

CONJUGATE LATERAL EYE MOVEMENTS AND CREATIVITY; COGNITIVE AND
PERSONALITY CORRELATES

by

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ABSTRACT

The present investigation attempted to determine the cognitive and perceptual correlates of two primary variables, Conjugate Lateral Eye Movements (CLEM), a measure of hemisphericity, and creativity as measured by the How Do You Think Test. Forty male and 40 female right handed and 16 male and 16 female nonright handed undergraduate students were each given a battery of cognitive and perceptual tests. Sex and handedness were treated as moderating variables.

CLEM was found to have little association with field dependence (Rod and Frame Test), perceptual closure (Perceptual Organization Test) or torque. However, for right handed subjects, a significant but low correlation was found between CLEM and a random sequence generation task indicating a greater ability on the part of left movers (right hemisphere dominance) to produce a random sequence. No relationship was found for non-right handed subjects. Also, CLEM was found to be significantly related to creativity in only the right handed male group, with right movers (left hemisphere dominance) demonstrating the highest creativity.

High creativity was significantly correlated with greater sensation seeking and susceptibility to boredom for all subjects. Cognitive complexity, on the other hand, was significantly related to greater creativity in females but only a trend was observed for males. Also, physiognomic perception (Physiognomic Cue Test) was found to be significantly correlated

with high creativity for only the right handed male and nonright handed female groups. In addition, no relationship was observed between creativity and either random sequence generation or field dependence. Overall, these results show the importance of sex and handedness as moderating variables in both CLEM and creativity.

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A. Introduction

Cerebral lateralization and creativity are two areas of study which have stimulated a vast amount of theoretical and empirical interest. As such, they will be treated as central to this thesis. A review of these two variables will be addressed at length followed by a discussion of how they relate to each other as well as to several other areas of research. In particular, the present introduction is concerned with the relationship of cerebral lateralization to perceptual organization, field dependence, torque and the ability to generate a random sequence and the relationship of creativity to sensation seeking, susceptibility to boredom, field dependence, cognitive complexity, physiognomic perception and the ability to generate a random sequence.

Cerebral Lateralization

The left hemisphere is typically thought to mediate verbal processing while the right hemisphere is thought to mediate nonverbal processing, particularly visuospatial ability (Kimura, 1961). The list of findings put forth to support this dichotomy is extensive. Among those functions attributed to the left hemisphere are sequential processing, temporal ordering (Carmon, 1978; Natale, 1977), categorization, interpretation and coding

(Bradshaw and Nettleton, 1981). Left hemisphere superiority has been found for matching tasks using names (Geffen, Bradshaw and Nettleton, 1972) and categories (Landis, Assal and Perret, 1979) as opposed to physical characteristics, implying a specialization for abstraction and semantic processing.

The right hemisphere, on the other hand, has been found to specialize in colour naming and discrimination (Davidoff, 1975; Pirot, Pulton and Sutker, 1977), dot localization (Bryden, 1976), face recognition (Benton, 1980; Carey and Diamond, 1977; Ley and Bryden, 1979), pattern displays (Moscovitch, 1979), perception of line orientation (Atkinson and Egeth, 1973) and perception of the duration of time (Hecaen, 1962; McFie and Zangwill, 1960) to name only a few.

More recently, in the face of mounting contradictory evidence, the adherence to a simplistic verbal-nonverbal dichotomy is being questioned (Bradshaw and Nettleton, 1981; Gazzaniga and LeDoux, 1978; Kinsbourne, 1982). There is sufficient evidence to suggest that hemispheric specialization may be influenced by the complexity or familiarity of the stimuli or task (Bisiach, Nichelli, and Sala, 1979; Ornstein, Johnstone, Herron and Swencionis, 1980), required storage duration (Moscovitch, Scullion and Christie, 1976) and the sex (McGlone, 1980; McGuinness and Pribram, 1979), handedness (Hardyk and Petrinovich, 1977; Hicks and Kinsbourne, 1978) and attentional set of the subject (Bartholomeux, 1974; Spellacy and Blumstein, 1970). For example Bakan (1979) states that there may

be two types of imagery, a global diffuse imagery mediated by the right hemisphere and a more articulated imagery mediated by the left hemisphere. Evidence to support this contention arises from the finding (Fontenot, 1973; Patterson and Bradshaw, 1975) that complex visuospatial stimuli may be processed by the right hemisphere while simplistic visuospatial stimuli may be processed by the left hemisphere. Similarly, Hannay, Dee, Burns and Masek (1981) have demonstrated that a left visual field advantage (right hemisphere) for forms on a tachistoscope may shift to a right visual field advantage (left hemisphere) when subjects are instructed to use verbal labels.

Equal in importance to the task and stimulus properties are a consideration of individual differences in subjects. According to Hardyck and Petrinovich (1977), left handed individuals tend to be less lateralized than right handers on tachistoscopic and dichotic listening tasks. This effect is particularly prominent in left handers with a familial history of sinistrality. Conversely, right handers with no familial history of sinistrality have been found to be the most lateralized. Additional and more direct support for this contention arises from studies of brain damage (Hecaen and Sauguet, 1971; Luria, 1970; Penfield and Roberts, 1959) and sodium amytal anaesthesia (Rasmussen and Milner, 1975). For example, left handed patients have been found to show less verbal and spatial impairment following left and right hemisphere damage respectively.

Several theories of sex differences in cerebral lateralization have been proposed. It has been suggested that females are left and males right hemisphere dominant (Levy, 1971), females are more lateralized on both verbal and spatial abilities (Buffery and Gray, 1972), females are less lateralized on both verbal and spatial abilities (Bryden, 1979; Flor-Henry, 1980; Hutt, 1979) and females are less lateralized for verbal abilities (McGlone, 1977). Research generally offers little support for the first two theories; however, the two latter theories have a substantial amount of evidence to support them. Less lateralization for verbal abilities tends to be the most stable and consistent finding (Kimura, 1980; McGlone, 1980) while the findings on spatial ability are somewhat more ambiguous. Equivocal results on spatial abilities are no surprise considering spatial abilities have also been proven to be less clearly lateralized than verbal abilities in the overall model of hemispheric specialization (Nebes, 1974). According to Bryden (1980), observed hemispheric differences may at least to some extent be an artifact of the different attentional or problem solving strategies of the subjects. Females may be more variable in their strategies, using verbal strategies for some spatial tests but not for others (Ray and Newcombe, 1980). Thus females may appear either left or right hemisphere dominant or bilateral according to the nature of the "supposed" spatial tasks and the particular strategies utilized.

The preceding discussion of sex differences partially conveyed the importance of attentional and cognitive strategies in laterality research. It has been demonstrated that physically identical stimuli may show differential hemispheric processing according to the subject's attentional set. For instance Goodglass and Calderon (1977) found that sung digits on a dichotic listening task may be processed by the right hemisphere when subjects attend to tonal properties and the left hemisphere when subjects attend to verbal content. Parallel results have been obtained with tachistoscopic studies (Robershaw and Sheldon, 1976; Seamon and Gazzaniga, 1973).

Conjugate Lateral Eye Movements (CLEM)

Numerous authors have postulated that there are two fundamental and seemingly opposite modes of perception or cognition. These modes have been described as logical-analytical versus synthetic-gestalt (Levy-Agresti and Sperry, 1968), sequential versus simultaneous (Luria, 1973), secondary process versus primary process (Freud, 1911), rational versus metaphoric (Bruner, 1962), and realistic versus autistic (McKellar, 1957; Vinacke, 1974). According to Bogen (1969, 1975), these two modes of perception reflect differences in hemispheric processing. Right hemisphere processing is appositional, synthetic and holistic while left hemisphere processing is propositional, serial and analytic. It should be

noted that Bogen's approach, which he terms "hemisphericity", stresses individual differences in mode of perception and corresponding hemispheric dominance. This is in direct contrast to the previous approach which stressed hemispheric specialization for specific kinds of stimuli.

One particularly prominent measure of hemisphericity is conjugate lateral eye movements (CLEM). Day (1964, 1967a, 1967b) noted that individuals upon answering reflective questions tended to consistently avert their gaze to either the right or left. Right and left movers were found to differ on both psychological and physiological indices. Bakan (1969) was the first to suggest that these differences may be related to cerebral lateralization. Right eye movements may reflect left hemisphere activation while left eye movements may reflect right hemisphere activation. On this basis one might expect right movers to be proficient at skills associated with the left hemisphere and left movers to excel at right hemisphere skills.

Consistent with this notion, Weiten and Etaugh (1973) found that right movers were significantly better at a concept identification task while left movers were better, though not significantly, at printing the alphabet in an inverted form. As previously mentioned the left hemisphere is thought to be specialized for conceptual tasks (Landis, Assal and Perret, 1979). According to Weiten and Etaugh, the alphabet printing task requires right hemisphere processing as it is predominantly a perceptual-motor skill. A second reason why this task may

necessitate right hemisphere processing is its inverted format. In a related study, Garren and Gehlsen (1981) found a right hemisphere superiority for tracing an inverted mirror image. Tucker and Suib (1978), using four subscales of the Wechsler Adult Intelligence Scale (WAIS), also found support for differential task performance by right and left movers. Right movers demonstrated greater verbal scores while left movers demonstrated better spatial scores. Similarly right movers have been found to be faster readers than left movers (Bakan and Shotland, 1969; Ogle, 1972). In another study Crouch (1976) presented subjects with cartoon faces with verbal captions underneath. Subjects were asked to describe the mood of each face and were scored according to their reliance on the facial versus verbal information. Right movers tended to utilize the verbal cues more while left movers tended to use the facial cues. This latter finding is consistent with studies (Benton, 1980) showing face perception is mediated by the right hemisphere. The aforementioned studies elucidate the different processing modes of right versus left and to some extent offer support for a relationship between CLEM and cerebral lateralization. Task differences however, are highly inferential and may provide ambiguous support as it is often difficult to discern whether a task is clearly right or left hemisphere oriented.

Since this model's conception, right and left movers have been distinguished using a vast array of cognitive and

personality measures. A list of some of the characteristics found is as follows. Right movers have been found to be narrow categorizers (Huang and Byrne, 1978), show a preference for math and sciences (Bakan, 1979; Weiten and Etaugh, 1973), are more likely to be obsessive-compulsive (Smokler and Shevrin, 1979) and are superior on the Stroop test (Bakan and Shotland, 1969; Dewitt and Averill, 1976) and the math portion of the SAT (Bakan, 1969; Weiten and Etaugh, 1973). Left movers, on the other hand, have been found to be more oriented toward subjective, internal experiences (Day, 1964), broad categorizers (Huang and Byrne, 1978), more likely to be hysterical (Smokler and Shevrin, 1979), more responsive to persuasive messages (Sherrod, 1972), more hypnotically susceptible (Bakan, 1969; Gur and Gur, 1974), have more vivid and frequent daydreaming (Meskin and Singer, 1974) and recall more dreams (Van Nuys, 1980).

Methodological Considerations of CLEM

Reliability

Reliability for CLEM has consistently been shown to be high. An early investigation by Duke (1968) revealed that subjects exhibit eye movements in the same direction about 86 percent of the time. Subsequent investigations have reported reliabilities ranging from .61 to .93 (Bakan and Strayer, 1973; Crouch, 1976; Dewitt, 1977; Etaugh and Rose, 1973; Hoffman and Kagan, 1977; Libby, 1970).

Validity

The suggestion that CLEM is related to cerebral lateralization has received support from a number of areas. For example, electrical stimulation of the frontal eye fields in one hemisphere elicits eye movements in the contralateral direction (Penfield and Roberts, 1959). Similarly, a study by Melamed (1977) found evidence to suggest a link between increased cerebral blood flow in one hemisphere and corresponding eye movements to the contralateral side. In addition to this, during administration of the Wada test (injection of sodium amytal to one hemisphere) to patients being tested for lateralization of

language prior to neurosurgery, it has been observed that there is a decrease of eye movements in the direction contralateral to the inactivated hemisphere (Wada and Rasmussen, 1960).

More recently, Gur and Reivich (1980) compared 11 left moving versus 10 right moving, right handed males on cerebral blood flow averaged across three measures, 1) baseline, 2) during covert response to spatial stimuli and 3) during covert response to verbal stimuli. Left movers were found to have significantly more blood flow to the right hemisphere while right movers showed a trend in favour of the left hemisphere, though not significantly.

Another physiological source of support for the relationship between CLEM and the cerebral hemispheres is studies utilizing EEG. Bakan and Svorad (1969) demonstrated that left movers exhibit more alpha during a resting state than right movers. This corroborates an earlier investigation by Day (1967a) showing left movers tend to produce more high amplitude, low frequency EEG activity. A subsequent experiment by Strayer (1970) on CLEM and biofeedback is consistent with these findings. In view of the fact that alpha is often found to be more predominant in the right hemisphere (Liske, Hughes and Stowe, 1967), these studies provide an indirect link between left movers and right hemisphere activation.

Along similar lines Meyer (1977) compared left and right movers at both parietal and occipital sites during performance on a spatial (Block Design) and verbal task (Similarities) from

the WAIS. Left movers showed significantly greater right hemisphere activation at the parietal sites. Likewise, Shevrin, Smokler and Kooi (1980) found that left movers demonstrated more event related potentials in the occipital region of the right hemisphere in response to a checkerboard reversal stimulus. Right movers, on the other hand, showed a preference for left hemisphere activation. Another finding pertinent to this issue comes from an investigation by Warren and Haueter (1981). An analysis of a right/left hemisphere alpha ratio revealed an increase of left hemisphere activation following right eye movements and an increase in right hemisphere activation following left eye movements. Also notable is the fact that this effect was independent of the type of question used to elicit the eye movements.

An area which may lend credence to the notion of CLEM as a measure of hemisphericity is dichotic listening studies. In this instance, one might expect an interaction between hemisphericity and hemispheric specialization. Partial support for this contention was derived from an experiment by Neilsen and Sorensen (1976). They found that right movers displayed a more pronounced right ear advantage for verbal items. This implies that left movers, in relying more on a right hemisphere mode of processing, show less lateralization for stimuli specialized for the left hemisphere. In a somewhat related study, Lefevre, Starck, Lambert and Genesee (1977) found that on a dichotic listening task, subjects produced significantly more left and

right eye movements during presentation of nonverbal and verbal stimuli, respectively.

In light of substantial evidence from experiments utilizing EEG, cerebral blood flow and dichotic listening tasks, it appears safe to conclude that lateral eye movements, as proposed by Bakan (1969), are related to cerebral lateralization.

Question Type

An alternative approach to interpreting CLEM has been proposed by Kinsbourne (1972). He suggested that the type of question asked (i.e., spatial versus verbal) determines which hemisphere will be activated. This perspective deemphasizes individual differences and stresses the importance of hemispheric specialization. Ehrlichman and Weinberger (1978) in a review of the CLEM literature, cite 21 experiments which have tested for a question-type effect. Of these, 9 found a significant effect for question type, 11 found no differences and one found a significant effect in the opposite direction. Of the 9 positive studies, three of these had the experimenter sit behind the subject rather than in front and subject's eye movements were monitored by a video camera. As Gur, Gur and Harris (1975) have noted, the experimenter-behind condition may facilitate a question type effect. Furthermore, according to Ehrlichman and Weinberger (1978), this condition makes it extremely difficult to ensure that the subjects eyes are

initially centered at the onset of each question.

Since their review, of 14 known studies looking at the effects of question type, 6 have reported a significant effect (Dewitt, 1977; Jones, Chew, Allman, Marble, Mitchell and Combs, 1980; Katz and Salt, 1981; Ogorman and Siddle, 1981; Segalowitz and McNaughton, 1980; Warren and Haueter, 1981), 6 have reported no differences (Combs, Hoblick, Czarnecki and Kamler, 1977; Hoffman and Kagan, 1977; McCallum, 1981; Paradowski, Brucker, Zaretsky and Alba, 1978; Reynolds and Kaufman, 1980; Smokler and Shevrin, 1979), and 2 have found a significant effect in the opposite direction (Berg and Harris, 1980; Richardson, 1978). Moreover, another interesting, though puzzling finding with regard to these studies as well as those cited in Ehrlichman and Weinberger (1978), is that most of the studies which found no differences had much larger sample sizes. However, the reason for this discrepancy is not clearly understood at this time.

Perhaps the greatest problem inherent to the question type paradigm is its lack of a clear definition of verbal versus spatial questions. For instance, Bakan, Coupland, Glackman and Putnam (1975) have developed a set of questions which are neutral with respect to hemispheric specialization. However their list is composed of many questions which to the naive observer may appear to be either spatial or verbal. Thus many of the question type studies may have failed to show any effects because of a poor selection of supposedly verbal versus spatial

questions.

In conclusion, it would seem that the question type effect is at best a weak effect which may be most apparent in the experimenter-behind condition. Overall, the 35 studies pertaining to this issue have found only marginal support for a hemispheric specialization interpretation of the CLEM phenomena.

Creativity

The creative process is often mistakenly associated with originality alone. According to Vinacke (1974) creativity entails two types of thinking, autistic and realistic. Thinking which is self referent, fantasy oriented, unstructured and novel may be classified as autistic thinking. The autistic style is largely determined by intrinsic forces arising from emotional and motivational sources. This description is consistent with past studies which have found the creative personality to be emotionally sensitive, nonconforming, curious, spontaneous, impulsive, and reflective or introspective (Csikszentmihalyi and Getzels, 1973; Davis, 1975; Drevdall and Cattell, 1958).

Autistic processing, in the absence of any reality orientation, may manifest itself as dreaming, psychedelic drug experiences, mystical rapture, or some other altered state of consciousness.

The realistic mode, on the other hand, is best characterized by rational and logical reasoning. It is thinking which is intentional, directed, goal oriented and more

influenced by extrinsic forces. A predominance of this style of thinking may eventuate in rigid, repetitive and rule governed behavior. While in day to day life this style may prove most efficient, its utility becomes restrictive in situations requiring creative problem solving. One instance of this sort may be functional fixedness (Duncker, 1926). The habitual functions of an object, based on past experience, may interfere with a person's ability to utilize the object in new ways. That is, traditional or conventional modes of perception are applied across situations regardless of the task demands of a specific situation.

A similar conception of creativity has been postulated from a psychoanalytical perspective. Whereas Freud's (1920) earlier formulation stressed sublimation as the only dividing line between creativity and mental illness, Kris's (1952) more popular explanation of "regression in the service of the ego" stressed the flexible and integrative aspects of the creative personality. The autistic and realistic modes may be analagous to Freud's primary and secondary processing respectively. The creative person has the ability to revert to a primary process state, under the guidance of the ego, and tap the inner recesses of the unconscious. Once the person has viewed things in a looser and less restrictive manner they can then shift back to secondary processing and apply his or her insights in a reality-appropriate manner. As Wallas (1926) states, the creative process involves an illumination stage where a

temporary and partially controlled reduction of psychic function occurs. Subsequently, during the verification stage a more conscious, reality oriented form of thought synthesizes, criticizes and integrates the illumination material. Further support for the notion that creative types express greater mobility between these two modes of thought, has been found in numerous studies (Del Gaudio, 1976; Gamble and Kellner, 1968; Pine and Holt, 1960; Wild, 1965). Thus it would seem that creative processing involves not only the capacity to generate random or novel ideas but also to apply them appropriately to reality.

Another common misconception about creativity is its relationship with psychopathology. While this relationship was suspected as early as the classical period, it was not until the nineteenth century that any systematic observation occurred (Andreasen, 1978). One method of establishing this link has been the compilation of historical figures thought to be creative, who have demonstrated or been rumoured to have some form of mental illness (e.g., Lombroso, 1981; Lange-Eichbaum, 1932; Nisbet, 1900). While on the surface this may seem to be an efficacious method it also entails several problems. For instance, the authors are choosing only those creative people thought to have disturbances and ignoring the healthier subjects. Other possible confounding factors are the dependency on historical accuracy, omission of unrecognized creative subjects and a disregard for the effects of fame and prosperity.

At best it would seem this method is largely speculative.

Another popular source of evidence comes from studies on creativity in relation to schizophrenia. Keefe and Magaro (1980) compared nonparanoid schizophrenics, paranoid schizophrenics, nonpsychotic psychiatric controls and normal subjects on two creativity tests, the Alternate Uses Test (Christensen, Guilford, Merrifield and Wilson, 1960) and the Baron-Welsh Figure Preference Test (Baron and Welsh, 1952). Overall, the nonparanoid schizophrenics obtained higher creativity scores than the other three groups. Similarly, MacKinnon (1960) found a group of creative architects to be high on the psychopathic deviate and schizophrenic subscales of the Minnesota Multiphasic Personality Inventory (MMPI).

An alternative explanation for these results may be that most creativity tests only focus on the more autistic elements of the creative process. A survey of the more frequently used creativity tests indicates an emphasis on original or unusual responses rather than reality-appropriate task demands. Indeed, Hasenpus and Magaro (1976) have suggested that tests designed to measure creativity are very similar to those designed to test schizophrenia performance deficits. Also, in a similar vein, MacKinnon suggested that the results from his study may only reflect less inhibition, freer impulses and unusualness of thought processes.

Claridge (1972) proposes that although creative individuals and psychotics may have some personality characteristics in

common, they differ in intellectual controls. Past research (Barron, 1961; Cross, Cattell and Butcher, 1967; Heinze, 1962; MacKinnon, 1961) indicates that creative personalities tend to possess high ego strength. In a fairly recent review of the literature, Dellas and Gair (1970, pg 68) state

although the creative appears to be subject to considerable psychic turbulence, empirical evidence has shown no basis for a significant and demonstrated relationship between psychopathology and creativity. Rather, it has demonstrated that the creative individual is possessed of superior ego strength and a positive constructive way of reacting to problems.

Kubie (1977) goes so far as to suggest that psychopathology and creativity are antithetical. While a preponderance of conscious activity may prove too restrictive to foster creativity, a prevalence of unconscious activity may result in a neurotic distortion of the creative process.

Further evidence for a link between creativity and schizophrenia may arise from research on attentional scanning strategies. Dykes and McGhie (1976) found that both creative and acute schizophrenic (nonparanoid) groups demonstrated more overinclusive strategies than low creative subjects on two object sorting tasks and a dichotic shadowing task. This suggests that both groups attend to a wider range of stimuli. The use of these divergent strategies (broad attention) may prove most profitable in situations requiring original thinking. However, they qualified these findings by arguing that creative subjects demonstrated the ability to fluctuate between convergent (narrow attention) and divergent strategies according

to specific task demands. Schizophrenic subjects, on the other hand, were consistently overinclusive and had impaired performance on tasks requiring convergent strategies. Thus it would seem that the major difference is that creative subjects exercise control over their attention in accordance with the particular task or stage of a task they are involved in. Several studies (Dewing and Battye, 1971; Mendelsohn and Griswold, 1964, 1966; Ward, 1969) using only "normal" subjects have found that the more creative subjects have a wider deployment of attention. For example, Mendelsohn and Griswold (1964) found that creative subjects tended to utilize incidental stimuli during anagram solving.

In the past, creativity has been assessed in terms of three different criteria, the person, the process and the product (Jackson and Messick, 1965). Perhaps most dubious of the three approaches are studies utilizing the creative product. These studies may include expert or nonexpert opinion, number of citations, fame, purchase price, etc. as criterion. Numerous problems emerge from this technique. The use of commercial success or fame may be an unsatisfactory index of quality. For example, although many Hollywood movies are tremendous box office hits their value as art is debatable. With regard to the credibility of judges, there is evidence (Golann, 1963; Knapp and Wulff, 1963) to suggest that experts differ from nonexperts in their judgement of art. Furthermore, the ability of judges to discriminate between creativity and other factors such as

intelligence is poor (Hocevar, 1981). For example, a teacher's judgement of a child's creative achievements may be confounded by his/her overall impression of the child. Also some personality characteristics which may moderate individual preferences are degree of conservativeness (Wilson, Ausman and Mathews, 1973), extroversion, naivety and complexity (Knapp, 1964). These personal preferences may introduce prejudice in situations requiring objective judgements. The art historian, E. H. Gombrich (1951), states that in the final analysis, the value of art comes down to the eyes of the beholder.

Although the preceding criticisms apply mainly to art, similar problems exist in the judgement of scientific achievements. One possible criterion for assessing the creative product is that it have value, importance and that it realize the creator's intention (Vinacke, 1974). However such a conception would exclude a myriad of past discoveries. Throughout history many inventions have been serendipitous, of questionable significance or used for purposes other than the creators intention. For instance, John Gorrie invented a primitive version of the air conditioner to treat malaria on an erroneous assumption that high temperature caused bad air (mal-aria) (Italian) which in turn caused malaria (Burke, 1981).

Another approach used to assess creativity is process. This refers to tests requiring the subject to perform a task. Some common tests which fall within this domain are the Remote Associates Test (Mednick and Mednick, 1967), divergent thinking

tests (Guilford, 1958) and Torrance Tests of Creative Thinking (Torrance, 1974). The third approach consists of studies focusing on the personality and motivational interests of the subjects. These tests are usually questionnaires such as the How Do You Think Test (HDYT) (Davis, 1975) and What Kind of Person Are You (Torrance and Khatena, 1970). A common problem with these last two approaches is their overemphasis on the autistic component of creativity. They often contain questions devoid of any reality appropriateness such as "Do you believe in flying saucers?". As mentioned earlier, these tests may lack the ability to discriminate between creative versus schizophrenic subjects.

These three methods lack convergent validity. However the tests within each method do tend to relate to each other (Hocevar, 1981). There is also a tendency for these studies to focus on artistic rather than scientific aspects of creativity. This may partially account for their overreliance on autistic elements as it is much more difficult to identify realistic components of art than of science. Overall, the area of creativity seems plagued by problems in definition and measurement. As such, one must interpret the findings from such studies with a degree of caution.

Cerebral Lateralization and Creativity

In addition to the characteristics previously noted, the right hemisphere has been associated with the ability to draw (Bogen, 1969; Edwards, 1979), imagery (Jaynes, 1976; Richardson, 1977), dreams (Bakan, 1975, 1976), and processing of incidental stimuli (Luria and Simernitskaya, 1977). Likewise creativity has been linked to imagery (Gowan, 1978; Khatena, 1978) and greater utilization of incidental cues (Mendelsohn and Griswold, 1964). Also dreams and hypnosis are frequently cited as possible sources of creative inspiration (Bowers, 1979; Bowers and Bowers, 1972; Gur and Reyher, 1976; Koestler, 1964). A popular illustration of this is Friedrich August von Kekule's apparent vision in a dream of a serpent swallowing it's own tail. This supposedly led to his formulation of the structural formula of the Benzene Ring.

In light of the evidence suggesting similarities between right hemispheric processing and creativity, two theories have evolved. The first approach argues that creativity is a right hemisphere process (Harnad, 1972). Such an approach is analogous to the view that creativity arises from primary or autistic processing. As mentioned previously, this perspective ignores the reality appropriateness often found in the creative product and tends to focus more on artistic than scientific type creativity.

Bogen and Bogen (1969) presented a second approach which stresses both the autistic and realistic components of the creative act. They proposed that bilateral individuals are the most creative as they benefit from the specialized abilities of both hemispheres. According to these authors the differential processing of the hemispheres is complementary rather than antagonistic. Thus the right hemisphere may predominate during the illumination or loose construing stage of the creative process and the left hemisphere may be more active during the verification or tight construing stage. Indeed, perhaps Einstein best illustrates this bimodal process in a description of his own thinking.

The physical entities which seem to serve as elements in thought are certain signs and more or less clear images...[in] combinatory play...The above-mentioned elements are, in my case, of visual and some of muscular type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the above-mentioned associative play is sufficiently established and can be reproduced at will... (cited in Galin, 1976, pg.49).

The two most prevalent laterality indices used to assess the relationship between creativity and cerebral lateralization are handedness and CLEM. On the basis that left handedness has been associated with pathology (Bakan, 1971; Bakan, Dibb and Reed, 1973) and as mentioned previously, some authors have suggested a link between creativity and pathology, one might expect left handers to be more creative. This is also consistent with reports of a high incidence of left handedness among famous artists (Hardyck and Petrinovich, 1977). Such a conclusion

implies that creativity may be associated with less lateralization since left handers tend to be less lateralized.

Of four studies testing for differences in creativity between left and right handers, two found no differences (Dusewicz, 1968; Katz, 1980) and two found significant differences with left handers being more creative (Newland, 1981; Stewart and Clayson, 1980). Since all of these studies used similar measures of creativity and there were no apparant differences in subject sample, these results must be viewed as highly inconclusive.

In a similar vein, research on lateral eye movements has also proven ambiguous, though this may be at least partially attributable to varied methodologies. Harnad (1972) in a comparison of 24 graduate students and 10 professors from a math department, found that left movers reported using more imagery and participating in more artistic activities than right movers. In a separate analysis involving 9 of these professors, the left movers were rated as more creative by their students. In addition, a second experiment comparing 20 college educated subjects on the Remote Associates Test (RAT), found that left movers were significantly more creative. While these results are interesting, they are based on very small sample sizes. However, a subsequent investigation by Jean (1974), also using the RAT, confirmed these findings. One deficiency of these studies is their lack of consideration of bidirectional subjects and as such their failure to test for Bogen and Bogen's bilateral

theory. According to Smith (1972), who subscribes to the bilateral theory of creativity, bidirectionals should be the most creative as they appear to utilize both hemispheres equally. As predicted, bidirectional subjects obtained the highest scores on the RAT and Torrance's figural creativity tests. However, while left movers tended to score higher than right movers on the figural tests, in contrast to the aforementioned studies, they tended to score lower on the RAT. Furthermore, no differences were found on Torrance's verbal tests.

It should also be noted, that more recently, three attempts to validate the findings of these earlier studies have reported no differences (Doerr, 1980; Hammerman, 1980; Wolf-Dorlester, 1976). Unfortunately, two of these studies (Hammerman, 1980; Wolf-Dorlester, 1976) used only or primarily females and one (Wolf-Dorlester, 1976) failed to include bidirectionals and specify the criteria used to determine unidirectional movers.

Hines and Martindale (1974) conducted an interesting though somewhat questionable variation on the CLEM test. In a series of three experiments, subjects were required to wear goggles which displaced their vision to either the peripheral right or left visual fields. As predicted, male subjects whose eye movements were forced to the left visual field, performed more creatively on both the RAT and Alternate Uses Test. Contrary to prediction however, females whose eye movements were forced to the right performed more creatively than females whose eye movements were

forced to the left, though these differences were not significant.

A third approach to the study of creativity and laterality has utilized Torrance, Reynolds and Riegel's (1976) Your Style of Learning and Thinking (SOLAT), a 36 item questionnaire purported to measure hemisphericity. Torrance and Mourad (1979) found that subjects classified as right hemisphere dominant or integrated (both hemispheres) were significantly more creative than left hemisphere dominant subjects on two creativity questionnaires, Something About Myself (SAM) (Khatena and Torrance, 1976) and What Kind of Person Are You (WKOPAY). Similar results were reported in an experiment by Sterling and Taylor (1980). Right dominant subjects were significantly more creative than left and mixed dominant (no clear preferences) subjects on SAM and WKOPAY. The integrated subjects however, were significantly more creative than left and mixed dominant subjects on SAM but similar on WKOPAY.

Other creativity measures utilized in the Torrance and Mourad study did not yield such positive findings. Although there was a trend toward greater creativity on the RAT for integrated subjects, these differences were not significant. Furthermore, while right dominant subjects performed more creatively on several subtests of the Torrance Tests of Creative Thinking, no differences were found on several others.

While these studies appear to offer at least partial support for both the right hemisphere and bilateral theories of

creativity, there are several problems inherent in this research. First of all, it is very questionable whether SOLAT is truly a measure of hemisphericity as few validity studies have been carried out (Torrance, Reynolds, Riegel and Ball, 1977; Torrance and Reynolds, 1978). Secondly, the results relating the SOLAT to SAM and WKOPAY may be misleading as they are all questionnaires. There is possibly a substantial overlap in the types of questions asked in the hemisphericity and creativity tests. Also Torrance and Mourad's experiment used students enrolled in a graduate course in creativity. Therefore these subjects were far from naive and this could easily have altered their performance on the creativity questionnaires. It is no wonder that Torrance and Mourad report creativity scores two standard deviations above the norm.

In summary, the research on laterality and creativity has yielded equivocal results. While there appears to be a trend in the data supporting both right and bilateral theories of creativity, there are several instances where these findings have not been confirmed. Furthermore, few studies have been conducted which have the capability of testing both hypotheses. As such, there is little evidence to distinguish between the two theories.

Creativity and Field Dependence

Field dependence-independence is a cognitive style arising out of earlier work by Werner (1948) on microgenesis. According to Werner, individuals vary in the extent to which they differentiate and organize their environments. Microgenetically primitive individuals are characterized by diffuse, global perception while microgenetically developed individuals tend to perceive and cognize in an articulated and analytic fashion. According to Witkin (1965), field dependence-independence is a bipolar continuum representing undifferentiated versus differentiated styles of thinking and perceiving respectively. A vast array of research over the last twenty years has found field dependent people more interpersonally oriented (Witkin and Goodenough, 1977) and more open in expressions of feelings and thoughts (Greene, 1976; Sousa-Poza and Rohrberg, 1976). Conversely, field independent individuals have been described as less distractable (Houston, 1969) and as having a more defined body concept (Witkin, Dyk, Faterston, Goodenough, and Karp, 1962).

More pertinent to this issue however, are the personality and behavioral traits which are often cited as evidence for a relationship between creativity and field independence. Field independent subjects have been described as individualistic, sensation seekers, nonconforming and guided by their own set of standards (Spotts and Mackler, 1967; Zuckerman, Kolin, Price and

Zoob, 1964). They are less functionally fixed and better at breaking a set in problem solving tasks (Busse, 1968; Dinuis, 1975; Harris, cited in Witkin, Moore, Goodenough and Cox, 1977). Conversely, field dependent subjects are unable to impose structure on an ambiguous task and do not respond effectively to new and unusual situations (Spotts and Mackler, 1967). These findings are consistent with studies (Barron, 1963; Davis, 1975) showing the creative personality to be autonomous and independent, nonconforming, and able to create order where none exists. Also, as previously stated, the creative person is able to overcome an inappropriate set in problem solving tasks.

Although this evidence seems to establish a link between field independence and creativity an examination of the more direct studies offers equivocal support. Numerous studies (Duffy, 1978; Gundlach and Gesell, 1979; Kaufman, 1975; Noppe and Gallagher, 1977) have found a significant relationship between field independence and creativity. However, while no inverse relationships have been reported, several studies (Bloomberg, 1971; McWhinnie, 1967, 1969, 1970) have failed to find a significant relationship. This may be partially due to the fact that most of the non-confirming studies used children as subjects. There is evidence (Witkin, Lewis, Hertzman, Machover, Meissner and Wapner, 1954; Haywood, Teeple, Givens and Patterson, 1977) to suggest that field dependence is much more prevalent among children and therefore this may be a confounding factor.

Another problem is that most of the studies in this area have only used male subjects. Those using female subjects have often found little relationship (Bieri, Bradburn and Galinsky, 1958; Hyde, Geiringer and Yen, 1975). This is consistent with Vernon's (1972) observation that correlations between field independence and other variables are often lower for women. The finding that more women are field dependent (Witkin et al, 1962; Harris, 1978) may account for this. Women tend to perform less well on spatial tasks (Waber, 1977; Harris, 1978) and spatial ability has been found to be a confounding factor in many field independence tests (Sherman, 1974). Thus women may be classified as field dependent more often and for different reasons than men.

Mackinnon (1962) found creative architects field independent and creative writers field dependent. To add to this confusion, many authors in compiling shared personality and behavioral traits of creative and field independent subjects have ignored the shared traits of creative and field dependent subjects. For example, field dependent subjects have been found to be impulsive, less controlled and better at incidental memory (Messick and Damarin, 1964; Spotts and Mackler, 1967), all traits associated with creative subjects (Davis, 1975; Mendelsohn and Griswold, 1963). Furthermore, Berent (1974) found that field dependent subjects have less legible, messier writing which is not well oriented on the page. Similarly, experiments by Charlton (1978) and Fischer (1971) found creative subjects

significantly more variable in their writing. Their orientation on the page often changed and the writing was less neat than that of less creative subjects.

In an attempt to resolve these apparent contradictions Bloomberg (1971) suggested that creative subjects have the ability to be either field dependent or independent. Witkin (1965) had earlier noted that some field independent subjects seem to shift between field dependence and independence according to their situation. More recently Witkin and Goodenough (1977) have acknowledged that there may be a third pole to field dependence-independence with some subjects capable of benefiting from both modes. In normal testing conditions, task instructions require subjects to be field independent. The tests are designed to measure field independence with field dependence being measured by default. Rudin (1968) found that field independent subjects were generally better than field dependent subjects at producing field dependent responses when instructed to do so. It may be that at least some field independent subjects are capable of being field dependent while none of the field dependent subjects display this plasticity. According to Bloomberg (1971), all creative subjects may be field independent; however, not all field independent subjects are creative. Thus creative subjects may represent a subgroup of field independent subjects capable of being field dependent if instructed to do so.

Creativity and Randomness

Throughout history, the notion of "unity with variety" has been a predominant theme in art (Osborne, 1968). According to Information Theory (Beardsley, 1968), the concept of entropy may be applied to the notion of order and disorder in the art form. That is, as a structure moves increasingly toward maximum entropy one attains maximum information content as no element is more predictable than another. The higher the degree of uncertainty within a structure the greater the information to be obtained from it. Therefore, in terms of art, the presentation of dissonant elements or novel structure yields high information content for the spectator.

However to present the spectator with a random, orderless structure alone would be directionless, inappropriate to the ordered nature of reality and may induce shock and anxiety. According to Kreidler and Kreidler (1972), "aesthetic distance" allows the spectator to view the dissonance within an art work from a safe perspective with the shock impact buffered.

In works of art the stimulating aspect of novelty is usually brought to the fore while the prominence of the shocking aspect is greatly reduced. This is accomplished by intermingling novel stimuli with familiar ones, by resolving unexpected developments, by embedding surprising events within logical sequences, etc. (Kreidler and Kreidler, 1972, pg. 332).

According to Beardsley (1968, pg. 218)

order enters art in the small, in the textural relations among the elements; and it enters in the structural relations among the larger segments. But freedom, diversity, and uniqueness mark the special emergent

quality of the whole, what stamps the work with individuality.

Arnheim (1971), on the other hand, suggests that order occurs on a macroscopic level tending towards a state of equilibrium while randomness occurs in microstates.

All of these ideas, while purely theoretical, imply an ability on the part of the creator to instill entropic relations in art. Thus one may infer from this that creative subjects have the ability to generate random responses. Such an ability may be rare since most of the research to date suggests that people in general are poor randomizers (Wagenaar, 1972).

The greatest problem in empirical studies of randomness is definition and measurement. According to Gardner (1968), there is no completely objective mathematical means for assessing randomness. It is far easier to demonstrate that a series is nonrandom than random (Wagenaar, 1972). To demonstrate nonrandomness you only have to show one type of systematic trend in the series; however, to show randomness you have to prove that no trend of any kind exists. Randomization experiments typically require the subject to generate as random a sequence as possible. The number of alternatives (e.g., heads and tails=2), the length of the series, and the method or order of analysis vary from study to study. For instance, one study may use a frequency analysis of alternatives while another may use a frequency analysis of pairs. While the former method looks at the number of, for example, heads versus tails, the latter looks at the number of runs of each alternative. The type of analysis

which can be carried out is partially determined by the length of the series, and, as such the experimental conditions change as well. Thus in comparing the results of randomization experiments, the type of analysis also has to be taken into consideration. To avoid such confusion, only results which seem relatively stable across conditions and method of analysis will be reported in the present discussion.

Several explanations of the results of randomization experiments have been proposed. However, a complete review is beyond the scope of this paper. Wagenaar (1972) states that one possible approach is what he terms Negative Attention Theory. This model predicts that when attention is less focused the ability to generate a random series is enhanced. A major source of support for this theory comes from studies requiring subjects to perform simultaneously a second task as a distractor. The second task taxes the subject's limited capacity to process information and parallel processing is necessary for the dual task performance. That is, subjects are required to divide their attention between the two tasks rather than focus on one. Numerous studies (e.g., Truijens, Trumbo and Wagenaar, 1976; Wagenaar, 1972) have found evidence to corroborate the idea that secondary tasks increase the ability to randomize. Also, in situations which tax our limited attentional capacity such as dual task performance (Kahneman, 1973) or rapid presentation of memory items (Hockey, 1973) subjects often show a facilitative effect from taking a passive attitude.

Graham and Evans (1977) have suggested that the process underlying increased ability to generate random sequences is deautomatization. According to Deikman (1966), deautomatization is regression to a more primitive mode of perception involving less reality orientation, parallel processing and a passive attitude. Deautomatization typically occurs in situations such as meditation, schizophrenia, hallucinogenic drug experiences and other altered states of consciousness (Deikman, 1971) and is in many ways akin to Freud's (1911) concept of primary processing or Vinacke's (1974) description of autistic thinking.

If in fact the ability to generate random sequences is enhanced by autistic processing and a wider deployment of attention, then one might expect creative subjects (as well as nonparanoid schizophrenics) to be superior to less creative subjects at this. This would be consistent with the evidence mentioned earlier suggesting creatives exhibit wider attention deployment and conditional autistic thinking as well as flattened response hierarchies (Mednick, 1962).

Creativity, Sensation Seeking and Boredom Susceptibility

Numerous authors (Barron, 1963; Eisenman and Robinson, 1967; Raychudhuri, 1966) have reported a preference for complexity and novelty among creative subjects. Similarly, a review of the literature indicates a positive relationship between sensation seeking and creativity. Of 11 studies

utilizing Zuckerman's (1979) sensation seeking questionnaire, seven found a significant linear relationship (Acker and McReynolds, 1967; Bone, Cowling and Belcher, 1974; Davis, Peterson and Farley, 1973; Farley, 1971; Kish, 1970; Lamb, 1966; Tepper, 1978), two found partial support for a linear relationship (Bone and Cowling, 1974; Zuckerman, 1979), one found a curvilinear relationship (Farley, 1976) and one found no relationship (Zuckerman, 1979). Also of particular relevance is that these studies used a wide array of creativity tests indicating that these findings are not specific to a particular test. The one exception to this however may be the RAT. Of the two studies using the RAT, Bone and Cowling (1974) only found a significant relationship for females and Zuckerman (1979) found no relationship. These discrepant results may be at least partially explainable in terms of recent criticisms of the RAT as a valid measure of creativity. The RAT allows for only one possible solution at the expense of viable alternatives, imposes a time limit and has been found to be related to verbal intelligence (Cropley, 1966).

Initially the results of the preceding research may seem somewhat paradoxical in light of the research linking creativity to moderately high tonic arousal (Fischer, 1971; Florek, 1973; Martindale, 1977; Wyspianski, Barry, and Dayhaw, 1963). However this may be due to the misconception that high arousal necessitates a reduction in sensation seeking (e.g., Farley, 1976). Such a conception ignores the possible influence of a

subject's cognitive interpretation of the stimuli (Schachter and Singer, 1962; Storms and Nisbett, 1970). According to Berlyne (1960), high arousal may result from either over or understimulation. Thus subjects in seeking an optimal level of arousal, may attempt to reduce or augment stimulation according to the cause for their high arousal. Situations of a meaningless or tedious nature may result in understimulation and accompanying feelings of boredom. Perhaps more creative subjects, bored by their often conventional or perceived-to-be-conventional environments, seek stimulation as a means of reducing their arousal.

There exist a small number of studies on boredom and creativity and these are at best highly inferential and only indirectly address the question. Schubert (1977, 1979) has been the most vocal with respect to these variables. He argues, contrary to my aforementioned argument, that creativity and boredom are in fact antagonistic. This conclusion is reached primarily on the basis of three avenues of research. First, he suggests that individuals who are highly susceptible to boredom tend to score low on creativity tests. Unfortunately, he offers no references to substantiate this claim. Secondly, he suggests that thrill seekers tend to be less creative and cannot tolerate ambiguity (a trait associated with creativity). However, as already seen, the literature on sensation seeking and creativity demonstrates just the opposite. The research on tolerance for ambiguity and sensation seeking would also tend to suggest the

opposite although the number of studies are few and therefore inconclusive (Zuckerman, 1979). Last of all, Schubert states that most situations which cause boredom decrease creativity. This too, is a questionable assertion. There are a number of studies (Maltzman, Simon, Raskin and Licht, 1960; Morin and Clark, 1973; Schubert, 1977) that have found an increase of original responses in repetitive situations. Also, only limited inferences can be drawn from this approach as the restrictive parameters of a repetitive task and its limited scope may obscure the findings. For instance, a highly repetitive situation may elicit reactions of boredom from a much larger sample of the population than just boredom prone subjects. Daub (1968) in a study of actuaries, found that more creative subjects showed performance deficits and were more bored with their work. Therefore, contrary to Schubert, it seems more likely that creative subjects are more susceptible to boredom.

Of equal importance to the tonic arousal research are studies relating phasic arousal to stages of creative problem solving, especially with regard to attention deployment. Bowers and Keeling (1971) demonstrated greater cardiac variability among creative subjects during performance on an ink blot task. They maintain that this variability reflects more shifts by the creative subjects from realistic to imaginal modes of thinking. Similarly, Florek (1973) found greater variability in the heart rate of creative painters during an inspirational period than while resting or actually painting. Furthermore, Martindale

(1977) found that highly creative types have a moderately high base line level of arousal. During performance of intellectual tasks the high arousal is maintained, however during performance of creative tasks low levels of arousal are indicated. Non-creative types on the other hand, tend to have lower arousal base lines and slightly increased arousal during both intellectual and creative task performance.

According to Fischer (1971), very high or low levels of arousal result in expansive or broad attention deployment while moderate arousal leads to focused and narrow attention. This may imply that reduced arousal and concomitant expansion of attention facilitates creative processing while relatively focused attention is more conducive to intellectual performance. This is consistent with the studies demonstrating greater attention deployment in creatives (Dewing and Battye, 1971; Mendelsohn and Griswold, 1964). According to Mednick (1962), creative subjects exhibit flat response hierarchies. That is, responses are more random as a single stimulus elicits many potential responses, all with about equal strength. It may be this flatness of response hierarchies that explains the remoteness of associations in creative thought. Various studies (Osgood, 1960; Martindale and Greenough, 1973; Martindale and Armstrong, 1974) indicate a relationship between arousal and flattening of response hierarchies. Very high or low levels of arousal were found to flatten response hierarchies.

While the results of the arousal studies are promising, they warrant a note of caution. To date there is considerable dispute in the area as to the value of EEG as an index of arousal (Frost, Burish and Holmes, 1978; Orne and Paskewitz, 1974). As well, there is considerable evidence (Berlyne, 1967; Zuckerman, 1979) to suggest a dissociation between cortical and autonomic measures of arousal in many situations, thus obscuring any clear physiological definition of arousal.

Creativity and Cognitive Complexity

Kelly, in 1955, proposed a cognitive approach to personality theory. He argued that each person is his own scientist in that we all have our own personal set of constructs from which we organize, interpret and predict the world around us. In a conception roughly analogous to "regression in the service of the ego", he refers to a creativity cycle which initially involves a loosening of constructs and then their subsequent tightening. Loose constructs lead to varying predictions while tight constructs lead to unvarying predictions. Thus the creative person generates novel ideas through loose construing and reapplies them in a more directed and reality oriented manner through tight construing. Grinder and Bandler (1976) state that one must differentiate a cognitive map which yields choice, flexibility and self awareness in order to live a creative and adaptive existence. According to Kelly

(1966) (cited in Bannister and Mair, 1968, pg.6 and 7)

Man can only come to know the world by means of the constructions he places upon it and he will be bound by events to the extent that his ingenuity limits his possibilities for reconstruing these events...Our ingenuity in devising alternative constructions is limited by our feeble wits and our timid reliance upon what is familiar. So we usually do things the way we have done them before or the way others appear to do them. Moreover, novel ideas, when openly expressed, can be disruptive to ourselves and disturbing to others. We therefore often avoid them, disguise them, keep them bottled up in our minds where they cannot develop in the social context, or disavow them in what we believe to be loyalty to the common interest, and often against our better judgement, we accept the dictates of authority instead, thinking thus to escape any personal responsibility for what happens.

Kelly's observations have been supported in numerous empirical studies indicating that creative types make the familiar strange (Gordon, 1961), are autonomous and independent (Barron, 1963; Roe, 1952), unconventional and nonconforming (Csikszentmihalyi and Getzels, 1973; Davis, 1975), self reflective (Davis, 1975; Drevdahl and Cattell, 1958) and open to experience (Dellas and Gair, 1970).

Rothenberg (1971), states that the most prominent feature of the creative process is Janusian Thinking. Creative processing involves the "capacity to conceive and utilize two or more opposite or contradictory ideas, concepts or images simultaneously." (pg. 197). The creative person can tolerate bipolarity, tentativeness, uncertainty and ambiguity, as well as integrate opposites (Maslow, 1958). According to Adams-Webber (1970, pg. 39), "new structure evolves within a personal construct system to accommodate elements which are ambiguous

within the context of existing structure". Through progressive differentiation and reintegration of structure, a person is able to accommodate novelty and ambiguity.

Crockett (1965) refers to this degree of differentiation and hierarchic integration as degree of cognitive complexity. People who have many concepts for dealing with others may be better at integrating conflicting information about another person (Cook, 1971). It has also been found that cognitively complex persons tend to be more neutral in their use of constructs in that they tend to stay away from bipolar judgements more than cognitively simple persons (Adams-Weber, 1978). Along these same lines, past studies seem to indicate that highly creative persons are less judgemental than low creative persons and tend to see things in relatively undefined ways rather than in black and white. MacKinnon (1962) found that creative types tend to be perceivers rather than judges, as measured by the Myers-Briggs Type Indicator (Myers, 1958), a measure of Jungian Typological Functions.

It may be inferred from the information available, that creative types may in fact have cognitively complex construct systems. As such, through progressive differentiation and hierarchic organization a creative person may, when confronted with an ambiguous situation, create or utilize permeable subordinate constructs to resolve the conflict. On the other hand, the less creative person with a cognitively simple construct system may tend to be less flexible and choose either

one or the other of the apparently contradictory poles. The cognitively simple person has a stereotyped view of people (Bannister and Fransella, 1971), shows conformity in problem solving (Perry, 1970) and makes black and white judgements (Adams, Harvey and Heslin, 1966). His or her behavior is conventional and noncreative in problem solving situations and shows a limited ability to change sets (Harvey, 1966).

Empirical studies on the relation between cognitive complexity and creativity are sparse. Tuckman (1966) using both the Interpersonal Topical Inventory and Sentence Completion Test (SC) (Schroder and Streufert, 1962) as measures of complexity, found a significant relation between degree of complexity and degree of creativity as measured by three creative process tasks (Gestalt Transformations, Match Problems 11 and Consequences) (Berger, Guilford and Christensen, 1957); Christensen, Merrifield and Guilford, 1958). However, a measure of creativity motivation, the Creativity Motivation Questionnaire (CMQ) (Golann, 1962), was found to relate to only the SC measure of complexity. In a subsequent study, using only males, Karlins (1967) found no relation between the Remote Associates Test and the Paragraph Completion Test, a measure of cognitive complexity (Shroder and Streufert, 1962). This replicates the findings of a previous study by Schroeder, Harvey, Hunt and Koslin (1965) using the same measures of complexity and creativity. Contrary to this however, Karlins, Coffman, Lamm and Schroder (1967) found evidence to suggest that

cognitively complex subjects are more active and request more information about a novel environment when attempting to solve complex problems. Such a conception may also be appropriate for creative subjects who have been found to utilize a wider array of stimuli in problem solving tasks (e.g., Mendelsohn and Griswold, 1962). Most recently, Quinn (1981) found that a group of writers rated highly creative by their peers were more cognitively complex, as measured by a Kelly Grid, than a control group. No differences were found though, between two similarly selected groups in the audio visual field.

Thus, it seems that while the theoretical literature implies a link between creativity and cognitive complexity, the results from the empirical studies are somewhat equivocal. The paucity of studies and their use of so many different measures of creativity and complexity contribute to the obfuscation. Also, there is sufficient evidence (Goldstein and Blackman, 1978) to suggest a lack of convergent validity between measures of cognitive complexity based on Kelly's (1955) model and measures based on Harvey, Hunt and Schroeder's (1961) model.

Creativity and Physiognomic Perception

The tendency to perceive inanimate objects and designs as expressive of moods or subjective states and as if they possess human or lifelike qualities has been described by Werner (1948) as physiognomic perception. According to Werner, this style of

perceiving, which is akin to anthropomorphism or personification, is most predominant in children, primitive societies, schizophrenics and individuals under the influence of intoxicants such as hashish or mescalen. Indeed, it would seem that this mode of perception is most common under conditions thought to reflect primary processing or deautomatization.

Werner's was the first intimation of a link between creativity and physiognomic perception based on phenomenological accounts of artists. In accordance with the discussion above on primary processing, Stein (1975) suggested that physiognomic perception is facilitated during regression in the service of the ego. The first empirical investigation of this relationship (Walker, 1955) attempted to compare a small sample of mathematicians and chemists on the Physiognomic Cue Test (PCT) (Stein, 1975), a measure of physiognomic perception. As predicted, the creative group scored significantly higher on the PCT. A major drawback of this study however, was its criterion for creativity. Subjects from a larger university were deemed more creative than those from a smaller university. This was the only creativity measure utilized.

A larger and more methodologically sound study was later conducted by Stein (1975). Sixty seven Ph.D. chemists were rated by colleagues on creativeness. The creative group was found to score significantly higher than the less creative group on both a total PCT score and a subscale (Factor B) thought to measure nonaffective physiognomic perception. There was also a trend for

these subjects to score higher on another subscale (Factor A) thought to measure physiognomic perception related to feeling or emotions.

Mitchell (1974), using a group of male student artists and accountants, found partial support for a relationship between creativity and the PCT. Creativity was assessed in terms of originality of Rorschach responses. Although the overall PCT scores didn't correlate with creativity for either student group there was a significant and positive relationship between factor A (physiognomic-feeling) and creativity for the accountants. In contrast, there was a significant relationship between factor B (physiognomic-thing) and creativity for the artists. The inverse nature of the results of these groups may be more apparent than real. Correlations between creativity and the total and factor A subscale of the PCT may have been suppressed in the student art group because of restriction of range. That is correlations between two variables may be suppressed if the subjects all have extreme scores in a consistent direction on one of the variables. In this instance, the art students tended to have higher scores on both of these scales. That art students tend to score higher on the PCT than other student groups has also been demonstrated elsewhere (Rosett, Robbins and Watson, 1967).

Finally, a study by Charlton (1978) corroborates the findings of Stein. Thirty-Five undergraduates of both sexes were administered the How Do You Think Test, a creativity questionnaire. A significant and positive correlation was

obtained between creativity and both the total PCT score and factor A. Also, though nonsignificant, there was a trend in the same direction for factor B. In conclusion, there appears to be sufficient evidence to indicate a relationship between physiognomic perception and creativity.

Cerebral Lateralization and Field Dependence

More recently many investigators have attempted to establish a relationship between field dependence and laterality. A variety of alternative theories have been posited. According to Witkin, Goodenough, and Oltman (1979) greater physiological differentiation should result in greater psychological differentiation. That is, subjects who are more lateralized should be more field independent. Furthermore they restrict their definition of greater lateralization to subjects who demonstrate a marked specialization of the left hemisphere for verbal processing and a specialization of the right hemisphere for gestalt processing.

Several problems emerge from this approach. Beyond the analogy of physical to psychological differentiation Witkin and his associates offer little rationale as to why greater segregation and specialization of the functions should be conducive to field independence. For one, they don't specify what role if any, the different functions of the hemispheres should play in field independent processing. Secondly, some

degree of rationale for their theory comes from the intimation that less lateralization results in impaired spatial ability. However, there is sufficient evidence (Epro and Granite, 1979) (see Table 1) to suggest that less lateralized subjects are at least as good if not more proficient at spatial skills. Even Zoccolotti and Oltman's (1978) experiment (see Table 1), one of the few which actually tests their specific definition of extent of lateralization and which reports evidence consistent with their theory, found the less lateralized group to be just as proficient at both the left and right hemisphere tasks.

Another popular notion is the proposal that field independence is a product of right hemisphere processing (Berlin and Languis, 1981). This is based on the evidence that spatial ability is a right hemisphere function and that field independence is partially if not wholly a product of spatial ability (Vernon, 1972). This is in stark contrast to another theory that the left hemisphere is necessary for field independence (Silverman, 1979). The left hemisphere has been associated with analytical functions while the right hemisphere has been associated with global processing. Similarly field independence is considered analytical while field dependence reflects global processing. This position was first submitted on the basis of an experiment on the effects of unilateral ECT on field dependence. Cohen, Berent and Silverman (1973) found that ECT to the left hemisphere resulted in increased field dependence while ECT to the right hemisphere resulted in

Table 1-Cerebral Lateralization and Field Dependence

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Hannay, 1976	30 males and 30 females (All right handed)	T Scope (used low complexity random shapes)	BD	Left visual field superiority is related to good BD performance for females. Males showed no differences
Zoccolotti and Oltman, 1978	Exp. 1-12 males Exp. 2-18 males	T Scope (used both face and letter stimuli)	RFT, EFT	FI subjects show right visual field advantage for letter discrimination on reaction time. FI subjects show right visual field advantage for letter discrimination on reaction time and a left visual field advantage for face recognition. Therefore FI subjects are more lateralized.
Rapaczynski and Ehrlichman, 1979	24 right handed females	T Scope (face recog.)	RFT	No differences between FI and FD subjects except that they show opposite lateralization (FI subjects used the left hemisphere)
Waber, 1977	40 males and 40 females from 10 to 14 years old (Both right and left handed)	Dichotic Listening	EFT, BD	More lateralized group were more FI.

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Bloom-Feshbach, 1980	25 male and 25 female undergraduate students (All right handed)	Dichotic Listening	Portable RFT	FD subjects had twice the ear advantage and are therefore more lateralized
Gilbert, 1977	64 undergraduate students (both sex and hand)	Handedness	BD	Strong right or left handedness was associated with better BD performance (only a trend). No differences between left and right handers.
Epro and Granite, 1979	23 female and 17 male college students (All right handed) and 4 males and 8 females (All left handed)	Handedness	BD	Left handers did better overall but showed no significant difference in lateralization of hands. Left hand performed best (for right handers). Right hand performed best (for left handers)
Zoccolotti, Passafiume and Pizzamiglio, 1979	30 male and 30 female, right handed students	Handedness (on a line orientation task)	RFT, EFT	FD subjects showed less hand asymmetry on the task Therefore FD subjects may be less lateralized
Newland, 1980	96 left and 96 right handers (both sex)	Handedness	Group EFT	Left handers were significantly more field independent

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Tucker, 1976	20 male and 19 female, right handed, undergraduate students	EEG Alpha Desynchrony	EFT	No differences
Mayes and Beaumont, 1977	13 right handed undergraduate students (sex not reported)	Visual Evoked Potential	Modified BD (1 motor and 1 non-manual version)	No differences
O'Connor and Shaw, 1978	3 male and 9 female right handed and 4 male and 8 female left handed	Intra and Interhemispheric Coherence	RFT	FD subjects were less lateralized
Gevins, Zeitlin, Doyle, Yingling, Schaffer, Callaway, and Yeager, 1979	18 male and 5 female right handed	Band Spectral Intensity	BD	No differences
Oltman, Semple and Goldstein, 1979	17 right handed males	Integrated EEG Amplitudes	RFT, EFT	Fluctuations over time in integrated EEG amplitudes recorded from the left and right hemispheres were more similar to each other (less differentiated) for the FD subjects. Therefore the FD subjects were less lateralized.

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Wogan, Kaplan, Moore, Epro and Harner, 1979	6 male and 5 female, right handed Undergraduate students.	Alpha Power Ratio	RFT, EFT, BD	Males-BD and RFT related to right hemisphere. -EFT had inconsistent replications over trials Females-BD related to left hemisphere for 3 of 4 replications -RFT and EFT and related to the right hemisphere
Moore and Haynes, 1980	21 male and 21 female right handers	Alpha Power Ratio	BD	No differences with respect to ability Right hemisphere more active during the task performance
Wogan, Moore, Epro and Harner, 1981	10 male and 11 female, right handed undergraduate students.	Alpha Power Ratio	BD	Both hemispheres involved according to the stage of the problem solving process and the strategy employed
Heilbrun, 1956	24 left, 15 right and 20 subjects with damage to both hemispheres. 20 control subjects were used. All subjects were right handed and sex was not reported	Brain Damage	BD	Right hemisphere damage subjects did significantly worse

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Teuber and Weinstein, 1956	43 control and 64 brain damaged subjects	Brain Damage	EFT	No differences although both left and right hemisphere damaged groups did worse than controls
Costa and Vaughan, 1962	18 left and 18 right hemisphere damage subjects All right handed but sex not reported	Brain Damage	BD	Right hemisphere damage subjects did significantly worse
Arrigoni and DeRenzi, 1964	70 left and 55 right hemisphere damage subjects and 50 controls Sex and handedness not reported	Brain Damage	Benton's 3 Dimensional Block Construction	Right hemisphere damage subjects did the worse although both brain damage groups did worse than controls
Warrington and James, 1967	36 right and 29 left damage, right handers of both sex	Brain Damage	BD	Right damage subjects performed worse (only based on mean data)
Parsons, Vega and Burn, 1969	Exp. 1-44 males with left, right or bilateral damage and 44 controls. Exp. 2-98 subjects of both sex	Brain Damage	BD	Right hemisphere damage subjects did worse

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Ben-Yishay, 1971	56 right and 49 left hemiplegics (all right handed and half male and female) 40 right handed controls of both sex	Brain Damage	BD	No differences between left and right hemiplegics Controls performed much better Left and right damage subjects used different strategies
Simpson and Vega, 1971	21 left and 23 right damage Sex and handedness not reported	Brain Damage	BD	Right damage subjects performed slightly worse (This increased more when scores were age corrected)
McGlone and Kertesz, 1973	35 male and 22 female, left damaged and 13 male and 8 female right damaged subjects (all right handed)	Brain Damage	BD	Right damage subjects did significantly worse with males with right damage showing the clearest deficit
Poeck, Kerschensteiner, Hartje and Orgass, 1973	20 left and 21 right damaged. Handedness and sex not reported	Brain Damage	EFT	Aphasics and right damage subjects did the same and significantly worse than nonaphasic left damage subjects

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Pizzamiglio and Carli, 1974	50 right damage and 31 left damage without aphasia and 27 left damage with aphasia All right handed and of both sex	Brain Damage	EFT (1 visual, 1 tactile and 1 acoustic version)	Right damage subjects performed worse on the tactile version No differences were found on the acoustic or visual versions No differences were found with respect to aphasia
Bentin and Gordon, 1979	14 left and 16 right damage subjects of both sex and hand	Brain Damage	BD	Right damage subjects did worse and both groups did worse than a group of controls
Corkin, 1979	10 left and 64 right handed males	Brain Damage	Hidden Figures Test	No differences
Bogen and Gazzaniga, 1965	-----	Split Brain	BD	Right hemisphere associated with better performance
LeDoux, Wilson and Gazzaniga, 1977	1 right handed 16 year old male	Split Brain and T Scope	BD	Both hemispheres performed correctly when hands were not used Right hemisphere advantage was found when hands were used (ie-a left hand superiority)

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
LeDoux, Wilson and Gazzaniga, 1978	Same as above	Split Brain and T Scope	BD	Free vision condition-left hand superiority(right hemisphere) T Scope condition-1)best performance obtained from right hemisphere and left hand 2)second best from right hemisphere and right hand 3)third best from left hemisphere and left hand 4)Worst on left hemisphere and right hand
Barnat, 1974	96 undergraduate students (half male and female) No handedness reported	CLEM	EFT	Left movers(right hemisphere) of both sexes were slightly faster but not significantly
DeWitt and Averill, 1976	48 right handed female undergraduate students	CLEM	EFT	No differences
Schroeder, Eliot, Greenfield and Soeken, 1976	39 boys and 37 girls from 4 to 6 years of age Handedness not reported	CLEM	Hidden Figures Test	Bidirectionals were more FD Author suggests that bidirectionals may be less lateralized
DeWitt, 1977	74 male and 112 female right handers	CLEM	EFT	No differences

Table 1- (Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Hoffman and Kagan, 1977	41 male and 39 female right handed undergraduate students.	CLEM	EFT, RFT, BD	Males-Bidirectional subjects scored lower than right or left movers and right and left movers tended to score the same. Females-There were little differences between the groups for the RFT and BD. Bidirectional subjects tended to score higher than right or left movers on the EFT.
Otteson, 1980	64 male and 72 female undergraduates of both handedness	CLEM	RFT, BD	No differences except that right moving females did worse on BD than left movers.
Shevrin, Smokler, and Wolf, 1979	23 male and 18 female, right handed, undergraduate students.	CLEM	EFT, RFT	No differences between right, left or bidirectional subjects.
Moretti, 1982	40 male and 40 female, right handed, undergraduate students.	CLEM	BD	Males-Bidirectionals tended to perform best although no significant differences were found. Females-Bidirectionals performed best. Right movers were significantly worse than both groups.

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Cohen, Berent and Silverman, 1973	12 patients receiving ECT to the left hemisphere, 12 to the right and 12 controls. (All right handed females)	Unilateral ECT	RFT	Left ECT patients became more FD while right ECT patients became more FI
Oltman and Copobianco, 1967	45 male and 34 female undergraduates (Both handedness)	Hand, Eye	Hidden Figures Test	No differences for handedness Strong eye dominance related to FI
Dawson, 1972	76 same and 29 mixed eye/hand dominance, male Temne adults	Hand, Eye	BD	Mixed subjects were significantly more FD
Ehrlichman, 1972	22 male and 32 female, right handed, undergraduates	CLEM, T Scope	EFT	No differences (Note- this was based on ipsative data)
McGlone and Davidson, 1973	25 male and 24 female right handers and 28 male and 22 female left handers.	Hand, Dichotic Listening (Verbal stimuli)	BD	Little differences between left and right handers though right handers performed slightly better. Left handers with left ear superiorities did the worst

Table 1-(Continued)

Author	Subject	Laterality Measure	Field Dependence Measure	Results
Pizzamiglio, 1974	25 right handed and 25 ambidextrous students (13 males and 12 females in each hand group)	Hand, Dichotic Listening (Verbal stimuli)	EFT, RFT, Draw A Person Test	Right handers were more FI on the EFT and Draw A Person Test Strong ear preferent subjects were more FI (only used a subgroup of 20 with no control for sex or handedness)
Dawson, 1977	5 samples of 80, 60, 61, 80 and 65. All Alaskan Inuit of both sex and handedness	Hand, Eye, Dichotic Listening (Verbal stimuli)	EFT, Portable RFT	Left eye/hand subjects were the most FD Right eye/hand subjects were the most FI Right eye/hand/ear subjects were also very FI

decreased field dependence. Unfortunately most of the subsequent experiments attempting to test this hypothesis have used verbal tasks as measures of laterality and as such have been excluded from the present review on the basis that they are too inferential.

A fourth alternative is implied by a recent EEG study utilizing the Kohs block design (Wogan, Moore, Epro and Harner, 1981) (see Table 1). The investigators found evidence to suggest that while both hemispheres are involved, one may predominate over the other according to the individual strategy used and the particular stage of the problem solving process. Reflective or undecided periods may be typified by greater alpha activity in the left hemisphere indicating a greater right hemisphere involvement. However during decisive, and manipulative stages subjects demonstrate greater left hemisphere activity.

Overall, a review of the studies on laterality and field dependence (see Table 1) offers little support for any of the aforementioned theories. The only theory which may account for some of the discrepancies is that of Wogan et al. (1981). Nevertheless, more experiments are needed to substantiate their claim. An examination of Table 1 shows no apparent systematic relations across the various field dependence and laterality measures. Nor does sex or sample size appear to bear on the issue.

For purposes of clarity, four types of studies have not been included in the present table. As mentioned previously,

studies using verbal measures (e.g., writing task-Berent, 1974) as indices of laterality were not included. Also studies using novel and unvalidated measures of laterality (e.g., frame tilt-Sherman, 1974, or forced eye movements-Gross, Feldman, and Glaubman, 1981) were excluded. Third, experiments which combined field dependence measures with measures of spatial ability or judged field dependence (especially in block design experiments) relative to verbal performance were omitted as no "pure" field dependence scores could be derived. Lastly, studies using the Stroop Test (Stroop, 1935) as a measure of field dependence were excluded as there is considerable evidence (Bloomberg, 1969; Broverman, 1964; Huckabee and McGown, 1971) to doubt this assumption.

One problem in obtaining a clear perspective on this issue is the diversity of measures used to determine field dependence. The present review includes studies using the Rod and Frame test (RFT), the Embedded Figures test (EFT), the Hidden Figures test (HFT), the Draw a Person test (DAP), and the Block Design. Block design was included in the present analysis as there is a multitude of studies showing its correlation with the more common measures of field dependence (Goodenough and Karp, 1961; Karp, 1963; Mischel and Metzner, 1962) and Witkin et al (1962), have acknowledged it may be a valid measure. According to Vernon (1972), researchers use the various measures too freely as if they all measure the same construct. As well as measuring field dependence they may be measuring abilities tangentially related

to it (Arbuthnot, 1972). Perhaps this explains the low correlations often reported between the measures (Elliott, 1961; Sherman, 1974). Witkin and Goodenough (1977) concede that the EFT best defines the construct they originally set out to measure while the EFT may overlap with other factors such as spatial or general abilities. In a review of the research on brain damage, Benton (1979) states that while all brain damaged patients showed an impairment on the EFT, the right damaged and left damaged with aphasia tended to show the worst deficit. On the basis of this functional relationship with aphasia, he concludes that the EFT may have a language dependent component in that it is facilitated by implicit verbal mediation. Thus it would seem that the EFT has both verbal and spatial components. In a similar vein Arbuthnot (1972) suggests that the Kohs Block Design Test may require both analysis and synthesis. Benton (1973) using a three dimensional block construction test found that aphasic patients (left hemisphere damage) with receptive impairment demonstrated a greater deficit than patients with right hemisphere damage. The confusion over the status of the block design is further emphasized by it's use as a verbal task in one experiment (Arndt and Berger, 1978) and a spatial task in another (Berlin and Languis, 1981). Also while it tends to load high on the spatial factor of the Wechsler Adult Intelligence Scale (WAIS) it also tends to correlate with the verbal items.

A further difficulty in interpretation arises from the number of different versions of each field dependence test and

the lack of a uniform method of administration. The RFT may differ in size and may be administered with varying degrees of rod and frame tilt, number of trials and distance from the subject. As Ebenholtz and Benzschawel (1977) note, performance on the RFT improves as one moves away from the apparatus. Furthermore the RFT involves limited feedback and no time limit like the other measures of field dependence. Similarly,

There are numerous versions of the Gottschaldt embedded figures, differing in speedness, length, group versus individual administration, multiple-choice versus open ended, achromatic versus colored, simple figures presented before the complex ones or simultaneously; and it seems most unlikely that these are interchangeable. (Vernon, 1972, pg. 369).

As well, Benton (1979) suggests that Block Design in its various forms may involve differences in

demands on sustained attention, the capacity for deliberation, perceptual acuity, the apprehension of spatial relationships, judgement of perspective and motor skill. (pg. 221).

The significance of this is clearly illustrated in Benton's (1967) finding that right hemisphere damaged patients did worse than left hemisphere damaged patients on a three dimensional block design yet performed no worse on a WAIS Block Design. This also calls into question LeDoux, Wilson and Gazzaniga's (1977) (Table 1) often cited split brain study suggesting that hemispheric differences on the Block Design are due to a manipulospatial factor. The Block Design used by them was essentially nothing more than a pattern recognition test.

Another difficulty in drawing conclusions from these data is the diversity of measures used to assess laterality. The

interrelationships among these measures is less well known than for the field dependence measures. There are essentially two types of experiments which have been conducted. Hemisphericity studies look at the individual differences in preferred hemispheric mode of processing and include tachistoscopic , dichotic listening, CLEM, hand and eye dominance studies. Hemispheric specialization studies, on the other hand, look at the role each hemisphere plays in the processing of the particular field dependence task and include the EEG, split brain and brain damage studies. Most importantly, the different methods do not equally represent the four theoretical positions presented earlier. Studies utilizing the EEG are able to test all of the theories although, as with most of the methods, all of the hypotheses are usually not considered. The tachistoscopic and dichotic listening studies are capable of testing the right versus left hemisphere dominance and extent of lateralization theories. CLEM studies are capable of examining right versus left hemisphere dominance. Similarly, split brain and brain damage studies only examine right versus left hemispheric asymmetries while hand and eye dominance experiments assess extent of lateralization. Overall, the right versus left hemisphere theories have been the most tested. While there have been numerous studies on extent of lateralization, only one (Zoccolotti and Oltman, 1978) directly tests Witkin's definition.

Cerebral Lateralization and Randomness

An often cited distinction with regard to hemispheric specialization is the use of parallel versus sequential processing by the right and left hemispheres, respectively. An examination of the stimulus material for which each hemisphere appears specialized, would certainly imply such an explanation. Verbal material, which is associated with left hemisphere processing, is read or spoken in a serial fashion whereas complex visuospatial material which is best processed by the right hemisphere, may require parallel and gestalt processing.

In a series of experiments using both letters and shapes as stimulus material, Cohen (1973) found that reaction time to stimuli presented tachistoscopically to the left hemisphere increased as a function of the number to items presented simultaneously. However reaction time to items presented to the right hemisphere appeared to be relatively independent of stimulus set size. On the assumption that parallel processing should be independent of the stimulus set size, Cohen argued that the right hemisphere processes the stimulus array concurrently. A more recent study by Ohgishi (1978), using letter stimuli, clearly replicated these results.

More inferential evidence for a link between the right hemisphere and parallel processing comes from studies on incidental memory. While active or intentional memory is dependent upon focused or selective attention to the specified

memory material, incidental memory is typified by a more passive and diffuse mode of attention. As previously stated, this passive state may also enhance memory in instances of rapid presentation of memory stimuli. Luria and Simernitskaya (1977) found that although brain damaged patients as a whole perform worse on memory tasks than control subjects, left hemisphere damaged subjects tend to do the worst on active or voluntary memory tests. Right hemisphere damaged subjects, on the other hand, do much worse on incidental memory tasks. In a similar though unrelated study using conjugate lateral eye movements, Day (1964) has implied a relationship between right hemisphere dominance and passive attending.

In light of the evidence showing a link between parallel processing and both random response generation and the right hemisphere, it may follow that the right hemisphere is more involved in random response generation. Further support for this contention arises from research on hypnotic susceptibility. Bakan (1969) was the first to propose that hypnotic susceptibility may be mediated by the right hemisphere. In a study of conjugate lateral eye movements, he found that left movers were significantly more hypnotizable than right movers. Subsequent research has demonstrated a relationship between hypnosis and right hemisphere processing in a split brain study (McKeever, 1981) as well as with CLEM (Gur and Gur, 1974; Morgan, McDonald and MacDonald, 1971). It should be noted however, that there have been several failures (e.g., Spanos,

Rivers and Gottlieb, 1978; Spanos, Pawlak, Mah and Deon, 1980) to confirm this relation. Graham and Evans (1977) found that hypnotically susceptible subjects were the best randomizers on a random-number generation task. This is consistent with Hilgard's (1965,1977) suggestion that hypnosis involves diffuse attention or parallel processing. Thus, overall, there seems to be sufficient evidence to imply a relationship between the right hemisphere and the ability to produce random responses.

Cerebral Lateralization and Perceptual Closure

As previously noted, the right hemisphere has been associated with a wide range of visuospatial abilities. On the basis of a series of experiments with commissurotomy patients, Nebes (1974) proposed that the right hemisphere is more efficient at perceiving the relationship between the parts of a stimulus or the overall stimulus configuration. This is in accordance with the previously reported evidence suggesting right hemisphere processing is synthetic, holistic or gestalt. Nebes found a right hemisphere superiority for three different types of part-whole tasks. The first task involved subjects haptically examining an arc which was hidden from view. They were then required to choose one of three visually presented circles from which the arc may have come. As predicted, the patients demonstrated superior ability with the left hand and hence the right hemisphere (Nebes, 1971).

For the second task, subjects were shown a series of fragmented pieces which if placed together would form a geometric shape. Following this, the patients haptically examined three solid geometric shapes hidden from view. They were asked to choose the one which they felt represented the composite of the fragmented pieces. Again, subjects demonstrated a left hand superiority (Nebes, 1972). On the third task, stimuli were presented tachistoscopically to either the left or right visual field. The stimuli consisted of square arrays of dots with spacing of the dots varying across the square. Thus according to the nature of the spacing, the stimuli appeared to be five lines of dots running either vertically or horizontally. Essentially this task illustrates the gestalt law of proximity (Wertheimer, 1958). That is, dots which are closer together spatially tend to be perceived as a group. Subjects were required to denote the direction of these lines for each presentation. As predicted, the patients demonstrated greater accuracy in the left visual field (Nebes, 1973).

Further support for the contention that right hemisphere processing is holistic arises from research utilizing perceptual closure tests. The most common of these measures is the Street Gestalt Completion Test (Street, 1931). This test, in its various forms consists of from 12 to 40 fragmented pictures of people and objects. Subjects are required to identify verbally each item within a specified time limit. Generally, the results from studies using clinical populations have been positive. The

right hemisphere has been associated with superior performance on the Street Gestalt in both brain damaged (DeRenzi and Spinnler, 1966; Orgass, Poeck, Kerschensteiner and Hartje, 1972) and split brain patients (Bogen, DeZure, Tenhouten and March, 1972; Nebes, 1978). Kohn and Dennis (1974a) however, found no differences between two left and two right hemidecorticate patients. They do suggest though, that this may be attributable to a reallocation of functions of the right hemisphere to the left hemisphere (Kohn and Dennis, 1974b).

Investigations using normal subjects have proven to be less conclusive. A right hemisphere superiority has been demonstrated in EEG (Ornstein, Johnstone, Hereron and Swencionis, 1980; Rogers, Tenhouten, Kaplan and Gardiner, 1977), cerebral blood flow (Gur and Reivich, 1980) and CLEM studies (Bilsker, 1980; Packer and Gur, 1980). However contrary to these findings, Ehrlichman (1971) and Fischer (1976) found no differences between right and left movers on the Street Gestalt. It should be noted though, that Ehrlichman's experiment used ipsatized data. Therefore any scores on the Street Gestalt would be relative to an individual's particular performance on the other tests included in the experiment (Bilsker, 1980). As such this obscures any inferences which could be drawn from the study. Furthermore, with regard to Fischer's study, an A/P ratio was utilized. This is a verbal/spatial ratio proposed and also used by Bogen et al. (1972) to measure hemisphericity. In this case, Fischer used the Street Gestalt as a right hemisphere, spatial

task and the Similarities subtest of the WAIS as a left hemisphere, verbal test. One drawback to this approach is that a subject's score on the Street Gestalt is relative to his/her verbal performance. Once again, this may obscure any conclusive findings as the subject's scores may vary according to whatever tests are used in the ratio.

Similar results have also been found with a comparable measure of perceptual closure, the Mooney Closure Test (Mooney and Ferguson, 1951). This test also contains up to 40 fragmented items of objects and people. Three studies of brain damaged subjects have demonstrated a right hemisphere superiority on this task (Lansdell, 1968, 1970; Newcombe and Russell, 1969), though Lansdell's 1970 study offers only inferential evidence as the Mooney test was included with numerous other tasks in a closure factor. More recently, Tucker (1976) using 20 male and 19 female right handed undergraduates, found equivocal support for the hypothesis. For males there was a significant correlation between greater alpha desynchrony in the right hemisphere and performance on the closure test, while for females no differences were found.

Warrington and James (1967) used the Gollin Figures Test (1960), a closure test which requires subjects to view a series of fragmented pictures, all representing the same object. Subjects are scored on the number of incomplete drawings needed before recognition occurs. As predicted, they found that patients with lesions of the left hemisphere performed

significantly better than patients with lesions in the right.

While these findings seem promising overall, the use of these types of closure tests may entail problems as they all require verbal identification of the pictures. DeRenzi, Faglioni and Scotti (1971) contend that in cases where spatial tasks have some attribute which is amenable to verbalization, no differences will be found between the hemispheres. In addition, according to Kohn and Dennis (1974b), when the number of alternative verbal responses on closure tests is limited, then impairment tends to occur in only right hemisphere damage cases, however when the number of alternatives is limitless then damage to either hemisphere results in a deficit, though this may be greater for the right hemisphere. Thus, it would appear that the inclusion of a verbal response in a primarily spatial task reduces the test's ability to reflect hemispheric differences.

A recent experiment by Bilsker (1980) attempted to overcome this problem. He used the Perceptual Organization Test (POT) (El-Meligi and Cott, 1978), a closure test similar to the Street and Mooney tests except that it requires the subject to match the fragmented picture with the picture it represents. Therefore, this test is entirely nonverbal as it bypasses the use of verbal responses. In a comparison of 21 male and 24 female undergraduates, left movers performed significantly more accurately than right movers on the POT. By the same token, left movers also had significantly longer response times though these were found to be unrelated to accuracy. Another facet of this

study which is germane to the issue at hand is Bilsker's inclusion of the Street Gestalt as a second closure task. Contrary to what one may expect on the basis of the preceding discussion of verbal responses, the POT proved to be no more sensitive to hemispheric differences than did the Street Gestalt.

In conclusion, there appears to be a sufficient amount of evidence to link right hemisphere processing to synthetic or holistic abilities. This association is especially supported by clinical studies whereas studies on normal populations have proven to be less conclusive.

Cerebral Lateralization and Torque

On the basis of his work with children in clinical settings, Blau (1977a,b) reported a high incidence of torque among those with academic and behavioral difficulties. Torque, according to Blau, is the tendency to draw circles in a clockwise direction. Subjects are required to draw three circles with their dominant hand and three circles with their nondominant hand. If one of these six circles is drawn in a clockwise direction the subject is classified as having torque. This phenomenon has been shown to be reliable over several years. In addition, Blau suggested that there is a developmental trend with most subjects eventually shifting to counterclockwise turning. While children as young as four years old have all been

found to demonstrate torque (Blau, 1977a) the incidence of torque diminishes to 30 percent by late adolescence (Blau, 1977a; Milton, 1976).

Numerous studies have found an association between aberrant behavior and torque (Alberts, 1977; Blau and Coleman, 1977, cited in Blau, 1977b; Milton, 1976; Torrington, 1976). Blau (1977a), in a study of over 300 children, reported a significant relationship between torque and several problems including neuroticism, neurological impairment, variable emotional behavior, variable intellectual performance, excess energy, stubbornness and continued bedwetting. Also, a subsequent investigation by Blau (1977b) with children ranging from four and a half to 14 years of age, found greater vulnerability to schizophrenia among torque subjects, with 11 of 52 torque subjects being diagnosed schizophrenic compared to only 1 of the 53 non-torque subjects.

Another interesting factor which has emerged from these studies is the higher incidence of torque among left handers (Alberts, 1977; Blau, 1977a,b; Ilg and Ames, 1972; Milton, 1976; Torrington, 1976). According to Blau (1977b), this is compatible with theories suggesting greater pathology among left handers (eg-Bakan, 1976; Corballis and Beale, 1976; Sperry, 1975). On the premise that left handedness may be indicative of less cerebral lateralization, Blau (1977b) further suggests that torque may be related to mixed cerebral dominance, perhaps resulting from dysfunction of the corpus callosum.

An investigation by Kay (1979) however, offers evidence to the contrary. A study using 39 mentally retarded adults with manifestations of psychosis revealed no relationship between torque and handedness. Unfortunately Kay failed to specify the number of subjects that were left handed. This obscures any definite conclusions especially since all previous studies have reported handedness differences. Kay also found little support for a relationship between torque and neurological abnormality or prenatal and perinatal problems. Indeed, there was a strong trend in the reverse direction. Partial support however, was obtained for Blau's findings pertaining to schizophrenia, as torque was significantly related to early childhood psychosis.

More recently, there have been several attempts to study the relationship between torque and cerebral lateralization on the basis of more than just handedness. In a study of 225 male college students, Woods and Oppenheimer (1980) reported evidence which they purport to be congruent with Blau's hypothesis of mixed cerebral dominance. Right handed subjects displayed torque more often with their nondominant hand while non-right handed subjects showed little differences between their hands. Woods and Oppenheimer interpreted this as support for less lateralization among torque subjects. Contrary to expected though, they reported no differences between right and non-right handed subjects overall. CLEM was the second laterality measure utilized in this experiment. Subjects were presented with twenty questions, ten thought to be emotional in nature and ten thought

to be neutral. An analysis of eye movements with respect to question type rather than individual differences, was conducted. Overall, torque subjects in contrast to non-torque subjects demonstrated a greater tendency toward right looking for both types of questions. While initially this may seem to imply a greater reliance on left hemisphere processing, the full import of these findings is vague since overall both groups showed a predominance of left looking for neutral questions and non-torque subjects also showed a predominance of left looking for emotional questions. Therefore, the evidence of left hemispheric activation arises from the finding of a greater predominance of right looking among torque subjects in response to emotional questions. It is this latter finding which Woods and Oppenheimer propose as further evidence of mixed cerebral dominance among torque subjects. Although left hemisphere activation for emotional material seems to imply cerebral specialization opposite to the norm, there is, in the opinion of this author, no evidence of mixed cerebral dominance.

Several other problems are inherent in the Woods and Oppenheimer investigation. First of all, they measured handedness on a ten item scale. Only subjects who answered all items as right handed were classified as right handers. This results in a large proportion of right handers being misclassified as non-right. This may also account for the failure to find expected differences between right and non-right handers on the incidence of torque and readers suspect the other

findings pertaining to handedness. Secondly, their analysis of questions rather than individual differences entails several difficulties. This approach lacks the ability to discriminate as clearly between right and left hemisphere processing. It involves the inclusion of bidirectional subjects who may not show distinct hemispheric preferences. Also it fails to detect unusual subject samples such as one composed largely of left lookers. In an experiment of this sort, this may result in a false observation of right hemisphere processing for both torque and non-torque subjects. Since the sampling distribution often varies in CLEM studies this is a very real problem. Finally, the failure to account for a handedness and CLEM interaction further obscures the results since left handers are more likely to show either reversed or mixed patterns of cerebral dominance.

A recent investigation by Winterbotham (1980) also used CLEM as an index of laterality. He proposed that we live in a predominantly left hemisphere oriented society. Therefore right hemisphere dominant people may, like torque subjects, exhibit greater problems in adjustment. Thus one may expect a relationship between torque and left moving. In study one, 97 right handed children of both sexes were administered four questions. As predicted, he found overall, a proportionally greater number of left movers among torque subjects, though this relationship was significant only for males. Study two involved the presentation of 20 neutral questions to 56 right handed undergraduates of both sexes. Once again, a strong trend

indicating a relationship between torque and left movers was reported. In addition, Winterbotham found a significant interaction between CLEM and torque on the MMPI with left movers with torque scoring highest on the schizophrenia (Sc) subscale. This is consistent with past studies showing both a relationship between torque and schizophrenia (Blau, 1977b) and right hemisphere activation and schizophrenia (Flor-Henry, 1972).

The studies reviewed up to this point offer extremely contradictory results. While the handedness data seem to suggest a mixed cerebral dominance explanation for torque, the CLEM data suggest both greater and less right hemisphere activation. One problem with the CLEM studies however is that neither addressed Blau's mixed dominance theory. Winterbotham's study omitted bidirectionals while Woods and Oppenheimer's used a question analysis which precludes the discrimination of bidirectionals.

Demarest and Demarest (1980) conducted the only investigation to date which has attempted to test Blau's mixed cerebral dominance theory with a laterality measure other than handedness. Forty one right and 33 left handed college subjects ranging in age from 14 to 44 were administered a dichotic listening test using verbal stimuli. Although left handedness was significantly related to a higher incidence of torque, no differences were reported for the dichotic listening task. On this basis, Demarest and Demarest argued that torque has in fact no relationship to cerebral dominance but rather the handedness differences which are often found, are due to the mechanics of

the hands. It may be easier or more natural to draw a clockwise circle with the left hand. This would also account for data showing that it is more often the left hand which manifests torque, even in right handed subjects (e.g., Winterbotham, 1980). Though plausible, this hypothesis must be viewed with caution as there were several drawbacks to their study. Only 1 out of 41 right handed subjects displayed torque, a lower proportion than any previously reported. This did not allow for an analysis of a hand by torque interaction as virtually all torque subjects were left handed. This may also explain why half the torque subjects showed reverse lateralization since left handedness has often been associated with reversed lateralization as well as less lateralization (Hardyk and Petrinovich, 1977).

Hypotheses of the Present Study

On the basis of the preceding discussions, the following hypotheses are proposed. It is expected that:

- 1) Left movers, as opposed to right movers, will produce more correct responses on the Perceptual Organization Test, a measure of gestalt perception.
- 2) Left movers will generate a more nearly random sequence than right movers.
- 3) Bidirectional subjects will demonstrate a greater incidence of torque.

- 4) There will be no differences between left, right or bidirectional movers on the Rod and Frame Test, a measure of field dependence.
- 5) Bidirectional subjects will demonstrate higher creativity scores on the How Do You Think Test.
- 6) The more creative subjects will be greater sensation seekers.
- 7) The more creative subjects will demonstrate greater susceptibility to boredom.
- 8) The more creative subjects will be more field independent.
- 9) The more creative subjects will demonstrate greater cognitive complexity.
- 10) The more creative subjects will demonstrate more physiognomic perception.
- 11) The more creative subjects will generate a more random sequence.

I. Method

Subjects

The subjects were 40 female and 40 male right handed and 16 female and 16 male non-right handed university students. They were told only that the experiment involved cerebral lateralization and individual differences in perception and cognition. Another 14 subjects were excluded from the analysis as they had a history of epilepsy or brain damage or were run in a room which may have been unsuitable for recording CLEM. The subjects ranged in age from 18 to 32 with a mean age of 22.2 for females and 23.7 for males.

Procedure and Design

The experiment was conducted in one session with subjects taking from an hour to an hour and 45 minutes to complete it. The tests were administered in a light tight room (to reduce dark adaptation on the Rod and Frame test) with a symmetrical background (to reduce distractions on the CLEM test). The ten tasks and questionnaires were presented in all possible orders so as to minimize any possible effects of order. During administration of the Conjugate Lateral Eye Movement Test (CLEM)

subjects were asked to sit facing the experimenter at a distance of approximately 75 centimetres. To avoid any confounding influence from question type the subjects were asked a set of 20 neutral questions devised by Bakan, Coupland, Glackman and Putnam, (1975) (see Appendix A). The subject's initial eye movement immediately following each question was recorded. Only lateral eye movements were scored. Trials on which the subject stared ahead, shifted his/her eyes vertically, closed them or looked away were not included. At least 75 percent of the questions had to yield scoreable responses in order for the subject to be included in the study. A laterality score (percentage of left movements) was obtained by taking the number of left movements, dividing by the total number of movements and multiplying by 100. During the questioning period the experimenter was careful not to reveal that he was recording the subject's eye movements rather than answers to the questions. To ensure that this had been achieved, subjects were asked at the end of the experiment whether they were aware that their eye movements were being monitored. However, none of the subjects reported being aware.

Subjects were administered form E of the How Do You Think Test (HDYT), a creative personality test devised by Davis (1977). The test assesses attitudes, values, beliefs, motivations and other personality and biographical items thought to pertain to creativity. There are one hundred questions to be answered on a 5 point scale.

A modified form of Crockett's (1965) test of cognitive complexity was used. The subjects were asked to describe in writing , in any way they wish, four people they know personally. The four people were to be 1) a female they like 2) a female they dislike 3) a male they like 4) a male they dislike. They were allotted 90 seconds for each description and were asked to use the full amount of time. They were told to use point form. This method was used to counter criticisms that verbal fluency may be a confounding factor and also it simplified the scoring. The order of the four descriptees was rotated across subjects within each sex to control for any possible order effects. Cognitive complexity was defined as the total number of constructs or descriptors used across the four descriptions.

Field dependence/independence was measured by the Rod and Frame Test . Subjects were instructed to sit upright in their chairs and not lean to either side. The Rod and Frame apparatus was a portable model of dimensions 37.5 by 37.5 cm. and was situated at a distance of 140 cm. from the subject. Eight trials were presented with the rod and frame in the following starting positions: 1) rod at 20 degrees to the left and frame at 20 degrees to the right 2) rod at 20 degrees to the right and frame at 20 degrees to the right 3) rod at 20 degrees to the right and frame at 20 degrees to the left 4) rod at 20 degrees to the left and frame at 20 degrees to the left. The same order of the positions was repeated for the last four trials. On each trial

the experimenter turned the rod slowly and subjects were instructed to say stop when the rod appeared to be perfectly vertical. If the subject felt the experimenter had turned the rod too far he/she could request the experimenter to turn it back in the opposite direction. The lights were turned out for the duration of each trial (approximately 30 to 60 seconds) but turned on between trials to minimize dark adaptation. A field dependence score was obtained by averaging across the 8 trials the number of degrees the rod deviated from the vertical on each trial.

Subjects were administered the Physiognomic Cue Test, a test devised by Stein (1975) to measure physiognomic perception versus geometric-technical perception. Physiognomic perception, the attribution of human-like qualities to objects, was divided into two subscales. Factor A measured physiognomic-feeling and factor B measured physiognomic thing perception. There is also a total score for physiognomic perception based on factor A, factor B and several miscellaneous questions. The test includes 32 drawings depicting ambiguous pictures of such objects as a straight line or two squares. Subjects were asked to place where on a six point continuum they felt the drawing best fit. One end of the continuum contained a geometric-technical response such as "it looks like a line". The other end contained a physiognomic response such as "it looks like monotony". The first response on the continuum indicated the drawing looked like the response on the left. The second box on the continuum

indicated the drawing looked something like the response on the left. The third box indicated the drawing looked very little like the response on the left but more like the left than the right. The fourth box on the continuum indicated the drawing looked very little like the response on the right but more like the right than the left. The fifth box indicated the drawing looked something like the response on the right. The sixth box indicated the drawing looked like the response on the right.

Sensation seeking was assessed by form 5 of Zuckerman's (1979) Sensation Seeking Questionnaire. The test contains 40 items which are subdivided into 4 subscales of 10 items each. Each item contains two statements. Subjects were instructed to choose the most preferred statement. The four subscales are 1) Boredom susceptibility (BS) 2) Thrill and adventure seeking (TAS) 3) Disinhibition (DIS) and 4) Experience seeking. Only the total score and boredom susceptibility were considered in the present study.

Subjects were asked to draw six circles, each about an inch in size, on a blank sheet of paper. The first three circles were to be drawn with their dominant hand and the last three circles with their nondominant hand. Torque was defined as any circle drawn in a clockwise direction (Blau, 1977a). Subjects were classified as having torque if at least one circle was drawn in this direction.

The Perceptual Organization Test (El-Meligi and Cott, 1978) was used to assess perceptual closure ability. The test consists

of nine black and white drawings of objects and three series of cards. Each series contains nine cards with degraded drawings corresponding to the nine drawings. Series 1 contained drawings which consisted of swirling lines. Series 2 drawings were made of broken lines and series 3 drawings were made of dots. The nine non-degraded drawings were placed in front of the subject and he/she was allowed to examine them for about 15 seconds. The experimenter then shuffled the cards for one series and placed them face down in front of the subject. The subject was given the following instructions: "When I say go, turn the top card over and match it as quickly and as accurately as possible to one of the drawings in front of you." After the card was matched, the experimenter took it away and recorded both completion time and accuracy. This procedure was repeated for the cards of all three series. The order in which the series were presented was permuted across subjects to control for any possible order effects. Subjects were scored both for total time taken and number correctly matched on all three series.

The subjects were also tested for their ability to generate a random binary series. They were given two computer answer sheets containing 150 items each and asked to treat the A and B alternatives as heads and tails, respectively. The C, D, and E alternatives were to be ignored. The subjects were asked to imagine that they were flipping an unbiased coin in a real life situation and fill in the A's (heads) and B's (tails) as they thought they would turn out. They were required to follow the

order of the questions on the sheets. Randomness was determined by the number of runs in the series. A run is a succession of either heads or tails. Too few runs may be indicative of grouping while too many runs indicate a repeated alternating pattern. This technique is based on the theory of runs (Hays, 1973).

The last of the measures used in this study was the Edinburgh Handedness Inventory (Oldfield, 1971). Only the first five items were used in the final analysis as Bryden (1977) found these to be the most related to familial handedness (which has been suggested to be the most discriminating criterion) and to be more consistent among right handers. A laterality quotient was obtained by taking the sum of the right hand responses and subtracting them from the sum of the left hand responses, then dividing by the sum of both and multiplying by 100. The resulting scores ranged from -100 (representing extreme left handers) to 100 (extreme right handers). Subjects with scores of 60 or over were classified as right handers.

Correlational analyses were used to test the individual hypotheses. With regard to the relationship between torque and CLEM, a chi square analysis was performed. In addition, where curvilinear relationships were hypothesized (hypotheses 3 and 5), polynomial regression analyses were completed. Finally, multiple regression analyses were used to further elucidate these relationships.

II. Results

Distribution of CLEM According to Sex and Handedness

Table 2 shows the frequency distribution of CLEM according to sex and handedness. In accordance with the criteria previously specified, subjects were classified as right movers if 70% of their lateral eye movements were in the right direction and left if 70% of their lateral eye movements were in the left direction. Any subjects not demonstrating at least 70% of their eye movements in a consistent direction were classified as bidirectional. It should be noted however, that for the correlational analysis to follow CLEM was treated as a continuous variable and these arbitrary cut off points were ignored.

Hypotheses

Since no significant effects for handedness or sex were found, the data for the relationship between CLEM and the POT were collapsed. Contrary to prediction, the correlation between CLEM and number of correct responses on the POT was not significant ($r = -.002$, $df = 111$, $p > .05$). Thus hypothesis 1 was not confirmed. Furthermore, a correlation between CLEM and average

Table 2
Incidence of Right, Bidirectional and
Left Movers According to Sex and Handedness

	<u>Right Movers</u>	<u>Bi-Movers</u>	<u>Left Movers</u>	<u>Total</u>
<u>Right Handers</u>				
<u>Males</u>	17	11	12	40
<u>Females</u>	9	13	18	40
<u>Left Handers</u>				
<u>Males</u>	2	5	9	16
<u>Females</u>	6	5	5	16
<u>Total</u>	34	34	44	112

response time on the PCT also failed to reach significance for all subjects combined ($r=.10$, $df=111$, $p>.05$).

A negative correlation of $r=-.16$ ($df=111$, $p>.08$) between left moving and random sequence generation was observed. While these results were in the predicted direction, they failed to reach significance. A closer examination however, revealed a different pattern of results according to handedness. A significant negative correlation of $r=-.23$ ($df=79$, $p\leq.05$) was observed for right handed subjects across sex. This indicates, as predicted, a greater ability among left movers to produce a random sequence. For nonright handed subjects however, no relationship was found. A nonsignificant, negative correlation of $r=-.05$ ($df=31$, $p>.05$) was observed.

Contrary to prediction, bidirectional subjects did not demonstrate a higher incidence of torque. Since there was a significantly greater incidence of torque among non-right handed subjects ($p\leq.01$), separate analyses were conducted for the two handedness groups. As Table 3 shows, for the right handed group, bidirectional subjects proportionally had the smallest incidence of torque (25%) compared to right (50%) or left movers (33%). This is totally opposite to the expected relationship. However, a Chi-square analysis ($\chi^2=3.56$, $p>.05$) revealed no significant differences between CLEM groups overall. Furthermore, a polynomial regression ($F(6,72)=-.80$, $p>.05$) also failed to show any evidence of a curvilinear relationship in the data.

Table 3
 Incidence of Right Handed Subjects With
 Torque as a Function of CLEM

	<u>Right Movers</u>	<u>Bi-Movers</u>	<u>Left Movers</u>	<u>Total</u>
<u>Torque</u>	13	6	10	29
<u>No Torque</u>	13	18	20	51
<u>Total</u>	26	24	30	80

For the non-right handed group, the proportion of bidirectional subjects with torque (70%) was greater than that of right (63%) or left movers (57%) (see Table 4). Again, these differences were found to be nonsignificant ($\chi^2=.41$, $p>.05$) and a polynomial regression ($F(6,24)=1.12$, $p>.05$) revealed no evidence of a curvilinear relationship. Therefore for both handedness groups there appears to be little support for hypothesis 3.

Since no significant effects for sex or handedness were found, the data for CLEM and the Rod and Frame Test were collapsed. As predicted in hypothesis 4, a nonsignificant, positive correlation ($r=.06$, $df=111$, $p>.05$) revealed no relationship between CLEM and field dependence.

The relationship between CLEM and creativity was found to be moderated by a sex by handedness interaction (see Table 5). While a positive correlation was found for both non-right handed males and right handed females, the opposite was true for right handed males and non-right handed females. Of these however, only the negative correlation between CLEM and creativity for right handed males was significant ($r=-.37$, $df=39$, $p\leq.05$). This indicates, contrary to hypothesis 5, a greater tendency for right moving males to be more creative. Furthermore, a polynomial regression revealed no curvilinear relationships in the data suggesting that bidirectional subjects are not more creative than right or left movers.

Table 4
 Incidence of Nonright Handed Subjects
 With Torque as a Function of CLEM

	<u>Right Movers</u>	<u>Bi-Movers</u>	<u>Left Movers</u>	<u>Total</u>
<u>Torque</u>	5	7	8	20
<u>No Torque</u>	3	3	6	12
<u>Total</u>	8	10	14	32

Table 5
 Correlations Between CLEM and Creativity
 According to Sex and Handedness

	<u>Males</u>	<u>Females</u>
<u>Right Handed</u>	-.37	.09
	p < .05	
<u>Nonright Handed</u>	.20	-.37

As predicted in hypothesis 6, creativity was found to be positively related to sensation seeking. Since no significant sex or handedness effects were observed, the data were collapsed. A significant, positive correlation of $r=.59$ ($df=111$, $p\leq.01$) was found. This indicates that creative subjects tend to be greater sensation seekers.

No significant sex or handedness effects were observed for the creativity and boredom data, thus the data were collapsed across groups. In accordance with hypothesis 7, a significant, positive correlation ($r=.40$, $df=111$, $p\leq.01$) between creativity and susceptibility to boredom was found. This indicates a tendency on the part of creative subjects to be more susceptible to boredom.

All sex and handedness groups were combined for the creativity and Rod and Frame data as no significant sex or handedness effects were observed. Contrary to hypothesis 8, a negative correlation of $r=-.10$ ($df=111$, $p>.05$) was found between creativity and performance on the Rod and Frame Test. However, this failed to reach significance. As such, there was little support for a relationship between creativity and field dependence.

An analysis of variance for the creativity and cognitive complexity data revealed a significant main effect for sex ($p\leq.01$). Therefore correlations for males and females were considered separately. A significant, positive correlation of $r=.32$ ($df=55$, $p\leq.05$) was observed for females. This indicates

that more creative females tend to be more cognitively complex. While there was a trend in the same direction for males, the correlation ($r=.25$, $df=55$, $p>.05$) failed to reach significance.

Only marginal support was obtained for hypothesis 10. Since a significant sex by handedness interaction for total physiognomic perception was observed, sex and handedness groups were considered separately (see Table 6). Significant, positive correlations were obtained only for the right handed male and non-right handed female subjects ($r=.34$, $df=39$, $p\leq.05$ and $r=.59$ $df=15$, $p\leq.05$, respectively). A closer examination also revealed a different pattern of results for the physiognomic-thing (factor B) and physiognomic-feeling (factor A) subscales for the separate sex and handedness groups (see Table 7). Again, the only significant correlations obtained were for the right handed males and non-right handed females on factor A ($r=.38$, $df=39$, $p\leq.05$ and $r=.62$, $df=15$, $p\leq.05$ respectively). This indicates that for these subjects greater creativity is associated with greater physiognomic perception of a feeling nature. According to the results presented in Table 7, there appears to be little relation between creativity and factor B for any of the groups.

No significant sex or handedness effects were observed for the creativity and random sequence data. Thus, all groups were combined. A nonsignificant, positive correlation of $r=.04$ ($df=111$, $p>.05$) was found indicating little association between creativity and the ability to generate a random sequence. Thus hypothesis 11 was not confirmed.

Table 6
 Correlations Between Creativity and
 Physiognomic Perception. (Total)
 According to Sex and Handedness

	<u>Males</u>	<u>Females</u>
<u>Right Handed</u>	.34	.26
	$p < .05$	
<u>Nonright Handed</u>	-.39	$p < .05$

Table 7
 Correlations Between Creativity and Physiognomic-Thing
 and Physiognomic-Feeling Perception According to Sex
 and Handedness

	<u>Physiognomic-Feeling</u>		<u>Physiognomic-Thing</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
<u>Right Handed</u>	.38	.18	.17	.21
	p<.05			
<u>Nonright Handed</u>	-.27	.62	-.26	.24
		p<.05		

Secondary Analysis

In order to elucidate the relationship between CLEM or creativity and their corresponding predictors further, multiple regressions were performed. All of the multiple regressions used a backward elimination technique.

Separate multiple regressions on CLEM, according to sex and handedness groups revealed a similar pattern of results. Therefore, all groups were combined. The resulting regression equation contained only the randomness variable. Though significant (see Table 8), an adjusted R squared of .03 showed this equation accounts for little of the variability in CLEM. Therefore, overall, none of the independent variables were good predictors of CLEM performance.

Separate multiple regressions were calculated for creativity, according to sex and handedness. To resolve a problem of multicollinearity, the subscale of boredom susceptibility was subtracted from the total sensation seeking score. As can be seen from Tables 9 to 12, all of the regression equations are highly significant except the one for non-right handed males. Table 13 shows the adjusted R squared and standardized regression coefficients for the different sex and handedness groups. The best set of predictors is quite different for each group. Right handed males and non-right handed females have almost totally opposite predictors with CLEM being the only

Table 8

ANOVA For The Regression Equation For

All Groups on CLEM

<u>Source</u>	<u>SS</u>	<u>DF</u>	<u>MS</u>	<u>F Ratio</u>	<u>Prob.</u>
Regression	3726.332	1	3726.332	3.96	p<.05
Residual	103462.63	110	940.569		

Table 9

ANOVA For The Regression Equation For Right
Handed Males On Creativity

<u>Source</u>	<u>SS</u>	<u>DF</u>	<u>MS</u>	<u>F Ratio</u>	<u>Prob.</u>
Regression	23780.570	3	7926.855	12.08	p<.01
Residual	23616.422	36	656.0117		

Table 10

ANOVA For The Regression Equation For Right
Handed Females On Creativity

<u>Source</u>	<u>SS</u>	<u>DF</u>	<u>MS</u>	<u>F Ratio</u>	<u>Prob.</u>
Regression	30945.434	2	15472.71	25.65	p<.01
Residual	22316.262	37	603.1421		

Table 11

ANOVA For The Regression Equation For Nonright
Handed Males On Creativity

<u>Source</u>	<u>SS</u>	<u>DF</u>	<u>MS</u>	<u>F Ratio</u>	<u>Prob.</u>
Regression	3485.5845	1	3485.5845	2.50	p>.05
Residual	19548.656	14	1396.333		

Table 12

ANOVA For The Regression Equation For Nonright
Handed Females On Creativity

<u>Source</u>	<u>SS</u>	<u>DF</u>	<u>MS</u>	<u>F Ratio</u>	<u>Prob.</u>
Regression	10755.309	6	1792.551	7.53	p<.01
Residual	2143.6572	9	238.1841		

Table 13

Regression Equations and Adjusted R Squared
For Creativity According To Sex And Handedness

	<u>N</u>	<u>R²</u>	<u>Equation</u>
<u>Right Handed</u>			
<u>Male</u>	40	.46	$-.385 (\text{Clem}) + .346 (\text{Physiognomic-Feeling}) + .437 (\text{Sens. Seek.})$
<u>Female</u>	40	.56	$.590 (\text{Sens. Seek.}) + .283 (\text{Boredom})$
<u>Nonright Handed</u>			
<u>Male</u>	16	.09	$.389 (\text{Sens. Seek.})$
<u>Female</u>	16	.72	$.489 (\text{Clem}) + 1.087 (\text{Physiognomic-Total}) - .406 (\text{Physiognomic-Thing}) - .768 (\text{RFT}) + .495 (\text{Randomness}) + .428 (\text{Cognitive Complexity})$

predictor common to both.

III. Discussion

The hypothesis that left movers would demonstrate superior performance on the POT was not supported in this study. No relationship was found for either the accuracy or response time components of the POT. These results are not in accordance with Bilsker's (1980) finding that left movers are superior on accuracy yet have longer response times.

One possible explanation for this discrepancy is a difference in instructions. Personal communication from Bilsker suggested that while he may have emphasized the speed component of the test, the present author may have emphasized the accuracy component. These differences could easily have resulted through both verbal and nonverbal behavior. A greater emphasis on speed may have resulted in lower accuracy overall and larger between subject differences on accuracy. In the present experiment, a mean accuracy score of 23.8 out of a possible 27 indicated that in general, the subjects were quite accurate. As noted earlier, studies utilizing normal populations have been less conclusive than those using clinical populations. This may be partially due to the fact that most of the closure tests are relatively easy to perform, at least for subjects without neurological impairment. Therefore, if the POT's complexity is increased by placing more emphasis on speed, between subject differences in accuracy may be more pronounced.

Marginal support was obtained for the hypothesis that left lateral eye movements are associated with greater ability to generate a random sequence. Though a significant correlation was obtained for the right handed subjects, it should also be noted that it accounted for little variance. The finding of no relationship between CLEM and random sequence generation for the non-right handed subjects may be attributable to a different pattern of cerebral lateralization in non-right handed subjects. If, as suggested earlier, left handers are more likely to exhibit opposite or less lateralized patterns of cerebral specialization, then given the already weak association found for right handers, it may follow that this relationship is totally obscured in non-right handed populations.

The present investigation found little support for a relationship between torque and CLEM. These results provide support for Demarest and Demarest's (1980) contention that torque is not related to cerebral lateralization but rather is nothing more than a product of the mechanics of the hand. Indeed, the finding of a significantly greater incidence of torque among non-right handed subjects may provide further corroboration of their theory.

As predicted, no relationship was found between CLEM and performance on the rod and frame test. These findings are consistent with other studies (Hoffman and Kagan, 1977; Otteson, 1980; Shevrin, Smokler and Wolf, 1979) which have utilized these measures (see Table 1). In addition, from a more general

perspective, these results corroborate the author's review of the literature which showed little systematic relationship between cerebral lateralization and field dependence. One drawback however, to the present investigation is the failure to test Witkin's theory of extent of lateralization or Wogen et al.'s (1981) contention of differential hemispheric activation according to the stage of the problem solving process. While it has been suggested that bidirectionals may be less lateralized, this still doesn't enable one to test Witkin's theory since right and left movers do not fit his criteria for greater lateralization.

The present study found little support for the hypothesis that bidirectional subjects are more creative than left or right movers. Though interesting, the finding of a different pattern of results according to sex by handedness further complicates any lucid interpretation. The only significant correlation indicates a tendency on the part of right moving, male, right handers to be more creative. While this is contrary to both popular theories of creativity and cerebral lateralization (right hemisphere and bilateral theory), it is partially consistent with the findings of Smith (1972), using the Remote Associations Test. It is also interesting to note that a recent study by Moretti (1982) found a similar pattern of results for performance on the WAIS. Right moving, male, right handers and left moving, female, right handers tended to perform better on the WAIS, though the differences for males were much less

pronounced. In all, it would seem that more research is necessary before any clear interpretation of these results can be made.

The failure to find higher creativity scores among bidirectional subjects may be at least partially attributable to an inadequate methodology resulting from a poor understanding of the cerebral lateralization of bidirectional subjects. Though it is commonly assumed that bidirectionals are less lateralized there is little research to support this notion. A study by Gur, Gur and Harris (1975) however, may shed some light on this issue. Using only male subjects, they found two types of bidirectionals, those elicited by both the experimenter-behind and in front condition and those who demonstrate a bidirectional preference only in the experimenter-behind condition. As mentioned previously, it is the experimenter-behind condition which most facilitates a question-type effect (hemispheric specialization). In conjunction with this, they found that most of the subjects showing a bidirectional preference in the experimenter-in-front condition exhibited no question type effect. This may imply that there are two types of bidirectionals, those responding to question type and hence showing greater lateralization for verbal and spatial stimuli, and those showing no discrimination between question type. The latter, according to Gur, Gur and Harris (1975), may be less lateralized. Therefore, since the present experiment utilized an experimenter-in-front procedure, it may be assumed that most of

the bidirectional subjects were less lateralized.

The problem in the present experiment and in past research as well, is confusion with respect to the usage of the terms bilateral dominance and less lateralization. While the former refers to hemisphericity, the latter usually refers to hemispheric specialization. Models of hemisphericity assume as their starting point that there is a lateralization of functions. They imply that individuals may demonstrate a preference for using either hemisphere or both hemispheres and will, as such, have superior abilities for the functions of the hemisphere or hemispheres they tend to use. Therefore, the bilateral theory suggests that more creative individuals benefit from both the gestalt and spatial functions of the right hemisphere and the verbal, sequential functions of the left hemisphere since they differentially use both hemispheres according to the nature or stage of the task at hand.

If as Gur, et al.'s (1975) research suggests, the bidirectional subjects used in the present study were less lateralized, then it may have been a major mistake to assume they should demonstrate greater creativity. Less lateralization refers to a lack of hemispheric specialization of function and does not necessarily imply superior abilities for these functions. As mentioned previously, some researchers even suggest this may result in a deficit in abilities. Perhaps further research with CLEM and creativity would benefit by the discrimination of bidirectionals into less and more lateralized

groups according to the criteria set in the Gur et al. (1975) experiment. This may help explain any differences which may exist between bilateral and less lateralized individuals.

The present investigation found evidence to suggest that more creative subjects are sensation seekers and are more susceptible to boredom. These findings corroborate past research on sensation seeking (Zuckerman, 1979) and offer indirect support for the theory that creative subjects may seek novel experience in an attempt to reduce high arousal resulting from boredom. This explanation however, should be regarded as tentative since, as mentioned previously, there is considerable confusion with respect to arousal research and its interpretation.

Contrary to prediction, creativity was found to have no relationship with field dependence. These results however, are not entirely inconsistent with past findings. As noted earlier, there have been several failures to establish any relationship (Bloomberg, 1971; McWhinnie, 1967, 1969, 1970). Perhaps as Bloomberg (1971) suggests, while most creative individuals may be field independent, not all field independent subjects are creative. This may have resulted in the failure to find a significant relationship.

The present study offers marginal support for a positive relationship between cognitive complexity and creativity. This relationship was significant for females yet only a trend in the same direction was observed for males. This discrepancy

according to sex may be partially due to the finding that females were significantly more complex than males. This resulted in a wider range of scores and hence greater between subject differences for females. It is possible that the female subjects, on average, obtained higher complexity scores because of the verbal nature of the test. However, past research (Goldstein and Blackman, 1978; Quinn, 1981) does indicate conflicting results with regard to sex differences in complexity.

A different pattern of results according to sex and handedness complicates the interpretation of the data relating to physiognomic perception and creativity. While the finding that male, right handers and female, non-right handers demonstrate a positive and significant relationship between creativity and greater physiognomic perception corroborates past studies (Charlton, 1978; Stein, 1975) the negative though significant relationship for male, non-right handers is puzzling. It may be that this is only an artifact of a very small sample size for the non-right handed group.

Furthermore, similar findings for the physiognomic-feeling scale support those of Charlton (1978) who used the same measures. The lack of any significant relationship for physiognomic-thing perception is also consistent with Charlton's findings. One possible explanation for the stronger relationship for feeling rather than thing perception lies in the failure to control for academic background. More of the thing-perception

items may be sensitive to a person's experience with symbols or forms from math or the sciences. For example, if a subject is asked to describe whether a picture looks more like a falling object or a circle with two tangents, a science or math student may be more inclined to choose the latter. Therefore, this may have been a confounding factor.

The present study failed to find any relationship between ability to produce a random sequence and creativity. It may be that production of a random sequence is not necessarily equatable with the ability to instill random structure in an art work, as Arnheim (1971) suggests. However, if this be the case, it also illustrates that Arnheim's theory does not easily lend itself to testable hypotheses and as such, its utility is questionable.

The results from the multiple regressions reveal a very different pattern for creativity according to both sex and handedness. The best set of predictors for right handed males was CLEM, physiognomic-feeling and sensation seeking whereas for non-right handed females, CLEM, physiognomic total and thing, field dependence, randomness and cognitive complexity proved to be the best set of predictors. The reasons why these two groups display almost totally opposite predictors is not readily apparent. While an effect for sex may have been expected from past literature, a handedness effect was not. However, these results do stress the importance of accounting for both sex and handedness in future creativity research.

Appendix : CLEM Test

1. 1. What is the meaning of the proverb: a watched pot never boils.
2. 2. What is the meaning of the proverb: it is an ill wind that blows no one good fortune.
3. 3. Make up a sentence using two forms of the same verb.
4. 4. Tell me two verbs beginning with "N".
5. 5. What is the meaning of the proverb: a poor worker blames his tools.
6. 6. Spell "therapeutic".
7. 7. What is the meaning of the proverb: Call no man happy 'til he's dead.
8. 8. List two adverbs.
9. 9. What is the meaning of the proverb: lend your money and lose your friends.
10. 10. What is the meaning of the proverb: more than enough is too much.
11. 11. List two prepositions.
12. 12. What is the meaning of the proverb: words should be weighed, not counted.
13. 13. What is the meaning of the proverb: he is rich who has few wants.
14. 14. Define inflation.
15. 15. What is the meaning of the proverb: a rolling stone gathers no moss.
16. 16. Make up a sentence using two adverbs.

17. 17. Tell me two verbs beginning with "R".
18. 18. What is the meaning of the proverb: the hardest work is to go idle.
19. 19. What is the meaning of the proverb: what saddens a wise man, gladdens a fool.
20. 20. Define the word "economics".

References

- Acker, M. and McReynolds, P. The need for novelty: A comparison of 6 instruments. The Psychological Record, 1967, 17, 177-182.
- Adams, D., Harvey, O. and Heslin, R. Variation in flexibility and creativity as a function of hypnotically induced past histories. In O. J. Harvey (Ed.), Experience, Structure and Adaptability, New York:Springer, 1966, 217-234.
- Adams-Webber, J. Actual structure and potential chaos: Relational aspects of progressive variations within a personal construct system. In D. Bannister (Ed.), Perspectives in Personal Construct Theory, New York: Academic Press, 1970.
- Adams-Webber, J. Personal Communication, 1978.
- Alberts, F. L. Jr. Base rates of torque in a standard classroom in comparison with classes for educationally dysfunctional and emotionally disturbed. Unpublished masters thesis, University of South Florida, 1977.
- Alexander, J. B. and Gudeman, H.E. Personal and interpersonal measures of field dependence. Perceptual and Motor Skills, 1965, 20, 79-86.
- Andreasen, N. C. Creativity and psychiatric illness. Psychiatric Annals, 1978, 8, 113-119.
- Arbuthnot, J. Cautionary note on measurement of field dependence. Perceptual and Motor Skills, 1972, 35, 479-488.
- Arndt, S. and Berger, D. E. Cognitive mode and asymmetry in cerebral functioning. Cortex, 1978, 14, 78-86.
- Arnheim, R. Entropy and Art. Berkeley: University of California Press, 1971.
- Arrigoni, G. and DeBenzi, E. Constructional apraxia and hemispheric locus of lesion. Cortex, 1964, 1, 170-197.
- Atkinson, J. and Egeth, H. Right hemispheric superiority in visual orientation matching. Canadian Journal of Psychology, 1973, 27, 152-158.
- Bakan, P. Hypnotizability, laterality of eye movement and functional brain asymmetry. Perceptual and Motor Skills, 1969, 28, 927-932.

- Bakan, P. Handedness and birth order. Nature, 1971, 229, 195.
- Bakan, P. Dreaming, REM sleep and the right hemisphere. International Congress on Sleep Research, Edinburgh, 1975. Abstract in M. H. Chase, W. C. Stern and P.L. Walter (Eds.), Sleep Research, 1975, 4, Brain Information Service/Brain Research Institute, UCLA, Los Angeles, pg 23.
- Bakan, P. The right brain is the dreamer. Psychology Today, 1976, 10, 66-68.
- Bakan, P. Two streams of consciousness: A typological approach. In K. Pope and J. L. Singer (Eds.), The Stream of Consciousness, New York: Plenum Press, 1978.
- Bakan, P. Imagery, raw and cooked: A hemispheric recipe. Paper presented at First Annual Conference on Imagery of the American Association for the Study of Mental Imagery, June 22-24, 1979, Los Angeles, California.
- Bakan, P., Coupland, S., Glackman, W. and Putnam, W. Direction of lateral eye movements: individual differences and cognitive content effects. Paper to Canadian Psychological Association, 1974, Windsor.
- Bakan, P., Dibb, G. and Reed, P. Handedness and birth stress. Neuropsychologia, 1973, 11, 363-366.
- Bakan, P. and Shotland, R. L. Lateral eye movement, reading speed, and visual attention. Psychonomic Science, 1969, 15, 93-94.
- Bakan, P. and Strayer, F. F. On reliability of conjugate lateral eye movements. Perceptual and Motor Skills, 1973, 36, 429-430.
- Bakan, P. and Svorad, D. Resting EEG alpha asymmetry of reflective lateral eye movements. Nature, 1969, 223, 975-976.
- Bannister, D. and Fransella, F. Inquiring Man, London: Penguin Books, 1971.
- Bannister, D. and Mair, J. M. The Evaluation of Personal Constructs. New York: Academic Press, 1968.
- Barnat, M. R. Some personality correlates of the conjugate lateral eye movement phenomenon. Journal of Personality Assessment, 1974, 38, 223-225.
- Barron, F. Creative vision and expression in writing and painting. In Conference on the Creative Person. Berkeley: University of California, Institute of Personality

Assessment and Research, 1961.

- Barron, F. Creativity and Psychological Health: Origins of Personality and Creative Freedom. Princeton, N. J.: Van Nostrand, 1963.
- Barron, F. and Welsh, S. Artistic perception as a possible factor in personality style: Its measurement by a figure-preference test. Journal of Psychology, 1952, 33, 199-203.
- Bartholomeux, B. Effects of task requirements on ear superiority for sung speech. Cortex, 1974, 10, 215-223.
- Beardsley, M. C. Order and disorder in art. In P. G. Kuntz (Ed.), The Concept of Order. Seattle: University of Washington Press, 1968.
- Benton, A. L. Constructional apraxia and the minor hemisphere. Confinia Neurologica, 1967, 29, 1-16.
- Benton, A. L. Visuoconstructive disability in patients with cerebral disease: its relationship to side of lesion and aphasic disorder. Documenta Ophthalmologica 1973, 34, 67-76.
- Benton, A. Visuoperceptive, visuospatial, and visuoconstructive disorders. In K. M. Heilman and E. Valenstein (Eds.), Clinical Neuropsychology. New York: Oxford University Press, 1979, 186-233.
- Benton, A. L. The neuropsychology of facial recognition. American Psychologist, 1980, 35, 176-186.
- Ben-Yishay, Y., Diller, L., Mandleberg, I., Gordon, W. and Gerstman, L. J. Similarities and differences in block design performance between older normal and brain-injured persons: A task analysis. Journal of Abnormal Psychology, 1971, 78, 17-25.
- Berent, S. Field dependence and performance on a writing task. Perceptual and Motor Skills, 1974, 38, 651-658.
- Berg, M. R. and Harris, L. J. The effect of experimenter location and subject anxiety on cerebral activation as measured by lateral eye movements. Neuropsychologia, 1980, 18, 89-93.
- Berger, R. M., Guilford, J. P. and Christensen, P. R. A. Factor analytic study of planning activities. Psychological Monograph, 1957, K71, No.6 (Whole No.435).
- Berlin, D. F. and Languis, M. L. Hemispheric correlates of the Rod and Frame test. Perceptual and Motor Skills, 1981, 52,

- Berlyne, D. E. Conflict, Arousal, and Curiosity. New York: McGraw Hill, 1960.
- Berlyne, D. E. Arousal and reinforcement. In D. Levine (Ed.), Nebraska Symposium on Motivation, 15, Lincoln: University of Nebraska Press, 1967.
- Berry, G. A., Hughes, K. L. and Jackson, L. D. Sex and handedness in simple and integrated task performance. Perceptual and Motor Skills, 1980, 51, 807-812.
- Bieri, J., Bradburn, W. M. and Galinski, M. D. Sex differences in perceptual behavior. Journal of Personality, 1958, 26, 1-12.
- Bilsker, D. Conjugate lateral eye movements and perceptual abilities. M.A. Thesis, Simon Fraser University, 1980.
- Bisiach, E., Nichelli, P. and Sala, C. Recognition of random shapes in unilateral brain damaged patients: A reappraisal. Cortex, 1979, 15, 491-499.
- Blau, T. H. The sinister child. JSAS Catalog of Selected Documents in Psychology, 1977, 7, 110 (Ms. No. 1595) (a).
- Blau, T. H. Torque and schizophrenic vulnerability: As the world turns. American Psychologist, 1977, 32, 997-1005, (b).
- Blau, T. H. and Coleman, L. A study of torque in seriously disturbed children at a residential treatment center. Unpublished manuscript, 1977.
- Bloomberg, M. Differences between field independent and field dependent persons on the Stroop Colour-Word test. Journal of Clinical Psychology, 1969, 24, 45.
- Bloomberg, M. Creativity as related to field dependence and mobility. Journal of Genetic Psychology, 1971, 118, 3-12.
- Bloom-Feshbach, J. Differentiation: Field dependence, spatial ability, and hemispheric specialization. Journal of Personality, 1980, 48, 135-148.
- Bogen, J. E. The other side of the brain 1. Dysgraphia and dyscopia following cerebral commissurotomy. Bulletin of the Los Angeles Neurological Society, 1969, 34, 73-105.
- Bogen, J. E. The other side of the brain 11. An appositional mind. Bulletin of the Los Angeles Neurological Society, 1969, 34, 135-162.

- Bogen, J. E. Some educational aspects of hemispheric specialization. UCLA Educator, 1975, 17, 24-32.
- Bogen, J. E. and Bogen, G. M. The other side of the brain 111. The corpus collosum and creativity. Bulletin of the Los Angeles Neurological Society, 1969, 34, 191-220.
- Bogen, J. E., DeZure, M., TenHouten, W. D., and March, J. F. The other side of the brain IV: The A/P ratio. Bulletin of the Los Angeles Neurological Society, 1972, 37, 49-61.
- Bogen, J. E. and Gazzaniga, M. S. Cerebral commissurotomy in man: Minor hemisphere dominance for certain spatial functions. Journal of Neurosurgery, 1965, 24, 394-399.
- Bone, R. N., Cowling, L. W. and Belcher, M. M. Sensation seeking and the similes preference inventory. 1974, Cited in Zuckerman, M. Sensation Seeking: Beyond the Optimal Level of Arousal. Hillsdale, New Jersey: Laurence Erlbaum, 1979.
- Bone, R. N. and Cowling, L. W. Sensation seeking and creativity. Cited in Zuckerman, M. Sensation Seeking: Beyond the Optimal Level of Arousal. Hillsdale, New Jersey: Laurence Erlbaum, 1979.
- Bowers, K. S. and Bowers, P. G. Hypnosis and creativity: A theoretical and emperical rapprochement. In Fromm, E. and Shor, R. E. Hypnosis: Research Developments and Perspectives. Chicago: Aldene, 1972.
- Bowers, K. S. and Keeling, K. R. Heart-rate variability in creative functioning. Psychological Reports, 1971, 29, 160-162.
- Bowers, P. Hypnosis and creativity: The search for the missing link. Journal of Abnormal and Social Psychology, 1979, 88, 564-572.
- Bradshaw, J. L. and Nettleton, N. C. The nature of hemispheric specialization in man. The Behavioral and Brain Sciences, 1981, 4, 51-91.
- Broverman, D. M. Generality and behavioral correlates of cognitive styles. Journal of Consulting Psychology, 1964, 28, 487-500.
- Bruner, J. On Knowing: Essays for the Left Hand. Cambridge, Mass.: Harvard University Press, 1962.
- Bryden, M. P. Response bias and hemispheric differences in dot localization. Perception and Psychophysics, 1976, 19, 23-28.
- Bryden, M. P. Measuring handedness with questionnaires.

Neuropsychologia, 1977, 15, 617-624.

- Bryden, M. P. Evidence for sex differences in cerebral organization. In M. Wittig and A. Peterson (Eds.) Determinants of Sex-related Differences in Cognitive Functioning, New York: Academic, 1979.
- Bryden, M. P. Sex differences in brain organization: different brains or different strategies? Behavioral and Brain Sciences, 1980, 3, 230-231.
- Buffery, A. W. H. and Gray, J. A. Sex differences in the development of spatial and linguistic skills. In C. Ounsted and D. C. Taylor (Eds.) Gender Differences: Their Ontogeny and Significance. Edinburgh: Churchill Livingstone, 1972.
- Burke, J. Connections. London: MacMillan Ltd., 1978.
- Busse, T. V. Establishment of the flexible thinking factor in fifth-grade boys. Journal of Psychology, 1968, 69, 93-100.
- Carey, S. and Diamond, R. From piecemeal to configurational representation of faces. Science, 1977, 195, 312-314.
- Carmon, A. Spatial and temporal factors in visual perception of patients with unilateral cerebral lesions. In M. Kinsbourne (Ed.), Asymmetrical Function of the Brain. London: Cambridge University Press, 1978.
- Charlton, S. J. The nature of creative processing. Unpublished Honours B.A. thesis, Brock University, St Catharines, Canada, 1978.
- Christensen, P. R., Guilford, J. P., Merrifield, P., and Wilson, R. Alternate Uses Test. Beverly Hills, California, Sheridan Psychological Service, 1960.
- Christensen, P.R., Merrifield, P. R. and Guilford, J. P. Consequences: Manual for Administration, Scoring and Interpretations. Beverly Hills, California: Sheridan Supply, 1958.
- Claridge, S. The schizophrenics as nervous types. British Journal of Psychiatry, 1972, 121, 1-17.
- Cohen, B. D., Berent, S. and Silverman, A. J. Field-dependence and lateralization of function in the human brain. Archives of General Psychiatry, 1973, 28, 165-167.
- Cohen, G. Hemispheric differences in serial versus parallel processing. Journal of Experimental Psychology, 1973, 97, 349-356.

- Combs, A. L., Hoblick, P. J., Czarnecki, M. J. and Kamler, P. Relationship of lateral eye-movement to cognitive mode, hemispheric interaction, and choice of college major. Perceptual and Motor Skills, 1977, 45, 983-990.
- Cook, M. Interpersonal Perception. London: Penguin Books, 1971.
- Corballis, M. C. and Beale, I. L. The Psychology of Left and Right. Hillsdale, N. J.: Erlbaum, 1976.
- Corkin, S. Hidden-figures-test performance: Lasting effects of unilateral penetrating head injury and transient effects of bilateral cingulotomy. Neuropsychologia, 1979, 585-605.
- Costa, L. D. and Vaughan, H. G. Performance of patients with lateralized cerebral lesions, 1: Verbal and perceptual tests. Journal of Nervous and Mental Disease, 1962, 134, 162-168.
- Crockett, W. H. Cognitive complexity and impression formation. In Progress in Experimental Personality Research, B. A. Maher (Ed.), New York: Academic Press, 1975.
- Cropley, A. J. Creativity and intelligence. British Journal of Educational Psychology, 1966, 36, 259-260.
- Cross, P. G., Cattell, R. B. and Butcher, H. J. The personality patterns of creative artists. British Journal of Educational Psychology, 1967, 37, 292-299.
- Crouch, W. Dominant direction of conjugate lateral eye movements and responsiveness to facial and verbal cues. Perceptual and Motor Skills, 1976, 42, 167-174.
- Crutchfield, R. S., Woodworth, D. G. and Albrecht, R. E. Perceptual performance and the effective person. (WADC-TN-58-60), Lackland Air Force Base, Texas: Wright Air Development Center, 1958, (NTIS NO.AD-151039).
- Csikszentmihalyi, M. and Getzels, J. W. The personality of young artists: An empirical and theoretical exploration. British Journal of Psychology, 1973, 64, 91-104.
- Dauw, D. C. Creativity research on actuaries. Journal of Creative Behavior, 1968, 2, 274-280.
- Davidoff, J. B. Hemispheric differences in the perception of lightness. Neuropsychologia, 1975, 13, 121-124.
- Davis, G. A. In frumious pursuit of the creative process. Journal of Creative Behavior, 1975, 9, 75-87.
- Davis, G. A. How Do You Think Test, Form E, Adult University of

Wisconsin, 1977.

- Davis, G. A., Peterson, J. M. and Farley, F. H. Attitudes, motivation, sensation seeking and belief in ESP as predictors of real creative behavior. Journal of Creative Behavior, 1973, 8, 31-39.
- Dawson, J. L. M. Temne-Arunta hand/eye dominance and cognitive style. International Journal of Psychology, 1972, 7, 219-233.
- Dawson, J. L. Alaskan Eskimo hand, eye, auditory dominance and cognitive style. Psychologia, 1977, 20, 121-135.
- Day, M. E. An eye-movement phenomenon related to attention, thought and anxiety. Perceptual and Motor Skills, 1964, 19, 443-446.
- Day, M. E. An eye-movement indicator of individual differences in the physiological organization of attentional processes and anxiety. Journal of Psychology, 1967a, 66, 51-62.
- Day, M. E. An eye-movement indicator type and level of anxiety: Some clinical observations. Journal of Clinical Psychology, 1967b, 23, 438-444.
- Deikman, A. J. Deautomatization and the mystic experience. Psychiatry, 1966, 29, 324-338.
- Deikman, A. J. Bimodal Consciousness. Archives of General Psychiatry, 1971, 25, 481-489.
- Del Gaudio, A. C. Psychological differentiation and mobility as related to creativity. Perceptual and Motor Skills, 1976, 43, 831-841.
- Dellas, M. and Gaier, E. L. Identification of creativity: The individual. Psychological Bulletin, 1970, 73, 55-73.
- Demarest, J. and Demarest, L. Does the torque test measure cerebral dominance in adults? Perceptual and Motor Skills, 1980, 50, 155-158.
- De Renzi, E., Faglioni, P. and Scotti, G. Judgement of spatial orientation in patients with focal brain damage. Journal of Neurology, Neurosurgery and Psychiatry, 1971, 34, 489-495.
- De Renzi, E. and Spinnler, H. Visual recognition in patients with unilateral disease. Journal of Nervous and Mental Disease, 1966, 142, 515-525.
- Dewing, K. and Battye, G. Attention deployment and nonverbal fluency. Journal of Personality and Social Psychology, 1971,

- Dewitt, G. W. Laterality, personality, and the perception of emotional stimuli. Ph.D. dissertation, University of Massachusetts, 1977.
- Dewitt, G. W. and Averill, J. R. Lateral eye movements, hypnotic susceptibility and field independence-dependence. Perceptual and Motor Skills, 1976, 43, 1179-1184.
- Dinius, S. H. The role of personality characteristics in the choice of accounting as a major and in success in accounting courses. (Doctoral dissertation, Auburn University, 1974) Dissertation Abstracts International, 1975, 35, 3608B (University Microfilms No. 75-556).
- Doerr, S. L. Conjugate lateral eye movement, cerebral dominance, and the figural creativity factors of fluency, flexibility, originality, and elaboration in community college students. Dissertation Abstracts International, 1980, 40, (4361-A).
- Drevdahl, J. E. and Cattell, R. B. Personality and creativity in artists and writers. Journal of Clinical Psychology, 1958, 14, 107-111.
- Duffy, R. A. An analysis of aesthetic sensitivity, creativity, artistic potential, visual-haptic aptitude, cognitive style, personality and demographic variables in grades four, six, eight and ten. Dissertation Abstracts International, 1978 (6476-A).
- Duke, J. B. Lateral eye-movement behavior. Journal of General Psychology, 1968, 78, 189-195.
- Duncker, K. On problem solving. Psychological Monographs, 1945, 58, No. 270.
- Dusewicz, R. A. Lateral dominance and creativeness. Perceptual and Motor Skills, 1968, 27, 826.
- Dykes, M. and McGhie, A. A comparative study of attentional strategies of schizophrenics and highly creative normal subjects. British Journal of Psychiatry, 1976, 128, 50-56.
- Ebenholtz, S. M. and Benzsshawel, T. L. The rod and frame effect and induced head tilt as a function of observation distance. Perception and Psychophysics, 1977, 22, 491-496.
- Edwards, B. Drawing on the Right Side of the Brain. Los Angeles: Tarchner, 1979.
- Ehrlichman, H. Hemispheric functioning and individual differences in cognitive abilities. (Doctoral Dissertation,

New School for Social Research, 1971) Dissertation Abstracts International, 1972, 33, 2319B. (University Microfilms No. 72-27, 869).

Ehrlichman, H. and Weinberger, A. Lateral eye movements and hemispheric asymmetry: A critical review. Psychological Bulletin, 1978, 85, 1080-1101.

Eisenman, R. and Robinson, N. Complexity-Simplicity, creativity, intelligence and other correlates. Journal of Psychology, 1967, 67, 331-334.

Elliott, R. Interrelationships among measures of field dependence, ability, and personality traits. Journal of Abnormal and Social Psychology, 1961, 63, 27-36.

El-Meligi, A. M. and Cott, A. Perceptual Organization Test (POT) for the differentiation between schizophrenia, and brain damage. Journal of Orthomolecular Psychiatry, 1978, 7, 156-166.

Epro, R. and Granite, M. M. Cerebral lateralization measured by performance on a block design task. International Journal of Neuroscience, 1979, 10, 57-60.

Etaugh, C. and Rose, M. Lateral eye movement: Elusive personality correlates and moderate stability estimates. Perceptual and Motor Skills, 1973, 37, 211-217.

Farley, F. H. Measures of individual differences in stimulation seeking and the tendency toward variety. Journal of Consulting and Clinical Psychology, 1971, 37, 394-396.

Farley, F. H. Arousal and cognition: Creative performance, arousal and the stimulation-seeking motive. Perceptual and Motor Skills, 1976, 43, 703-708.

Florek, H. Heart rate during creative activity. Studia Psychologica, 1973, 15, 158-161.

Flor-Henry, P. Schizophrenia-like reactions and affective psychosis associated with temporal lobe epilepsy. American Journal of Psychiatry, 1972, 126, 400-404.

Flor-Henry, P. Evolutionary and clinical aspects of lateralized sex differences. Behavioral and Brain Sciences, 1980, 3, 235-236.

Fischer, E. F. Functional asymmetry: Some right hemisphere functions. Dissertation Abstracts International, 1976, 37, (3071-B).

Fischer, R. A cartography of the ecstatic and meditative states.

Science, 1971, 174, 897-904.

Fontenot, D. J. Visual field differences in the recognition of verbal and nonverbal stimuli in man. Journal of Comparative and Physiological Psychology, 1973, 85, 564-569.

Freud, S. Formulations on the two principles of mental functioning. Standard Edition, 1911, 12, 213-26.

Freud, S. Creativity and the Unconscious Washington: Washington Square Press, 1920.

Frost, R. O., Burish, T. G. and Holmes, D. S. Stress and EEG-alpha Psychophysiology, 1978, 15, 394-397.

Galin, D. The two modes of consciousness and the two halves of the brain. In P. R. Lee, R. E. Ornstein, D. Galin, A. Deikman and C. T. Tart (Eds.) Symposium on Consciousness, New York: Viking Press, 1976.

Gamble, K. R., and Kellner, H. Creative functioning and cognitive regression. Journal of Personality and Social Psychology, 1968, 9, 266-271.

Gardiner, M. Mathematical games: On the meaning of randomness and some ways of achieving it. Scientific American, 1968, 219, 116-121.

Garren, R. B. and Gehlsen, G. M. Hemispheric superiority for processing a mirror image. Perceptual and Motor Skills, 1981, 52, 484-486.

Gazzaniga, M. S. and Le Doux, J. E. The Integrated Mind. New York: Plenum Press, 1978.

Geffen, G., Bradshaw, J. L. and Nettleton, N. C. Hemispheric asymmetry: Verbal and spatial encoding of visual stimuli. Journal of Experimental Psychology, 1972, 95, 25-31.

Gevins, A. S., Zeitlin, G. M., Doyle, J. C., Yingling, C. D., Schaffer, R. E., Callaway, E. and Yeager, C. L. Electroencephalogram correlates of higher cortical functions. Science, 1979, 203, 665-668.

Gilbert, C. Non-verbal perceptual abilities in relation to left-handedness and cerebral lateralization. Neuropsychologia, 1977, 15, 779-791.

Golann, S. E. The creativity motive. Journal of Personality, 1962, 30, 588-600.

Golann, S. E. Psychological study of creativity. Psychological Bulletin, 1963, 60, 548-565.

- Goldstein, K. M. and Blackman, S. Cognitive Style. New York: John Wiley and Son, 1978.
- Gollin, E. S. Perceptual and Motor Skills, 1960, 11, 289.
- Gombrich, E. H. The Story of Art, New York: Phaidon, 1951.
- Goodenough, D. R. The role of individual differences in field dependence as a factor in learning and memory. Psychological Bulletin, 1976, 83, 675-694.
- Goodenough, D. R. and Karp, S. A. Field dependence and intellectual functioning. Journal of Abnormal and Social Psychology, 1961, 63, 241-246.
- Goodglass, H, and Calderon, M. Parallel processing of verbal and musical stimuli in right and left hemispheres. Neuropsychologia, 1977, 15, 397-407.
- Gordon, W. J. Synectics. New York: Macmillan, 1961.
- Gowan, J. C. Incubation, imagery and creativity. Journal of Mental Imagery, 1978, 2, 23-32.
- Graham, C. and Evans, F. J. Hypnotizability and the deployment of waking attention. Journal of Abnormal Psychology, 1977, 86, 631-638.
- Greene, L. R. Effects of field dependence on affective reactions and compliance in dyadic interactions. Journal of Personality and Social Psychology, 1976, 34, 569-577.
- Grinder, J. and Bandler, R. The Structure of Magic 11. Science and Behavior Books, 1976.
- Gross, Y., Even, A., Feldman, B. and Glaubman, H. Effects of induced lateral gaze on performance on the rod and frame test. Perceptual and Motor Skills, 1981, 52, 771-776.
- Gur, R. C. and Gur, R. E. Handedness, sex and eyedness as moderating variables in the relation between hypnotic susceptibility and functional brain asymmetry. Journal of Abnormal Psychology, 1974, 83, 635-643.
- Gur, R. C. and Reivich, M. Cognitive task effects on hemispheric blood flow in human: Evidence for individual differences in hemispheric activation. Brain and Language, 1980, 9, 78-92.
- Gur, R. C. and Reyher, J. Enhancement of creativity via free-imagery and hypnosis. The American Journal of Clinical Hypnosis, 1976, 18, 237-249.
- Gur, R. E., Gur, R. C. and Harris, L. J. Cerebral activation, as

measured by subject's lateral eye movements, is influenced by experimenter location. Neuropsychologia, 1975, 13, 35-44.

- Guilford, J. P. Intelligence, Creativity and their Educational Implications. San Diego, California: Robert R. Knapp, 1968.
- Gundlach, R. H. and Gesell, G. P. Extent of psychological differentiation and creativity. Perceptual and Motor Skills, 1979, 48, 319-333.
- Hammerman, D. Creativity: The illumination matrix: adaptive regression, ideational fluency, inner directedness and hemispheric functioning. Dissertation Abstracts International, 1980 (1891-B) 41.
- Hannay, H. J. Real or imagined incomplete lateralization of function in females? Perception and Psychophysics, 1976, 19, 349-352.
- Hannay, H. J., Dee, H. L., Burns, J. W. and Masek, B. S. Experimental reversal of a left visual field superiority for forms. Brain and Language, 1981, 13, 54-66.
- Hardyck, C. and Petrinovich, L. F. Left handedness. Psychological Bulletin, 1977, 84, 385-404.
- Harnad, S. R. Creativity, lateral saccades and the nondominant hemisphere. Perceptual and Motor Skills, 1972, 34, 653-654.
- Harris, L. J. Sex differences in spatial ability: possible environmental, genetic and neurological factors. In M. Kinsbourne (Ed.) Asymmetrical Function of the Brain. London: Cambridge University Press, 1978.
- Harvey, O. J. Experience, Structure and Adaptability. New York: Springer, 1966.
- Harvey, O. J., Hunt, D. E. and Schroder, H. M. Conceptual Systems and Personality Organization. New York: John Wiley, 1961.
- Hays, W. L. Statistics for the Social Sciences. New York: Holt, Rinehart and Winston, 1973.
- Haywood, K., Teeple, J., Givens, M. and Patterson J. Young children's rod and frame test performance. Perceptual and Motor Skills, 1977, 45, 763-769.
- Hecaen, H. Clinical symptomatology in right and left hemispheric lesions. In V. B. Mountcastle (Ed.), Interhemispheric Relations and Cerebral Dominance. Baltimore: John Hopkins University Press, 1962.

- Hecaen, H. and Sauguet, J. Cerebral dominance in left handed subjects. Cortex, 1971, 7, 19-48.
- Heilbrun, A. B. Psychological Test performance as a function of lateral localization of cerebral lesion. Journal of Comparative and Physiological Psychology, 1956, 49, 10-14.
- Heinze, S. J. Job adaptation and creativity in industrial research scientists. Unpublished doctoral dissertation. University of Chicago, 1962.
- Hicks, R. E. and Kinsbourne, M. Human handedness. In M. Kinsbourne (Ed.), Asymmetrical Function of the Human Brain, New York: Cambridge University Press, 1978.
- Hilgard, E. R. Hypnotic Susceptibility. New York: Harcourt, Brace and World, 1965.
- Hilgard, E. Divided Consciousness. New York: John Wiley and Sons, 1977.
- Hines, D. and Martindale, C. Induced lateral eye movements and creative and intellectual performance. Perceptual and Motor Skills, 1974, 39, 153-154.
- Hocevar, D. Measurement of creativity: Review and critique. Journal of Personality Assessment, 1981, 45, 450-464.
- Hockey, G. R. J. Rate of presentation in running memory and direct manipulation of input processing strategies. Quarterly Journal of Experimental Psychology, 1973, 25, 104-111.
- Houston, K. Field independence and performance in distraction. The Journal of Psychology, 1969, 72, 65-69.
- Huang, M. and Byrne, B. Cognitive style and lateral eye movements. British Journal of Psychology, 1978, 69, 85-90.
- Huckabee, M. W. and McGown, W. P. Differences between field independent and field dependent persons on the Stroop Color-Word test: A failure to replicate. Journal of Clinical Psychology, 1971, 27, 226.
- Hutt, C. Cerebral asymmetry and hemispheric specialization - some implications of sex differences. International Journal of Behavioral Development, 1979, 2, 73-86.
- Hyde, J. S., Geiringer, E. R. and Yen, W. M. On the empirical relation between spatial ability and sex differences in other aspects of cognitive performance. Multivariate Behavioral Research, 1975, 24, 289-309.

- Ilg, F. and Ames, L. B. School Readings. New York: Harper and Row, 1974.
- Jackson, P. W. and Messick, S. The person, the product and the response: Conceptual problems in the assessment of creativity. Journal of Personality, 1965, 33, 309-329.
- Jaynes, J. The Origin of Consciousness in the Breakdown of the Bicameral Mind. Boston: Houghton Mifflin, 1976.
- Jean, P. Eye movements and creativity. 1974 (unpublished paper), Simon Fraser University.
- Jones, D. S., Chew, R. E., Allman, N. A., Marble, A. D., Mitchell, P. A. and Combs, A. L. Lateral eye movements and dream recall. Perceptual and Motor Skills, 1980, 50, 1090.
- Kahneman, D. Attention and Effort. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1973.
- Karlins, M. An initial description of the community development task presented with findings concerned conceptual complexity in Peace Corps volunteers. Unpublished Masters thesis, Princeton University, 1965.
- Karlins, M. Conceptual complexity and remote-associative proficiency as creativity variables in a complex problem solving task. Journal of Personality and Social Psychology, 1967, 6, 264-278.
- Karlins, M., Coffman, T., Lamm, H. and Schroder, H. M. The effect of conceptual complexity on information search in a complex problem solving task. Psychonomic Science, 1967, 7, 137-138.
- Karp, S. A. Field dependence and overcoming embeddedness. Journal of Consulting Psychology, 1963, 27, 294-302.
- Katz, A. N. Do left handers tend to be more creative? Journal of Creative Behavior, 1980, 14, 271.
- Katz, J. and Salt, P. Differences in task and use of language: A study of lateral eye movements. Perceptual and Motor Skills, 1981, 52, 995-1002.
- Kaufman, J. L. The relationship between cognitive style and creativity in urban seventh grade children. Unpublished Doctoral dissertation. Fordham University, 1975.
- Kay, S. R. Significance of torque in retarded mental development and psychosis: Relationship to antecedent and current pathology. American Psychologist, 1979, 34, 357-362.

- Keefe, J. A. and Magaro, P. A. Creativity and schizophrenia: An equivalence of cognitive processing. Journal of Abnormal Psychology, 1980, 89, 390-398.
- Kelly, G. A. The Psychology of Personal Constructs. New York: Norton, 1955.
- Khatena, J. Frontiers of creative imagination imagery. Journal of Mental Imagery, 1978, 2, 33-46.
- Khatena, J. and Torrance, P. E. Manual for Khatena-Torrance creative perception inventory. Chicago: Stoelting Company, 1976.
- Kimura, D. Sex differences in intrahemispheric organization of speech. Behavioral and Brain Sciences, 1980, 3, 240-241.
- Kimura, D. Cerebral dominance and the perception of verbal stimuli. Canadian Journal of Psychology, 1961, 15, 166-171.
- Kinsbourne, M. Eye and head turning indicates cerebral lateralization. Science, 1972, 176, 539-541.
- Kinsbourne, M. Hemispheric specialization and the growth of human understanding. American Psychologist, 1982, 37, 411-420.
- Kish, G. B. Cognitive innovation and stimulus seeking: A study of the correlates of the Obscure Figures Test. Perceptual and Motor Skills, 1970, 30, 95-101.
- Knapp, R. H. and Wulff, A. Preference for abstract and representational art. Journal of Social Psychology, 1963, 60, 255-262.
- Knapp, R. H. An experimental study of a triadic hypothesis concerning the source of aesthetic imagery. Journal of Projective Techniques, 1964, 28, 49-54.
- Koestler, A. The Act of Creation. New York: Dell, 1964.
- Kohn, B. and Dennis, M. Patterns of hemispheric specialization after hemidecortication for infantile hemiplegia. In Hemispheric Disconnection and Cerebral Function. M. Kinabourne and W. L. Smith (Eds.), Springfield: Charles C. Thomas, 1974 (b).
- Kohn, B. and Dennis, M. Selective impairments of visuo-spatial abilities in infantile hemiplegics after right cerebral hemidecortication. Neuropsychologia, 1974, 12, 505-512 (a).
- Kreitler, H. and Kreitler, S. Psychology of the Arts. Durham, North Carolina: Duke University Press, 1972.

- Kris, E. Psychoanalytic Explorations in Art. New York: International Universities Press, Inc. 1952.
- Kubie, L. S. Neurotic Distortion of the Creative Process. Toronto: McGraw-Hill Ryerson Ltd., 1977.
- Lamb, C. W. Forms of need for variety: Differential expression following arousal and boredom. Unpublished Doctoral Dissertation, Ohio State University, 1966.
- Landis, T. Assal, G. and Perret, E. Opposite cerebral hemispheric superiorities for visual associative processing of emotional facial expressions and objects. Nature, 1979, 278, 739-740.
- Lange-Eichbaum, W. The Problem of Genius. London: Kegan, Paul, French and Trubner, 1931.
- Lansdell, H. C. Effect of extent of temporal lobe ablations on two lateralized deficits. Physiological Behavior, 1968, 3, 271-273.
- Lansdell, H. Relation of extent of temporal removals to closure and visuomotor factors. Perceptual and Motor Skills, 1970, 31, 491-498.
- Le Deaux, J. E., Wilson, D. H. and Gazzaniga, M. S. Manipulo-spatial aspects of cerebral lateralization: Clues to the origin of lateralization. Neuropsychologia, 1977, 15, 743-750.
- Le Deaux, J. E., Wilson, D. H. and Gazzaniga, M. S. Block design performance following callosal sectioning. Archives of Neurology, 1978, 35, 506-508.
- Lefevre, E., Starck, R., Lambert, W. E. and Genesee, F. Lateral eye movements during verbal and nonverbal dichotic listening. Perceptual and Motor Skills, 1977, 44, 1115-1122.
- Levy, J. Lateral specialization of the human brain: Behavioral manifestations and possible evolutionary basis. Paper presented at the 32nd Annual Biology Colloquium. Oregon State University, 1971.
- Levy-Agresti, J. and Sperry, R. W. Differential perceptual capacities in major and minor hemispheres. Proceedings of the National Academy of Sciences, U.S.A., 1968, 61, 1115-1119.
- Ley, R. G. and Bryden, M. P. Hemispheric differences in processing emotions and faces. Brain and Language, 1979, 7, 127-128.
- Libby, W. L. Eye contact and direction of looking as stable

- individual differences. Journal of Experimental Research in Personality, 1970, 4, 303-312.
- Linn, M. C. and Kyllonen, P. The field-dependence-independence construct: Some, one or none. Journal of Educational Psychology, 1981, 73, 261-273.
- Liske, E., Hughes, H. and Stowe, D. Crosscorrelation of human alpha activity: normative data. EEG and Clinical Neurophysiology, 1967, 22, 429-436.
- Lombroso, C. The Man of Genius. London: Walter Scott, 1891.
- Luria, A. R. Traumatic Aphasia. The Hague, The Netherlands: Mouton, 1970.
- Luria, A. R. The Working Brain. New York: Basic Books, 1973.
- Luria, A. R. and Simernitskaya, E. G. Inter-hemispheric relations and the functions of the minor hemisphere. Neuropsychologia, 1977, 15, 175-178.
- MacKinnon, D. W. What do we mean by talent and how do we test for it. In The Search For Talent. New York: College Entrance Examination Board, 1960.
- MacKinnon, D. W. The study of creativity and creativity in architects. In, Conference on the Creative Person. Berkeley: University of California, Institute of Personality Assessment and Research, 1961.
- MacKinnon, D. W. The personality correlates of creativity: A study of American architects. In Proceedings of the Fourteenth Congress on Applied Psychology, 2, Munksgaard, 1962, 11-39.
- Maltzman, I., Simon, S., Raskin, D. and Licht, L. Experimental studies in the training of originality. Psychological Monographs, 1960, 74, (Whole No. 493).
- Martindale, C. Creativity, consciousness and cortical arousal. Journal of Altered States of Consciousness, 1977, 3, 69-85.
- Martindale, C. and Armstrong, J. The relationship of creativity to cortical activation and its operant control. Journal of Genetic Psychology, 1974, 124, 311-320.
- Martindale, C. and Greenough, J. The differential effect of increased arousal on creative and intellectual performance. Journal of Genetic Psychology, 1973, 123, 329-335.
- Maslow, A. Toward a Psychology of Being. New York: Von Nostrand, 1958.

- Mayes, A. and Beaumont, G. Does visual evoked potential asymmetry index cognitive activity? Neuropsychologia, 1977, 15, 249-256.
- McCallum, R. S. Cognitive style as a function of ability. Perceptual and Motor Skills, 1981, 52, 955-958.
- McFie, J. and Zangwill, O. Visual-constructive disabilities associated with lesions of the left cerebral hemisphere. Brain, 1960, 83, 243-260.
- McGlone, J. Sex differences in the cerebral organization of verbal functions in patients with unilateral brain lesions. Brain, 1977, 100, 775-793.
- McGlone, J. Sex differences in human brain asymmetry: A critical survey. The Behavioral and Brain Sciences, 1980, 3, 215-263.
- McGlone, J. and Davidson, W. The relation between cerebral speech laterality and spatial ability with special reference to sex and hand preference. Neuropsychologia, 1973, 11, 105-113.
- McGlone, J. and Kertesz, A. Sex differences in cerebral processing of visuospatial tasks. Cortex, 1973, 9, 313-320.
- McGuinness, D. and Pribram, K. H. The origins of sensory bias in the development of gender differences in perception and cognition. In M. Bartner (Ed.), Cognitive Growth and Development. New York: Brunner/Mazel, 1979.
- McKellar, P. Imagination and Thinking. London: Cohen and West, 1957.
- McWhinnie, H. J. Some relationships between creativity and perception in sixth grade children. Perceptual and Motor Skills, 1967, 25, 979-980.
- McWhinnie, H. J. Some relationships between creativity and perception in fourth grade children. Acta Psychologica, 1969, 31, 169-175.
- McWhinnie, H. J. A third study of some relationships between creativity and perception. California Journal of Educational Research, 1970, 21, 25-42.
- Mednick, S. A. The associative basis of the creative process. Psychological Review, 1962, 69, 220-232.
- Mednick, S. A. and Mednick, M. Remote Associates Test: Examiner's Manual. Boston: Houghton Mifflin, 1967.
- Melamed, F. Regional cerebral blood flow during eye movements in

man. Acta Neurologica Scandinavia (suppl), 1977, 56, 530-531.

- Mendelsohn, G. A. and Griswold, B. B. Differential use of incidental stimuli in problem solving as a function of creativity. Journal of Abnormal and Social Psychology, 1964, 68, 431-436.
- Mendelsohn, G. A. and Griswold, B. B. Assessed creative potential, vocabulary level and sex as predictors of the use of incidental cues in verbal problem solving. Journal of Personality and Social Psychology, 1966, 4, 423-433.
- Mendelsohn, G. A. and Griswold, B. B. Anxiety and repression as predictors of the use of incidental cues in problem solving. Journal of Personality and Social Psychology, 1967, 6, 353-359.
- Meskin, B. and Singer, J. Daydreaming, reflective thought and lateral eye movements. Journal of Personality and Social Psychology, 1974, 30, 64-71.
- Messick, S. and Damarin, F. Cognitive styles and memory for faces. Journal of Abnormal and Social Psychology, 1964, 69, 313-318.
- Meyer, S. G. Interhemispheric interruption of alpha as a function of problem type, eye movement, imagery use, and relative hemispheric ability. Dissertation Abstracts, 1977, 37 (B), 5860-5861.
- Milton, C. Study of circling direction preferences indicating type of cerebral dominance in primary and secondary school pupils. Unpublished Science Fair Report, Valparaiso, Florida, High School, 1976.
- Mischel, W. and Metzner, R. Preference for delayed reward as a function of age, intelligence, and length of delay interval. Journal of Abnormal and Social Psychology, 1962, 64, 425-431.
- Mitchell, R. R. Physiognomic responsiveness, primary process thinking and Rorschach measures of creativity. Unpublished doctoral dissertation, New York University, 1974.
- Mooney, C. M. and Ferguson, G. A. A new closure test. Canadian Journal of Psychology, 1951, 5, 129-133.
- Moore, W. H. and Haynes, W. O. A study of alpha hemispheric asymmetries for verbal and nonverbal stimuli in males and females. Brain and Language, 1980, 9, 338-349.
- Moretti, M. Conjugate Lateral Eye Movements and Performance on

the Wechsler Adult Intelligence Scale-Revised. Unpublished Masters Thesis, Simon Fraser University, 1982.

- Morgan, A., McDonald, P. N. and MacDonald, H. Differences in bilateral alpha activity as a function of experimental task: with a note on lateral eye movements and hypnotizability. Neuropsychologia, 1971, 9, 459-469.
- Morin, S. F. and Clark, P. M. Influence of massed versus distributed work sessions on creative thinking. Proceedings of the 81st Annual Convention, American Psychiatric Association, 1973, Washington D.C.: American Psychological Association, 1974.
- Moscovitch, M. Information processing and the cerebral hemispheres. In M. S. Gazzaniga (Ed.), Handbook of Behavioral Neurobiology, 2, New York: Plenum Press, 1979.
- Moscovitch, M., Scullion, D. and Christie, D. Early versus late stages of processing and their relation to functional hemispheric asymmetries in face recognition. Journal of Experimental Psychology: Human Perception and Performance, 1976, 2, 401-416.
- Myers, L. B. Some findings with regard to type and manual for Myers-Briggs type indicator, Form E, unpublished, 1958.
- Nadien, M., Schaeffer, D. S. and Schmeidler, G. P. Mood as a confounding variable in eye dominance, field dependence and reading. Perceptual and Motor Skills, 1969, 29, 277-278.
- Natale, M. Perception of nonlinguistic auditory rhythms by the speech hemisphere. Brain and Language, 1977, 4, 32-44.
- Nebes, R. D. Superiority of the minor hemisphere in commissurotomed man for the perception of part-whole relations. Cortex, 1971, 7, 333-347.
- Nebes, R. D. Dominance of the minor hemisphere in commissurotomed man in a test of figural unification. Brain, 1972, 95, 633-638.
- Nebes, R. D. Perception of dot patterns by the disconnected right and left hemisphere in man. Neuropsychologia, 1973, 11, 285-290.
- Nebes, R. D. Hemispheric specialization in commissurotomed man. Psychological Bulletin, 1974, 81, 1-14.
- Nebes, R. Direct examination of cognitive functions in the right and left hemispheres. In M. Kinsbourne (Ed.), Asymmetrical Function of the Human Brain. New York: Cambridge University Press, 1978.

- Neilsen, H. and Sorensen, J. H. Hemispheric dominance, dichotic listening and lateral eye movement behavior. Scandinavian Journal of Psychology, 1976, 17, 129-132.
- Newcombe, F. and Russell, W. R. Dissociated visual perceptual and spatial deficits in focal lesions of the right hemisphere. Journal of Neurology, Neurosurgery and Psychiatry, 1969, 32, 73-81.
- Newland, G. A. Differences in measures of creativity and field dependence between left and right handers. Dissertation Abstracts International, 41, 1980, 3956-A.
- Newland, G. A. Differences between left and right handers on a measure of creativity. Perceptual and Motor Skills, 1981, 53, 787-792.
- Nisbet, J. F. The Insanity of Genius. New York: Charles Scribner's Sons, 1900.
- O'Connor, K. P. and Shaw, J. C. Field dependence, laterality and the EEG. Biological Psychology, 1978, 6, 93-109.
- O'Gorman, J. G. and Siddle, D. A. T. Effects of question type and experimenter position on bilateral differences in electrodermal activity and conjugate lateral eye movements. Acta Psychologica, 1981, 49, 43-51.
- Ogle, W. T. Lateral eye movements: Their relationship to reading speed, cardiac responsivity, and ability to process speeded information in the visual and auditory modes. Ph.D. dissertation, 1972, Washington University. Dissertation Abstracts International, 1972, 33, (3-B) 1293.
- Ohgishi, M. Hemispheric differences in the mode of information processing. Japanese Journal of Psychology, 1978, 49, 257-264.
- Oldfield, R. C. The assessment and analysis of handedness: The Edinburgh inventory. Neuropsychologia, 1971, 9, 97-113.
- Oltman, P. K. and Capobianco, F. Field dependence and eye dominance. Perceptual and Motor Skills, 1967, 25, 645-646.
- Oltman, P. K., Semple, C. and Goldstein, L. Cognitive style and interhemispheric differentiation in the EEG. Neuropsychologia, 1979, 17, 699-702.
- Orgass, B., Poeck, K., Kerschensteiner, M. and Hartje, W. Visuo-cognitive performances in patients with unilateral hemispheric lesions. Z. f. Neurol., 1972, 202, 177-195.
- Ornstein, R., Johnstone, J., Herron, J. and Swencionis, C.

- Differential right hemisphere engagement in visuospatial tasks. Neuropsychologia, 1980, 18, 49-64.
- Osborne, H. Aesthetics and Art Theory: An Historical Introduction. New York: E. P. Dutton and Company, 1968.
- Osgood, C. E. Some effects of motivation on style of encoding. In Style in Language, Sebeok, T. A. (Ed.). Cambridge: MIT Press, 1960.
- Otteson, J. P. Stylistic and personality correlates of lateral eye movements: A factor analytic study. Perceptual and Motor Skills, 1980, 50, 995-1010.
- Packer, J. K. and Gur, R. C. cited in Gur, R. C. and Reivich, M. Cognitive task effects on hemispheric blood flow in human: Evidence for individual differences in hemispheric activation. Brain and Language, 1980, 9, 78-92.
- Padarowski, W., Brucker, B., Zaretsky, H. and Alba, A. The effect of unilateral brain damage on the appearance of question-induced CLEM reactions. Cortex, 1978, 14, 420-430.
- Parsons, O. A., Vega, A. and Burn, J. Different psychological effects of lateralized brain damage. Journal of Consulting and Clinical Psychology, 1969, 33, 551-557.
- Patterson, K. and Bradshaw, J. L. Differential hemispheric mediation of nonverbal visual stimuli. Journal of Experimental Psychology: Human Perception and Performance, 1975, 1, 246-252.
- Penfield, W. and Roberts, L. Speech and Brain Mechanisms. Princeton, N.J.: Princeton University Press, 1959.
- Perry, W. G. Forms of intellectual and ethical development in the college years: a scheme. New York: Holt, Rinehart and Winston, 1970.
- Piazza, D. M. The influence of sex and handedness in the specialization of verbal and nonverbal tasks. Neuropsychologia, 1980, 18, 163-176.
- Pine, R. and Holt, R. R. Creativity and primary process: A study of adaptive regression. Journal of Abnormal and Social Psychology, 1960, 61, 370-379.
- Pirot, M., Pulton, T. W. and Sutker, L. W. Hemispheric asymmetry in reaction time to colour stimuli. Perceptual and Motor Skills, 1977, 45, 1151-1155.
- Pizzamiglio, L. Handedness, ear preference, and field dependence. Perceptual and Motor Skills, 1974, 38, 700-702.

- Pizzamiglio, L. and Carli, B. Visual, tactile and acoustic embedded figures tests in patients with unilateral brain damage. Cortex, 1974, 10, 238-246.
- Poeck, K., Kerschensteiner, M., Hartje, W. and Orgass, B. Impairment in visual recognition of geometric figures in patients with circumscribed retrolandic brain lesions. Neuropsychologia, 1973, 11, 311-317.
- Quinn, E. Creativity and cognitive complexity. Social Behavior and Personality, 1981, 13, 213-215.
- Rapaczynski, W. and Ehrlichman, H. Opposite visual hemifield superiorities in face recognition as a function of cognitive style. Neuropsychologia, 1979, 17, 645-652.
- Ray, W. J. and Newcombe, N. Interpreting sex differences in lateralization. Behavioral and Sciences, 1980, 3, 246.
- Raychudhuri, M. Perceptual preference pattern and creativity. Indian Journal of Applied Psychology, 1966, 3, 67-70.
- Reynolds, C. R. and Kaufman, A. S. Lateral eye movement behavior in children Perceptual and Motor Skills, 1980, 50, 1023-1037.
- Richardson, A. Verbalizer-Visualizer: A cognitive style dimension. Journal of Mental Imagery, 1977, 1, 109-126.
- Richardson, A. Subject, task, and tester variables associated with initial eye movement responses. Journal of Mental Imagery, 1978, 2, 85-100.
- Robersshaw, S. and Sheldon, M. Laterality effects in judgement of the identity and position of letters: A signal detection analysis. Quarterly Journal of Experimental Psychology, 1976, 28, 115-121.
- Roe, A. A study of imagery in research scientists. Journal of Personality, 1951, 19, 459-470.
- Rogers, L. TenHouten, W. D., Kaplan, C. D., and Gardiner, M. F. Hemispheric specialization of language: an EEG study of bilingual Hopi Indian children. International Journal of Neuroscience, 1977, 7, 1-6.
- Rosett, H. L., Robbins, H. and Watson, W. S. Standardization and construct validity of the Physiognomic Cue Test. Perceptual and Motor Skills, 1967, 24, 403-420.
- Rothenberg, A. The process of Janusian thinking in creativity. Archives of General Psychiatry, 1971, 24, 195-205.

- Rudin, S. A. Figure-ground differentiation under different perceptual sets. Perceptual and Motor Skills, 1968, 27, 71-77.
- Russo, M. and Vignolo, L. A. Visual figure-ground discrimination in patients with unilateral cerebral disease. Cortex, 1967, 3, 113-127.
- Schachter, S. and Singer, J. E. Cognitive, social and physiological determinants of emotional state. Psychological Review, 1962, 69, 379-399.
- Schroder, H. M. and Streufert, S. The Measurement of Four Systems of Personality Structure Varying in Level of Abstractness. (Sentence Completion Method) Princeton University: ONR Technical Report 11, NONR 1858 (12), 1962.
- Schroeder, N., Eliot, J., Greenfield, S. and Soeken, K. Consistency of lateral eye shift related to preschoolers performance on an analytical perceptual task. Perceptual and Motor Skills, 1976, 42, 634.
- Schubert, D. S. P. Increase of creativity by prior response to a problem. The Journal of General Psychology, 1977, 96, 323-324.
- Schubert, D. S. P. Creativity and coping with boredom. Psychiatric Annals, 1978, 8, 46-54.
- Seamon, J. G. and Gazzaniga, M. S. Coding strategies and cerebral laterality effects. Cognitive Psychology, 1973, 5, 249-256.
- Segalowitz, S. J. and McNaughton, H. Lateral eye movements and cerebral activation: Effect of question type. Abstract from the Neuropsychological Society Meeting, In International Journal of Neuroscience, 1980, 11, 193.
- Sherman, J. A. Field articulation, sex, spatial visualization, dependency, practice, laterality of the brain and birth order. Perceptual and Motor Skills, 1974, 38, 1223-1235.
- Sherrod, D. Lateral eye movements and reaction to persuasion. Perceptual and Motor Skills, 1972, 35, 355-358.
- Shevrin, H., Smokler, S. and Kooi, K. A. An emperical link between lateral eye movements and lateralized event-related brain potentials. Biological Psychiatry, 1980, 15, 691-697.
- Shevrin, H., Smokler, I. A. and Wolf, E. Field independence, lateralization and defensive style. Perceptual and Motor Skills, 1979, 49, 195-202.

- Silverman, A. J. Field dependency, brain asymmetry and psychophysiological differences. Psychother. Psychosom., 1979, 31, 133-142.
- Simpson, C. D. and Vega, A. Unilateral brain damage and patterns of agecorrected WAIS subtest scores. Journal of Clinical Psychology, 1971, 27, 204-208.
- Smith, J. Lateral reflective eye movements and creativity. M.A. thesis, Michigan State University, 1972.
- Smokler, I. A., and Shevrin, H. Cerebral lateralization and personality style. Archives of General Psychiatry, 1979, 36, 949-954.
- Sousa-Poza, J. F., and Rohrberg, R. Communicational and interactional aspects of self-disclosure in psychotherapy: Differences related to cognitive style. Psychiatry, 1976, 39, 81-91.
- Spanos, N. P., Pawlak, A. E., Mah, C. D. and D'leon, J. L. Lateral eye-movements, hypnotic susceptibility and imaginal ability in right handers. Perceptual and Motor Skills, 1980, 50, 287-294.
- Spanos, N. P., Rivers, S. M. and Gottlieb, J. Hypnotic responsivity, meditation, and laterality of eye movements. Journal of Abnormal Psychology, 1978, 87, 566-569.
- Spellacy, F. and Blumstein, S. The influence of language set on ear preference in phoneme recognition. Cortex, 1970, 6, 430-439.
- Sperry, R. W. Left brain, right brain. Saturday Review, August 9, 1975, 30-33.
- Spotts, J. V. and Mackler, B. Relationships of field-dependent and field-independent cognitive styles to creative test performance. Perceptual and Motor Skills, 1967, 24, 239-268.
- Stein, M. I. Manual for the Psychognomic Cue Test. Behavioral Publications, Inc.: New York, 1975.
- Sterling, S. M. and Taylor, I. A. Creative self-perception, hemispheric laterality and sex differences. Journal of Creative Behavior, 1980, 14, 12-13.
- Stewart, C. A. and Clayson, D. A note on change in creativity by handedness over a maturational time period. The Journal of Psychology, 1980, 104, 39-42.
- Storms, M. and Nisbett, R. Insomnia and the attribution process. Journal of Personality and Social Psychology, 1970, 16,

- Strayer, F. F. Lateral eye movements as an index of alpha enhancement with auditory feedback. M.A. thesis, 1970, Simon Fraser University.
- Street, R. F. A Gestalt Completion Test. Teachers College, Columbia University, Contributions to Education, 1931, 481.
- Stroop, J. R. Studies of interference in serial verbal reactions. Journal of Experimental Psychology, 1935, 18, 643-661.
- Tepper, J. The influence of varying levels of sensation seeking and fantasy on the creativity of college students. Dissertation Abstracts International, 1978 (7247-A).
- Teuber, H. L. and Weinstein, S. Ability to discover hidden figures after cerebral lesions. Archives of Neurology and Psychiatry, 1956, 76, 369-379.
- Thurstone, L. L. A Factorial Study of Perception. Chicago: University of Chicago Press, 1944.
- Torrance, E. P. Torrance Test of Creative Thinking: Norms Technical Manual. Pri Princeton, New Jersey: Personnel Press/Ginn. 1974.
- Torrance, E. P. and Khatena, J. What kind of person are you? The Gifted Child Quarterly, 1970, 14, 71-75.
- Torrance, E. P. and Mourad, S. Role of hemisphericity in performance on selected measures of creativity. The Gifted Child Quarterly, 1979, 23, 44-55.
- Torrance, P. E. and Reynolds, C. R. Images of the future of gifted adolescents: Effects of alienation and specialized cerebral functioning. Gifted Child Quarterly, 1978, 22, 40-54.
- Torrance, E. P., Reynolds, C. R. and Riegel, T. Preliminary norms-technical manual for "Your Style of Learning and Thinking". Athens, Ga: Georgia Studies of Creative Behavior, University of Georgia, 1976.
- Torrance, E. P., Reynolds, C. R., Riegel, T. and Ball, O. E. Your style of learning and thinking, forms A and B: Preliminary norms abbreviated technical scores scoring keys, and selected references. Gifted Child Quarterly, 1977, 21, 563-573.
- Torrington, M. C. Effects of bilateral manual exercises on the laterality and behaviors of elementary school children.

Unpublished doctoral dissertation, United States
International University, 1976.

- Truijens, C. L., Trumbo, D. A. and Wagenaar, W. A. Amphetamine and barbituate effects on two tasks performed singly and in combination. Acta Psychologica, 1976, 40, 233-244.
- Tucker, D. M. Sex differences in hemispheric specialization for synthetic visuospatial functions. Neuropsychologia, 1976, 14, 447-454.
- Tucker, G. H. and Suib, M. R. Cleft direction and it's relationship to performance on verbal and visuospatial tasks. Neuropsychologia, 1978, 16, 251-254.
- Tuckman, B. W. Integrative complexity: Its measurement and relation to creativity. Educational and Psychological Measurement, 1966, 26, 369-382.
- Van Nuys, D. W. Lateral eye movements and dream recall. Journal of Altered States of Consciousness, 1980, 5, 147-152.
- Vernon, P. E. The distinctiveness of field dependence. Journal of Personality, 1972, 40, 366-391.
- Vinacke, W. E. The Psychology of Thinking. New York: McGraw Hill Inc. 1974.
- Waber, D. P. Sex differences in mental abilities, hemispheric lateralization, and rate of physical growth at adolescence. Developmental Psychology, 1977, 13, 29-38 (a).
- Waber, D. P. Biological substrates of field dependence: Implications of the sex difference. Psychological Bulletin, 1977, 84, 1076-1087(b).
- Wada, J. and Rasmussen, T. R. Intracarotid amytal for the lateralization of cerebral speech dominance. Journal of Neurosurgery, 1960, 17, 266-282.
- Wagenaar, W. A. Sequential Response Bias. Rotterdam, Netherlands: Brander-offset, 1972.
- Walker, D. R. The relationship between creativity and selected behavior of chemists and mathematicians. Unpublished doctoral dissertation, University of Chicago, 1955.
- Wallas, G., The Art of Thought. New York: Harcourt, Brace, 1926.
- Ward, W. C. Creativity and environmental cues in nursery school children Developmental Psychology, 1969, 1, 543-542.
- Warren, L. R. and Hauter, E. S. Alpha asymmetry as a function of

- cognitive mode: The role of lateral eye movements. International Journal of Neuroscience, 1981, 13, 137-141.
- Warrington, E. K. and James, M. Disorders of visual perception in patients with localised cerebral lesions. Neuropsychologia, 1967, 5, 253-266.
- Weiten, W. and Etaugh, C. Lateral eye movement as related to verbal and perceptual-motor skills and values. Perceptual and Motor Skills, 1973, 36, 423-428.
- Werner, H. Comparative Psychology of Mental Development. New York: International Universities Press, Inc. 1948.
- Wertheimer, M. Principles of perceptual organization. In D. C. Beardslee and M. Wertheimer (Eds.), Readings in Perception, Princeton, N.J.: Van Nostrand, 1958.
- Wild, C. Creativity and adaptive regression. Journal of Personality and Social Psychology, 1965, 2, 161-169.
- Wilson, G. D., Ausman, J. and Mathews, T. R. Conservation and art preferences. Journal of Personality and Social Psychology, 1973, 25, 286-288.
- Winterbotham, R. G. Torque, conjugate lateral eye movements, and scoring on the Minnesota Multiphasic Personality Inventory (MMPI), Unpublished Masters Thesis, Simon Fraser University, 1980.
- Witkin, H. A. Psychological differentiation and forms of pathology. Journal of Abnormal Psychology, 1965, 70, 317-336.
- Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., and Karp, S. A. Psychological Differentiation. New York: Wiley, 1962.
- Witkin, H. A. and Goodenough, D. R. Field dependence and interpersonal behavior. Psychological Bulletin, 1977, 84, 661-689 (a).
- Witkin, H. A. and Goodenough, D. R. Field dependence revisited (ETS RB 77-16). Princeton, N.J.: Educational Testing Service, 1977 (b).
- Witkin, H. A., Goodenough, D. R. and Oltman, P. K. Psychological differentiation: Current status. Journal of Personality and Social Psychology, 1979, 37, 1127-1145.
- Witkin, H. A., Lewis, H. B., Hertzman, M., Machover, K., Meissner, P., and Wapner, S. Personality Through Perception. New York: Holt, 1954.

- Wogan, M., Kaplan, C., Moore, S., Epro, R. and Harner, R. Sex differences and task effects in lateralization of EEG-alpha. International Journal of Neuroscience, 1979, 8, 219-223.
- Wogan, M., Moore, S. Epro, R. and Harner, R. N. EEG measures of alternative strategies used by subjects to solve block designs. International Journal of Neuroscience, 1981, 12, 25-28.
- Wolf-Dorlester, B. Creativity, adaptive regression, reflective eye movement responses. Dissertation Abstracts International, 1976, 36, (6458-B).
- Woods, D. J. and Oppenheimer, K. C. Torque, hemispheric dominance and psychosocial adjustment. Journal of Abnormal Psychology, 1980, 89, 567-572.
- Wyspianski, J. O., Barry, W. F. and Dayhaw, L. T. Brain wave amplitude and creativity thinking. Revue de l'Universite' d'Ottawa, 269-276, 1963.
- Zoccolotti, P. and Oltman, P. K. Field dependence and lateralization of verbal and configurational processing. Cortex, 1978, 14, 155-163.
- Zoccolotti, P., Passafiume, D. and Pizzamiglio, L. Hemispheric superiorities on a unilateral tactile test: Relationship to cognitive dimensions. Perceptual and Motor Skills, 1979, 49, 735-742.
- Zuckerman, M. Sensation Seeking: Beyond the Optimal Level of Arousal. Hillsdale, New York: Lawrence Erlbaum, 1979.
- Zuckerman, M., Kolin, E. A., Price, L., and Zoob, I. Development of a sensation seeking scale. Journal of Consulting Psychology, 1964, 28, 477-482.