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Lateralized Emotional and Cognitive Processes in Personality

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LATERALIZED EMOTIONAL AND COGNITIVE PROCESSES IN PERSONALITY

by
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Lateralized Emotional and Cognitive Processes in Personality

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Research on hemispheric specialization has generated theories of lateralized cognition, personality traits, and emotional experience and expression. Of these the research on lateralized cognition has provided the most reliable and interpretable results. Using the lateralized cognitive attributes as a guideline, a personality model of hemispheric activation is hypothesized which suggests that each hemisphere provides a distinctive overall approach to information gathering, cognitive processing, emotional experience and behavioral expression. This model predicts that detail-oriented perception, rumination, and analytic processing are the domain of the left hemisphere, while a more spatial perceptual approach and holistic cognitive processing are the domain of the right hemisphere. Interestingly, these lateralized cognitive and personality styles appear quite similar to two of the neurotic styles observed and described by Shapiro (1965)--the obsessive-compulsive and the hysteric neurotic styles. The similarities and further implications between these models are discussed with reference to recent empirical support for such a correlary (Smokler & Shevrin 1979).

In order to investigate the validity of the personality model of hemispheric activation and its possible relationship to clinically observed neurotic styles, a wide variety of personality and cognitive variables were collected across thirty-three undergraduate students. Simple and complex statistical analyses were performed comparing the variables to an index of hemispheric activation, lateral eye movement. Although the results from the simple analyses are minimal, the complex analyses reveal a lateralized personality/cognitive factor that is loaded in a way consistent with the hypothesized model.

Caution is suggested in interpreting the results since the number of variables manipulated outnumber the number of subjects in the experiment. Suggestions for further research are offered. The ramifications and utility of such a model in the conceptualization of daignosis and treatment of mental health problems are explored.

This Thesis submitted by Steven Lee Dawson in partial fulfillment of the requirements for the Degree of Master of Arts from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

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Date Feb. 9, 1981

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ABSTRACT

Research on hemispheric specialization has generated theories of lateralized cognition, personality traits, and emotional experience and expression. Of these the research on lateralized cognition has provided the most reliable and interpretable results. Using the lateralized cognitive attributes as a guideline, a personality model of hemispheric activation is hypothesized which suggests that each hemisphere provides a distinctive overall approach to information gathering, cognitive processing, emotional experience and behavioral expression. This model predicts that detail-oriented perception, rumination, and analytic processing are the domain of the left hemisphere, while a more spatial perceptual approach and holistic cognitive processing are the domain of the right hemisphere. Interestingly, these lateralized cognitive and personality styles appear quite similar to two of the neurotic styles observed and described by Shapiro (1965)--the obsessive-compulsive and the hysteric neurotic styles. The similarities and further implications between these models are discussed with reference to recent empirical support for such a correlary (Smokler & Shevrin 1979).

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CHAPTER I

INTRODUCTION

Over the last forty years medical and psychological researchers have shown increasing interest in differential attributes of the cerebral hemispheres. Study in the area of laterality originated through the astute observation of brain-damaged patients. Observers, noting that such patients appeared to show cognitive and/or emotional changes consistent with laterial hemispheric damage, hypothesized models of hemispheric attributes. Researchers have since further developed and refined these early models through experimental manipulation, using both brain damaged and normal subjects.

While interpretation from research on brain damaged subjects are seemingly straight-forward, their generalizability is limited. On the other hand, selecting a reliable, valid index of hemisphere activation with which to measure normal subjects has met with some controversy in the literature. The following review will present results from both brain damaged and normal subjects, with particular attention to the latter. Although a number of different indices of hemispheric activation for normal subjects will be presented, particular emphasis will be given to the index of lateral eye movement (LEM), due to its heuristic theoretic appeal as a measure of cerebral activation, and its prolific use as an index of such across several research areas (i.e., cognition, emotion, and personality) throughout the literature.

The area of research that has provided the most reliable and consistent results in describing hemispheric attributes is the relative contributions of the hemispheres to perception and cognition. Basically, the results indicate that the left hemisphere is responsible for verbal functions, as well as for providing a sequential, analytic approach to perception and cognition, while the right hemisphere is responsible for non-verbal functions, as well as for providing a holistic, spatial approach to perception and cognition. Another area of research that has received such attention concerns the possible differential hemispheric contributions to the experience of emotion. Unfortunately, while results appear to demonstrate significant differences, the theoretical interpretations within this area are less clear than that of perception and cognition.

This paper reviews these two general areas of research on laterality, that is, cognition and emotion, with particular attention to the latter. Although the reviewed studies describe the hemispheres as separate and sometimes antithetical perceiving and processing units, human experience and behavior suggest a certain unity of approach and action. In order to understand how two possibly contradictory decision-making hemispheres can provide overall organismic interpretation of experience and action, two theories of interhemispheric interface are presented. These theories, postulated by Galin (1974) and Bogen (1969) respectively, suggest that final hemispheric resolution is a product of the hemisphere most adaptive for a function or a product of the cooperative harmonious contributions of both hemispheres that produce the most creative and beneficial solution.

While these theories may provide a simplistic framework for hemispheric conflict resolution, they do not speak to the more subjective issue of conscious (or unconscious) human "choice," which may not necessarily follow the most "creative" or "adaptive" approach to information gathering, cognitive processing, emotional experience and behavioral action. In a different hypothesis, Ornstein (1978) suggests that hemispheric utilization is based on individual "choice" and not necessarily the type of material he confronts. Viewing Ornstein's concept of "choice" as being determined by or consistent with an individual's personality, it is hypothesized that the individual's personality provides an overall organizational framework, within which the individual "chooses" a certain approach style to a task, regardless of task type, which then dictates hemisphere utilization. Research studies that provide support for such a model are presented.

Assuming that personality is an organizing principle for the differential utilization of the characteristic hemispheric types of "thought," it should be possible to account for individual differences among subjects, as well as prove useful in reconciling some of the discrepancies found throughout the literature on the relative contributions of the hemispheres to the experience of emotion. This study will attempt to show that the hemispheres are differentially "primed" for certain types of "thought" by the individual's personality style. An important dimension in clinical personality observations has been global vs. analytic styles of thought (Shapiro 1965). Smokler and Shevrin (1979) have suggested these styles may reflect

differing contributions from the global versus analytic hemispheres, with individuals showing more left hemisphere usage tending toward more obsessive-compulsive personality, while more right hemisphere oriented persons may be characterized by a more hysteric style. The present study will attempt to examine these relations with the hypothesis that subjects' scores on left hemispheric cognitive tasks vary with personality measures of obsessive-compulsive-like thought and behavior, while scores on right hemispheric cognitive tasks vary with personality measures of hysterical-like thought. Finally, using an index of cerebral hemispheric activation (i.e., lateral eye movement), this study will examine the notion that subjects demonstrating a predominant use of their right hemispheres show an overall cognitive and emotional performance similar to a hysterical personality style, while those subjects demonstrating a predominately left hemispheric use, show an overall cognitive and emotional performance similar to an obsessive-compulsive personality style.

CHAPTER II

REVIEW OF THE LITERATURE

Hemispheric Specialization for Cognition

One of the most widely accepted and reliable models of the characteristic attributes of the hemispheres describes their differential cognitive and perceptual strategies. This model suggests that the right hemisphere is responsible for spatial, holistic and Gestalt-like perception and cognition, while the left hemisphere is credited with sequential, analytic, and rational perception and cognition. Evidence for this view of differential hemispheric functions comes from research on both brain damaged and normal subjects.

Research From Brain Damaged Subjects

Historically, astute observers working in wards with brain damaged patients noted that certain deficits and, in some cases, improvements in abilities and performance appeared to accompany lesions to the right or left hemisphere. As early as 1861, Broca noted in post mortem studies of asphasic veterans that the left temporal lobe was particularly important in speech. Since that time, other researchers have systematically looked at the correlation of lesions and task performance, as well as measured task performance of patients with corpus callosum commissurotomies. These researchers have verified Broca's observations of the left hemisphere's control of speech (Bogen 1969; Day & Ulatowska 1979; Gazzaniga 1970; Lansdell

1961; Ornstein 1978), as well as its relative superiority in performing verbal tasks (Benton 1962; Bogen 1969; Lansdell 1962; McGlone & Davidson 1973; Nebes 1974; Wexler 1980; White 1969); auditory tasks (Day & Ulatowska 1979); sequential/analytic processing (Bogen 1969; Galin 1974; Nebes 1974; Sperry 1968); propositional thinking (Bogen 1969; Galin 1974); musical understanding tasks (Hacaen 1962); tasks requiring abstraction of relevant details and symbolic representation of elements (Day & Ulatowska 1970; Nebes 1974); digit tasks (White 1969); writing tasks (Gazzaniga 1970; Ornstein 1978); tasks of fine motor coordination (Day & Ulatowska 1979); and constrained ideation (Hall, Hall & Lavoie 1968).

Researchers have also demonstrated specific right hemispheric superiorities over the left hemisphere. These right hemisphere strengths include: facial recognition (Benton & Van Allen 1968; Wexler 1980); spatial perception (Benton & Van Allen 1968; Bogen 1969; Gazzaniga 1970; McGlone & Davidson 1973; Nebes 1974; Ornstein 1978; Semmes 1968; Sperry 1968; Wexler 1980; White 1969); visual memory, particularly for spatial relationships (Bogen 1969; Day & Ulatowsky 1979); integrating sensory data (Benton & Van Allen 1968; Galin 1974; Semmes 1968); nonverbal communication (Bogen 1969; Galin 1974; McGlone & Davidson 1973; White 1969); appositional thinking (Bogen 1969; Galin 1974); recognition of musical sounds (Bogen 1969); visual perception and visual/motor skills (Day & Ulatowska 1979); unconscious information processing (Galin 1974; Galin, Dimond & Braff 1977); dreaming (Galin 1974); expansive ideation (Hall, Hall & Lavoie 1968); artistic judgment (Lansdell 1962); musical perception

(Milner 1962; Ornstein 1978; White 1969); insight and intuition (Ornstein 1978); and lower reaction times (Sperry, Zaidel & Zaidel 1979).

Neurological Studies

The concept of separate and different perceptual and processing abilities per hemisphere is also suggested by anatomical and neurochemical studies. In a study of 52 epileptic patients, Lansdell (1967) found that an increase in task performance deficits was proportional to the amount of ablated left temporal cerebrum, while the extent of right hemisphere damage did not appear to significantly vary with task performance. Lansdell therefore hypothesized that the left hemisphere differs from the right, such that the left hemisphere is more focally organized and the right is more diffusely organized. In agreement with Lansdell, Semmes (1968) also suggested that the left hemisphere was more focally oriented than the right, and more adapted for manual tasks and speech; while the right hemisphere was more diffuse and therefore better suited for associating dissimilar units of information, as in the synthesis of sensory and motor input, and performing spatial tasks. Tucker (in press) reviewing the results of Semmes and Lansdell, suggests that these anatomical hemispheric differences heuristically parallel the basic cognitive differences of the hemispheres (i.e., focal/analytic versus diffuse/global) and, therefore, the hemispheres' differential abilities may be a function of or facilitated by their differential neuroanatomical structures.

Two final studies suggesting an inherent difference between the hemispheres are Galaburda, LeMay, Kemper, and Geschwind's study (1978)

of brain anatomy and Oke, Keller, Mefford and Adams' study (1978) of neurochemistry. Galaburda et al., using computerized axial tomography, demonstrated that the right frontal lobe is larger than the left frontal lobe, whereas the left posterior region of the left hemisphere is larger than its counterpart in the right. Oke et al., in a study measuring amounts of neurotransmitters in locations within the brain, found that the presence of norepinephrine is differentially lateralized within the brain. Although the specific implications of these findings are not readily apparent, the fact that the hemispheres are structured and neurochemically distributed differently, lends support to the postulation of distinct, characteristic functioning of the hemispheres.

Research on brain damaged patients and on basic anatomical/neurochemical differences of the hemispheres suggests that the right and left hemispheres are structurally and functionally different. In particular, research from brain damaged patients suggests that the hemispheres provide distinct, characteristic approaches to perception and information processing. The right hemisphere is characterized as being superior in nonverbal, holistic and spatial functioning, with the left hemisphere being characterized as superior in verbal, sequential, and analytical functioning. While the characteristic descriptions of each of the hemispheres appears to be consistent throughout the brain damage literature, applications of these findings to the general population would be unreasonable until congruent results are obtained from samples of normal subjects.

Research on Normal Subjects

Although evidence presented thus far for a cognitive model appears to lend convergent validity to the respective abilities of the hemispheres, most of the previously presented research was performed on brain damaged, epileptic, brain ablated, or corpus callosum commissuratomy patients, thereby making generalizations from these studies to normals tentative, at best. In order to research normal subjects, experimenters have postulated many techniques to measure brain activation. While numerous measures have been suggested, not all of these gave gained wide usage. Therefore, representative research studies utilizing a few of the more popular indices of lateral brain activation and performance are briefly presented, with the exception of lateral eye movements. The index of lateral eye movement is reviewed more fully due to its prolific use in this literature, and its utility in research on hemispheric function and personality.

Using visual half-field stimulation, Kimura (1966) and Kinsbourne (1970) assumed that visual stimuli presented to a visual half-field is received and processed in the contralateral hemisphere, and found that the left hemisphere appears to be important in verbal perception and processing, while the right is more attuned to non-verbal stimuli (Kimura 1966). Other researchers, assuming that auditory stimuli presented to one ear are processed more thoroughly in the contralateral hemisphere, found results suggestive of a right hemisphere superiority for melodies (Kimura 1967) and tone of voice (Safer & Levanthal 1977), and a left hemisphere superiority for objective analysis of auditory content (Safer & Levanthal 1977).

Using a more direct measure of hemispheric activity, Morgan, McDonald and MacDonald (1971) recorded electroencephalographic activity (EEG) and found that the right hemisphere tends to be more active than the left on tasks that are spatial, non-verbal and non-analytical, while the left hemisphere tends to be more active for tasks that are sequential, verbal, and analytical. The authors also found that subjects who consistently used their right hemispheres more than their left hemispheres, were more hypnotizable and glanced more to the left. Finally, Galin and Ornstein (1972), using EEG recordings, found more right hemispheric activity in processing spatial tasks, and more left hemispheric activity on verbal and written tasks.

Another index of cerebral activation that has gained wide usage is a measure of lateral eye movement (LEM). The major assumption of this measure is that cerebral hemispheric activation is accompanied by a shift in eye gaze in the direction contralateral to the hemisphere which is perceiving and/or processing the information. LEMs are generally utilized by researchers in two distinct fashions. One way in which researchers measure lateral eye movements is by comparing the total number of left lateral eye movements to the total number of right lateral eye movements for a given subject. The subject is then characterized as a right or left looker (or mover), depending on the direction of the majority of movements. Assuming that the type of looker is an indicator or general contralateral hemispheric activation, the type of looker (i.e., left or right) is then compared to the particular measure the experimenter is

researching. The right looker versus left looker model of measuring lateral eye movements was first suggested by Day (1964) when he noticed that when a subject is asked a reflective question he will break eye contact to glance fairly consistently to one direction.

Since the Day (1964) publication, various researchers have shown that the type of looker one is can be characterized by certain cognitive abilities. For example, Bakan (1969) has shown that left lookers who chose "soft majors," are poorer on the quantitative section of the SAT, and have clearer visual imagery than right lookers. From a review of relevant literature and the results of his study, Bakan suggested that LEMs were an indication of contralateral hemispheric activation and thus the results characterize the right hemisphere as being specialized for pre-verbal, pre-logic, subjective, global, syncretic, and diffuse psychological functioning. Other researchers have since demonstrated results consistent with Bakan's 1969 findings. Crouch (1976) has shown right movers to be more responsive to verbal cues, right for verbal questions and to the left for spatial questions. In agreement with Kinsbourne's findings, Weitan and Etaugh (1974) found that verbal and numerical questions elicited more right lateral eye movement than did musical and spatial questions. Although primarily studying of the effects of experimenter location on LEMs, Gur (1975) and Gur, Gur and Harris (1975) have also shown that when an experimenter is sitting behind a subject, the subject will glance to the right when answering verbal questions and to the left when answering spatial questions.

Although both the individual-specific and question specific measures of LEM demonstrate similar findings (i.e., the right

produced similar results, some question remains concerning their true nature since the former ignores the latter's theoretical basis. This question will be addressed further in the next section on emotion.

Hemispheric Specialization for Emotion

Unlike the previously presented research on the cognitive attributes of the hemispheres, results from research on emotion are more complex and controversial. Essentially, researchers have postulated two conflicting theories to describe hemispheric specialization for emotion. One group of researchers postulates that emotion is a function of the right hemisphere, while the left hemisphere is basically unemotional and can exert inhibition influences over the emotional experience and expression of the right hemisphere. The other group of researchers postulate that the left and right hemispheres are differentially involved in positive and negative emotions, respectively.

Research from brain damaged, psychiatric and normal subjects has provided evidence on lateralization and emotion. Due to the complexities and voluminous numbers of studies in this area, only selected, representative studies will be discussed here. Although some interpretations and hypotheses of the research are discussed, the reader is referred to Tucker's (in press) literature review for a more comprehensive exploration of this literature and its interpretive problems.

Research on Brain Damaged Patients

Results from research on the relative contributions of the hemispheres to the emotional experience of brain damaged and

hemisphere is specialized for spatial, musical and holistic tasks while the left is specialized for verbal, numerical and analytical tasks) some question remains as to how two contradictory measure usages could generate similar results. In other words, it would be expected that, if the type of reflective question is dictating the activation of a hemisphere, an equal number of right and left hemispheric activating questions should result in an equal number of looks to either side, thereby negating the possibility of being characterized a right looker or a left looker. And reciprocally, it would be expected that, if one were a right or left looker, that he would continue to glance fairly consistently in that direction, regardless of the question type. The question of how these different and seemingly contradictory ways of equating LEMs to questionnaires produce similar results will be addressed later.

In summary, research from brain damaged and normal populations has produced similar results which suggest that the hemispheres are lateralized for cognition. Although using normal subjects has generated some question as to the most valid measure of hemispheric activation, a few have gained popular usage. One such index that has proved valuable in researching both cognition and emotion is the measure of lateral eye movement. Essentially, researchers utilize LEMs in two distinct fashions. One group of researchers use the LEM questionnaire to characterize an individual as a right looker or left looker Iindividual specific characterization), while other researchers use the measure to relate eye movements to reflective questions (question specific characterization). Although both approaches have

unilaterally sedated patients are confusing and contradictory. One group of results suggest that emotion is a product of the right hemisphere while another set of results suggest that the hemispheres are differential for types of emotion (i.e., positive or negative). In support of the former model of emotion, Flor-Henry (1969a, 1969b) has shown that "schizophrenic-like" psychotic reactions were associated with dominant (left) temporal lobe epilepsy while schizo-affective and manic-depressive manifestations were associated with non-dominant temporal lobe epilepsy. The suggestion of these studies is that thought disorder (e.g., schizophrenia) is associated with the left hemisphere and emotional disorder (e.g., manic-depressive illness and schizo-affective psychosis) is associated with the right hemisphere.

Further support of an emotional right hemisphere model comes from studies of the brain damaged patient's ability to judge, recall, and express emotion. Heilman, Scholes, and Watson (1975) asked patients to judge the emotional tones of a speaker and found that patients with right hemisphere dysfunction as evidenced by unilateral neglect were deficient in comprehending affective speech (affective agnosia). Tucker, Watson and Heilman (1976) replicated Heilman et al.'s findings (1975) of the right hemisphere damaged patient's inability to comprehend affect. At the same time, Tucker et al. also demonstrated that right hemisphere damaged patients are deficient in their ability to express emotion. This latter finding has been recently replicated by Ross and Mesulam (1979), who found that right hemisphere damaged patients had difficulty utilizing emotional inflections in everyday communication. Finally, Wechsler (1972) has

shown that right hemisphere damaged patients have a reduced ability to recall emotionally charged, verbally presented material.

Postulating differential emotions for the hemispheres, other researchers have suggested that emotion is a bihemispheric phenomena with the right hemisphere primarily responsible for positive emotion and the left hemisphere responsible for negative emotion. Gainotti (1972a, 1972b) examined 160 patients (80 with left lesions and 80 with right lesions) and found that catastrophic or anxiety depression was more frequent among left hemisphere damaged patients while spatial neglect, unilateral altercations of body schema, and euphoria reactions was associated with lesions of the right hemisphere.

In a similar vein, Black (1975) matched 15 right hemisphere damaged patients for age, education, and recency of injury and found that left hemispheric damaged patients demonstrated significant elevations on the Sc (schizophrenia), D (depression) and Hs (hypochrondriasis) scales of the Minnesota Multiphasic Personality Inventory (MMPI). Black concluded that his results suggested that left hemispheric damage was associated with increased psychopathology and supported the notion of catastrophic depression with left hemispheric damage. Recently, Gasparrini, Satz, Heilman, and Coolidge (1978) have shown that, when controlling for cognitive deficit and expressive ability, patients with left hemisphere damage had significantly higher scores on the depression scale of the MMPI than did right hemisphere damaged patients.

In a study employing both subjective reporting of epileptic patients and of observers, Bear and Fedio (1977) found that right

hemisphere damaged patients rated themselves as less severely disrupted than did the observers, whereas the reverse was true for left hemisphere damaged patients. Bear and Fedio characterize the right hemisphere damaged patient's unawareness of their disruption as "denial" and the left hemisphere damaged patient's exaggeration of his disruption as "catastrophic" overemphasis of dissocial behavior. These findings, along with the finding that epileptic foci in either hemisphere appeared to influence affective association, led the authors to conclude that "the simple concept of right hemisphere dominance for emotion requires qualification" (Bear & Fedio 1977, p. 465).

Thus far, the research presented on emotion and cerebral activation with brain damaged patients indicates that the hemispheres may be lateralized for different types of emotion (i.e., positive and negative) or that the right hemisphere houses emotion while the left hemisphere is specialized for nonemotional functioning. While these two general hypotheses appear straightforward and testable, there are many complexities that need to be considered. As with the research on brain damaged patients, the research on non-brain damaged subjects (i.e., psychiatric patients and normal subjects) is so intricate and complex that full justice can not be given to the literature within the confines of this paper; therefore a general, brief overview of the general trends of the literature relating hemispheric activation and emotion will be given for both psychiatric populations and normal subjects.

Research on Psychiatric Populations

Research utilizing psychiatric populations to study cerebral activation and emotion has examined the laterality of schizophrenic and depressive patients. Generally, research from these two groups indicates that schizophrenia is associated with some type of dysfunction of the left hemisphere while depression seems to be a dysfunction of the right. Serafetinides (1973) found that chlorpromazine administration (an anti-psychotic medicine) was correlated with increased EEG amplitude over the left hemisphere, while Flor-Henry (1976) found that schizophrenics, compared to patients with affective disorders, appeared to be impaired on dominant (left) frontal and temporal functions.

In a more recent study Gur (1978) found that schizophrenic patients showed a right visual half-field performance deficit in comparison to control subjects, suggesting some type of left hemisphere decrement in schizophrenia.

In regards to depression, Flor-Henry (1976) found affective disorders to be suggestive of a right temporal dysfunction. Other researchers have also found results consistent with Flor-Henry's finding. Studying the effects of unilateral ECT, researchers found that administration of unilateral ECT to the right side reduced depression (Cohen, Penick & Tarter 1974) and improved right hemispheric functioning (Kronfol, Hamsher, Digre, & Waziri 1978). Recently, Yozawitz, Bruder, Sutton, Sharpe, Gurland, Fleiss and Costa (1979), using an auditory discrimination task, compared depressed patients to schizophrenics and found that depressed patients,

unlike schizophrenics, evidenced an auditory performance pattern indicative of right hemisphere dysfunction.

Although the implication that schizophrenia (a thought disorder) is a left hemispheric dysfunction while depression (a mood disorder) is a right hemispheric dysfunction appears to be well substantiated, various authors are in disagreement as to what these results mean. Tucker (in press), in a review of research relating laterality to emotion, lists a number of these theories and discusses their merits and weaknesses. Discussing the findings of research done on psychiatric patients, Tucker concludes "the phenomena of emotion in this literature on emotional disorders seems to emerge somewhere between the operation of lateralized arousal systems and the organization of lateralized conceptual processes" and that the interaction between arousal systems and conceptual processes is important in examining hemispheric emotional characteristics (Tucker, in press, p. 31).

Research with Normal Subjects

Although research from brain damaged patients and psychiatric populations provide significant and sometimes complementary results, the generalization of these results to the population at large (i.e., normal) is limited. Utilizing indices of cerebral activation used to study normal subjects, mentioned earlier, researchers are exploring characteristic hemispheric contributions to the experience of emotion. Once again, interpretation of the research findings is not always simple.

Using visual half-field presentations to stimulate the individual hemispheres, Dimond, Farrington, and Johnson (1976) have

shown that films presented to the right hemisphere (i.e., left visual half-fields) were judged to be more unpleasant, while films presented to the left hemisphere (i.e., right visual half-fields) did not differ from evalations of subjects who had films presented simultaneously to both hemispheres. The authors conclude that the right hemisphere appears to contribute most heavily to the experience of negative emotion. Recently, Ley and Bryden (1979) presented pictures of faces varying in the degree of emotional expression and found that facial and emotional recognition was greater for those stimuli presented to the left visual half-fields (i.e., right hemisphere). The authors infer that the right hemisphere appears to be specifically favored for the mediation of affective information.

While Dimond et al. (1976) suggest that the right hemisphere contributes most to the experience of negative emotion and Ley and Bryden (1979) intimate that the right hemisphere may be responsible for all types of affective processing, another group of researchers, using visual half-field stimulation, have shown that the left hemisphere may also play a role in emotion. Tucker, Antes, Stenslie, and Barnhardt (1978) have shown that reported anxiety is associated with relatively greater errors on tasks presented to the right visual half-fields (i.e., left hemisphere). The authors suggest that anxiety places a processing overload on the left hemisphere and thereby reduces its ability to effectively process incoming stimuli. In a second experiment, Tucker et al. further confirmed this finding by demonstrating that trait anxious subjects are also characterized by a decrease in left lateral eye movements and a right ear attentional bias.

Other researchers, using monaural auditory stimuli, have shown hemispheric differences for emotion. Safer and Levanthal (1977) have shown that, when subjects were asked to evaluate a verbal passage and stimuli were presented to their left ears (i.e., right hemisphere), subjects used tone of voice cues and were less accurate in objective ratings of tone of voice and content than when subjects used their right ears. The authors conclude that the right hemisphere is relatively specialized for subjective and/or emotional information, while the left hemisphere is selective for analytic processing of objective information. In a different study linking cognitive approach and emotion, Shearer and Tucker (in press) have suggested that the left hemisphere's analytic processing style may serve to inhibit emotional arousal while the right hemisphere's imaginal, global style may serve to facilitate emotional arousal.

Other evidence for lateralized characteristics of emotion in normals is provided by electroencephalographic (EEG) studies. Recording the brain waves of subjects generating positive or negative emotional moods, one group of researchers found differences between these moods in EEG asymmetry over the temporal lobes. Harmon and Ray (1977) have shown that there is greater left temporal activation during a negatively induced mood, while Ehrlichman and Wiener (1978) have shown right temporal activation during a positively generated mood. Suggesting different hemispheric effects, Davidson, Schwartz, Saron, Bennett, and Coleman (1978) and Tucker, Stenslie, Roth, and Shearer (in press) monitored the brain waves of subjects while they experienced positive and negative emotions. Essentially, both sets

of authors found right frontal hemispheric activation during a depressed mood. Davidson et al. also found left frontal activity associated with positive emotion. In reconciling the discrepancy between studies finding parietal differences and studies finding frontal differences, Tucker (in press) suggests that one possible explanation is that during negative emotion the right frontal lobe activates and exerts inhibitory influence on posterior regions of the right hemisphere, and the left frontal lobe exerts inhibitory influence over the left posterior hemisphere during positive emotion.

In a novel approach to studying hemispheric asymmetry for emotion, Sackiem, Gur and Saucy (1978) had subjects judge right and left facial composites for emotional expressiveness. The authors found that left facial composites, compared to right composites, were judged as expressing emotion more intensely. Assuming that the right hemisphere has greater control over left facial muscles, the authors conclude that the right hemisphere exerts greater control over the production of emotional expression than does the left. Making this same assumption, Schwartz, Ahern, and Brown (1979) measured right versus left facial muscle responses and found that left facial muscles were more active than right in negative emotion, while right facial muscles were more responsive during positive emotions.

Finally, LEMs have also provided some indications of differential hemisphereic contributions to emotion. Using the approach of question specific LEM measurement, Ahern and Schwartz (1979) found that positive emotional reflective questions elicited eye movements to the right(i.e., left hemispheric processing) while negative

emotional reflective questions elicited eye movements to the left (i.e.,right hemispheric activation). Using the approach of individual specific LEM measurement, Day (1968) and recently Woods (1977) have shown left lookers to be more feeling (i.e., subjective, responsive, and expressive) oriented in comparison to right movers. Yet Etaugh (1972) finds that left movers are less affected by feelings and are more shrewd and suspicious than right movers. Beyond the immediate difficulties of reconciling the contradictory premises of the two approaches to measuring LEMs (i.e., type of mover versus type of question); the results of the presented representative LEM research provide diametrically opposite results and conclusions.

The research done on the characteristic contributions of the hemispheres to the experience of emotion has demonstrated confusing and contradictory results. Theories based on these results are complex and not readily obvious. Some researchers postulate the right hemisphere as the main contributor to emotion, while others suggest that the hemispheres are specialized for emotion. Some theorists postulate that the right hemisphere being specialized for positive emotion and the left hemisphere being specialized for negative emotion, while other theorists postulate just the opposite. These discrepancies seem to exist across type of measure used (VHFs, LEMs, etc.) as well as within measures in the two approaches of using LEMs as a measure of cerebral activation.

Hemispheric Integration

Thus far, the research presented indicates that the hemispheres are functionally differentiated for cognition and emotion.

The suggestion of this research is that each hemisphere houses its own cognitive and emotional style of gathering, processing, and acting on information. Assuming the distinction between the hemispheres to be accurate, the generally smooth, immediate subjective experience of problem solving becomes difficult to reconcile with the functional independence of the hemispheres in information acquisition and processing. Specifically, looking at the aforementioned reliable model of cognitive differences, normal hemispheric functioning implies constant competition between two antithetical problem-solving systems, yet subjective experience of problem solving is paradoxically smooth and conflict-free, even if it may be an illusion (Galin 1978).

In general, three theories describing hemispheric interrelation have addressed this problem. Nebes (1974) suggests that both hemispheres develop individual strategies for the task at hand and final choice of approach is resolved in favor of the hemisphere most adapted for that particular task. In a different vein, Bogen (1969) suggests that the "position of two independent problem-solving organs increases the prospects of a successful solution to a novel situation" (p. 191). Basically, Bogen suggests that the individual hemispheres interact to gain harmonious/creative solutions, this being the most adaptive approach to problem-solving. In support of this conjecture, Zaidel (1979), in a recent study of patients with corpus callosum commissurotomies, demonstrated that interhemispheric task solution was superior to independent hemispheric solution.

Although sponsoring a theory of mutual cooperation between the hemispheres, Bogen recognizes the possible "hazard of conflict in

the event of different solutions" and suggests that the "propositional" model of the left hemisphere could inhibit the right hemisphere's "appositional" mode. Essentially agreeing with Bogen and using Freud's terms of secondary process and primary process for the processing styles of the left and right hemispheres respectively, Galin (1974) suggests a more dynamic model in which the left hemisphere (secondary process) inhibits the right (primary process). McLaughlin (1978) eloquently expands Galin's model in describing the parallels between hemispheric processing and the psychoanalytic model. He further suggests that these processes continue throughout life, interactively inhibiting and facilitating each other's growth and development.

Finally, in contrast to the previously presented views of conflict resolution between the differential approaches of the hemispheres, Ornstein (1978) suggests that the hemispheres do not compete for ascendency in performing a given task, nor is the determination always made in favor of the most appropriate processing style for a given task. Ornstein selected two groups of subjects, lawyers and ceramicists, in order to test this hypothesis, and found that lawyers (considered to use more verbal and analytical skills) used their left hemispheres more (as measured by electroencephalograph recordings) regardless of task demand, as compared to ceramicists (considered to use more spatial/holistic skills). Ornstein concludes "apparently the hemispheres are specialized for the kind of thought or information a person chooses to use, not necessarily for the type of material he confronts" and that the hemispheres are "not specialized

for different types of material (verbal and spatial), but for different types of thought" (Ornstein 1978, pp. 81, 82). Ornstein's proposal of hemispheric utilization is radical in that it hypothesizes that the hemispheres are specialized for "thought" and the person "chooses" what material he will use. The concept of "choice," as an organizing principle for utilization of specific hemispheric skills, will be elaborated later in this paper in a hypothesis suggesting that "choice," as defined by Ornstein, is a function of the individual's personality, which ultimately directs hemispheric utilization in perceptual information selection and task solution.

Personality Theory of Hemispheric Activation

Thus far, evidence has been presented suggesting that the hemispheres are specialized for different types of cognition and emotional experience. Yet, while the evidence appears to delineate two semi-autonomous organs that provide separate and sometimes antithetical solutions, human subjective experience and behavioral performance suggests a unity of approach, resolution and feeling. In other words, typical human subjective experience and behavioral performance would seem to suggest that there exists some underlying organization or principle that preselects or instantaneously selects one hemispheric style or the other.

One theorist who speaks to this issue is Ornstein (1978). Ornstein's theory (1978) of hemispheric utilization suggests that the underlying principle that may govern preselection or selection of hemispheric utilization is human choice. Although Ornstein is apparently referring to the cognitive characteristics of the hemispheres,

it seems reasonable that this theory might also suggest the mechanism for emotional experience. In fact the distinction between cognition and emotion may be more arbitrary than real. Tucker (in press), in a recent review of the literature, states that "It thus may be necessary to accept the interdependence between cognition and affective arousal as going both ways, with emotion emerging not only from a post hoc cognitive evaluation of an arousal state, but also from the operation of neurophysiological processes which can excite or attenuate cognitive activity" (Tucker, in press, p. 62).

Drawing upon Ornstein's theory of hemispheric utilization and Tucker's suggestion of the interdependence of cognition and affective arousal, it is possible and reasonable to postulate a theoretical framework within which to view the relationship of cognition and affect, as well as accounting for an individual's uniqueness in choosing his personal approach to a problem of experiencing emotion. This framework will be referred to as the personality theory.

In essence, the personality theory of hemispheric activation suggests that the hemispheres are not only differentiated for "types of thought" as Ornstein suggests (i.e., verbal and spatial), but also for types of emotional experience, and that these two elements are interconnected. In other words, the type of cognition a hemisphere employs dictates the type of affective arousal (and vice versa), and hemispheric selection is the result of an individual's unique background, genetic makeup and social interactions, that is, his personality.

In order to more fully comprehend such a relationship between cognition and emotion within a hemisphere, it is necessary to return

to the research on the cognitive differences of the hemispheres and proceed in an inductive fashion. Given that the hemispheres are lateralized for cognition, and cognition and emotion are interrelated, then it is logical that the type of affective arousal or emotional expression of the hemisphere should be congruent with or a logical extension of that hemisphere's characteristic cognition. For example, the right hemisphere's propensity for non-verbal and holistic content and perceptual approach, would seem to facilitate immediate, undifferentiated, and affectively-charged experience and/or expression. These experiences and expressions would be "felt" and less available to verbal description, analytic recall, or modifiable by verbal, logical and/or sequential thinking and discussion than information processed by the left hemisphere. In fact, recall for the right hemisphere might best be facilitated by entering a similar relationship, situation, or emotional experience, because right hemispheric storage of this information occurs in a fusion of experience into a single, syncretic (Tucker, in press) holistic concept. Specific emotions would be experienced and expressed intensely and undifferentially, opening the possibility of distortion of the factual information or situation.

In contrast to the global, non-verbal cognitive structure and perceptual approach of the right hemisphere, the left hemisphere might provide a more sequential and analytical approach involving symbolic representation through words and digits. By accurately defining and separating various components of cognition and affect, the left hemisphere would be able to utilize various components of an experience separately in order to arrive at an expression. Therefore,

for example, the left hemisphere would be capable of representing a given event in a purely cognitive form, divorced from its emotional elements or, if affect were being expressed, it might best be described as verbal rumination or worry.

The proposed inductively generated descriptions of the hemispheres define hemispheric styles of emotional and cognitive functioning (to be called hemispheric personality styles) that bear striking resemblance to two neurotic styles described by Shapiro (1965) in his book, Neurotic Styles. In general, Shapiro suggests that, for whatever reason (i.e., genetic, behavioral, psychosexual, etc.) an individual develops a characteristic matrix of thinking, experiencing, and feeling, and that this matrix then regulates or promotes the type and amount of perceptual information gathered, the processing performed, and the behavior exhibited. Shapiro further suggests that neurotic manifestations would be consistent with or logical extensions of this matrix. For example, Shapiro states that no one is surprised to hear that a very logical, exacting person chooses the profession of a bookkeeper and that, when a psychological problem occurs, it manifests itself as an obsessional type of neurosis.

Two basic matrices described by Shapiro are the obsessive-compulsive neurotic style and the hysterical neurotic style. The obsessive-compulsive style is characterized by analytical cognition with a great attention to detail, deliberate activity and expression. Shapiro states that maintenance of this vigilance to detail and purposeful activity calls for "tense deliberateness" that restricts the abilities of imagination, fantasizing, "whim, playfulness, and spontaneous action in general" (Shapiro 1965, p. 44).

Shapiro also characterizes people with this style as dogmatic and worrisome. As can be seen from the preceeding description, Shapiro's description of the obsessive-compulsive neurotic style is similar to that proposed for a left-hemispheric personality style. A similarity is also evident between Shapiro's description of a hysteric neurotic style and the proposed personality style of the right hemisphere.

Shapiro describes the hysteric neurotic style as being more global, diffuse and impressionistic in cognition and perceptual approach. It is characterized by a relative absence of active, complex cognitive integration, and numerous emotional outbursts that are not truly representative of the hysteric's overall feelings. Shapiro also states that this neurotic style is particularly likely to utilize the psychological defense of repression, that is, "the loss not of affect but of ideational contents to achieve the status of conscious memory or of memories available to consciousness" (Shapiro 1965, p. 109), or "to put it another way, the hysterical affect, like the cognition, does not emerge as a well-developed and articulated mental concept in a clearly focused well-differentiated awareness, but immediately dominates and captures a diffuse and passive awareness" (Shapiro 1965, p. 131).

Thus far, the hemispheric personality style model postulates that the hemispheres are specialized for certain interrelated types of cognition and emotion. By drawing a parallel to Shapiro's descriptions, it may be hypothesized that the right hemispheric personality style is congruent with an hysteric-like personality style. Evidence supporting such a hypothesis is provided by several studies. Relating a hysteric-like symptom (denial) and right hemisphere activation, Gur and Gur (1975) measured lateral eye movements of normal

subjects and found that "left lookers" scored significantly higher than right movers on Reversal, a subtest of the Defense Mechanism Inventory, which is considered to demonstrate defenses, such as repression, denial, negation and reaction formation that "deal with conflict by responding in a positive or neutral fashion to a frustrating object." The authors also found that "left lookers" evidence more psychosomatic symtomology. Intimating that hysteria and psychosomatic tendencies are linked, Sommerschield and Reyker (1973) have shown that the degree of repression (a hysteric defense mechanism) present is related to the number of psychosomatic complaints and symptoms.

Other researchers have further demonstrated that psychosomatic difficulties are linked to hysteria and the right hemisphere. Galin, Dimond and Braff (1977) reviewing the cases of female hysterics, found that a significant portion of them exhibited conversion symptoms on their left sides. Kenyon (1964) reviewing records of patients with unilateral psychosomatic symptoms, also found that the symptoms were mostly evidenced on the left side. These findings, plus Gur and Gur's findings on normals, suggest that the right hemisphere may be particularly important to hysterical defense mechanisms and symptomology.

Reviewing previously presented cognitive research it is apparent that the descriptions of left hemispheric functions are congruent with Shapiro's description of the obsessive verbal, analytical style. Although the exact type of emotional expression of the obsessive-compulsive is not stated by Shapiro, it is not unreasonable to infer from Shapiro's descriptors of "tense deliberateness," worry, and dogma, that the left hemisphere's emotional expression might be

one of tension or anxiety that, in times of stress, is characterized by negative self-statements and verbal ruminations (i.e., depressive-like affect). Several studies have demonstrated just such a link between anxiety/depression and the left hemisphere.

Using brain damaged subjects, researchers have shown that patients with left hemisphere damage report more depression (Black 1975; Dikmen & Reitan 1977; Gasparini, Satz, Heilman, & Coolidge 1978) and anxiety (Dikmen & Reitan 1974) on the Minnesota Multiphasic Inventory. In another study, using the lateral eye movements of normal subjects to indicate hemispheric activation, Day (1967a) found that right movers (i.e., left hemisphere) experience more anxiety and experience it as having an external locus (Day 1967b).

In another approach in which researchers interrupted normal left hemisphere functioning by unilaterally injecting sodium amytol in the brains of pre-surgery patients to determine speech lateralization (Rossi & Rosadini 1967; Terzian 1964) or administering unilateral ECT (Deglin & Nikolaenko 1975) to psychiatric patients. Although the subject populations were different, the results were the same. Both sets of researchers found that left hemispheric disturbance (i.e., injection or ECT) produced behavioral phenomena suggestive of a catastropic depressive reaction, while induced disruption of the right hemisphere produced patient behavior suggestive of euphoria.

Specifically looking at anxiety and lateral cerebral function, Tucker, Antes, Stenslie, and Barnhardt (1978) performed two experiments that indicated left hemispheric involvement. In the first experiment they found that higher reported anxiety is associated with

greater errors in the right visual half-field. Measuring lateral eye movements and auditory attentional bias, they performed a second experiment that demonstrated that reported trait anxiety is correlated with a decrease in left eye movements and a right ear attentional bias. The authors conclude that anxiety appears to be a left hemisphere phenomena that may reduce the left hemisphere's ability to process hemisphere-specific perceptual information due to a hemispheric processing demand overload.

In summary, each hemisphere appears to have a characteristic form of cognition and emotion and, by exploring the interrelationship of these two characteristics, a general personality style can be attributed to each hemisphere. Through comparing this hemispheric personality style model to the clinically generated neurotic styles described by Shapiro (1965) it is possible to heuristically label the right hemispheric personality style as being hysteric-like and the left hemisphere's as being obsessive-compulsive-like. Yet, although it is possible to generate personality style descriptors for the two hemispheres, this model has only characterized the hemispheres as discrete, functioning units. In the following section the interaction and overall individual experience will be explored.

Personality's Affect on Laterality

To this point, the personality theory of hemispheric activation (e.g., personality style theory) has been developed in such a way as to suggest that the hemispheres are differently characterized by certain types of interelated cognition and emotion, yet it has not been postulated how two such diverse and antithetical personality styles exist

within one individual. Once again returning to Ornstein's concept of choice as an indicator of hemispheric utilization, it is reasonable to postulate that each hemisphere has its own style of cognitive and emotional functioning and that an individual will "preferentially rely on one hemisphere more than the other, regardless of the type of material that confronts him" (Ornstein 1978, p. 82). It would follow that the more an individual's overall personality tends toward an extreme, the more that individual would rely on a particular hemisphere. Conversely, the less stylized the individual's personality the more flexible would be his response pattern and, therefore, his hemispheric utilization. In terms of hemisphere utilization the idiom "well-balanced" may literally mean just that.

In an experiment that is relevant to such a model, Smokler and Shevrin (1979) administered selected Rorschach cards and several subtests of the Wechsler Adult Intelligence Scale to a group of subjects. Based on their test performance, subjects who tended toward the hysterical or the obsessive-compulsive extremes were administered a lateral eye movement questionnaire. The authors found that subjects who tended toward a hysterical extreme produced LEMs suggestive of right hemisphere involvement (i.e., were left lookers) while subjects who tended toward an obsessive-compulsive extreme produced LEMs suggestive of a basically left hemisphere involvement (i.e., were right lookers).

In another study that specifically addresses the relation between the obsessive-compulsive syndrome and the left hemisphere, Flor-Henry, Yeudall, Koles, and Howarth(1979) utilized both neuropsychological tests and EEG recordings as indices of hemispheric

activation. The author found that patients with obsessive compulsive syndrome demonstrated neuropsychological performance suggestive of left frontal dysfunction and EEG data reflective of perturbations in the left temporal and parietal regions. They conclude that their results suggest that the syndrome is the product of a dysfunctional left frontal lobe that is no longer able to inhibit the verbal rumination from the posterior areas.

By viewing the hemispheres as being lateralized for certain types of thought and that an individual chooses which he will utilize, it becomes possible to explain some of the apparent discrepancies in the literature on emotion, seeming contradictions between the two, and uses of LEMs as an indicator of hemispheric activation. Briefly, by comparing a right hemispheric personality style (i.e., hysteric) to a left hemispheric personality style (i.e., obsessive-compulsive) experimenters might incorrectly surmise that the left hemisphere is non-emotional. This misinterpretation might occur due to the left hemisphere's capability to modulate its level of affective expression via its superiority for deliberate activity, that is, its ability to differentiate experience into discrete units (words, digits, concepts, etc.) thereby allowing it to more effectively control and manipulate these units than if the emotion were experienced by a more "diffuse and passive awareness" (i.e., the right hemispheric personality style). In other words, since the left hemisphere has more conscious control to deliberately and accurately express itself, its more controlled emotional verbalization and expression may be seen as miniscule or non-existent in comparison to the right hemisphere's diffuse emotional outbursts (Shapiro 1965). Results

suggestive of the left hemisphere's control over affect can be found in articles by Shearer and Tucker (in press), Tucker and Newman (in press), and Galin (1974).

As well as suggesting that the right hemisphere is the locus for emotion or has relative superiority in the generation of affective expression, some experimenters might also mistakenly characterize the right hemisphere's emotional style as positive (Terzian 1964; Gainotti 1972a, 1972b; Ehrlichman & Wiener 1978) in comparison to a left hemispheric emotional style of negativity (Black 1975; Harmon & Ray 1977; Tucker, Antes, Stenslie & Barnhardt 1978). This misinterpretation might naturally occur as a result of the right hemisphere's hysteric-like personality style which experiences emotion in a transtory fashion. Shapiro (1965), describing the hysteric's affect as immediate and unowned, states "hysterical people do regard their own emotional outbursts very much as they might regard conversion symptoms; that is, they do not quite regard the content of their outburts as something they have really felt, but rather as something that has been visited on them or, as it were, something that has passed through them" (Shapiro 1965, p. 126). Therefore, negative affect, although immediately felt and intensely presented, may not be truly owned by the right hemispheric individual, whereas the left hemispheric individual's tendency toward differentiation, integration, rumination and worry might easily lend itself to owning negative affect, and, particularly if stressed, intensely focusing on and accentuating this affect.

This discussion of the hemisphere's subjective experience and behavioral experience of negative and positive affect might be useful

in explaining Bear and Fedio's results (1977). Recalling that the authors found significant incongruity between observers' ratings of epileptic patients' displayed personality attributes and emotional expression with the patients' own ratings of this variable, it is proposed that the patients with right hemisphere epileptic foci subjectively rated themselves as less affectively disturbed (i.e., more elation) since their affect was not really owned by them; while observers, noting the intensity of expression, would rate them as more affectively disturbed (i.e., more depressed). Similarly, epileptics with left hemisphere damage, due to their more consciously differentiating and integrating style, would be more aware of and focused on their deficits and therefore feel more depressed than objective observers might rate the patients, since the observers would be seeing the more modulated affect of the left hemisphere.

Finally, the personality style model of hemispheric activation might also serve to explain the seeming discrepancy between the theoretical basis of individual specific LEM measurement versus question specific LEM measurement. Briefly, this model suggests that each hemisphere has a characteristic personality style and that hemispheric utilization is a result of the individual's personality. By extending this line of reasoning, it can be hypothesized that the more an individual is characteristically globally or analytically oriented the more that individual will rely on the hemisphere whose style is most congruent with that individual's personality. In terms of lateral eye movements, measuring the overall number of lateral eye movements and generally characterizing an individual as

either a "right or left mover" (i.e., individual specific measure) may be synonomous with characterizing a person's overall behavior pattern (i.e., personality). Similarly, measuring discrete units of lateral eye movements to specific questions across a number of diverse subjects (i.e., question specific measure) would be more congruent with characterizing a hemisphere's characteristics. Therefore, both measures of LEM would actually measure hemispheric activation with individual specific measures characterizing the individual's personality and question specific measures characterizing a hemisphere's personality style. And the two measures would be related, in that the individual specific measure would simply be the characteristic usage of one hemisphere over the other.

Summary and Statement of the Problem

In conclusion, it has been shown that the left and right hemispheres have individual styles of perceptual approach, information processing, and affective experience. Briefly, the right hemisphere has been found to be superior in performing spatial, non-verbal and holistic cognition, as well as seeming to contribute more heavily to affective lability and, for some researchers, the specific emotional experience of positive affect (i.e., euphoria). On the other hand, the left hemisphere has been found to contribute more to sequential, verbal, and analytical cognition and some researchers have shown it to contribute to the subjective emotional experience of negative affect (i.e., depression and anxiety). Support for such differences has been provided by research using normal, brain damaged and

psychiatric patients, thereby allowing researchers to make powerful inferences to the general population.

Combining Tucker's (in press) notion of the interrelationship between cognition and emotion with Ornstein's (1978) theory that the hemispheres are lateralized for types of "thought" an individual "chooses" to use, a hypothesized model of hemispheric personality styles is presented. This model suggests that each hemisphere has a specific personality style that is the logical result of the interrelation between its affective arousal and its cognition. The hypothesized hemispheric personality styles are compared to Shapiro's (1965) descriptions of two neurotic styles, that is, the hysterical style and the obsessive-compulsive style. A heuristic parallel is drawn between the hypothesized hemispheric personality styles and Shapiro's neurotic styles suggesting that the right hemisphere's personality style is consistent with hysteric-like performance and emotion, while the left is consistent with obsessive-compulsive-like affective arousal and cognition. Previous research provides results consistent with such a parallel.

Whereas the previous studies provide descriptions of hemispheric differences, very few provide a model with which to view hemispheric selection. One of the most attractive hypotheses addressing the issue is provided by Ornstein's notion of ultimate hemispheric resolution (i.e., choice) which posits that overall hemispheric utilization is consistent with the individual's personality (i.e., more hysteric or more obsessive-compulsive). Assuming such a relation, it is expected that the more an individual's personality is toward one of these two extremes, the more he will rely on the

personality consistent hemisphere, thereby exhibiting more activation of that hemisphere, as measured by EEG, LEM, cerebral blood flow, etc.

If indeed such a hypothesis is a reasonable description of each hemisphere style of integration, the personality theory of hemispheric activation theory might explain certain discrepancies in the literature of emotion, as well as the seeming contradiction between the theoretical bases of the two measures of LEM (i.e., question specific and individual specific). The following study proposes to test this hypothesis by comparing individuals' performance on cognitive tasks with their scores on various indices of personality. It is expected that subjects performing well on right hemispheric cognitive tasks will also produce personality scores suggestive of hysteric-like functioning, while individuals performing well on left hemispheric cognitive tasks will demonstrate scores suggestive of obsessive-compulsive-like functioning. Finally, an index of hemispheric utilization (i.e., LEM) should show overall percentage hemispheric patterns consistent with the individual's personality.

The hypothesis of a close interdependence between cognition and affect within personality would also suggest that measures of lateralized emotional style should covary closely with a measure of lateral cognitive style.

CHAPTER III

METHOD

Purpose

The purpose of this study was to research the possible relationship between a subject's personality and his scores on two general indices of cerebral activation, neuropsychological task performance and lateral eye movement. Assuming that a subject's personality predisposes him to utilize a certain hemisphere and its concommitant skills more than the other, it should be possible to demonstrate personality consistent performance bias on neuropsychological tasks in the predicted direction, as well as demonstrate a higher percentage of lateral eye movements contralateral to that hemisphere suggested by personality measures and neuropsychological task performance.

Subjects

The subjects were 33 right-handed (by self report), undergraduate students enrolled in an introductory psychology course at the University of North Dakota. They were solicited from a population of 50 students who had previously served as practice testing subjects for UND graduate students of psychology. The graduate students had previously administered and scored four personality measures, the Minnesota Multiphasic Personality Inventory, the Rorschach, the Wechsler Adult Intelligence Scale, and the Thematic Apperception Test. These tests were reviewed and corrected for scoring accuracy by a graduate teaching

assistant and finally by the professor, a clinical psychology Ph.D. The results were then forwarded to the experimenter for later analysis.

Attempts were made to contact all 50 of the undergraduate subjects but only 42 were reachable. These 42 subjects were offered a ten dollar incentive to participate in an experiment in which they would have their brain waves recorded while they performed various tasks. Of the forty-two students contacted, forty agreed to participate. Six subjects later refused or were unable to participate due to scheduling conflicts and one subject was rejected due to sinistrality. Of the remaining thirty-three subjects partial data was lost on 10 subjects, leaving full data on 23 subjects, and of these, 16 were female and 7 were male.

Interviewers

The experimenter, a male undergraduate student, and a female undergraduate student, served as interviewers for this experiment. The two undergraduate students were instructed to greet the subject, place electrodes on the subject's head for electroencephalographic recording (results of which would be used in a different analysis) and then administer several pencil and paper tests. The undergraduate students were volunteers who endeavored to gain experience in psychological research.

The experimenter, a clinical psychology graduate student, was responsible for administering both the neuropsychological test battery and lateral eye movement questionnaire. Due to some controversy surrounding the interrater reliability of the later measure (see Bakan & Strayer 1973), the experimenter undertook special care to

gain adequate training in observing and recording lateral eye movements. Training consisted of three steps. First, the experimenter practiced observing responsive eye directionality among fellow students and friends. Once sensitized, the experimenter than practiced administering the lateral eye movement questionnaire to five friends. Finally, the experimenter viewed a videotape in which he observed and recorded eye movements following twenty specific questions. Rater reliability across four viewings of this videotape was .97.

Questionnaires

Before the subject came to the experimental session, he had already been administered three different tests of personality and an intelligence test. These tests were the MMPI, TAT, WAIS and Rorschach. Of these tests, only three were used and of these three, specific subtests within each measure were chosen as more sensitive to the dichotomy being researched (i.e., obsessive-compulsive versus hysteria). Variables thought to be sensitive to the obsessive compulsive dimension were MMPI scales of D, Pk, and Sc and the WAIS Verbal IQ, while variables thought to reflect the hysteric dimension included MMPI scales Hy, Pd, and Hs; WAIS subtests of Block Design and Object Assembly, and the WAIS Performance IQ. The Rorschach scale selected included the total color responses, total achromatic color responses, affective ratio, FC/CF + C, whole to detail ratio experience base, experience balance, and the egocentricity index. Rorschach scores reflecting affect, uninhibitedness, Gestalt perception, and impulsivity were thought to measure the obsessive compulsive dimension while scores reflecting constrained or painful affect,

anxiety, withdrawal, and detail oriented perception were thought to measure the hysteric dimension.

Besides the four measures of personality already collected on the subjects, five other pencil and paper personality questionnaires were administered. These questionnaires consisted of a social desireability scale (Crowne & Marlow 1960), a trait anxiety scale (Spielberger 1968), an adjective checklist (to be used in another study), a handedness scale (Crovitz & Zener 1962), and a lateral eye movement questionnaire.

The last measure, LEM, is a somewhat controversial index of hemisphere activation. Since Bakan (1969, 1971) first suggested that lateral eye movements were indicative of contralateral hemispheric activation, authors have argued LEMs' reliability and validity. Suggesting that handedness and sex may influence the direction of eye movement, Kinsbourne (1972), Gur and Gur (1974), and Gur, Gur and Harris (1975) have shown that only right handed subjects show a consistent pattern of correlations of lateral eye movements to cognitive and personality variables, while McGlone and Davidson (1973) have shown that women, unlike men, are less lateralized linguistically.

Other researchers have also demonstrated that women consistently use their left hemispheres more than men (Schweitzer, Becker & Welsh 1978), score the opposite of men on hypnotizability (Gur & Gur 1974), make less right LEMs than men (Weiten & Etaugh 1974), and demonstrate no particular correlations between LEMs and repression-sensitization whereas men did (Woods 1977). These studies suggest, at least, handedness and sex affect the validity of LEM as a measure for all groups.

Further, the type of question may have demonstrable effect on lateral eye movements. Some researchers suggest that the processing demand of the question directs the type of LEM. Kocel, Galin, Ornstein and Merrin (1972), Kinsbourne (1972), and Weitan and Etaugh (1974) suggest that the cognitive demand (i.e., verbal and analytic versis spatial) of the task influence eye movement; while Schwartz, Davidson and Maer (1975) suggest that the affective tone of the question may be a factor. In addition to processing demand, Kinsbourne (1972) and Galin and Ornstein (1974) have added another dimension by suggesting that vertical, as well as horizontal, LEMs must be taken into account, while Ehrlichman, Weiner and Baker (1974) suggest that the effects of verbal and spatial questions on eye movement were reliable only for the vertical dimension. A model for reconciling the discrepancy between question demand and type of "looker" is provided by Gur, Gur and Harris (1975), who suggest that for right-handed males, experimenter location can influence whether the subject's eye movements are a result of question content or hemispheric preference (i.e., "right looker" or "left looker"), when only the lateral dimension is scored. The authors found that when the experimenter sits in front of the subject, the subject consistently moved his eyes in one direction or the other. On the other hand, if the experimenter sat behind the subject, the subject moved his eyes in a direction consistent with task demand. The authors suggest that, when an experimenter and subject are face to face, the tension or anxiety of the subject encourages him to rely on his preferred hemisphere, regardless of task demand.

In an attempt to address the numerous discrepancies in the LEM literature, Ehrlichman and Weinberger (1978) undertook an extensive literature review. They found several methodological errors across the literature, the most important of which being the measure itself. Briefly, the authors question the major assumptions underlying LEM as a measure. Further, even granting these assumptions, they found discrepancies in the definitions of what constitutes a lateral eye movement and in the scoring of LEMs throughout the literature rendering comparisons of results across studies and overall conclusions difficult. Thus, Ehrlichman and Weinberger conclude that, if LEMs are to be used, only right and left LEMs should be scored and that a percentage of right over right plus left movements is the most appropriate expression of LEM behavior (Ehrlichman & Weinberger 1978, p. 1088). According to Ehrlichman and Weinberger, the index of LEM that may be worthy of study is the "left looker" versus "right looker" model of LEM measurement; however, they caution that this phenomenon may not be so much a measure of hemispheric activation, as it may be a measure of social training, cultural bias, or some other factor.

While Ehrlichman and Weinberger (1978) cast considerable doubt on the value of LEM as a measure of cognitive activation, it is an attractive index because of its rich history of results consistent with other research utilizing different measures of hemispheric activation, and its ease of administration. LEM may prove to be a reliable index of hemispheric activation as long as researchers adhere to Ehrlichman and Weinberger's specific suggestions regarding administration, minimizing extraneous factors to which the measure may be

extremely sensitive, and interpret results in terms of possible social, emotional, and situational variables. Thus, with reservations, it was decided to use LEM as an index of dominant hemispheric activation.

Procedure

When the subject arrived at the appointed hour, he was met by one of the undergraduate interviewers and escorted to a room. The subject was then seated and the undergraduate interviewers proceeded to attach electrodes and administer the pencil and paper tests. Following this, the experimenter entered, wearing a sport coat, dress pants, dress shirt, and carrying a clipboard. He directed the subject into an adjoining experimental room which had been set up to provide a homogeneous and symmetrical visual field for the subject.

The experimenter seated the subject and then seated himself directly across from, and facing the subject. The experimenter then read the following instructions to the subject:

> I have a variety of questions I would like to ask you before we begin the EEG experiment. Please listen carefully to each question and try to answer to the best of your ability. Do you have any questions before we begin? Then let's begin.

The experimenter's dress and the instructions were designed to encourage a mild level of anxiety in the subject. In accordance with the findings of Gur, Gur and Harris (1975) this mild level of anxiety should encourage the subject to respond with lateral eye movements reflective of his hemispheric preference, rather than movements specific to the type of questions asked.

After the instructions were read, the experimenter administered the lateral eye movement questionnaire (Appendix A). To assure eye contact and proper eye movement observation, the experimenter looked

up at the subject's eyes for the last three words of each question. The subject's initial eye movement following the completion of each question was recorded by the experimenter. A circle was used to represent the field of possible eye movements with the center of the circle representing a fixed stare. A line was drawn from the center to a point on the circle, closest representing the direction of the subject's gaze upon the completion of the question. After the experiment, the direction of gaze was then scored as either right or left. Any movement to either side was scored with the exception of direct stares (i.e., no break in eye contact with the experimenter upon completion of the question) and eye movements in a vertical direction.

The subject was then taken to a small soundproof booth and placed in a chair facing a television screen and a lamp. The subject's electrodes were attached to a receptacle and a hand-held button was placed in the subject's left hand. The subject was given headphones and a microphone with which he could communicate with the experimenter. The experimenter then reassured the subject and explained briefly that the subject should try to relax as much as possible to insure clear recordings of his brain waves during the tasks to follow. When the interviewer felt the subject was fairly calm and comfortable, the experimenter stepped outside the booth, shut off the light, and went to the control panel.

When the subject appeared sufficiently calm (i.e., clean EEG recordings and subject's self report), the subject was administered a set of tasks designed to measure neuropsychological functioning. These tasks included the Word Fluency, Digits Forward, Digits Backward, Tones Forward, Tones Backward, Verb Count, Embedded Figures,

Mooney's Faces, and Imagination tasks. At the completion of these tasks, the subject was requested to relax. A spectral plot of the subject's brain waves was printed, and this, and a check for ten dollars were presented to him. The subject was then taken to another room and debriefed by the undergraduate interviewers.

Statistical Analyses

Statistical exploration of the data was divided into two sets. The first set of analyses was designed to investigate selected individual variables of personality and cognition to each other and to a specific index of hemispheric activation, LEM. This set of analyses consisted of three groups. The first group of analyses compared the number of LEMs to the right and to the left with two cognitive summary scores constructed to tap right hemispheric cognitive skills (i.e., Mooney Faces, tonal memory, Imagination, and Block Design) and left hemispheric cognitive skills (i.e., Word Fluency, memory for digits, Vocabulary and Arithmetic). Comparisons were made via Pearson product moment correlations and the results describe the degree to which LEMs coincide with cognitive performance in indicating an activated hemisphere. It would be expected that right LEMs would be significantly correlated with the left cognitive summary score (CLSUM) and left LEMs with the right cognitive summary score (CRSUM).

In the second group selected pencil and paper and projective measures were compared to LEMs via t-tests, Pearson product moment correlations, and multiple regression analyses. The pencil and paper variables were selected because of their previous use in the literature and include trait anxiety (Tucker et al. 1978), repression

sensitization (Woods 1977) and social desireability (Orlofsky 1976). The projective variables (RZD, RREFLT, WDRATIO) selected reflect considerations made by Smokler and Shevrin (1978) in distinguishing between obsessive-compulsive and hysteric styles. The comparisons should demonstrate relationships and differences that suggest that the hysteric descriptors of repression, high social desireability scores, low trait anxiety, underincorporation, egocentricism and attention to wholes are related to left eye movements while the obsessive-compulsive descriptors of sensitization, low social desireability scores, high trait anxiety, overincorporation, low egocentrism and attention to detail should be related to right eye movements.

The third group of analyses compared the cognitive summary scores to the selected pencil and paper and projective measures, as well as two MMPI summary scores. First, an MMPI summary score suggestive of conversion-hysteric functioning, scales Hs and Hy, and one suggestive of depression and rumination, scales D and Pk, were correlated with the two cognitive summary scores. Secondly, the selected pencil and paper and projective measures were compared to the cognitive summary scores via Pearson product moment correlations and multiple regression analyses. It was expected that descriptors of hysteric-like functioning should significantly relate to the right cognitive summary score and descriptors of depressive/compulsive-like functioning should be significantly related to the left cognitive summary score.

Although the first set of analyses were designed to investigate the validity of the model by using research suggested indices of personality, there is no certainty that the specific indices that

have previously been used within the literature are the most representative ones nor are there any studies to the author's knowledge that have researched the power of multiple personality variables, both self-report and projective, in predicting hemispheric preference. In order to address these concerns, factor analysis was selected for further investigation of personality and cognitive variables and their interactions.

Before performing factor analysis it was felt that the issue of confounding variance due to sex should be addressed. It was assumed that the variance accounted for by sex basically reflected the less well-defined laterality contributed by females and that this variance would not significantly affect the actual laterality effects within the data. In order to extract this variance a multiple regression procedure was used to partial out the variance due to sex and the residual variance was then submitted to factor analysis.

Factor analyses were divided into three groups, the first two groups of factor analyses were designed to compare personality variables to cognitive variables in order to compare any lateralized cognitive factors to personality factors. These comparisions were made utilizing personality in two separate fashions. The first group divided personality variables into pencil and paper and projective measures in order to explore any significant comparissons that specific types of personality variables might provide. The second group of factor analysis explored the possible significant relationships that may exist between personality and cognitive factors, when all personality variables are considered at the same time. In order to statistically produce the above comparisons factor scores were

generated from the residual variance. These scores were then used in Pearson product moment correlations.

In a final analysis factors were generated from both cognitive and personality variables. This particular analysis was performed in order to describe any personality/cognitive matrices that might exist. It was expected from the personality style model that a specific kind of matrix (obsessive-compulsive versus hysteric) would appear and that this matrix should be related to the index of cerebral activation described by Ehrlichman and Weinberger (1978) (PLEM). The statistical procedures followed the same design as described above with PLEM being correlated to the factors produced. Should this analysis demonstrate a significant correlation between a PLEM and a factor describing obsessive-compulsive/hysteric variables in the predicted direction, that is, left lateral eye movements with hysteric descriptors and right lateral eye movements with obsessive-compulsive descriptors), it will provide a basis for the serious consideration of such a model of laterality. On the other hand should this analysis not produce any signifiant correlations, two possibilities are indicated. First, that since the particular measure of laterality selected (PLEM) is questionable, other indices should be utilized in order to research this model or the model itself is not relevant in describing the basic differences of the hemispheres.

CHAPTER IV

RESULTS

Demographic Data

Analysis of the data on the 33 subjects revealed that the average age was 19.88, ranging from 18 to 30 years (S.D. = 2.8). Subjects' scores on the Crovitz and Zener (1962) handedness scales ranged from 16 to 38 ($\overline{X}$ = 33.4), indicating that the sample of subjects were within norms for right handedness. Because some data were lost through attrition and computer error, analyses were performed using the greatest number of observations allowable for the particular variable. There were 24 females and 9 males when analyses using an n = 33 were performed, 23 females and 9 males when analyses of n = 32 were performed, 19 females and 7 males when analyses of n = 26 were performed, and 18 females and 7 males when analyses of n = 25 were performed.

Simple Analyses Using Selected Variables

Comparison of LEMs and Cognitive Measures

In the first set of analyses, simple statistical designs were performed. The analyses were divided into three groups. In the first group the relationships between lateral eye movements (LEM) and measures of cognitive performance were examined by correlating the number of LEMs in one direction or the other with two cognitive performance summary statistics. The summary measures of cognitive

performance were constructed to be representative of left hemispheric cognitive processing versus right hemispheric cognitive processing. The tasks selected to be included in the right hemisphere summary cognitive score (CRSUM) included the total number of correctly identified Mooney Faces (MFTS), the total number of correctly identified tone patterns (both forward and backward) (TTOT), a subjective rating score of imagination (IMAG), and the Scaled Score for the Block Design subtest of the WAIS (BLDS). The summary score representative of left hemispheric performance was composed of a word fluency task (WFTS), a total for the number of correctly repeated series of digits (both forward and backward) (DTOT), the scaled score of the Vocabulary subtest of the WAIS (VOCAB), and the scaled score of the Arithmetic subtest of the WAIS (ARITH). None of these correlations was significant (see Table 1).

Comparisions of LEMs and Personality Measures

In the second troup of analyses three statistical techniques were used to study the relationships between selected personality variables and the LEM measures: an overall significance test and individual t-test on means, Pearson product moment correlations, and multiple regression analyses. For these analyses, personality variables were divided into pencil and paper measures and projective measures. The overall test of significance (Hotelling-Lawley Trace) did not demonstrate significant differences between right lookers and left lookers for either pencil and paper variables or projective variables. Individual t-tests between means also revealed no significant differences between right lookers and left lookers for

TABLE 1

PEARSON PRODUCT MOMENT CORRELATIONS FOR THE COGNITIVE SUMMARY SCORES AND NUMBER OF LATERAL EYE MOVEMENTS

	Left LEMs	Right LEMs
Left Hemisphere	.07	.05
Cognitive Summary	p = .74	p = .82
Score (CLSUM)	n = 25	n = 25
Right Hemisphere	-.02	-.06
Cognitive Summary	p = .91	p = .15
Score (CRSUM)	n = 25	n = 25

either groups of variables with the possible exception of the Social Desirability variable, a pencil and paper measure, which approached significance ($t = 1.8659$; $df = 31$; $p = .0715$). Further investigation revealed that this difference between right lookers and left lookers was only true for women ($t = 1.7784$; $df = 22$; $p = .0892$).

Next, three specific variables from both the pencil and paper group (TANX, REPS, SDS) and the projective group (RZD, WDRATIO, RREFLT) were selected for correlation with the number of LEMs in one direction or the other. These variables were selected because of previous research (Tucker et al. 1978; Smokler & Shevrin, in press; Woods 1977) suggesting that they might prove to be especially sensitive to the direction of eye gaze. Pearson product moment correlations were performed. The only correlation that proved to be near significance was between the social desirability scale and total number of lateral eye movements to the right ($r = -.32$, $n = 32$, $p = .07$), suggesting that right movers score lower on the scale.

The same variables were also used to perform multiple regression equations wherein first the selected paper and pencil variables and then selected projective variables were used to predict both LEMs to the left and LEMs to the right. None of these proved significant.

Comparisons Between Personality and Cognitive Variable

The third group of analyses compared personality variables to the summary cognitive scores. For this investigation the personality variables were divided into MMPI variables, Rorschach variables, and the remaining pencil and paper tests (SDS, trait anxiety, and

repression sensitization). First, two MMPI variables, a conversion-hysteric score (i.e., summation of the T scores of scale Hs and Hy) and a depressive-ruminative score (i.e., summation of the T scores of scale D and scale Pk) were correlated with the summary cognitive scores. No significant relationships were discovered. Secondly, selected pencil and paper measures, TANX, REPS, and SDS, and selected projective measures (RZD, WDRATIO, and RREFLT) were compared to the cognitive summary scores by correlation and multiple regression. Both Pearson product moment correlations (Table 2) and multiple regressions demonstrated significant relationships (Table 3) for the pencil and paper variables.

The only significant Pearson product moment correlation for selected paper and pencil variables was the negative correlation between TANX and CRSUM ($r = .50$, $p = .009$), indicating lower trait anxiety scores are associated with better performance on cognitive tasks believed to tap right hemispheric functioning. Multiple regression demonstrated that all three variables contributed to a significant R^2 ($R^2 = .42$, $p = .0079$) prediction of CRSUM with TANX and REPS providing individually significant contributions (TANX, $F = 8.54$, $p = .008$; REPS, $F = 6.02$, $p = .02$). The beta weights for this model indicate that TANX is negatively loaded while REPS is positively loaded, suggesting that good right hemispheric cognitive performance is predicted by lower trait anxiety and greater sensitization (TANX, $\beta = -.5944$; REPS, $\beta = .4657$). The regression equation for CLSUM was non-significant.

For selected projective variables the only correlation that proved significant was between RZD and CLSUM ($r = -.42$, $p = .04$),

TABLE 2

PEARSON PRODUCT MOMENT CORRELATIONS FOR SELECTED COGNITIVE AND PAPER AND PENCIL VARIABLES

	Trait Anxiety (TANX)	Repression Sensitization (REPS)	Social Desirability (SDS)
Left Hemisphere Cognitive Summary Score (CLSUM)	-.14 p = .50 n = 25	-.03 p = .89 n = 25	-.07 p = .72 n = 25
Right Hemisphere Cognitive Summary Score (CRSUM)	-.51 p = .009 n = 25	.09 p = .67 n = 25	.29 p = .15 n = 25

TABLE 3

MULTIPLE REGRESSION ANALYSIS FOR SELECTED COGNITIVE AND PERSONALITY VARIABLES

Dependent Variable	R^2	df	F	Pr > F
CLSUM	.06	(3,21)	.47	.7031
Independent Variables	**β**	**df**	**F**	**Pr > F**
TANX	-.2745	1	1.12	.302
REPS	-.0524	1	.05	.830
SDS	-.2908	1	.92	.348
Dependent Variable	**R^2**	**df**	**F**	**Pr > F**
CRSUM	.42	(3,21)	5.16	.0079
Independent Variables	**β**	**df**	**F**	**Pr > F**
TANX	-.5944	1	8.54	.008
REPS	.4657	1	6.02	.023
SDS	.2261	1	.91	.352

with the direction of the correlation suggesting that higher performance on tasks thought to tap left hemisphere function is negatively associated with organizational activity on the Rorschach. Multiple regression analyses attempting to predict summary cognitive scores from selected projective variables demonstrated no significant relationships.

Summary of Simple Analyses

In summary, the results presented suggest that right hemispheric cognitive performance (CRSUM) is predicted by higher sensitivity and lower trait anxiety and is directly associated with the single effect of lowered trait anxiety. Left hemispheric cognitive performance (CLSUM) is associated with underincorporation on the Rorschach. The only other variable approaching significance in predicting hemispheric activation was the SDS score. The SDS score was marginally significant ($p = .07$) in its negative association ($r = -.32$) with right LEMs and in distinguishing between right lookers and left lookers ($t = 1.8659$), yet there is some question as to its validity since this last difference approached significance only for women ($t = 1.7784$, $p = .0892$).

Overall, these analyses were the result of simple manipulations of a few variables selected for their relevance to the hypothesized personality model and their use in the literature (Tucker et al. 1978; Smokler & Shevrin 1979; Woods 1977). However, they may not necessarily be the best measures for these purposes, particularly when considered alone. For example, though low scores on the repression sensitization scale are thought to indicate repression, researchers

have shown that low scores may be indicative of non-repressors as well as repressors and that the scores are only meaningful when combined with a scale of social desirability (Orlofsky 1976).

In order to explore the possible interrelations among variables, Pearson product moment correlations within the three groups of variables (i.e., pencil and paper variables, projective variables, and cognitive variables) were performed. Since there were numerous significant correlations among the variables, factor analysis was chosen for further exploration to describe various underlying dimensions within the separate domains of personality and cognition. The dimensions revealed were also analyzed for lateralized representation.

Before factor analyses were performed, certain precautions were instituted to insure that sex could not confound the results. The first set of analyses suggested that sex may have been a confounding variable in this sample. Researchers have generated results suggesting that the sex of the subject can be a major influencing factor and for this reason have suggested that only men be utilized for laterality research. In this experiment, both men and women were utilized in order to provide more generalizable results. In order to limit the possible confounding effects of sex, a multiple regression analysis was performed to partial out the effects due to gender. The residual variance was then factor analyzed and the factors were used to create factor scores which allowed correlations among sex-partial factors and the percentage measure of lateral eye movement (PLEM).

Within and Between Group Correlations

When the variables were divided into three groups, a pencil and paper group, projective group, and a cognitive group, Pearson product moment correlations yielded complex interrelations among variables (see Appendices B, C and D). Since the variables proved to be intricately related, factor analysis was performed in order to determine whether or not this analysis could more accurately describe the shared variance within these complex and extensive correlations. Before performing factor analysis the effect of sex was partialed out of the data due to its history as a confounding variable. The partial correlation matrix was factored using promax factor rotation. These factors were used to create factor scores, which were then used to compute correlations among the various factors and lateral eye movements.

Factor Analyses Using All Variables

In order to explore the numerous variables via factor analysis, three approaches were used. In the first approach the personality variables were divided into two groups (i.e., pencil and paper and projective measures). Factors were generated for the groups, as well as the cognitive measures (see Table 4). Factors with eigenvalues greater than one were used to generate factor scores and the factors were correlated with one another. Of the correlations showing significance ($p \leq .05$) and near significance ($p \leq .1$), four were between the two groups of personality factors and one was between a pencil and paper (Factor 3) factor and a cognitive factor (Factor 3) (see Table 5).

TABLE 4

FACTOR STRUCTURES OF THE PENCIL AND PAPER, PROJECTIVE, AND COGNITIVE MEASURE WITH SEX PARTIALED OUT

Pencil and Paper Measures

Promax Rotated Factor Pattern

	Factor 1	Factor 2	Factor 3
SDS	0.01147	-0.69983	-0.36396
TANX	-0.01588	0.33041	0.78035
REPS	0.36762	0.72489	0.09437
M1	0.67280	-0.43514	0.15717
M2	0.20845	0.04210	0.74592
M3	0.71522	-0.38610	0.00986
M4	0.72379	-0.01298	0.21601
M7	0.59284	0.00676	0.47246
M8	0.74658	0.06827	0.27857
ML	0.28743	-0.73889	-0.03082
MF	0.83184	0.44889	-0.39094
MK	0.11486	-0.88907	-0.08518

Cognitive Measures

Promax Rotated Factor Pattern

	Factor 1	Factor 2	Factor 3	Factor 4
WAISP	-0.19561	0.09774	-0.58506	0.36994
WAISV	-0.63663	0.07357	-0.31106	0.12858
WFTS	-0.15938	-0.28047	0.35919	0.76986
DTOT	-0.40604	-0.37617	-0.41891	0.20791
TTOT	0.69883	-0.21456	-0.51422	0.09152
IMBFTS	0.17791	0.37902	-0.33822	0.49351
MFTS	-0.02250	0.85770	0.11316	0.15112
IMAG	0.23090	-0.60585	0.09573	0.15845
ARITH	-0.89747	0.06067	-0.06700	-0.03687
BLDS	-0.05942	-0.01956	-0.93859	-0.21462
OBJASM	0.03968	0.08619	-0.05832	0.92403

TABLE 4--Continued

Projective Measures

Promax Rotated Factor Pattern

	Factor 1	Factor 2	Factor 3	Factor 4
REBSM	-0.71521	0.02409	0.02399	-0.05205
REBBIG	-0.13098	-0.21543	-0.82607	-0.12967
RA	-0.28078	-0.06166	0.81050	-0.05668
RCOLORT	0.21037	0.11011	-0.11679	0.73875
ECOLOR	0.19836	0.76477	-0.06223	0.30037
RZD	0.73694	0.23249	-0.16072	-0.08738
COLRAT	-0.66540	0.27477	-0.08904	0.33448
WDRATIO	0.04618	-0.20140	0.21524	0.81325
RAFR	0.06129	0.89558	0.28023	-0.15254
RREFLT	-0.36173	0.66635	-0.07894	-0.21673

TABLE 5

SIGNIFICANT CORRELATIONS AMONG FACTORS COMPUTED FROM PAPER AND PENCIL MEASURES, FROM PROJECTIVE MEASURES AND FROM COGNITIVE MEASURES

Factors	Correlation Coefficients	Prob |R|	n =
Pencil & Paper 1 X Pencil & Paper 3	.31	.08	32
Pencil & Paper 2 X Projective 4	-.54	.001	32
Pencil & Paper 3 X Projective 1	.40	.02	32
Pencil & Paper 3 X Cognitive 3	.51	.009	25
Pencil & Paper 3 X Projective 4	-.33	.06	32

Three Pencil and Paper, two of the four Projective, and one of the three Cognitive factors proved significant ($p \leq .05$) or approached significance ($p < .10$) in the correlational analysis. Pencil and Paper factor 1, whose loadings suggest a self-reported pathology factor, correlated with Pencil and Paper factor 3, whose loadings suggest a self-reported anxious/depressive factor. The correlation between these two factors suggest that individuals who report anxious and depressive feelings are also likely to report other pathological descriptors. The third Pencil and Paper factor also correlated with Projective factors 1 and 4 as well as with Cognitive factor 3. Both Projective factor 1, whose loadings suggest an over-incorporating and an affectively expressive style, and Cognitive factor 3, whose loadings suggest poor intellectual skills, were positively correlated with Pencil and Paper factor 3, the anxious depressive/depressive factor. Overall this correlation describes a cluster of descriptors suggesting that the depression/anxiety dimension is characterized by negative self-description, experience of painful affect and loss of affective control, reduced intellectual ability, and greater word fluency.

Pencil and Paper factor 3 also correlated in a negative direction with Projective factor 4, whose loadings suggest a perceptually holistic, controlled, affective and internally prompted factor. The direction of the correlation once again indicates that the Pencil and Paper factor 3 is associated with uncontrolled available affect, and suggests that the third factor may index a detail-oriented perceptual style.

The last significant correlation of the analysis is between Pencil and Paper factor 2 and Projective factor 4. Pencil and Paper factor 2 describes a self-reported non-denying, sensitizing, and somewhat stressed factor which is negatively correlated with Projective factor 4, and again suggests that reported stress and sensitivity are associated with a detail-oriented perceptual style, experience of painful affect, and loss of affective control.

To summarize, the factor analyses and correlations revealed several interrelated factors. The direction of these relationships appear to describe a personality cluster suggestive of a detail-oriented, overincorporative perceptual approach, experience of painful affect and loss of affective control, and self-reported negative feelings of depression and anxiety. This cluster also appears to be associated with poor intellectual performance but higher word fluency.

In order to further explore this personality cluster and relate it to the cognitive domain, the Pencil and Paper and Projective variables were combined in one factor analysis (Table 6) and those factors accounting for about the same amount of variance (70%) accounted for by the cognitive factors, were retained. The resultant six factors were promax rotated and then correlated to each other and to the factors previously generated from the cognitive measures (Table 7).

Two of the six personality factors produced significant or near significant Pearson product moment correlations. Combined Personality factor 1, whose loadings suggest few endorsements of pathological self-statements, correlated with Combined Personality factor 4, which is loaded heavily on available affect presently controlled in outward

TABLE 6

FACTOR STRUCTURES OF ALL PERSONALITY AND COGNITIVE MEASURES WITH SEX PARTIALED OUT

Cognitive Measures

Promax Rotated Factor Pattern

	Factor 1	Factor 2	Factor 3	Factor 4
WAISP	-0.19561	0.09774	-0.58506	0.36994
WAISV	-0.63663	0.07357	-0.31106	0.12858
WFTS	-0.15938	-0.28047	0.35919	0.76986
DTOT	-0.40604	-0.37616	-0.41891	0.20791
TTOT	0.69883	-0.21456	-0.51422	0.09152
IMBFTS	0.17791	0.37902	-0.33822	0.49351
MFTS	-0.02250	0.85770	0.11316	0.15112
IMAG	0.23090	-0.60585	0.09573	0.15845
ARITH	0.89747	0.06067	-0.06700	-0.03687
BLDS	-0.05942	-0.01956	-0.93858	-0.21462
OBJASM	0.03968	0.08619	-0.05832	0.92403

TABLE 6--Continued

Pencil and Paper Measures and Projective Measures

Promax Rotated Factor Pattern

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
SDS	0.17839	0.90789	-0.19171	-0.20661	0.08636	0.22547
TANX	-0.31433	-0.63758	-0.07323	-0.10591	-0.41538	-0.00670
REPS	-0.11787	-0.62851	-0.16050	-0.21057	0.20439	0.23525
M1	-0.84490	0.29520	-0.05808	0.02767	0.05095	-0.17952
M2	-0.49700	-0.34101	-0.18847	-0.29137	0.17702	-0.17601
M3	-0.79520	0.32760	-0.13813	0.15626	-0.01008	0.05007
M4	-0.73817	0.02686	0.06362	0.02125	0.13866	0.37566
M7	-0.81918	-0.18417	0.01499	0.06951	-0.05932	0.07087
M8	-0.76912	-0.12200	-0.00495	-0.06198	-0.15485	0.28248
ML	-0.30234	0.77982	0.05131	-0.28668	-0.12931	0.05025
MF	-0.37732	-0.09945	0.13202	-0.03750	0.31018	0.50451
MK	-0.29065	0.79961	0.01977	0.02280	0.11395	-0.29114
REBSM	0.54517	0.00427	-0.17561	0.20504	0.26782	0.31041
REBBIG	-0.07408	0.06328	0.14841	-0.04032	-0.37956	0.86870
RA	0.01611	0.13618	-0.05014	-0.04704	0.95913	-0.23341
RACOLORT	0.04635	0.52942	-0.11989	0.32553	-0.08914	0.16950
ECOLOR	0.20572	0.17798	-0.69797	-0.08243	-0.33893	-0.16099
RZD	-0.07280	0.10507	-0.19115	-0.82358	-0.05427	0.24761
COLRAT	-0.07280	0.10507	-0.19115	0.85918	-0.05427	0.24761
WDRATIO	-0.10806	0.67191	0.21017	0.09953	0.22632	-0.02448
RAFR	-0.07291	-0.08634	-0.88888	-0.05114	0.19873	-0.20359
RREFLT	-0.17775	-0.17462	-0.72441	0.36432	-0.01129	0.06140

TABLE 7

SIGNIFICANT CORRELATIONS FOR PERSONALITY AND COGNITIVE FACTORS

Factors	Correlation Coefficients	Prob > |R|	n =
Combined Personality 1 X Combined Personality 4	.32	.08	32
Combined Personality 5 X Cognitive 3	-.39	.05	25

expression, underincorporation, and a lack of self-reported stress and depression. Essentially this correlation suggests a relation between controlled affective resources and impulsivity with denial of any pathological symptomology on self-reported personality scales. It should be noted that these factor loadings are the same ones discussed in previous sections only with opposite signs.

The other significant correlation is between combined Personality factor 5 whose loadings suggest an ideographic, introversive, and anxious factor that is negatively correlated with Cognitive factor 3. This relationship suggests that inner ideational gratification and stress is associated with good performance on IQ tests, although there may be some reduction in word fluency.

In summary, both sets of factor analyses have demonstrated a cluster of factors that are suggestive of a dichotomy that on one hand is descriptive of a sensitizing, anxious, depressive, and detail-oriented dimension and on the other, describes a denying, lack of reported pathology, affective, and holistically perceptive dimension. In the next step of the analysis, all variables, i.e., personality and cognitive) are used in a factor analysis.

Lateralization of Personality Styles

Thus far, correlations between factors have demonstrated that both personality and cognition are related. This finding is consistent with the personality model of hemispheric activation proposed earlier. In order to further test the hypothesis proposed by the model that a personality style exists for each hemisphere and is best described by a matrix of interrelated personality and cognitive

variables, a final factor analysis on all variables was performed. The generated factors were correlated with the percentage LEM measure (PLEM) suggested by Ehrlichman and Weinberger (1978) and the raw number of non-lateral eye movements (NONL), since it has been shown that this dimension may also be important in describing personality (Tucker et al. 1978).

To investigate this question, factors were compared to a percentage index of lateral eye movements (PLEM). For the factor analysis, seven factors, accounting for 70% of the variance, were retained (Table 8). These factors were used in the previously described manner to produce correlations among the factors, the percentage LEM measure, and a non-lateral eye movement score (i.e., stares and vertical eye shifts) (NONL). These correlations produced only two noteworthy correlations. The third largest factor (Factor 2) correlated significantly with non-lateral eye movement ($r = -.47$, $p = .02$) and the second largest factor (Factor 3) approached significance in correlation with the percentage LEM measure ($r = 0.35$, $p = .08$) (see Table 9).

It is interesting to note that even using promax rotation, none of the retained factors were significantly correlated with each other, suggesting that these were unique factors. Factor 2 significantly correlated with non-lateral eye movement and the correlation between Factor 3 and PLEM approached significance. Implications from the factor loadings and directions of the correlations suggest that NONL are associated with poorer performance on IQ tests, more conventional interests, higher reported anxiety and some repression, suggesting a cognitively limited performer who is attempting to constrain (RCOLOR, REPS) some painful affect (TANX, COLRAT). The implications of the

TABLE 8

FACTOR STRUCTURE OF ALL MEASURES COMBINED
WITH SEX PARTIALED OUT

Factors From All Measures Combined

Promax Rotated Factor Pattern

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
SDS	-0.00695	0.14172	0.85141	0.13411	0.24099	0.00879	0.08446
TANX	0.35364	-0.26003	-0.46200	0.01788	-0.23920	0.40224	0.00338
REPS	0.25883	0.30083	-0.66445	0.15131	-0.06856	0.00876	0.25433
M1	0.17375	0.04100	0.04663	0.15245	-0.03155	0.11614	0.11897
M2	0.42829	-0.14117	-0.35450	-0.01365	-0.12823	-0.33611	0.25380
M3	0.32485	0.20237	0.13454	0.00700	0.11313	0.05351	-0.15355
M4	0.94875	-0.02013	0.11095	-0.13196	0.10543	-0.24440	-0.08572
M7	0.74090	-0.02862	-0.07304	0.01116	-0.19818	0.08711	0.09253
M8	0.75712	-0.07833	-0.03096	0.03753	-0.00759	0.19928	0.09023
ML	0.16310	0.12569	0.73664	-0.03242	-0.24127	0.26808	0.02329
MF	0.77222	0.43760	-0.08944	-0.01402	0.05802	-0.09052	-0.10299
MK	-0.00770	-0.03813	0.88200	0.09317	-0.09348	-0.23338	0.00326
REBSM	-0.02257	0.12840	-0.02954	0.00157	0.09506	-0.07503	-0.45665
REBBIG	0.52320	0.18270	0.02314	-0.32544	0.57942	0.40079	-0.02111
RA	0.18750	0.06918	0.05485	0.16822	0.01734	-0.96902	-0.22874
RCOLORT	0.00831	-0.30179	0.34621	0.08295	0.32389	0.05933	-0.55069
ECOLOR	-0.38995	0.16721	0.26229	0.51017	-0.21712	0.41452	0.10521
RZD	0.12739	0.17948	-0.04739	0.16122	0.20069	0.33886	0.68345
COLRAT	0.14842	0.24244	-0.03244	0.15691	-0.12279	-0.02247	-0.88665
WDRATIO	0.02411	-0.04048	0.75088	-0.21088	-0.19918	-0.11975	0.00381
RAFR	-0.13558	0.06059	-0.05392	0.99238	0.09213	-0.16451	0.03156
RREFLT	0.12114	-0.02287	-0.31428	0.57896	0.17388	-0.21140	-0.39572

TABLE 8--Continued

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
WFTS	0.26608	-0.31964	0.03375	0.02062	-0.17113	0.16699	-0.07845
IMBFTS	-0.17024	0.31151	-0.07548	-0.53048	0.12259	-0.39075	0.27182
MFTS	0.37510	-0.01890	0.32871	0.01542	-0.14659	-0.56383	0.21253
IMAG	-0.06374	-0.05608	0.05099	0.23684	0.08617	-0.10784	0.25438
DTOT	0.11684	0.57139	0.10875	-0.03912	-0.44851	-0.08268	-0.03377
TTOT	-0.16067	0.11481	-0.07669	0.08589	0.74414	-0.17604	-0.09002
BLDS	0.04654	0.98134	0.02335	0.02065	0.08149	-0.03175	-0.07975
OBJASM	0.21178	-0.03446	0.09548	0.02521	0.08970	0.00923	0.08187
WAISV	-0.23642	0.23361	-0.14684	-0.15998	-0.40292	0.00077	-0.42809
WAISP	0.06689	0.54163	-0.17740	0.22146	-0.07450	0.00942	-0.02995
ARITH	-0.05422	0.17640	0.09546	-0.07750	-0.75272	-0.00931	-0.44558

TABLE 9

SIGNIFICANT CORRELATIONS OF FACTORS COMPUTED FROM COMBINED PERSONALITY AND COGNITIVE MEASURES WITH TWO MEASURES OF LEM

Factors	Correlation Coefficient	Prob |R|	n =
Combined Personality and Cognitive 2 X NONI	-.47	.02	25
Combined Personality and Cognitive 3 X PLEM	-.35	.08	25

analysis of PLEM suggest that right lookers (left hemisphere) are described by nondenial, nonendorsement of socially desirable self statements, sensitization, self-reported anxiety, depression, detail-orientation, and poorer spatial skills. In contrast, left lookers (right hemisphere) demonstrate denial, endorsement of socially desirable items, repression, lack of self-reported depression and anxiety, spatial skill and attention to wholes. The latter finding is consistent with the personality model of hemispheric style.

As predicted, the percentage LEM score correlated with factor 3 in a direction which suggests that the right hemisphere (i.e., percentage of left LEMs) is associated with denial, repression, spatial/holistic perception, lack of anxiety and depression, and affective resources, while a greater proportion of right LEMs is associated with affective constraint, rumination, anxiety, depression, painful affect, and a detail approach to perception.

CHAPTER V

DISCUSSION

The purpose of this study was to explore the utility of a hypothetical framework that describes hemispheric activation in terms of a personality/cognition matrix by investigating the relationships between personality descriptors, cognitive performance skills and a measure of hemispheric activation. There were two sets of statistical analyses. In the first set, simple statistical designs to examine selected variables were employed. Several simple comparisons produced significant results. The social desireability scale was the only individual measure that appeared to discriminate between right and left lookers and to correlate with direction of gaze. This implies that endorsing socially desireable statements is related to left lateral eye movements (right hemispheric activation). While interpretation of this result appeared straightforward, further investigation revealed that this difference between right and left lookers was true only for women.

Although none of the other selected variables produced significant results when compared to LEMs, comparisons made between personality variables and cognitive summary scores designed to be reflective of left or right hemispheric processing did provide significant results. Trait anxiety was found to be significantly negatively correlated with right hemispheric cognitive performance

tasks but was not significantly related to left hemispheric cognitive performance tasks. One possible interpretation of this result is that trait anxiety arouses left hemispheric functioning and reduces or inhibits right. This interpretation is consistent with Tyler's (1980) recent finding that left hemispheric performance is enhanced by a modicum of anxiety. Regression analysis further indicated that a measure of repression sensitization significantly increased the trait anxiety scale's ability to predict right cognitive performance. The positive direction of the beta weight for the repression sensitization scale suggests that higher right hemispheric cognitive performance is predicted by a lower reported trait anxiety, overintellectualizing conflicts, and hyperviligence to threat, which causes them to experience high level of anxiety (Orlofsky 1976). From a theoretical viewpoint this could mean that an integrative style including denial of anxiety (right hemispheric style), and intellectualization (left hemispheric style) produce improved right hemispheric cognitive performance.

The only other simple effect that proved significant was a Pearson product moment correlation between the Z difference score of the Rorschach and the left hemispheric cognitive summary score. The negative direction of this correlation suggests the underincorporation or impulsiveness (Exner 1974) is associated with higher left hemispheric cognitive performance. From a theoretical point of view, this result may also reflect an integrating style suggesting that analytical, sequential, and numeric tasks (left hemispheric style) are better performed by a subject utilizing an impulsive style (right hemispheric style). At this point it is unclear whether

hemispheric activation and in particular hemispheric cognitive performance is being described by certain personality traits or whether these traits are serving some qualifying function for an underlying factor. For example, is it that impulsive people do better on analytical tasks or could it be that those analytical people who formulate faster answers perform better than those analytical people who ruminate or obsess over a response. In order to address this and other issues, more complex analyses were performed.

Thus, the simple order analyses, while demonstrating some strong individual affects, have raised a further question of whether these results reflect simple, straight-forward phenomena or are reflective of more complex processes. The results have further indicated that sex may prove to be a confounding variable. In order to address these issues more complex analysis using all of the collected data was performed. For the second set of analyses, forty-nine variables consisting of scale scores from the MMPI, selected indices of the Rorschach, performance scores from the neuropsychological task set, the trait anxiety score, the social desireability score, and the repression sensitization score were included in a series of three factor analyses.

A precautionary note is necessary at this point due to the range of variables included in the analyses. Since the number of variables is almost twice the number of subjects included in the study, it was expected that some artifactual results might emerge. Yet due to the exploratory nature of the research, it seemed reasonable to include all variables in order to fully investigate the

relative contributions of each variable to the possible construction of a lateralized personality factor. Further, it was felt that if a sizeable factor with loadings aligned consistent with the predicted experimental model was correlated with the measure of cerebral activation, the factor could be more strongly regarded as a real result. Further replication would be necessary in order to actually confirm such a finding.

The complex analyses factor analysis was performed on all variables after the variance due to sex was partialed out. Three separate factor analyses were performed on the residual variance. The first factor analysis generated obliquely rotated factors for pencil and paper (P & P) personality variables, projective personality variables (PRO) and cognitive variables (C) separately. The factors were then correlated with each other. The resulting significant and near significant correlations described a cluster of personality descriptors, characterized by P & P 3, PRO 1; PRO 4, C 3. P & P 3 is characterized by anxiety (TANX, M7), depression (M2), narrowed interests (-MF) (Duckworth & Duckworth 1975), and indifference toward social approval (-SDS). PRO 1 is characterized by overincorporation (RZD), repressed or suppressed emotive pain, and withdrawal (-REBSM), lack of control over affective display (-COLRAT) which is associated with depression (Exner 1974), and lack of egocentricity (-RREFLT) associated with depression and obsessive-compulsive tendencies (Exner 1974). PRO 4, as represented by its negative association with P & P 3, is characterized by attention to details (-WDRATIO), lowered overall available affect (-ECOLOR) and unavailable affect (-RCOLORT), and

lack of control over affective display (-COLRAT). C 3 is characterized by poor spatial performance (-BLDS, -IMBFTS), poor tonal discrimination (-TTOT), poor intellectual abilities (-WAISP, -WAISV), poor memory for digits (-DTOT), and higher verbosity (WFTS). Overall this cluster of descriptors appear to describe a cognitive personality matrix including detail orientation, verbosity (possibly related to ruminative/depressive thinking), poor intellectual skills, and anxiety. The remaining significantly correlated factors (P & P 1, P & P 2) appear to reiterate the cluster described above. P & P 1 describes self-reported feelings of general pathology (MF, M8, M4, M3, M1, M7) and hypervigilance to threat (REPS). P & P 2 in its negative relation to PRO 4 suggests descriptors of feeling bad about oneself (-MK), admitting human failings (-ML), hyperviligance to threat and an overintellectualizing style (REPS), not seeking social approval (-SDS), stress, and anxiety (M7, TANX).

In the second factor analysis, P & P variables were combined with PRO variables and six factors were generated. The factors were then correlated to each other and to the previously generated C factors. Two significant correlations were produced. For the correlation between combined personality (COMB) 1 with COMB 4, the previously described cluster of descriptors once again arise, only with opposite loading signs. COMB 1 is defined by a general absence of self-reported pathology (-M1, -M7, -M3, -M8, -M4, -M2, -MF), promptings by less-organized ideational needs (REBSM), lowered anxiety (-TANX) and immediacy of affect (COLRAT), impulsivity (-RZD), hysterical features (RREFLT) (Exner 1974), cautiousness (RCOLORT), and lack of depression (-M2).

The second significant correlation demonstrated a relationship between cognition and personality. COMB 5 essentially destribed by concrete reality testing (RA) (Exner 1974), lower trait anxiety (-TANX), introtensiveness (-REBBIG) (Exner 1974), narrowed interests (NF), primitive ideation (REBSM), affect (RAFR), and sensitization (REPS) is negatively correlated with C 3. The negative direction of this correlation suggests that COMB 5 is associated with cognitive abilities that are spatial (BLDS, IMBFTS) and tonal (TTOT) in nature, as well as ability to perform well on an intellectual test (WAISP, WASIV, DTOT). Word fluency is poor on this factor.

Overall the second analysis redescribed the general personality cluster outlined in the first analysis suggesting that this cluster is a dependable phenomenon for these subjects. The second analysis further suggests that this cluster describes two personality types depending on the factor loadings signs. One set of signs seems to describe a hysterical/impulsive style while the other set seems to describe an obsessive-compulsive/depressive/anxious style.

The second analysis also reiterates a correlation between cognition and personality. Unlike the first factor analysis where the personality factor P & P 3 correlated with the cognitive variable in a way predicted by the personality model of hemispheric activation, the second factor analysis presents a less clear relationship. The personality variable (COMB 5) which significantly correlates with the cognitive variable C 3 is confusing in that it mixes variables hypothesized as right hemispheric personality variables (RA, -TANX, REBSM, RAFR) with those hypothesized to be left (-REBBIG, MF, REPS)

in relation to a cognitive variable that describes basically right hemispheric cognitive abilities (BLDS, IMBFTS, TTOT, WAISP, -WFTS). Although the relationship described does not seem to present a theoretically attractive cognitive personality dimension as described in the first complex analysis, the correlation in the second analysis between personality and cognition reaffirms their interrelatedness. In the first factor analysis, C 3 was associated with P & P 3, such that P & P 3 indicated poor cognitive performance. In the second analysis C 3 demonstrated that the factor associated with good cognitive abilities is not just the absence of the variables described by P & P 3; rather it is a whole different personality experience.

In the third factor analysis all variables were used to generate seven factors. The factors were then correlated to each other and to a measure of cerebral activation. The percentage measure of LEM (PLEM) and the raw number of non-lateral eye movements. None of the factors significantly correlated with each other, suggesting that each factor was unique. The third largest factor, factor 2, negatively correlated significantly with non-lateral eye movements. This indicates that non-lateral eye movements are associated with poor spatial skills (BLDS, IMBFTS), lower IQ scores (WAISP, -WAISV, -DTOT), lower stress (-MF), withdrawal or constrained affect (RCOLOR), higher word fluency (WFTS), overintellectualizing conflicts. A possible interpretation of this correlation is that non-lateral eye movements may represent lower arousal and poor cognitive abilities, and therefore, little or no lateralized cerebral arousal. Conversely, this interpretation may also suggest that lateralized cerebral activation as

indicated by LEMs is necessary for optimum performance on cognitive tasks.

The only other correlation proving to be nearly significant was between PLEM and the second largest factor, factor 3. The negative direction of this correlation suggests that the percentage of right lateral eye movements is associated with caustic self descriptions (-MK) (Duckworth & Duckworth 1975), little desire to seek social approval (-SDS), attention to details (-WDRATIO), admissions of human weaknesses (-ML), overintellectualizing conflicts (REPS), anxiety (TANX), depression (M2), poorer spatial skills (-MFTS), and egocentricity (RREFLT). Conversely, the percentage left LEMs is associated with feeling competent in managing one's life (MK), seeking social approval (SDS), attention to wholes (WDRATIO) and spatial skills (MFTS), repression (REPS, SDS), denial (ML), and lack of feelings of depression (-M2) or anxiety (-TANX). This result suggests that the personality cluster described on the first and second analysis is consistent in the third and appears to be a lateralized factor. Although only one of the neuropsychological cognitive tasks was loaded into this factor, it was a spatial task and did load in the hypothesized fashion. The WDRATIO of the Rorschach, a spatial/detail measure, provided further indications of spatial versus detail function. In total, this factor appears to describe a personality/cognition matrix whose loadings suggest an obsessive-compulsive/detail-oriented style associated with left hemispheric activation and a hysteric/repressive/spatially oriented style associated with right hemispheric activation.

It is interesting that the more complex analyses appear to provide results that are consistent with previous research, while simple analyses provided minimal results, some of which were difficult to reconcile with the literature. This seems to suggest that research comparing personality descriptors to cognitive task performance and lateral eye movements may not be straightforward. There appears to be many measures of personality which do not seem to describe lateralized functioning. There is also the possibility that single descriptors are not necessarily the most useful way of assessing lateralized style and that an underlying factor made up of interrelated personality and cognitive variables is needed to describe lateralization.

Further, the results seem to suggest that the subject's sex could confound main effects. This conclusion has been suggested throughout the literature, although to this author's knowledge no one has used a partialing procedure to eliminate this variance. The advantage of such a procedure is that it allows the use of both men and women, thereby making results more generalizable. This procedure might also prove valuable in utilizing right handed, left handed, and familial left handed subjects, thereby allowing further generalizability. Before utilizing the partialing procedure on such a wide variety of variables and their interactions, the researcher should first explore the amount of variance contributed by these variables. It may be that these variables and their interaction account for so much variance as to make manipulations on the residual variance uncalled for. Such results would serve to revolutionize thinking about laterality, indicating that laterality affects are so specialized that general conclusions would be worthless.

Since sex did not account for a sizable part of the variance and the factors 2 and 3 in the third factor analysis represent true findings and not mere artifacts of the variables to subjects ratio, there appears to be evidence of a lateralized personality/cognition matrix in support of the creation of a personality style model of hemispheristy. Essentially such a theory would postulate that each hemisphere has a personality/cognition matrix. As predicted by Shapiro's (1965) neurotic styles, Tucker's (in press) suggestion of the interdependence of emotion and cognition, and Smokler and Shevrin's (1979) lateralized personality findings, this study suggests that the right hemisphere can be characterized by a hysteric-like matrix of gestalt/spatial perceptual style and personality characteristics of impulsiveness, repression, denial, affectual readiness, and marked lack of depression and anxiety. Conversely, the left hemisphere can be characterized by an obsessive-compulsive/depressive matrix including detail perceptual organization and personality traits of slow deliberateness, anxiety, depression, verbal rumination, and sensitivity.

Although the preceding hemispheric personality descriptions appear to delineate two independent, possibly antithetical, personality styles, two general considerations need to be addressed before the acceptance of such a model. The first general consideration is a statistical one. It should be noted that, while factor analysis is a valuable research tool, its major function is descriptive. Given the small number of subjects and large number of variables it is possible that the factor analyses are only descriptive of the specific sample analyzed. Once a factor analysis is performed the factors are usually given a label which the experimenter feels characterizes

the various factor loadings of the factor. This labeling can lead to fallacious assumptions about the characteristics of a factor. Although unintentional, it is possible that an experimenter may accentuate factor loadings that exemplify his theory while deemphasizing loadings that are not so heuristic. Another problem in factor labeling occurs due to the essence of the relations among the variables of the factors. It is possible that some intrafactor variables may describe different traits dependent upon the direction and strength of their loadings in relation to other intrafactor variables.

The second general consideration concerns the applicability of the model itself. The preceding descriptions of hemispheric personality suggest that each hemisphere provides a unique personality style, yet neither description characterizes all people. This fact suggests that few people are truly the result of the pervasive use of one hemisphere or the other; rather it is more likely that individuals have an innate drive to utilize the hemisphere most adaptive to perform a given task, as hypothesized by Galin (1974) and Bogen (1969). The possible qualifier to this rule, as proposed by Ornstein (1978) and elaborated here, is human choice, that is, one's psychosocial development and genetic predisposition may override utilization of the most adaptive hemisphere.

Extending this line of thought, it is possible that because of one's development or the stress/anxiety of a certain situation as suggested by Gur (1974), an individual may come to rely more heavily on one hemisphere and its concomitant personality style. Depending on the extent to which the individual comes to rely on this hemisphere and the situations he finds himself, his "choices" may prove to

be consistently maladaptive. Shapiro (1965) suggests that this lack of adaptive flexibility due to genetic endowment, development and/or the situation, is neurosis. Shapiro argues that neurotic defenses and traits are not the isolated result of some specific event, rather they are the logical extension on the individual's characteristic style or personality.

Equating Shapiro's concept of neurotic style with the maladaptive overutilization of a particular hemisphere implies that normal functioning is the flexible usage of either hemisphere to approach a task with some variation as a result of personal choice, while neurotic functioning might be the use of a particular hemispheric personality style to such an extreme as to produce problems in living. Interestingly, research on brain damaged patients (Bear & Fedio 1977) and reports on hospital patients receiving unilateral sedation (Terzian 1964; Rossi & Rosadini 1967) have suggested similar hemispheric related personality manifestations. While there is some controversy concerning whether a hemisphere is actually overactivated or disinhibits the other hemisphere, it is important to note that the behavioral manifestations and self-descriptions in the brain damaged and sedated populations are quite similar to those found in the present study of normal personality and cognition.

Other evidence for the model has been provided from research using normal (Smokler & Shevrin 1979) and psychiatric populations. Both in research on hysteria (Galin, Dimond, & Braff 1977; Kenyon 1964) and obsessive-compulsiveness (Flor-Henry 1979) the results have suggested right and left hemispheric asymmetries, respectively. Extending the model of lateralized personality processes, it may be

possible to postulate that the hemispheric styles observed in this experiment define patterns of normal functioning which are exaggerated in the personalities of brain damaged and mental health patients.

Before expanding on the role of the personality style model, it should be noted that the major loadings of factor 3 were self-report personality variables while the only two moderately loaded (i.e., greater than 3.0) projective variables (ECOLOR, RREFLT) were loaded in un unpredicted direction. This apparent discrepancy supports the findings of Bear and Fedio (1977), who found that patients' self-reports and beliefs about the type and severity of the problem that they are experiencing may not truly reflect their internal state or their behavior. Specifically hysteric-like patients deny overly bad feelings and low self-esteem while their behavior may be more descriptive of emotional upset and personality turmoil and their internal states are those of lowered self-esteem and depressive feelings. On the other hand, repressive or obsessive-like patients focus on and report more feelings of devastation or depression yet they exhibit more ego strength and affective control than they report.

This suggests that the previously described incongruities of self-report and projective measures may not necessarily be deceptions or manipulation; rather they are part of the symptomology of the patient. One possible direction therapy might provide is to help the patient integrate his "unrealized" side and thereby help him gain control over his particular problems. The process of such a procedure, although complex might also be suggested by this model. It seems reasonable that the depressive-obsessive patients may be overly

experiencing their affect because in their typical style they have segregated their cognitive controls from their affective elements and have then focused upon these affective elements. The specific possibility is also suggested by DeKosky, Heilman, Bowers, and Valenstein (1980). Without the cognitive controls to keep the affect in perspective, depressive-obsessive patients may become aroused and express their concern in their typical style, verbal rumination. Treatment therefore might focus on holistic integrating forms of therapy that would encourage the union of cognitive and affect, thereby helping the patient to regain perspective of their pain and begin to develop effective coping strategies to overcome their present difficulties.

On the other hand, hysteric-like patients may not be aware of (i.e., denying) the true extent of their present difficulties and therefore are relatively unmotivated to deal with their problems. This is not to say that this patient does not appear to experience intensive and at times overwhelming pain and discord, rather as suggested by Shapiro (1965) due to the patient's diffusely organized awareness the patient does not remember the full experience of this pain and/or the event that is causing the discord. Therapy in this case might focus on helping the patient to learn cognitive strategies that can help him to attend to and focus an element of his experience, thereby helping him to gain a more accurate perception of his present difficulties and to take specific task-oriented steps toward correcting the difficulty. Although the patient may report more psychic pain with this approach, the pain would be a necessary

part of therapy providing motivation to develop more adaptive coping strategies and indicating progress in that the patient would be becoming more aware of repressed material.

Support for just such an approach is provided by Tucker, Shearer and Murray (1977). They separated speech anxious college students into two groups. One group consisted of students who indicated a left hemispheric preference, that is, majority of lateral eye movements to the right, while the other group consisted of right hemispheric preference students. The author then administered opposite coping strategies to the two groups, that is, the left hemispheric preference students received a strategy consisting of an imagining technique to reduce speech anxiety while the right hemispheric preference group received a strategy consisting of a verbal strategy.

Although not significant, the results indicate a tendency for students to benefit most from a treatment strategy opposite of that which might be expected by knowing their hemispheric utilization. Further research is needed before such a treatment strategy could be employed with certainty. Nonetheless, the personality theory of hemisphericity may prove fruitful as one possible framework within which to view the diagnosis and treatment of a neurotic client.

In summary, the results of this experiment appear to suggest that each of the hemispheres has its own unique personality/cognition matrix. The right hemisphere's matrix might be characterized as having a hysteric-like style while the left hemisphere might be characterized as having an obsessive-compulsive-like style. Further research is needed to replicate the findings due to the limited

number of subjects and numerous variables included. It is suggested that research might proceed in both as unitary and multiple variable fashion using variables that were found to be most heavily loaded in the generated laterality factor. Tentative implications of this model concerning diagnosis and treatment of mental health clients are suggested by such a model but research and utilization of these hypotheses should be treated cautiously until the validity of such a model is further explored.

APPENDIX A

LATERAL EYE MOVEMENT QUESTIONNAIRE

Name_____

Which hand do you write with_____
Do you do anything with your (L/F) Hand?

1. Envision the keyboard of typewriter. In which corner of the keyboard is the letter "P".

2. Tell me how you feel when you are anxious.

3. What is meant by the proverb: one today is worth two tomorrows?

4. Visualize and describe the most upsetting photograph of the Vietnam war that you have seen.

5. What is the primary difference between the meanings of the words mischief and malice?

6. Make up a sentence using the words code and mathematics.

7. If you were crossing a street from west to east, and a car coming from the south smashed into you, which leg would be shattered first?

8. Imagine a rectangle. Draw a line from the upper left hand corner to the lower right hand corner. What two figures do you now have?

9. Imagine that you are relaxing in hot sulfur baths looking westward over the Pacific Ocean in California on a clear, sunny day. Your friend is peacefully resting with his back toward your right side. Approximately what direction is your friend looking out over?

10. Visualize the Prudential Tower in Boston and the United Nations building in New York and tell me which one is taller.

11. Make up a sentence using the words shock and sadness.

12. What is the primary difference between the meanings of the words recognize and remember?

13. For you is anger or hate a stronger emotion?

14. Envision walking through your house or apartment and tell me how many doors there are.

15. Picture the last automobile accident that you have seen. In which direction were the cars going?

16. Do you use the word logical or rational more often?

17. What is meant by the proverb: the more cost, the more honor?

18. When you visualize your father's face, what emotion first strikes you?

19. On the face of the quarter does the face of George Washington look to the left or right?

20. Tell me how you feel when you are frustrated?

APPENDIX B

SIGNIFICANT CORRELATIONS AMONG PERSONALITY VARIABLES

TABLE 10

SIGNIFICANT CORRELATIONS AMONG PERSONALITY VARIABLES

Variables	r	p≤	n
TANX x M7	.46	.008	32
TANX x M8	.47	.006	32
TANX x SDS	-.58	.0004	33
TANX x REPS	.44	.01	32
TANX x RA	-.35	.052	32
TANX x MK	-.49	.0043	32
TANX x M2	-.58	.0005	32
SDS x LEM	-.32	.07	33
SDS x ML	.54	.001	32
SDS x MK	.64	.0001	32
SDS x M2	-.32	.07	32
SDS x WDRATIO	.45	.0099	32
SDS x REPS	.56	.0008	32
SDS x RCOLORT	.47	.007	32
SDS x ECOLOR	.47	.007	32
REPS x ML	-.35	.05	32
REPS x MF	.50	.0038	32
REPS x MK	-.66	.0001	32
REPS x M2	.39	.0257	32
REPS x M7	.426	.01	32
REPS x M8	.0459	.02	32
ML x MK	.56	.0009	32
ML x M1	.39	.0259	32
ML x M3	.47	.006	32
MF x M3	.34	.06	32
MF x M4	.47	.006	32
MF x MF	.36	.04	32
MF x M7	.36	.04	32
MF x M8	.53	.002	32
MK x M1	.37	.04	32
MK x M3	.30	.09	32
REBSM x M1	-.42	.02	32
REBSM x M2	-.40	.02	32
REBSM x M7	-.36	.04	32
REBSM x M8	-.38	.03	32
M1 x M3	.64	.0001	32
M1 x M4	.46	.008	32
M1 x M7	.51	.003	32
M1 x M8	.56	.0008	32
M2 x M4	.51	.003	32
M2 x M7	.557	.0009	32

TABLE 10--continued

Variables	r	p≤	n
M8 x M2	.47	.006	32
M3 x M4	.45	.009	32
M3 x M7	.35	.05	32
M3 x M8	.44	.01	32
M4 x M7	.70	.0001	32
M4 x M8	.68	.0001	32
M7 x M8	.79	.0001	32
RCOLORT x COLRAT	.36	.04	32
RCOLORT x WDRATIO	.38	.03	32
RAD x COLRAT	-.47	.007	32
RAFR x RZD	.52	.002	32
TANX x RZD	.32	.08	32
TANX x WDRATIO	-.38	.03	32
REPS x RCOLORT	-.42	.02	32
REBSM x RZD	-.31	.08	32
REBSM x COLRAT	.34	.06	32
RREFLT x COLRAT	.38	.03	32
RREFLT x RAFR	.51	.003	32
RA x REBBIG	-.38	.03	32
ML x WDRATIO	.40	.02	32
MF x ECOLOR	.40	.02	32
MK x WDRATIO	.45	.01	32
M2 x RAD	.34	.06	32
M4 x COLRAT	-.31	.08	32
M4 x REBBIG	.43	.01	32
M4 x ECOLOR	-.37	.04	32
M8 x RZD	.36	.04	32
M8 x REBBIG	.31	.08	32
REPS x VALID	.74	.0001	32

APPENDIX C

SIGNIFICANT CORRELATIONS AMONG NEUROPSYCHOLOGICAL VARIABLES

TABLE 11

SIGNIFICANT CORRELATIONS AMONG NEUROPSYCHOLOGICAL VARIABLES

Variables	r	p≤	n
WAISV x WAISP	.51	.002	32
WAISV x WAISFS	.91	.001	32
WAISP x WAIFS	.82	.0001	32
WAISP x DF	.41	.04	25
WAISP x DB	.41	.04	25
WAISFS x DF	.36	.08	25
WAISFS x DB	.36	.08	25
WAISV x ARITH	.62	.0001	32
WAISV x DS	.59	.0004	32
WAISV x BLDS	.37	.03	32
WAISP x DS	.48	.005	32
WAISP x BLDS	.58	.0006	32
WAISFS x ARITH	.57	.0006	32
WAISFS x DS	.62	.0002	32
WAISFS x BLDS	.52	.0024	32
DF x IMBFTS	.36	.07	26
DF x DS	.35	.08	25
DF x BLDS	.41	.04	25
DB x ARITH	.50	.01	25
DB x DS	.39	.056	25
TB x BLDS	.35	.08	25
ARITH x DS	.47	.006	32
DS x BLDS	.38	.03	32
WAISV x OBJASM	.36	.04	32
WAISV x VOCAB	.68	.0001	32
WAISP x OBJASM	.60	.0002	32
WAISP x VOCAB	.34	.05	32
WAISFS x OBJASM	.53	.002	32
WAISFS x VOCAB	.62	.0001	32
WFTS x OBJASM	.60	.001	25
IMAG x VOCAB	-.53	.007	25
ARITH x OBJASM	.31	.08	32
ARITH x VOCAB	.33	.06	32

APPENDIX D

SIGNIFICANT CORRELATIONS BETWEEN THE RAW NUMBER OF LATERAL EYE MOVEMENTS AND ALL PERSONALITY AND COGNITIVE VARIABLES

TABLE 12

SIGNIFICANT CORRELATIONS BETWEEN THE RAW NUMBER OF LATERAL EYE MOVEMENTS AND ALL PERSONALITY AND COGNITIVE VARIABLES

Variables	r	$p \leq$	n
RLEM x SDS	-.32	.07	33
QLEM x SDS	-.32	.07	33
MF x NONL	-.45	.0096	32
M1 x NONL	-.40	.02	32
DF x NONL	-.33	.099	26
IMBFTS x RLEM	.33	.097	26
BLDS x NONL	-.37	.03	32

BIBLIOGRAPHY

Ahern, G. L., & Schwartz, G. E. Differential lateralization for positive versus negative emotion. Neuropsychologia, 1979, 17, 693-698.

Bakan, P. Hypnotizability, laterality of eye-movements, and functional brain asymmetry. Perceptual and Motor Skills, 1969, 28, 927-932.

Bakan, P. The eyes have it. Psychology Today, 1971, 4, 64-67, 96.

Bakan, P., & Strayer, F. F. On the reliability of conjugate lateral eye movement. Perceptual and Motor Skills, 1973, 36, 429-430.

Bear, D. M., & Fedio, P. Quantative analysis of interictal behavior in temporal lobe epilepsy. Archieves of Neurology, 1977, 34, 454-467.

Benton, A. L. Clinical symtomology in right and left hemisphere lesions. In Mountcastle, V. B. (Ed.), Interhemispheric relations and cerebral dominance. Baltimore: John Hopkins Press, 1962.

Benton, A. L., & Van Allen, M. W. Impairment of facial recognition in patients with cerebral disease. Cortex, 1968, 4, 344-358.

Black, F. W. Unilateral brain lesions and MMPI performance: A preliminary study. Perceptual and Motor Skills, 1975, 40, 87-93.

Bogen, J. E. The other side of the brain: I, II, III. Bulletin of the Los Angeles Neurological Society, 1969, 34, 73-105, 135-162, 191-220.

Cohen, B. D., Penick, S. B., & Tarter, R. Anti-depressant effects of unilateral electroconvulsive shock therapy. Archives of General Psychiatry, 1974, 31, 673-675.

Crouch, W. W. Dominant direction of conjugage lateral eye movements and responsivity to facial and verbal cues. Perceptual Motor Skills, 1976, 42, 167-174.

Crovitz, H. F., & Zener, K. A group test for assessing hand and eye dominance. The American Journal of Psychology, 1962, 75, 271-276.

Crowne, D. P., & Marlow, O. A. A new scale of social desirability independent of psychopathology. Journal of Consulting Psychology, 1960, 24, 349-354.

Davidson, R. J., Schwartz, G. E., Saron, C., Bennett, J., & Coleman, D. Frontal versus parietal EEG asymmetry during positive and negative affect. Paper presented at the Annual Meeting of the Society for Psychophysiological Research, Tampa, September, 1978.

Day, M. E. An eye movement phenomena relating to attention, thought, and anxiety. Perceptual & Motor Skills, 1964, 19, 443-446.

Day, M. E. An eye-movement indicator of type and level of anxiety. Some clinical observations. Journal of Clinical Psychology, 1967a, 23, 438-441.

Day, M. E. An eye movement indicator of individual differences in the psychological organization of attentional processes and anxiety. Journal of Psychology, 1967b, 66, 51-62.

Day, M. E. Attention, anxiety & psychotherapy. Psychotherapy, Theory, Research and Practice, 1968, 5, 146-149.

Day, P. S., & Ulatowska, H. K. Perceptual, cognitive and linguistic development after early hemispherectomy: Two case studies. Brain and Language, 1979, 7, 17-33.

Deglin, V. L., & Nikolaenko, N. N. Role of the dominant hemisphere in the regulation of emotional states. Human Physiology, 1975, 1, 394.

Dekosky, S. T., Heilman, K. M., Bowers, D., & Volenstein, E. Recognition and discrimination of emotional faces and pictures. Brain and Language, 1980, 9, 206-214.

Dikmen, S., & Reitan, R. M. Minnesota multiphasic personality inventory correlates of dysphasic language disturbances. Journal of Abnormal Psychology, 1974, 83, 675-679.

Dikmen, S., & Reitan, R. M. MMPI correlates of adaptive ability deficits in patients with brain lesions. The Journal of Nervous and Mental Disease, 1977, 165, 247-254.

Dimond, S. J., Farrington, L., & Johnson, P. Differing emotional responses from right and left hemispheres. Nature, 1976, 261, 690-692.

Duckworth, J. C., & Duckworth, E. MMPI interpretation manual for counselors and clinicians. Muncie: Accelerated Development Inc., 1975.

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

Ehrlichman, H., Weiner, S. L., & Baker, A. H. Effects of verbal and spatial questions on initial gaze shifts. Neuropsychologia, 1974, 12, 265-277.

Ehrlichman, H., & Wiener, M. J. Dimensions of EEG asymmetry during covert mental activity. Paper presented to the American Psychological Association, New York, September, 1978.

Etaugh, C. F. Personality correlates of lateral eye movement and handedness. Perceptual and Motor Skills, 1972, 34, 751-754.

Exner, J. E. The Rorschach: A comprehensive system. New York: Wiley, 1974.

Flor-Henry, P. Psychosis and temporal lobe epilepsy: A controlled investigation. Epilepsia, 1969a, 10, 363-395.

Flor-Henry, P. Schizophrenic-like reactions and affective psychoses associated with temporal lobe epilepsy: Etiological factors. American Journal of Psychiatry, 1969b, 126, 400-404.

Flor-Henry, P. Lateralized temporal-limbic dysfunction and psychopathology. Annals of the New York Academy of Sciences, 1976, 280, 777-797.

Flor-Henry, P., Yeudall, L. J., Koles, Z. J., & Howarth, B. G. Neuropsychological and power spectral EEG investigations of the obsessive-compulsive syndrome. Biological Psychiatry, 1979, 14, 119-130.

Gainotti, G. Emotional behavior and hemispheric side of the lesion. Cortex, 1972a, 8, 41-55.

Gainotti, G. Studies on the functional organization of the minor hemisphere. International Journal of Mental Health, 1972b, 1, 78-82.

Galaburda, A. M., LeMay, M., Kemper, T. L., & Geschwind, N. Right-left asymmetries in the brain. Science, 1978, 199, 852-856.

Galin, D. Implications for psychiatry of left and right cerebral specialization: A neurological context for unconscious processes. Archives of General Psychiatry, 1974, 31, 572-583.

Galin, D. Lateral specialization and psychiatric issues: Speculations on development and the evolution of consciousness. Annals of New York Academy of Sciences, 1978, 5, 397-411.

Galin, D., Dimond, R., & Braff, D. Lateralization of conversion symptoms: More frequent on the left. American Journal of Psychiatry, 1977, 134, 578-580.

Galin, D., & Ornstein, R. Lateral specialization of cognitive mode: An EEG study. Psychophysiology, 1972, 9, 412-418.

Galin, D., & Ornstein, R. Individual differences in cognitive style--I. Reflective eye movements. Neuropsychologia, 1974, 12, 367-376.

Gasparrini, W. G., Satz, P., Heilman, K., & Coolidge, F. L. Hemispheric asymmetries of affective processing as determined by the Minnesota Multiphasic Personality Inventory. Journal of Neurology, Neurosurgery, and Psychiatry, 1978, 41, 470-473.

Gazzaniga, M. S. The bisected brain. New York: Appleton-Century-Crofts, 1970.

Gur, R. E. Conjugate lateral eye movements as an index of hemispheric activation. Journal of Personality and Social Psychology, 1975, 31, 751-757.

Gur, R. E. Left hemisphere dysfunction and left hemisphere overactivation in schizophrenia. Journal of Abnormal Psychology, 1978, 87, 226-238.

Gur, R. C., & Gur, R. E. Handedness, sex, and eyedness as moderating variables in the relation between hypnotic susceptability and functional brain asymmetry. Journal of Abnormal Psychology, 1974, 83, 635-643.

Gur, R. E., & Gur, R. C. Defense mechanisms, psychosomatic symptomology, and conjugate lateral eye movements. Journal of Consulting Clinical Psychology, 1975, 43, 416-420.

Gur, R. E., Gur, R. C., & Harris, L. J. Cerebral activation, as measured by subjects' lateral eye movements, is influenced by experimenter location. Neuropsychologia, 1975, 13, 35-44.

Hall, M. M., Hall, G. C., & Lavoie, P. Ideation in patients with unilateral or bilateral midline brain lesions. Journal of Abnormal Psychology, 1968, 73, 526-531.

Hacaen, H. Clinical symptomatology in right and left hemispheric lesions. In V. B. Mountcastle (Ed.), Interhemispheric relations in cerebral dominance. Baltimore: John Hopkins Press, 1962.

Harmon, D. W., & Ray, W. J. Hemispheric activity during affective verbal stimuli: An EEG study. Neuropsychologia, 1977, 15, 457-460.

Heilman, K. M., Scholes, R., & Watson, R. T. Auditory affective agnosia: Disturbed comprehension of affective speech. Journal of Neurology, Neurosurgery, and Psychiatry, 1975, 38, 69-72.

Kenyon, F. E. Hypochondriasis: A clinical study. British Journal of Psychiatry, 1964, 110, 478-488.

Kimura, D. Dual functional asymmetry of the brain in visual perception. Neuropsychologia, 1966, 41, 275-285.

Kimura, D. Functional asymmetry of the brain in dichotic listening. Cortex, 1967, 3, 163-178.

Kinsbourne, M. The cerebral basis of lateral asymmetries in attention. Acta Psychologica, 1970, 33, 193-201.

Kinsbourne, M. Eye and head turning indicates cerebral lateralization. Science, 1972, 176, 539-541.

Kocel, K., Galin, D., Ornstein, R., & Merrin, E. Lateral eye movement and cognitive mode. Psychonomic Science, 1972, 27, 223-224.

Kronfol, Z., Hamsher, K. deS., Digre, K., & Waziri, R. Depression and hemispheric functions: Changes associated with unilateral ECT. British Journal of Psychiatry, 1978, 132, 560-567.

Lansdell, M. The effect of neurosurgery on a test of proverbs. American Psychologist, 1961, 16, 448.

Lansdell, M. A sex difference in effect of temporal lobe neurosurgery on design preference. Nature, 1962, 194, 852-854.

Lansdell, M. Effect of extent of temporal lobe ablations on two lateralized deficits. Physiology and Behavior, 1967, 3, 271-273.

Ley, R. G., & Bryden, M. P. Hemispheric differences in processing emotions and faces. Brain and Language, 1979, 7, 127-138.

Milner, B. Laterality effects in audition. In J. B. Mountcastle (Ed.), Interhemispheric relations and cerebral dominance. Baltimore: John Hopkins Press, 1962.

McGlone, J., & Davidson, W. The relation between cerebral speech laterality and spatial ability with special reference to sex and hand preference. Neuropsychologia, 1973, 11, 105-113.

McLaughlin, J. T. Primary and secondary process in the context of cerebral hemispheric specialization. Psychoanalytic Quarterly, 1978, 47, 237-266.

Morgan, A. H., McDonald, D. J., & 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.

Nebes, R. D. Hemispheric specialization in commisurotomized man. Psychological Bulletin, 1974, 81, 1-14.

Oke, A., Keller, R., Mefford, I., & Adams, R. V. Lateralization of norepinephrine in human thalamus. Science, 1978, 200, 1411-1413.

Orlofsky, J. L. Repression-sensitization and affect cognition: An examination of the two defensive modes purportedly measured by the R-S scale. Journal of Clinical Psychology, 1976, 32, 599-603.

Ornstein, R. The split brain and the whole brain. Human Nature, May 1978, 76-89.

Ross, E. D., & Mesulam, M. M. Dominant language functions of the right hemisphere? Prosody and emotional gesturing. Archives of Neurology, 1979, 36, 144-148.

Rossi, G. F., & Rosadini, G. Experimental analysis of cerebral dominance in man. In C. H. Millikan and F. L. Darley (Eds.), Brain mechanisms underlying speech and language. New York: Greene and Stratton, 1967.

Sackeim, H. A., Gur, R. C., & Saucy, M. C. Emotions are expressed more intensely on the left side of the face. Science, 1978, 202, 434-436.

Safer, M. A., & Levanthal, H. Ear differences in evaluating emotional tone of voice and of verbal content. Journal of Experimental Psychology: Human Perception and Performance, 1977, 3, 75-82.

Schwartz, G. E., Ahern, G. L., & Brown, S. L. Lateralized facial muscle response to positive and negative emotional stimuli. Psychophysiology, 1979, 16, 561-571.

Schwartz, G. E., Davidson, R. J., & Maer, F. Right hemisphere lateralization for emotion in the human brain: Interactions with cognition. Science, 1975, 190, 286-288.

Schweitzer, L., Becker, E., & Welsh, H. Abnormalities of cerebral lateralization in schizophrenic patients. Archives of General Psychiatry, 1978, 35, 982-985.

Semmes, J. Hemispheric specialization; a possible clue to mechanism. Neuropsychologia, 1968, 6, 11-26.

Serafetinides, E. A. Voltage lateralization in the EEG of psychiatric patients. Diseases of the Nervous System, 1973, 34, 190-191.

Shapiro, D. Neurotic styles. New York: Basic Books, 1965.

Shearer, S. L., & Tucker, D. M. Differential cognitive contributions of the cerebral hemispheres in the modulation of emotional arousal. Cognitive Therapy and Research, in press.

Smokler, I. H., & Shevrin, H. Cerebral lateralization and personality style. Archives of General Psychiatry, 1979, 36, 949-954.

Sommerschield, H., & Reyker, J. Posthypnotic conflict, repression and psychopathology. Journal of Abnormal Psychology, 1973, 82, 278-290.

Spielberger, C. D. Self-evaluation questionnaire. STAI Form X-2. Palo Alto, California: Consulting Psychologists Press, 1968.

Sperry, R. W. Hemispheric deconnection and unity in conscious awareness. American Psychologist, 1968, 23, 723-733.

Sperry, R. W., Zaidel, E., & Zaidel, D. Self recognition and social awareness in the deconnected minor hemisphere. Neuropsychologia, 1979, 17, 153-166.

Terzian, H. Behavioral and EEG effects of intracortoid sodium amytal injection. Acta Neurochir, 1964, 12, 230-239.

Tucker, D. M. Lateral brain function, emotion, and conceptualization. Psychological Bulletin, in press.

Tucker, D. M., Antes, J. R., Stenslie, C. E., & Barnhardt, T. M. Anxiety and lateral cerebral function. Journal of Abnormal Psychology, 1978, 87(3), 380-383.

Tucker, D. M., & Newman, J. P. Lateral brain function and cognition inhibition of emotional arousal. Cognitive Therapy and Research, in press.

Tucker, D. M., Shearer, S. L., & Murray, J. D. Hemispheric specialization and cognitive behavior therapy. Cognitive Therapy and Research, 1977, 1, 263-273.

Tucker, D. M., Stenslie, C. E., Roth, R. S., & Shearer, S. L. Right frontal lobe activation and right hemisphere performance decrement during a depressed mood. Archives of General Psychiatry, in press.

Tucker, D. M., Watson, R. T., & Heilman, K. M. Affective discrimination and evacation in patients with right parietal disease. (abstract). Neurology, 1976, 26, 354.

Tyler, S. Differential hemispheric specialization and its relationship to repression. Unpublished doctoral dissertation, University of North Dakota, 1980.

Wechsler, A. F. The effect of organic brain disease on recall of emotionally charged versus neutral narrative text. Neurology, 1972, 23, 130-135.

Weiten, W., & Etaugh, C. Lateral eye movement as a function of cognitive mode, question sequence, and sex of subject. Perceptual and Motor Skills, 1974, 38, 439-444.

Wexler, B. E. Cerebral laterality and psychiatry. American Journal of Psychiatry, 1980, 137, 279-291.

White, M. J. Laterality differences in perception: A review. Psychological Bulletin, 1969, 72, 387-405.

Woods, D. J. Conjugate lateral eye movements, repression-sensitization and emotional style: Sex interactions. Journal of Clinical Psychology, 1977, 33, 839-841.

Yozawitz, A., Bruder, G., Sutton, S., Sharpe, L., Gurland, B., Fleiss, J., & Costa, L. Dichotic perception: Evidence for right hemisphere dysfunction in affective psychosis. British Journal of Psychiatry, 1979, 135, 233-238.

Zaidel, F. Performance on the ITPA following cerebral commissuratomy and hemispherectomy. Neuropsychologia, 1979, 17, 259-280.