	31	19	05	04	-05	13	-10	-10	-23	31	-14	14	-07	-12	12
13	-13	27	-03	01	10	-30	02	-22	-01	37	16	37		06	86	-10	40	10	01	-26	-03	01	-34	25	04	12	-20	08	27
14	-19	19	03	09	10	-14	-16	00	-14	-07	-16	-04	19		37	36	-21	10	35	47	04	04	-26	04	15	-12	06	-07	-06
15	-11	35	01	04	12	-33	05	-16	05	31	03	34	89	26		-06	25	08	05	-12	-03	10	-45	36	04	12	-05	00	12
16	-25	-03	23	17	09	26	-23	34	-15	-18	42	-26	-19	-33	-25		-06	14	15	18	-23	08	-01	-08	05	-06	05	-10	-07
17	12	34	04	08	06	-26	19	10	13	15	-04	15	09	03	16	-10		53	28	-38	-01	15	-16	17	-01	15	-12	22	14
18	35	16	-02	-19	-23	-14	-06	19	-20	-25	-30	-18	-13	06	-06	-29	46		70	-09	-18	24	03	-04	03	05	-19	48	11
19	19	22	-05	-11	-13	-27	11	11	00	-01	-36	08	12	12	16	-18	47	61		43	-15	13	12	-10	00	07	-02	25	01
20	02	-38	-28	-16	-03	00	-17	-10	-14	-02	-06	04	11	-01	03	-02	-63	-29	09		01	00	12	-08	-08	12	-03	-11	06
21	10	06	31	24	17	33	-16	-20	-19	03	-20	04	-05	13	02	-05	13	17	00	-33		-46	09	-06	04	-10	13	05	-13
22	-12	25	10	17	16	-08	-14	21	-09	-14	36	-22	12	-07	17	28	01	-04	-04	19	-47		-11	10	-03	09	-08	-16	09
23	29	-14	-06	08	12	09	-10	07	-13	-24	-10	-19	-28	-21	-33	-04	24	01	-07	-23	29	-35		-24	-51	-04	-37	29	30
24	-06	19	-06	-06	-01	-26	-16	-10	-15	17	-07	21	52	24	53	07	00	08	18	07	02	15	-50		-69	08	-08	12	09
25	-28	-06	11	00	-08	17	25	04	27	09	20	-01	-25	02	-21	-03	-20	-10	-03	18	-29	17	-47	-51		-11	37	-26	-34
26	20	12	15	06	00	10	-02	10	04	04	11	05	10	-13	11	16	-15	03	-23	00	28	21	-16	10	-09		01	-08	03
27	-15	-04	-09	01	08	-09	21	-16	30	15	-03	22	-14	03	-10	-11	-11	-14	-05	12	12	-27	15	-30	22	-05		-63	-98
28	09	08	19	07	-04	17	-25	17	-32	-22	10	-29	-01	02	-12	14	00	05	-06	-16	-21	13	-09	12	-11	02	-84		51
29	14	-01	01	-04	-05	05	-13	10	-22	-01	-03	-08	21	-03	27	02	20	22	21	-04	04	30	-17	39	-24	-03	-84	43	

5) Intercorrelations among scores on cognitive control tests. HI Ss are below the median and LI Ss are above the median (N=30).

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	-33	-19	-35	-35	-14	-24	-31	-26	-58	-33	-41	12	08	09	18	11	45	28	-14	-08	14	-01	-06	07	-01	-12	08	09
2	-07		51	55	39	04	16	29	10	-04	17	-10	01	-29	09	-18	21	01	02	-07	-28	34	13	-01	-06	16	13	-21	-04
3	-12	49		77	40	47	-20	19	-25	-13	03	-29	-26	-36	-22	-10	-16	-01	-06	00	-14	21	21	01	-13	30	-03	20	-20
4	-23	51	78		84	31	-06	10	-02	11	17	-03	-19	-31	-14	-06	-09	-24	-19	08	11	30	02	17	-13	39	20	-11	-22
5	-11	40	57	91		42	12	-06	19	25	-05	04	-11	-09	-02	-16	-25	-42	-27	18	31	16	-08	27	-16	43	30	-28	-23
6	-01	-57	42	18	10		10	04	04	05	-57	-31	-38	07	-20	-41	-59	-28	-18	18	03	-04	05	17	-17	09	02	17	-29
7	-05	-20	-32	-33	-28	-07		18	95	48	11	32	08	-23	10	-24	05	-22	-38	-23	-21	07	-17	01	14	-14	08	-11	-01
8	18	-24	-25	-19	-11	02	40		18	00	22	-07	-34	-16	-19	15	12	03	-07	-10	-32	31	-01	08	-04	-22	07	01	-13
9	-05	-22	-33	-28	-24	-07	95	33		48	12	34	09	-16	10	-19	05	-31	-38	-23	-08	05	-24	00	20	-11	15	-16	-07
10	-20	-06	-24	-03	00	-16	31	-09	36		43	88	17	-01	20	-03	-07	-36	-41	06	11	-31	-17	13	00	19	04	-07	10
11	26	02	-03	11	20	-04	-19	26	-18	-31		59	23	-31	10	41	39	02	-19	-25	00	01	-06	-18	21	13	04	-05	05
12	-19	-11	-23	-04	00	-07	34	-15	39	97	-35		27	-03	27	02	17	-13	-28	-01	18	-26	-13	14	-05	17	01	-12	23
13	13	08	21	15	11	16	-04	-08	-08	20	-09	24		18	85	-09	19	05	-07	-17	-10	-06	-38	09	16	37	-04	-15	29
14	-27	03	-01	00	-17	-03	-22	-24	-24	19	-08	17	04		37	-10	-18	-02	31	43	25	-17	-39	05	22	-07	19	-20	-05
15	04	04	12	07	02	08	03	-10	-03	33	-14	34	89	29		-23	20	14	-01	-19	00	05	-52	23	16	39	09	-28	28
16	-42	-11	03	-07	-19	10	-17	05	-11	08	04	04	-19	43	-05		13	07	13	07	02	-18	15	-28	15	-07	-04	10	-11
17	38	17	28	26	22	12	-04	06	-10	03	11	-02	32	03	23	-32		43	26	-49	-30	33	-09	-02	11	-14	08	-19	11
18	39	16	05	-07	-15	-09	-19	-03	-27	03	-07	01	-09	28	-10	-16	58		68	-09	-27	31	-05	07	-04	03	-07	-03	23
19	32	19	09	-07	-10	-11	-01	-15	-08	33	-22	32	18	16	18	-09	48	62		39	-20	27	03	-16	13	-05	11	-17	05
20	-14	-07	00	08	18	18	-23	-10	-23	06	-25	-01	-17	43	-19	07	-49	-09	39		19	-17	07	04	-13	12	-03	-02	10
21	27	00	33	17	10	31	-05	08	-17	-17	12	-21	06	-14	01	-27	39	25	05	-55		-36	18	09	-20	29	32	-32	-17
22	-15	16	16	13	01	-04	-29	-05	-22	-14	08	-13	17	25	23	43	-11	-06	-16	31	-52		-22	06	16	-17	09	-13	03
23	11	11	-10	12	13	-23	-16	04	-13	-15	-22	-22	-26	-16	-31	-12	15	06	04	-17	20	-29		-33	-38	-04	11	-08	-19
24	-20	-07	13	-02	-09	23	-02	-04	-02	38	-05	37	69	23	66	25	20	-04	21	-06	-10	19	-43		-73	21	-16	01	31
25	06	-08	-04	-10	-05	04	09	01	04	-22	30	-16	-37	-01	-29	-13	-30	00	-16	22	-07	04	-57	-47		-18	20	-06	-25
26	24	06	10	00	-04	06	12	19	15	05	09	06	06	-17	06	15	-10	04	-17	02	19	23	-15	07	-08		02	-07	07
27	01	-27	02	00	00	24	24	-13	32	07	-01	12	-29	-07	-19	-03	-25	-25	-14	11	08	-34	-09	-25	34	-03		-90	-68
28	02	32	13	20	20	-15	-14	30	-24	-04	23	-13	13	16	08	02	27	22	20	-23	06	10	10	19	-25	07	-70		33
29	-01	17	-05	-07	-05	-17	-27	01	-33	-08	-06	-11	35	00	23	-01	24	23	14	-03	-11	36	04	26	-30	-06	-94	45	

APPENDIX I

1) Mean W scores (Stroop Colour-Word Test) for Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	55.87 (9.27)	54.26 (9.70)
	Low	53.60 (5.54)	51.93 (6.63)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	40.01	1	40.01	.59
Intelligence	79.31	1	79.31	1.17
Interaction	.01	1	.01	.00
Within Cells	3804.00	56	67.95	

$F_{.90}$ (1,56) - 2.78

2) Mean C Scores (Stroop Colour-Word Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	98.33 (18.07)	94.60 (12.99)
	Low	90.93 (16.16)	90.73 (18.47)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	58.70	1	58.70	.20
Intelligence	477.80	1	477.80	1.63
Interaction	47.00	1	47.00	.17
Within Cells	16370.00	56	292.32	

$F_{.90}(1,56) = 2.78$

3) Mean CW Scores (Stroop Colour-Word Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	159.93 (45.08)	162.93 (24.75)
	Low	146.33 (30.57)	146.53 (29.68)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	38.45	1	38.45	.04
Intelligence	3374.00	1	3374.00	2.83*
Interaction	27.00	1	27.00	.02
Within Cells	66690.00	56	1190.89	

*$F_{.90}$ (1,56) = 2.78

4) Mean C/(C+W) Scores (Stroop Colour-Word Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	63.40 (3.12)	63.07 (5.27)
	Low	62.53 (3.67)	60.60 (14.68)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	4.27	1	4.27	.22
Intelligence	.01	1	.01	.00
Interaction	11.26	1	11.26	.59
Within Cells	1067.00	56	19.00	

$F_{.90}(1,56) = 2.78$

5) Mean Number of Errors (Scanning A) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	1.0 (1.2)	1.2 (.83)
	Low	1.3 (.99)	.80 (.65)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	.27	1	.27	.28
Intelligence	.07	1	.07	.00
Interaction	1.67	1	1.67	1.74
Within Cells	53.53	56	.96	

$F_{.90}$ (1,56) = 2.78

6) Mean Number of Errors (Scanning B) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	1.07 (.99)	1.40 (1.67)
	Low	2.00 (1.41)	1.60 (2.06)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	1.67	1	1.67	.63
Intelligence	4.82	1	4.82	1.81
Interaction	2.01	1	2.01	.75
Within Cells	149.10	56	2.66	

$F_{.90}$ (1,56) = 2.78

7) Mean First Correct Response (Tolerance for Ambiguity) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	4.23 (1.08)	4.15 (1.23)
	Low	4.17 (1.14)	4.82 (1.17)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	1.23	1	1.23	.98
Intelligence	1.41	1	1.41	1.13
Interaction	1.95	1	1.95	1.56
Within Cells	79.88	56	1.25	

$F_{.90}$ (1,56) = 2.78

8) Mean Trial Correct Response Stabilizers (Tolerance for Ambiguity) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	6.19 (1.20)	5.35 (1.10)
	Low	5.53 (.95)	6.07 (1.22)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	.32	1	.32	.24
Intelligence	.01	1	.01	.00
Interaction	7.21	1	7.21	5.38
Within Cells	75.12	56	1.34	

$F_{.90}$ (1,56) = 2.78

9) Mean Percentage Pairs (Equivalence Range) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	39.67 (24.72)	39.40 (28.39)
	Low	38.47 (26.12)	51.47 (24.01)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	608.10	1	608.10	.85
Intelligence	443.10	1	443.10	.62
Interaction	658.00	1	658.00	.92
Within Cells	39950.00	56	713.39	

$F_{.90}$ (1,56) = 2.78

10) Mean Percent Perceptible (Object Sorting Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	32.60 (31.66)	22.26 (23.79)
	Low	22.67 (18.08)	13.27 (17.51)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	1459.00	1	1459.00	2.49
Intelligence	4.00	1	4.00	.00
Interaction	1343.00	1	1343.00	2.28
Within Cells	32800.00	56	585.71	

$F_{.90}$ (1,56) = 2.78

11) Mean Percent Functional (Object Sorting) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	40.93 (24.84)	44.47 (25.91)
	Low	44.27 (26.84)	44.87 (24.05)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	64.42	1	64.42	.09
Intelligence	52.40	1	52.40	.08
Interaction	31.50	1	31.50	.05
Within Cells	38670.00	56	690.54	

$F_{.90}$ (1,56) = 2.78

12) Mean Percent Nominal (Object Sorting Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	23.40 (27.30)	32.13 (29.00)
	Low	29.93 (25.61)	40.20 (27.13)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	1353.00	1	1353.00	1.71
Intelligence	799.70	1	799.70	1.01
Interaction	7.30	1	7.30	.01
Within Cells	44240.00	56	790.00	

$F_{.90}$ (1,56) = 2.78

13) Mean Percent Fiat Equivalence (Object Sorting Test) for the Four Groups

		CREATIVITY	
		High	Low
INTELLIGENCE	High	1.67 (6.23)	.40 (1.50)
	Low	.33 (1.25)	.00 (.00)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	9.60	1	9.60	.84
Intelligence	11.26	1	11.26	.99
Interaction	3.24	1	3.24	.29
Within Cells	636.90	56	11.37	

$F_{.90}$ (1,56) = 2.78

14) Mean Percent Superordinate Grouping (Object Sorting Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	79.40 (25.41)	81.60 (23.42)
	Low	85.40 (19.84)	92.60 (5.85)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	333.10	1	333.10	.77
Intelligence	1084.00	1	1084.00	2.52
Interaction	90.00	1	90.00	.21
Within Cells	24100.00	56	430.36	

15) Mean Percent Complexive Grouping (Object Sorting Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	5.60 (11.63)	1.67 (3.53)
	Low	5.87 (12.80)	.87 (2.22)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	299.20	1	299.20	3.54
Intelligence	4.13	1	4.13	.05
Interaction	1.07	1	1.07	.01
Within Cells	4732.00	56	84.50	

F.90 (1,56) = 2.78

16) Mean Percent Thematic Grouping (Object Sorting Test) for the Four Groups (N=60)

		CREATIVITY	
		High	Low
INTELLIGENCE	High	12.93 (17.01)	14.80 (18.61)
	Low	6.67 (7.64)	5.73 (6.23)

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS	F
Creativity	3.27	1	3.27	.02
Intelligence	880.50	1	880.05	4.50
Interaction	30.30	1	30.30	1.55
Within Cells	10950.00	56	195.54	

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