

EXPERIMENTAL VALIDATION AND PERSONALITY
CORRELATES OF CONJUGATE LATERAL EYE
MOVEMENTS AS AN INDEX OF CONTRALATERAL
HEMISPHERIC ACTIVATION

Dissertation for the Degree of Ph. D.

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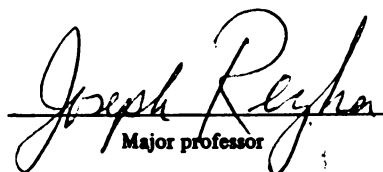
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ABSTRACT

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By

Raquel Gur

The direction of S's conjugate lateral eye movements, when S is asked to solve a problem "in his head", is consistent, according to some studies, within individuals and correlates with a variety of personality and physiological measures. Other studies show that eye directionality, for spatial and verbal problems, depends on problem type. The paradigms used in the two kinds of studies differ. In the first, the experimenter was seated in front of the subject when testing eye directionality. In the second, the experimenter was behind the subject, and the eye movements were monitored by a hidden video-recorder.

The present investigation used a within-subject design to compare the two procedures. 32 right handed males served as Ss.

In the E-facing-S situation Ss eye movements consistently were to one direction. When the experimenter was behind the subject eye directionality was related to problem type: Ss tended to move their eyes to the left in response to "spatial" questions and to the right in response to "verbal" questions. No consistency in eye directionality was found in response to "numerical" questions.

Subjects who moved their eyes consistently (70 percent or more of the times) to the left in the E-facing-S situation (left-movers) differed on a variety of personality tests from those who moved their eyes

consistently to the right in that situation (right-movers) and from those who did not show any consistency (bidirectionals). The three groups of subjects did not differ in the Drive Presence and Drive Level measures derived from the TAT stories. Nor did the three groups differ in their psychopathology scores, as derived from the Draw-A-Person Test. Although the three groups did not differ in the number of symptoms reported on a Symptom Questionnaire, left-movers reported a significantly higher proportion of psychosomatic symptoms as compared to both right-movers and bidirectionals. On the Defense Mechanism Inventory left-movers showed a significantly higher use of "Reversal" as a defense than did right-movers. Right-movers, on the other hand, used the defenses of "Turning Against Object" and "Projection" significantly more often than left-movers. Bidirectionals fell between the two groups in the use of these defenses. The three groups did not differ in their vocational interests as measured by the Strong Vocational Interest Blank. On the Minnesota Spatial Relations Test right-movers performed significantly better than left-movers.

These results are consistent with the hypothesis that the direction of conjugate lateral eye movements represents the activation of the contralateral cerebral hemisphere. The results suggest that at least two factors seem to determine eye directionality: 1. problem type, and 2. characteristic use of a certain hemisphere by a given individual. The second factor seems to be related to personality variables in ways that are theoretically meaningful and clinically significant.

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INTRODUCTION

A. Historical Background for the Functional Differentiation Between the Two Cerebral Hemispheres.

The human brain is divided into two hemispheres which are nearly mirror images of each other and which are interconnected by a body of nerve fibers known as the "corpus callosum." Each hemisphere is responsible for the functioning of the part of the body contralateral to the side of that hemisphere. Thus, the left hemisphere controls the right side of the body and the right hemisphere controls the left side of the body.

These features of the human brain are shared by other primates and have been known to investigators for many years. It was the consensus at the beginning of the nineteenth century that the two hemispheres are complete mirror images of each other both in structure and in function. The first investigator (Dax, 1830; cited by Von Bonin, 1962) who found functional differences between the two hemispheres was generally ignored by the scientific community. Dax noted that aphasia was generally associated with a lesion of the left hemisphere in right handed people. He concluded that the two cerebral hemispheres are not equipotential so far as language is concerned. It was not until 1861, when Broca published his observations of the consistent relation between motor aphasia and lesions of the left frontal lobe, that intense investigation on the functional and structural differences between the two hemispheres was begun.

1. Morphological differences between the cerebral hemispheres.

One line of research that followed Broca's discovery (e.g. Boyd, 1861; Ogle, 1871; Wagner, 1864, all cited by Von Bonin, 1962) has attempted to find differences in weight between the two hemispheres of the human brain. Measurements of the internal length of the skull, on the left and right side of the brain, led Hoadley and Pearson (1929) to conclude that the right hemisphere was slightly larger than the left one. Aresu (1914) found the volume of the left hemisphere to be larger than the right one. Eberstaller (1884) measured different fissures of both hemispheres. He found them (sylvian fissure, insula, sulcus cingoli and calarine fissure) to be longer on the left side of the brain. Such findings led to the conclusion that the left hemisphere has slightly higher specific gravity than the right hemisphere. Von Bonin (1962) concluded that these morphological differences are small and, in any event, hardly explain the dramatic functional differences in hemispheric functioning to be discussed below.

A more recent line of evidence, however, has pointed to gross anatomical differences between the hemispheres. Geschwind and Levitsky (1968) reported that the planum temporale, a portion of the temporal lobe, was 9mm longer, or about a third longer, in the left hemisphere. McRae, Branch, and Milner (1968), who studied the relation between handedness and the length of the occipital horn, found that a longer left occipital horn correlated moderately well with right handedness. The frequency of a longer right occipital horn in left-handers was also above chance. The results might suggest that the parieto-occipital lobe is larger (since the corresponding occipital horn is smaller) in the right hemisphere of right handed people. Since speech is usually located mainly in the left temporal lobe, and spatial perception in the right parieto-occipital region, these results are congruent with

neuropsychological findings, to be discussed presently, which suggest verbal specialization in the left hemisphere and spatial specialization in the right.

A series of studies by Carmon (1970; Carmon and Gombos, 1970; Carmon, Harishamu, Lowinger, and Lavy, 1972) has demonstrated that in normal, right-handed subjects the right hemisphere receives a larger blood supply than the left hemisphere. Left-handedness and left ear preference were correlated, though less strongly, with larger blood volume in the left hemisphere. This finding seems to suggest that the left hemisphere is not "dominant", at least in respect to blood supplies, and that the term "hemispheric specialization" may be more meaningful and less misleading than the term "hemispheric dominance". The left hemisphere's higher status, implied by the latter, seems to have been shaken by Carmon's findings, and Carmon (1970) seems justified in calling for a re-examination of the concept of left-hemisphere dominance.

2. Functional differences between the cerebral hemispheres.

Mapping of the brain is typically done by an integration of clinical findings regarding brain-injured patients with more rigorous investigations of animals. Clinical data are frequently difficult to interpret because there is usually little or no pretesting, the extent of the injury is extremely hard to determine, and conclusions are generally post-hoc. Since the hemispheres seems to be functionally different only in man, investigation of these differences was considerably hampered until the recent developments of various indirect methods for "communicating" with one, rather than another, hemisphere.

Clinical studies following Broca's discovery have clearly corroborated his observations. It has been repeatedly shown that lesions to the left hemisphere result in aphasia, deterioration of intellectual abilities,

impairment in language comprehension, disturbances in naming, loss of reading ability, and loss of verbal recall. (e.g. Milner, 1958; Costa and Vaughn, 1962; Zangwill, 1964; Smith, 1966; Bogen, 1969; Gazzaniga, 1970; Kimura, 1973). The right hemisphere was largely neglected in early studies and was generally considered to be merely a "weaker" version of the "dominant" left hemisphere (Benton, 1972).

More recently, it has been suggested that this bias toward the left hemisphere might have been a result of a cultural bias favoring the verbal aspect of human nature (Harris, 1973). It has become increasingly evident that the right hemisphere does play a crucial role in many non-verbal cognitive functions. In fact, as early as 1874, Jackson had argued that the posterial lobes of the right hemisphere may subserve "visual ideation." His observations, however, were largely ignored at the time. More clinical data reported during and after World War II indicated that patients with well lateralized brain lesions tended to show more severe spatial and other perceptual disorders after right hemisphere lesions than after left (Paterson and Zangwill, 1944; Hecaen, de Ajuriaguerra, and Massonnet, 1951; Hecaen, Denfield, Bertrand, and Malmö, 1956; Milner, 1958, 1962, 1968; McFie and Zangwill, 1960; Piercy and Symth, 1962; DeRenzi, 1966; DeRenzi and Spinnler, 1966; Newcombe, 1969).

The development of the dychothic listening techniques has yielded much new information on the differential functioning of the two hemispheres. These studies have revealed a consistent right ear (left hemisphere) advantage for verbal material such as words, digits, and consonants (Kimura, 1967; Shankweiler and Studdert-Kennedy, 1967; Darwin, 1971) as well as for recognition of the speaker's voice (Doehring and Bartholomeus, 1971). On the other hand, the left ear (right hemisphere) has shown an advantage in the recognition of non-verbal environmental sounds

(Curry, 1967; Knox and Kimura, 1970), melodies (Kimura, 1967), and simple pitch patterns (Darwin, 1971).

The development of techniques for tachistoscopic presentation of stimuli to the left and right visual fields has yielded still more information about hemispheric differentiation. These findings are, by and large, consistent with clinical data as well as with the results of dichotic listening experiments. Thus, Kimura (1966) and McKeever and Huling (1971) have demonstrated a right field (left hemisphere) superiority for the perception of alphabetical material. A right field superiority was also demonstrated for the perception of familiar objects (Wyke and Ettlinger, 1961). A left field (right hemisphere) superiority was found for face recognition (Rizzolatti, Umiltà, and Berlucchi, 1971), for perceiving the location and number of dots (Kimura, 1966, 1969; McGlone and Davidson, 1973) for discriminating the slope of lines and for binocular depth perception (Durnford and Kimura, 1971).

Another method for investigating hemispheric specialization has been introduced by Wada (1949). This method consists of injecting sodium amytal into the internal carotid or the common carotid, in order to produce a contralateral hemiparesis. Using this technique, Wada and Rasmussen (1960) found aphasic disturbances with left hemisphere, but not right hemisphere paralysis.

Studies of patients who have undergone a cerebral commissurotomy to control major epileptic seizures have lent direct support for these inferences from normal subjects. Gazzaniga and Sperry (1967) have introduced an important qualification, suggesting that, even for right-handers, the left hemisphere dominance for language is not absolute. Although the right hemisphere commissurotomized patients emit few, if any, words and appear incapable of propositional speech or writing, they do show some

rudimentary understanding of verbal input. The commissurotomized patients can only give verbal accounts of sensory input that reaches their left hemisphere. They can only name and describe objects flashed into their right visual fields. On verbal dichotic listening tasks these patients fail to report stimuli presented to their left ear in the presence of competing stimuli to the right (Milner, Taylor, and Sperry, 1968). On the other hand, Bogen (1969) found that these patients copy geometric designs better with the left hand than with the right, although the reverse is true for cursive writing. Gazzaniga, Bogen, and Sperry (1965), as well as Milner and Taylor (1971), have also demonstrated with commissurotomized patients that the right hemisphere is superior for tasks involving visualization of spatial relations and in the perception of spatial patterns.

These and other studies have led several investigators (e.g., Bogen, 1969; Benton, 1972; Harris, 1973) to conclude that, at least in right-handed persons, the left hemisphere subserves propositional, verbal functions, whereas the right hemisphere can be best characterized as subserving spatial functions and appositional modes of thinking.

The picture seems to be somewhat more complicated for females as well as for left-handers, who seem to be less lateralized than male right-handers. Both in left-handers and in females language functions seem to be more nearly ambilaterally represented with more language capacity in the right hemisphere. Both groups seem to have more problems in performing spatial tasks, as compared to male right-handers (Lansdell, 1961, 1962; Knox and Kimura, 1970; Miller, 1971; Nebes, 1971). A good theoretical model for explaining these differences is yet to be developed. However, Levy (1969) has postulated that in a hemisphere which is not strongly lateralized for one particular mode of information processing

one would expect to find a conflict between the two modes. The poorer performance of females and left-handers in spatial tasks is caused, according to this "competition" model, by the presence, in the right hemisphere, of two modes of information processing ("Analytic" and "synthetic," to use Levy's terms, or "propositional" and "appositional," to use Bogen's). Recent evidence seem to indicate, however, that the generalization regarding poorer spatial abilities in left-handers may not be true for all of them. Gilbert (in press) has found that strongly lateralized left-handers perform as well as right-handers on a test of memory for faces. Both groups performed better than weakly lateralized left-handers. Furthermore, the adequacy of the "competition" model seems questionable even for those females and left-handers for whom one hemisphere, either the left or the right, subserves both verbal and spatial functions. McGlone and Davidson (1973) found that although there were significant differences favoring male, right-handers to both females and left-handers on spatial tasks. Ss who had one hemisphere subserving both verbal and spatial functions (as determined by a dichotic words test and by a dot enumeration test presented to each visual field) were not significantly superior to Ss whose hemispheres were more specialized. They concluded that the left hemisphere may be a less efficient non-verbal mediator than the right hemisphere, regardless of speech laterality. (For a more thorough review of sex differences in brain lateralization see Bakan, 1973 and Harris, 1973; for a similar review on left-handers see Hecaen and Ajuriaguerra, 1964, and Harris, 1973).

B. Conjugate lateral eye movements as an index of contralateral hemispheric activation - research leading to the present investigation.

The survey of the literature thus reveals a body of evidence, through a variety of techniques, indicating that the two cerebral hemispheres of the human brain serve different functions. The left hemisphere is involved in verbal functions and in the analysis of speech sounds, and the right hemisphere serves visuo-spatial and temporal functions.

Recently Kinsbourne (1972) has described still another and seemingly even simpler technique for studying cerebral lateralization. The technique presupposes that the direction of orientation of the eyes and head indicates innervation or activation of the cerebral hemisphere contralateral to the direction of movement. The reasoning is as follows: The frontal areas of the brain control the turning of the head and eyes. When both centers are equally activated, attention is directed straight ahead. Because the cerebrum is a highly-linked system, an activation of the cognitive functioning of one hemisphere will "overflow" to the orientation center of that hemisphere and cause eye movement contralateral to that hemisphere, or, as Kinsbourne expresses it, "driving attentional balance off center..." (Kinsbourne, 1972, p. 539).

In support of this formulation, Kinsbourne recorded eye and head movements of undergraduate subjects as they responded to questions asked by an E seated behind them. The recordings were made by a hidden videotape camera. It was found that direction of movement was related to problem type: Subjects showed a significant tendency to move their eyes to the right for verbal problems, and either upwards or to the left for spatial problems. The differences in lateralization appeared strongest between verbal and spatial problems, but negligible for numerical problems. These differences were found in right-handed subjects. In left-handers,

eye movement lateralization was fairly evenly distributed regardless of problem type, a finding possibly consistent with evidence that left-handers are less well lateralized for hemispheric functioning than are right-handers. (Benton, 1962; Hecaen and Ajuriaguerra, 1964; Subirana, 1969).

These findings, however, seem inconsistent with results obtained from an independent line of research in which E faces S during testing for eye directionality. In this situation, when S reflects upon a question asked by E, S usually breaks eye contact and moves his eyes either to the right or to the left. This observation was first reported by Teitelbaum (1954) and later was investigated more thoroughly by Day (1964), who found that the direction in which the eyes move is fairly consistent for a given individual. Duke (1968) offered further experimental support for these observations and suggested a new typology, "left-movers" and "right-movers." A series of investigations by Day (1964, 1967a, 1967b, 1968) revealed various differences between "right-movers" and "left-movers" which were "most clearly related to differences in the experience of anxiety, language styles, cognitive styles and thus to personality variables" (Day, 1967b).

The attentional processes of left-movers were found to be more passive-internal with auditory distribution of attention, while those of right-movers were found to be active-external with visual haptic distribution of attention (Day, 1967b). Left-movers tended to describe anxiety as a state with a "definite internal locus" (Day, 1968), and to describe these experiences more emotionally and subjectively. Conversely, the right-movers tended to describe anxiety as having an "external locus" and to emphasize the objective and logical aspects of their experiences.

Bakan and Shotland (1969) found that right-movers perform better than left-movers on specific tasks which require visual attention. Left-movers

on the other hand, reported clearer visual images (Bakan, 1969) and were verbally more fluent. In addition, left-movers were more likely to display waking alpha EEG, more frequently majored in the humanities and social sciences in college, and performed better on the Verbal than the Mathematical section of the Scholastic Aptitude Test. Right-movers were less likely to display waking alpha EEG, preferred majors in sciences, and had higher scores on the Mathematical section of the SAT (Bakan, 1969, 1971; Bakan and Svorad, 1969) however, Barnat (1972) failed to replicate the findings relating eye directionality to preferences in choosing majors.

Left-movers also were found to be more highly susceptible to hypnosis than right-movers (Bakan, 1969). Gur and Reyher, (in press) found that left-movers were more responsive to a passive style of hypnotic induction. Another finding of that study was that a significantly higher proportion of male left-movers than right-movers preferred to have a female E.

This finding agrees with Fischer's (1966) finding that male college students who tend to pay more attention to the left side of their body also tend to be more spontaneous and uninhibited and more successful in dating, compared with males who tend to pay more attention to the right side of their body. Bakan (1969) found that left-movers pay closer attention to the left side of their body, and that right-movers pay closer attention to the right side of their body.

Thus, the empirical studies suggest that left-movers are more spontaneous and emotional and localize anxiety and conflicts internally. Right-movers, on the other hand, seem to be more verbal and intellectual and to see the source of their anxiety and conflicts outside themselves.

Bakan (1971) tried to explain the differences between left-movers and right-movers by viewing eye directionality as an indication of the relative dominance of one cerebral hemisphere over the other. According

to Bakan (1971), lateral eye movement is "symptomatic of easier triggering of activity in the hemisphere contralateral to the direction of eye movement" regardless of the content of the problem put to the subject.

Differences in procedure may account for the apparent inconsistency between these results and those obtained by Kinsbourne (1972). The most obvious difference between the procedures is that in Kinsbourne's (1972) study E was seated behind S and the eye movements were recorded by a hidden video-recorder camera. Kinsbourne (1971) suggests that the face-to-face findings may be attributable to errors caused by the experimenter's own subconscious lateral gaze behavior, as well as from lack of control of the appearance of the background. However in at least some of the E-facing-S studies (Bakan and Shotland, 1969; Gur and Reyher, (in press), both such factors have been rigorously controlled. Furthermore, it is hard to reconcile the notion that these results are artifacts with the various personality and behavioral differences found to be associated with each movement type. It appears that an experimenter's presence before the subject affect the lateralization of underlying cerebral activities in lawful and meaningful ways, and that some factor in the relationship between E and S may be responsible. Thus the difference between the two lines of results may indeed be tied to aspects of the experimental situation, but, contrary to the implication in Kinsbourne's criticism, in a lawful and theoretically significant way. Perhaps the E-facing-S situation, being obviously interpersonal, is more threatening and anxiety provoking, so that an anxious subject then falls back on characteristic modes of response. Thus, when questioned, the subject tends to rely on that hemisphere which is the more characteristically used, even though it might be the "wrong" hemisphere for a particular kind of problem. When the testing situation is "impersonal" (E-behind-S), this anxiety

would tend to be elicited in a smaller degree permitting a hemispheric differentiation of response related to problem type.

In one phase of the current investigation, this hypothesis was tested by directly comparing the two procedures and determining whether, within individual subjects, directionality of eye movements is influenced by experimenter location. Specifically, two hypotheses were tested in this phase:

Hypothesis I: The direction of an individual's conjugate lateral eye movements is a function of the type of question asked of him when the questioner is behind him (i.e. left to spatial, right to verbal). ✓

Hypothesis II: The direction of an individual's conjugate lateral eye movements is consistently in one direction, irrespective of type of question, when the questioner is facing him. ✓

The purpose of the second phase of this investigation is to explore further the personality differences between subjects who tend to move their eyes to the left in the E-facing-S situation and those who turn their eyes to the right, if indeed such a consistency is found in the first phase of the experiment. The three specific hypotheses tested in this phase of the experiment were based on previous reported clinical impressions that left-movers tend to be more spontaneous and more in tune with internal emotional and sensory processes as compared with right-movers (Bakan, 1969, Bakan, 1971; Day, 1964, 1967a, 1967b, 1968; Fischer, 1966; Gur and Reyher, in press):

Hypothesis III: Left-movers express drives more readily than do right-movers.

Hypothesis IV: Left-movers reveal a higher degree of direct expression of unsocialized drives than do right-movers.

Hypothesis V: Left-movers show less evidence of psychopathology than do right-movers.

In addition to testing these hypotheses, explorations were made in this phase of the investigation in order to find other personality correlates of eye directionality, using psychological tests. The tests measured the use of defense mechanisms, vocational interests, and spatial abilities. A physical health questionnaire was also administered in order to explore the relationship between eye directionality and symptomatology.

METHOD

Subjects

Thirty-two right-handed male undergraduates from an introductory psychology class served as Ss in this experiment. Their ages ranged from 17 to 25 ($\bar{X} = 19.3$).

Materials

Following Kinsbourne (1972), three types of questions were used: "verbal" (explanation of proverbs), "numerical" (solution of arithmetical problems), and "spatial" (visualization and identification of spatial relationships of familiar places and visual arrangements). There were twenty pairs of parallel questions for each type, constituting a pool of 120 questions, and from this pool of questions four test forms of thirty questions each were constructed. Each test form contained ten "verbal," ten "numerical," and ten "spatial" questions. To assure a randomized, counterbalanced order of presentation, each pair of equivalent questions, within a given type, was assigned randomly to one of two subsets. This produced six subsets of twenty questions each: two verbal, two numerical, and two spatial. Each subset was then divided randomly into two sections of ten questions each. These sections were combined into the four test forms in a random order with the restriction that each form contained one verbal, one numerical, and one spatial section. Finally, the three types of questions within each form were arranged in triads - verbal, numerical, and spatial - and the order of presentation within each triad was randomized. Each S received 60 questions in each session (two different forms). The forms were administered in a counterbalanced

design. (The actual forms are presented in Appendix A).

A video-recorder was hidden behind a dark cloth which had a small hole in it to enable recording of S's eye movements.

Humphrey's (1951) 20-item questionnaire, which assesses hand usage for a variety of tasks, was used to determine handedness. (The questionnaire was slightly modified from the version used in England in order to adjust it to the American culture). (See Appendix B).

Card 13MF of the Thematic Apperception Test (TAT) (Murray, 1943) was used to elicit fantasies that were analyzed for Drive Presence and Drive Level, following Pine's (1960) scoring system, in order to produce data pertinent to the testing of the third and fourth hypotheses.

The Draw-A-Person test (DAP) was used to test the fifth hypothesis. The DAP drawings were scored for psychopathology using a scale recently developed by Reyher (1972; see Appendix C).

Four additional measures were used to explore other possible correlates of eye directionality: 1. The Defense Mechanism Inventory (DMI) (Gleser and Ihilevich, 1969, see Appendix D) measured the subject's preference of defensive modes. 2. The Strong Vocational Interest Blank (SVIB) (Strong, 1943) measured the subject's vocational interest. 3. The Minnesota Spatial Relations Test (MSR) (Trabue and Paterson, 1930) measured the subject's ability for spatial manipulation. This test requires S to place cut-outs of various shapes into appropriate slots on a form board. (See Appendix E). 4. A physical health questionnaire (Symptom Questionnaire, see Appendix F) was used in order to obtain data on the number of reported symptoms, particularly the proportion of psychosomatic complaints, which was found to be reliably correlated with degree of repression (Burns, 1972; Perkins and Reyher, 1971; Reyher, 1958).

1961, 1962, 1967, 1968; Reyher and Basch, 1970; Sommerschild and Reyher, in press).

Procedure

Each S first answered the Humphrey (1951) handedness questionnaire, and only subjects who reported using their right hand for at least 15 of 20 tasks were retained. Four of 36 Ss initially tested did not meet this criterion, leaving a final N of 32.

Ss were tested individually in a 2.5 x 2 meters portable experimental room placed inside the laboratory. The walls of the room were two meters high and were completely covered with brown cloth to provide a perfectly homogeneous surrounding.

Two experimental sessions, separated by one week, were presented in a counterbalanced order:

E-behind-S (Kinsbourne): S was seated at a small table 1.2 meters from the wall, and E sat approximately 0.8 meters behind him. S was told to concentrate on answering a series of questions within 30 seconds (following Kinsbourne, 1972), to remain seated and to not look behind him. Two test forms were read to him by E who also recorded his answers. Each trial was concluded either when S answered or after 30 seconds. Eye directionality was recorded by the video-recorder hidden behind the wall and scored from a monitor by two independent judges seated in a separate room.

E-facing-S (Bakan): S sat in the same position as in the E-behind-S situation, but now the E sat directly across from him at a distance of 0.8 meters. The instructions were the same as in the E-behind-S situation. E presented the two alternate test forms and recorded both the answers and eye directionality.

The Es in both testing situations were twenty year old women. Testing time in each session was approximately 45 minutes.

A third session, coming approximately one week after the second, was conducted by a different female E in a different room. In this session the MDI, TAT, DAP, MSRT, SVIB, and the Symptom Questionnaire were administered. The testing time in this session was approximately two hours.

RESULTS

Comparisons between E-Behind-S and the E-Facing-S Situations.

The two independent judges who scored the eye directionality in the E behind S situation agreed in 89 percent of the movements. In eight percent of the cases one judge saw a movement when the other did not. In the remaining three percent the judges opposed each other in scoring the direction of movements. A third judge decided in both cases of disagreement.

Since each subject went through both situations with the order of the situation counterbalanced across subjects, the data were first examined for a possible order effect on eye directionality. No such effect was found: 54.8 percent of the movements in the first session were to the left compared with 52.1 percent movements to the left in the second session ($t < 1$).

Both Hypothesis I and Hypothesis II were supported. The results of the E-behind-S situation verified Kinsbourne's findings, and the results of the E-facing-S situation verified Bakan's findings. That is, directionality of eye movements depended on question type in the E-behind-S situation and was consistently in one direction in the E-facing-S situation. In the Ebehind-S situation, for the 20 verbal questions, 65.16 percent of eye movements were to the right - a significant proportion of the total ($z = 1.72$, $p < .05$, one tailed). For the 20 spatial questions, 67.81 percent of the eye movements were to the left ($z = 2.04$, $p < .025$, one tailed). For the 20 numerical questions, as had been the case in Kinsbourne's (1972) study, there was no significant trend to either

direction. In the Efacing-S situation, direction of eye movement was not significantly related to type of problem (see Table 1).

Table 1. Percent of Eye Movements to the Left in the Three Types of Questions under the Two Experimental Conditions.

Experimental Condition	Type of Question	Verbal	Spatial	Numerical
<u>E</u> -behind- <u>S</u>		34.84*	67.81**	54.25
<u>E</u> -facing- <u>S</u>		55.72	58.91	53.53

* $p \leq .05$

** $p \leq .025$

The results are more clearly brought out in the analysis of the performance of individual subjects in the verbal and spatial problems. The numerical problems were not included in this analysis, since there were no bases, from Kinsbourne's study (1972) for predicting whether the solution of numerical problems would be subserved more by one hemisphere than by another. In other words, given a subject who consistently moved his eyes in one direction to each of the twenty numerical questions, there are no theoretical grounds for deciding whether the subject's movements reflected characteristic usage of one hemisphere, in Bakan's sense, or were problem based, in Kinsbourne's sense. The Ss were thus classified into two categories in the following way:

1. Unidirectional. A significant majority (70 percent) of a subject's eye movements were to one direction. The 70 percent level, also used by

Bakan (1969, 1971, Bakan and Shotland, 1969, Bakan and Svorad, 1969), would be expected by chance at the $p < .01$, where $N = 40$ (20 verbal questions and 20 spatial questions). The unidirectional Ss were subclassified into a. Left-movers, when the majority of eye movements was to the left, and b. Right-movers, when the majority (i.e., 70 percent) of movements was to the right.

2. Bidirectionals Ss: Less than 70 percent of the eye movements were to one direction. The bidirectional Ss were further classified in the following manner: For the 20 verbal questions and the 20 spatial questions, if the larger proportion of movements to one direction in the verbal was the smaller proportion of movements to that direction in the spatial, the differences in the two sets of proportions were added. If the sum was at least 70, the subject was judged to be a "discriminator," with a confidence level of $p < .01$. Ss who summed differences in proportions were less than 70 were called "non-discriminators." The bidirectional Ss were thus subclassified into: a. Discriminators: Ss who moved their eye differentially according to the problem type; i.e., left to spatial and right to verbal, or the reverse (against the theoretically expected direction), right to spatial and left to verbal problems. b. Non-discriminators: Ss whose eye movements were inconsistently related to problem type and appeared haphazard.

The results of these classifications are summarized in Table 2.

Table 2. Numbers and Percentages (in Parentheses) of Unidirectionals (Left-Movers and Right-Movers) and Bidirectionals (Discriminators and Non-Discriminators) in the Two Experimental Conditions (N = 32).

<u>E-behind-S</u>			<u>E-facing-S</u>			
	N	%	Left-movers	Right-movers	Discriminators	Non-discriminators
Left-movers	2	(6.3%)	2			
Right-movers	2	(6.3%)		1		1
Discriminators	18*	(56.3%)	8	6	2	2
Non-discriminators	<u>10</u>	<u>(31.3%)</u>	<u>4</u>	<u>2</u>	<u>—</u>	<u>4</u>
N	32		14	9	2	7
%		100%	(43.8%)	(28.1%)	(6.3%)	(21.9%)

*one reversed discriminator.

The difference between the two experimental conditions was significant by the sign-test ($z = 4.37$, $p = .001$). Note that with the E-behind-S procedure, in line with Kinsbourne's (1972) findings, the great majority of Ss (88 percent) were bidirectional, most of them discriminators. With the E-facing-S procedure, in contrast, the majority of Ss (72 percent) were now classified as unidirectional, either left-movers or right-movers. These results are consistent with other findings using this procedure (Bakan, 1969, 1971; Bakan and Shotland, 1969; Bakan and Svorad, 1969; Gur and Reyher, in press).

Table 2 also shows that a small number of Ss remained either unidirectional or bidirectional in both conditions. The consistently unidirectional Ss did not change direction (i.e. left-movers remained left-movers; right-movers remained right-movers). They therefore appear to have shown an extremely strong preference for use of one hemisphere, whether the left or the right, across experimental conditions. The Consistently bidirectional Ss, most of whom were non-discriminators, appear to show little evidence of lateralization. Both groups of Ss represent potentially interesting populations for further study.

When these same analyses were repeated with the numerical questions included, the same distributions of unidirectional and bidirectional subjects emerged. In other words, in both experimental situations Ss who were either left or right-movers on the verbal and spatial questions showed the same preference, and in approximately the same proportion, in the numerical questions. Of the Ss classified as bidirectionals, whether discriminators or nondiscriminators, eye movement direction in the numerical questions was haphazard. The results, like Kinsbourne's (1972), therefore

suggest that neither cerebral hemisphere can be said to predominantly subserve the solution of numerical problems.

In light of these findings and data pertaining to the functional asymmetry of the brain, does direction of eye movements in response to a certain question type affect the correctness or quality of response? Since a movement of the eyes to the left presumably indicates activation of the right cerebral hemisphere, does a movement to the left in response to a spatial question result in a more accurate answer than a movement to the right for that question? Conversely, in view of left hemisphere specialization for verbal material, does a movement to the right, in response to a verbal question, result in a better answer than a movement to the left?

A comparison was made, within individual Ss, between accuracy of response for those verbal and spatial questions to which the direction of eye movements was appropriate and accuracy of response to those questions to which the direction was inappropriate. Only those Ss were included who made at least two movements in each direction within a set of 20 questions. The results indicate a tendency for movements to the right to be associated with better verbal responses, and for movements to the left to be associated with better spatial responses. This tendency, however, was significant only for the left movements in response to spatial questions in the E-facing-S situation ($t = 2.67$, $df = 18$, $p < .01$, one tailed). The questions thus proved to be not well enough designed to permit a sufficient degree of differentiation of response quality. This was particularly so for the verbal questions (explanation of proverbs).

Comparisons among Left-Movers, Right-Movers and Bidirectionals.

Left-movers were compared with right-movers and with bidirectional Ss on a variety of tests. Discriminators and non-discriminators were combined into one group of bidirectionals because of the small number of Ss in each sub-category. The classification of Ss into these categories was made on the basis of their eye movements in the E-facing-S situation, since this was the situation used by Bakan (1969, 1971) in his attempts to correlate eye directionality with various personality variables. The results of these comparisons are presented first as they relate to each of the hypotheses tested and then in relation to each of the exploratory tests.¹

1. The hypotheses:

Hypothesis III and Hypothesis IV were not supported by the analysis of the TAT stories. The Pine (1960) system of analyzing the TAT story yields two measures: Drive Presence and Drive Level. There are three levels of drives: Level I (direct-unsocialized) includes "those expressions of drive content where libidinal or aggressive impulses are directly expressed in a way contrary to conventional social values." Level II (direct-socialized) includes "those expressions of drive content where libidinal or aggressive impulses are expressed directly but in socialized ways." Level III (indirect-disguised; weak) includes "those instances that are associated with (often relatively strong) drives, but where the underlying impulse is neither explicitly thought not acted upon in the story." This level also includes "drives expressions which are weak and highly derived" (Pine, 1960, pp. 34-35). Two psychology students who were unfamiliar with S's group identity scored the protocols.

The percent agreement for Drive Presence was 85, for level I-82 percent, for level II-79 percent and for level III 87 percent.

The results of the analyses of variance for the three groups of Ss for drive presence and drive level are negative and are summarized in Table 3.

Table 3: Means, Standard Deviations (in Parentheses), and F Values Comparing Left-Movers (LM), Right-Movers (RM), and Bi-directionals (BD) on Drive Presence and Drive Level.

Eye Directionality		LM	RM	BD	F
Drives		N = 13	N = 8	N = 9	
Drive Presence		3.85 (1.96)	4.13 (2.71)	4.56 (3.13)	0.19
I		1.39 (1.33)	2.63 (1.22)	2.67 (1.41)	3.00
Drive Level	II	0.85 (0.86)	1.13 (1.69)	1.11 (0.99)	0.18
	III	1.62 (1.73)	0.38 (0.49)	0.78 (1.31)	2.02

Note: df = 2, 27.

As seen from the table none of the F ratios was significant.

Hypothesis V was not supported by the DAP drawings. The drawings were scored for psychopathology by two independent judges using the scale developed by Reyher (1972). The inter-judge reliability was .95. The results are summarized in Table 4.

Table 4: Means, Standard Deviations (in Parentheses), and the F Value Comparing Left-Movers (LM), Right-Movers (RM) and Bidirectionals (BD) on Psychopathology in the DAP.

LM N = 13	RM N = 8	BD N = 9	F
20.54 (9.75)	17.63 (12.82)	23.78 (9.50)	.65

Note: df = 2, 27.

As seen from this table psychopathology, as measured by this scale, does not differentiate the three groups.

2. Other Findings:

The DMI classified people according to the kinds of defenses they tend to use more frequently. Five major defenses are identified by this test: 1. Turning Against Object (TAO), characterized by Gleser and Ihilevich (1969) as dealing with conflict: "through attacking a real or presumed external frustrating object." 2. Projection (PRO) characterized by "expression of aggression toward an external object through first attributing to it, without unequivocal evidence, negative intent, or characteristics." 3. Principalization (PRN), characterized by dealing with conflicts "through invoking a general principle that 'splits off' affect from content and represses the former." 4. Turning Against Self (TAS), characterized by "directing aggressive behavior toward S himself." 5. Reversal (PEV), characterized by defenses such as repression, denial, negation and reaction formation which "deal with conflict by responding in a positive or neutral fashion to a frustrating object" (Gleser and Ihilevich, 1969, p. 52).

Analyses of variance were made to compare the three groups of Ss on each of these defenses. The results are summarized in Table 5.

Table 5. Means, Standard Deviations (in Parentheses), and F Values Comparing Left-Movers (LM), Right-Movers (RM), and Bidirectionals (BD) on the Five Defense Mechanisms Identified by the DMI.

Defense Mechanism	Eye Directionality	LM N = 12	RM N = 8	BD N = 8	F
TAO		35.67 (7.69)	46.25 (6.40)	42.50 (7.53)	4.82**
PRO		33.67 (6.15)	41.00 (4.12)	39.50 (3.50)	5.54**
PRN		49.92 (4.48)	46.00 (5.87)	46.13 (5.42)	1.68
TAS		38.08 (5.37)	34.50 (6.10)	36.88 (4.06)	1.00
REV		41.0 (5.67)	32.25 (8.37)	35.00 (6.78)	3.84*

Note: df = 2;25 for all comparisons

* $p < .05$

** $p < .025$

The results indicate that the three groups differ on three of the five defense mechanisms. Scheffes (1959) method for multiple comparisons was used to determine which differences among the group means contributed significantly to the between-group variance. On the TAO, right-movers scored significantly higher than left-movers, but not significantly higher than bidirectionals whose mean score fell between the two. On the PRO, both right-movers and bidirectionals scored significantly higher than left-movers and were not significantly different from each other. On REV, left-movers scores significantly higher than right-movers, but non significantly higher than bidirectionals.

It is interesting to note that the bidirectional's scores were between the right-movers' and the left-movers' on all five comparisons, being somewhat closer to those of right-movers.

Ss' scores on the twenty-two vocational interest scales derived from the SVIB were subjected to a two-way analysis of variance in a repeated measurements design. The analysis revealed significant differences among the various vocational interests across Ss ($F = 7.61$, $df = 21, 546$, $p < .01$). No group effects existed, however ($F < 1$) nor was there an interaction between groups and SVIB variables ($F = 1.19$, $df = 42, 546$, $p > .05$) (see Appendix G for the group means and the details of the ANOVA). It therefore seems that left-movers, right-movers, and bidirectional Ss did not differ in their vocational interests as measured by the SVIB.

An inspection of the profiles of the three groups on the basic interest scales indeed suggested that the similarities were more striking than the differences. When the basic interests of each group of Ss were rank ordered, a Spearman rank order correlation of .49 ($p < .05$)

was obtained between left-movers and right-movers, a correlation of .71 ($p < .001$) between right-movers and bidirectionals and a correlation of .78 ($p < .001$) between the left-movers and the bidirectionals. It can be concluded that the three groups are similar in their vocational interests with both right-movers and left-movers being somewhat more similar to bidirectionals than to each other.

Ss' score on the MSR was the total number of seconds to place blocks in various shapes into the appropriate slots. The means of the three groups are given in Table 6.

Table 6: Means, Standard Deviations (in Parentheses), and the F Value Comparing Left-Movers (LM), Right-Movers (RM), and Bidirectionals (BD) on MSR.

LM N = 13	RM N = 8	BD N = 9	F
513.00 (81.40)	439.63 (62.45)	506.11 (80.12)	2.27

Note: df = 2;27.

As seen from this table, the differences among the three groups on the MSR were not statistically significant. There does seem to be a considerable difference favoring the right-movers as compared with the left-movers, with the bidirectionals falling in between. When the scores of the three groups were plotted on a frequency distribution, it became evident that the distributions of left-movers and right-movers had very little overlap. The bidirectionals produced most of the overlap and were probably responsible for blurring the over-all differences by increasing the error factor. Since it could be theoretically expected that

bidirectionals would be less consistent in their approach to a spatial task than either left-movers or right-movers, a separate t-test was performed on the scores for left-movers and right-movers alone. The result of this t-test was significant ($t = 2.20$, $df = 19$, $p < .05$, two tailed). This result, because it is post hoc, should be interpreted with caution in view of the undesirability of performing t-tests to compare particular groups, when the over-all F fails to reveal significance.

Two scores were derived for each S from his responses to the Symptom Questionnaire: 1. Total number of symptoms reported. 2. Proportion of psychosomatic symptoms of the total.

The results for the three groups on the total number of reported symptoms are summarized in Table 7.

Table 7: Means, Standard Deviations (in Parentheses), and the F Value Comparing Left-Movers (M), Right-Movers (RM), and Bidirectionals (BD) on the Symptom Questionnaire.

LM N = 13	RM N = 8	BD N = 8	F
31.31 (14.03)	27.75 (11.77)	25.63 (8.92)	.52

Note: $df = 2; 26$.

As seen in this table, the three groups did not differ on the total number of symptoms.

The proportion of psychosomatic symptom of the total number of symptoms reported are summarized for the three groups in Table 8.

Table 8: Means, Standard Deviations (in Parentheses), and the F Value Comparing Left-Movers (LM), Right-Movers (RM), and Bidirectionals (BD) on the Proportion of Psychosomatic Symptoms.

LM N = 13	RM N = 8	BD N = 8	F
.312 (.127)	.192 (.055)	.200 (.063)	4.71*

* $p < .025$, $df = 2; 26$.

The results suggest that the three groups differ in their proportion of reported psychosomatic symptoms. An application of Scheffes (1959) method for multiple comparisons revealed that only the differences between left-movers and right-movers and between left-movers and bidirectionals were significant ($p < .05$).

DISCUSSION

The first phase of this investigation corroborated, using a within-subject design, both Kinsbourne's (1972) and Bakan's (1969, 1971) findings. The direction of eye movements in response to questions thus appears to be determined by at least two factors: 1. Problem type and 2. Characteristic use of a certain hemisphere by a given individual. The influence of the first factor seems to be maximized when E is seated behind S, whereas the influence of the second factor is maximized when E faces S.

At present one can only speculate as to the mechanisms involved in producing the rather drastic change, from one situation to another, in the influence of each of these factors on S's response. Perhaps in the E-behind-S situation S is faced only with the problems presented to him. The task of answering the problems is therefore more salient than in the E-facing-S situation and the different problem types may have a stronger "pull" on S's response. The E-facing-S situation confronts S with a new complex of stimuli to respond to and thereby decreases the saliency of the problem type. By being more interpersonal it also may make S more anxious in terms of physiological level of arousal. Anxiety, according to Sullivan (1953), is closely tied-up with interpersonal relationships, and tends to stand in the way of an appropriate problem or need-related behavior (Sullivan, 1953, p. 44). It threatens the "need for security," thus mobilizing the so called "security operations" in an attempt to maintain self esteem.

This anxiety, along with the decrease in problem-type saliency, may cause S to use his preferred hemisphere, either left or right, possibly

depending on personality variables, even when this is not the most "efficient" hemisphere for dealing with a particular problem.

There are several ways to test this explanation. The problem in the E-facing-S situation could be made more salient by rewarding correct answers or punishing mistakes. Such a manipulation should increase the number of eye movements according to problem type in the E-facing-S situation. Conversely, making S feel less anxious and more at ease, by using E of the same sex and by establishing some rapport prior to testing, should also result in more eye movements according to problem type in the E-facing-S situation.

Another way of testing this explanation would be by manipulating the difficulty of the questions. Harder questions ought to produce disproportionately more mistakes in the E-facing-S situation as compared to the E-behind-S situation, in view of the curvilinear relationship typically found to exist between anxiety and performance. S's descriptions of their perceptions of or feeling about the two situations could give further clues as to the effect of the manipulation. Such data may be corroborated with physiological measures of ANS activity related to anxiety, as well as by other objective tests (e.g. anxiety inventories).

One missing link in the chain of evidence seems to be the relationship between eye directionality, in response to a certain question type, and the correctness or quality of response. As mentioned earlier, the design of the questions used in the present investigation did not permit a conclusive answer to this question. The finding of a relation between correctness of response and eye movements to the left in the spatial questions in the E-facing-S situation is encouraging, however. Further refinement of the questions and scoring of answers in a way that will enable

a reliable and valid differentiation of response quality if clearly indicated.

The hypotheses regarding differences between left-movers and right-movers on amount of drive, drive representation, and psychopathology were not confirmed. Furthermore, the left-movers were found to be characterized more by repression and denial. Finally, the left-movers tended to have more psychosomatic complaints than the right-movers. These results indicate that these hypotheses were not sufficiently well founded. From the description of left-movers as being more spontaneous (Day, 1964, 1967a, 1967b, 1968), and more attentive to internal processes (Bakan, 1971; Day, 1968; Gur and Reyher, in press), and from the finding that male left-movers prefer a female to a male E (Gur and Reyher, in press) it was concluded that left-movers should also be less inhibited in expressing their needs and therefore show less evidence of psychopathology as well. But terms like "spontaneous" and "internally oriented" are vague and do not imply any underlying psychodynamic processes that would lead to the emergence of different clinical manifestations for left-movers and right-movers. "Internal orientation" may mean a tendency toward repression rather than projection, as much as it may mean awareness of feelings. The present investigation, by revealing a connection between eye directionality, repression, and symptomatology, permits a more differentiated statement of the relation between brain asymmetry and psychopathology.

Both in laboratory (Burns, 1972; Perkins and Reyher, 1971; Reyher, 1958, 1961, 1967; Sommerschild and Reyher, in press) and field (Reyher and Basch, 1970) studies, degree of repression has been found to be inversely related to the proportion of psychosomatic symptoms. The lifting of repression seems to be associated with a decrease in the proportion of psychosomatic complaints and an increase in symptomatology which is more

depictive of the repressed conflict. The finding that left-movers report a higher proportion of psychosomatic symptoms, as compared to right-movers, may, therefore, be a result of their heavy use of repression as a defense. This finding also agrees with Gambaro and Rabin's (1969) finding that psychosomatic symptoms (high blood pressure) are more likely to occur when S is forced to internalize his frustrations than when he can express his emotional reactions to the external source of conflict.

The lack of differences among the groups on their "drive presence" and "drive level" scores, derived from their TAT stories, suggests that these scores may not be directly related to level of repression. Theoretically, one would expect a high presence of drive expressed in a direct-unsocialized way (Level I in the Pine scoring system) to indicate a low level of repression. As Sommerschild and Reyher (in press) have pointed out, however, the Pine (1960) system of scoring does not allow for a differentiation between those drives that are objectionable to the S who projected them into his story (ego-dystonic drives) and those that are not (ego-syntonic drives). A subject may obtain a high "drive presence" score by expressing many ego-syntonic drives, while completely repressing any ego-dystonic drives. Sommerschild and Reyher also found no relation between the measures derived from the Pine system and an independent measure of repression of ego-dystonic drives, which was found to correlate with the amount of psychosomatic symptomatology.

The defense mechanism employed predominantly by left-movers ("Reversal"), is characterized by an immediate reaction of denial of reality, repression of the emotions provoked by external stress, and reaction formation. The defense mechanisms employed predominantly by right-movers ("Turning Against Object," "Projection") are characterized by externalizing the conflict

and acting against the environment. They also require an additional cognitive elaboration. These results agree with Day's (1964, 1967a, 1967b, 1968) findings that left-movers tend to view anxiety as emanating from internal sources, whereas right-movers tend to externalize the locus of anxiety. They also agree with a recent finding by Proctor and Kinsbourne (1973), who investigated the relation between eye directionality and reported perception of anxiety in a stressful situation (patients awaiting oral surgery). All left-movers underestimated and all right-movers overestimated their degree of anxiety as defined by an objective measure of physiological arousal (pulse rate).

These results are also congruent with Gur and Reyher's (in press) findings that left-movers responded better than right-movers to a passive style of hypnotic induction which emphasizes internal processes, but did worse when an active, externally oriented, induction style was used. Another finding of Gur and Reyher (in press) is harder to reconcile with the present results. The tendency of male left-movers to prefer a female to a male E, significantly more often than right-movers, was interpreted in that study to mean that left-movers were more in tune with the arousal caused by the female E. One way of explaining the discrepancy, in view of the tendency found in the present study for left-movers to use the defense of "Reversal," to conclude that the left-movers chose a female E as a reaction formation without being aware of their arousal. An alternative explanation would be that the DMT, which does not use any stories relating to sexual conflicts, measures defenses against anger rather than against libidinal strivings. Thus, it is still possible that left-movers tend to repress angry feelings, whereas right-movers repress conflicts related

to libidinal strivings. These are only speculations, however, and further research is needed.

The present investigation indicates that left-movers do not differ from right-movers in the amount of drives, their level, and general psychopathology, but rather in their characteristic way of handling these sources of conflict. If, indeed, Bakan is correct that eye directionality is indicative of the characteristic use of the contralateral hemisphere left-movers and right-movers should differ in accordance with differences in the modes of functioning between the two hemispheres.

Bogen (1969) has suggested that the "distinguishing feature of the left hemisphere is not its possession of words but its use of words in propositions (sequences of words in which the meanings of the words are interdependent)" (Bogen, 1969, p. 147). The right hemisphere, on the other hand, is characterized by "thought based on simultaneous grasp of related but differing phenomena" (Bogen, 1969), p. 148). The left hemisphere was therefore assumed by Bogen to subserve propositional thought, whereas the right hemisphere was assumed to subserve appositional thought. Bogen's (1969) distinction between appositional and propositional modes of thinking is similar to Freud's (1946) distinction between primary process (appositional) and secondary process (propositional) thinking. Primary process thinking is concrete and largely pictorial and illogical. Secondary process thinking is abstract, verbal, and logical. Sullivan (1953) similarly distinguishes parataxic (appositional) from syntactic (propositional) modes of experience. Parataxic modes are undifferentiated, "momentary, unconnected states of being" (Sullivan, 1953, p. 28). Syntactic modes are characterized by consensually validated symbol activity involving an appeal

to principles and their logical derivatives (Sullivan, 1953, pp. 28-29). Freud and Sullivan maintain that the first mode of thinking is more prevalent during infancy and diminishes from overt expression through the socialization process. Recent evidence (Crowell et al., 1973), indicating that the right hemisphere is more responsive to visual stimuli in the newborn infant, seems to bridge these psychodynamic theories with Bogen's (1969) theory which is based on brain research.

A more complicated theoretical issue evolves around the nature of the relation between the drive, or emotion, and its mode of expression. If they are related, would hemispheric specialization relate to both? Bogen seems to view the drive and its form of expression as independent: "Appositional thought is not synonymous with emotional thought. Emotion may or may not be involved in either propositional or appositional thought." (Bogen, 1969, p. 21). Freud, on the other hand, views primary process thinking as being more directly determined by drives than secondary process thinking. Sullivan would probably side more with Bogen on this issue, since Sullivan discusses the various formal modes of experience quite independently from his analysis of the system of needs. The results of the present investigation suggest that left movers do not differ from right movers in strength of drives, emotions, and conflicts, but rather in the preferred mode of approaching them or defending against them. It could therefore be concluded that the drives, emanating from physiological states, are integrated within a neural system which is probably lower than the cerebral cortex and which probably has little to do with hemispheric differentiation. It is only when the drives reach a more cognitive expression that hemispheric specialization can impose one or the other mode of structuring

the experience. The evidence from the present investigation supports this formulation only indirectly, however, and further, more refined research is needed.

The finding that right-movers perform better than left-movers on the MSR seems incongruent with the general belief (e.g. Kimura, 1973) that the right hemisphere subserves spatial functions. This finding, however, may mean that a verbal approach to this test may be more efficient than a spatial approach. This may also be the case in the Embedded Figures task (Witkin, 1950) on which male right-movers were found to perform better than male left-movers (Barnat, 1972). These findings may serve as a warning for designers of tests purported to measure spatial abilities. At least some of these tests can be successfully approached with a verbal mode of thinking. Perhaps there are no tests that are purely spatial, particularly for a college student population, trained throughout life to approach most tasks in a verbal fashion (Harris, 1973). The performance of left-movers vs. right-movers on such tests may serve as an additional indicator of the amount of contamination of spatial tests by verbal factors.

Since the developers of the MSR do emphasize its relative independence from verbal intelligence, however, an alternative explanation for these results may be suggested. The specialization of the two hemispheres into verbal and spatial functions seems to be special case of the more basic differentiation between analytic vs. synthetic (Levy, 1969) or propositional vs. appositional (Bogen, 1969) modes of thinking. Semmes (1968) suggests that the right hemisphere is more diffusely organized, and concludes that its organization best characterizes the spatial problem. It could be added,

however, that such an organization would also be best suited for an appositional or synthetic mode of thinking. The convergence between spatial-verbal and appositional-propositional or analytic-synthetic is not complete. There are spatial problems that would be best solved by an analytic approach, and the right hemisphere would be less likely to engage in their successful solution. It can be suggested, therefore, that the spatial relations test (MSR) measures the ability to solve spatial problems by an analytic approach. This approach to problem solving seems to be typically subserved by the left hemisphere.

The lack of differences among the groups in their vocational interests, as measured by the SVIB, disagrees with Bakan's (1971) finding that left-movers differ from right-movers in their choice of a major in college. The finding, however, is consistent with Barnat's (1972) failure to find differences among the groups using another vocational interest inventory (Kuder preference record--vocational, Kuder (1934-1956)). The subjects in both Barnat's and the present investigation, however, were college students enrolled in an Introductory Psychology course. The relative homogeneity of this population in terms of vocational interests would considerably reduce the expected variance, thereby reducing the chance of finding reliable differences among subgroups of this population. Moreover, all human work and problem solving contain elements of both propositional and appositional modes of thinking, though the "mix" will differ from job to job and from person to person. Although some professions may be more successfully approached with one mode of thinking rather than another, and some correlation should be expected between eye directionality and vocational preference in the population at large, the correlation will probably be low

or moderate and will account for a relatively small percentage of the variance. Further research is needed to establish the nature and magnitude of this relation. The lack of agreement between Bakan's (1971) findings, based on university students' statements of their major field of study, and Barnat's (1972) and the present findings, which used standardized vocational inventories, may also be traceable to the different procedures. A choice of major, particularly by the undergraduate student, can be determined by factors other than vocational interest, e.g., status, economic reasons, family pressures, and intellectual aptitudes in particular fields.

The present investigation seems to have uncovered the operation of two factors: stimulus characteristics of the question and characteristics within the individual-which influence the activation of the cerebral hemispheres. It has also revealed differences among Ss who characteristically respond with one hemisphere as compared to those who characteristically respond with the other. Whenever a physiological correlate of behavior is found, and hemispheric lateralization can be viewed as such, questions regarding the old nature vs. nurture controversy and physiological vs. psychological causality come to the fore. It should be noted, however, that the contribution of constitutional vs. environmental factors in the development of brain lateralization is yet to be determined. Reliance on a particular mode of problem solving may be acquired through learning, through hereditary links, or through an interaction of both.

The present findings cannot be generalized beyond male, right-handed college students. Further research should include females, left-handers, and Ss from different age levels and different socioeconomic backgrounds.

FOOTNOTES

1. Two left movers, one right-mover and one bidirectional failed to complete the DMI and were dropped from the analysis of the results for this test. One left-mover and one right-mover failed to complete the TAT the DAP and the MSR and were dropped from the analyses of the results of these tests. One left-mover, one right-mover and one bidirectional failed to complete the MSR and were dropped from the analysis of the results of this test. The number of Ss in each group is presented in the appropriate tables.

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APPENDIX A

APPENDIX A

TEST FORM "A" - SECTION "a"

Explain:

1. A watched pot never boils.
2. Solve: $3/5$ of 400 is:
3. Visualize your driver's license. Where is the date of expiration on it relative to your picture?
4. Explain: Rome was not built in a day.
5. Imagine the map of the United States. Where is Chicago relative to Minneapolis?
6. Solve: 69 times 14 is:
7. Solve: square 75-62.
8. Explain: One may ride a free horse to death.
9. Visualize sitting in front of a type-writer. Where is the letter 'R' relative to 'B'.
10. Solve: $4/5$ of 600 is:
11. Visualize you are on the corner of Abbott and Grand River and you start walking toward M.A.C. Name one store that you will pass on your way.
12. Explain: All that glitters is not gold.
13. Solve: 1935 minus 829 is:
14. Explain: Hope is the poor man's bread.
15. Imagine driving a car and approaching a "YIELD" sign which is in the shape of a triangle. To which direction does the triangle point?
16. Solve: 25 times 12 is:
17. Imagine a square rotating 360 degrees around it's axis. What shape would you get?

18. Explain: A drowning man will clutch at a straw.
19. Solve: The square of 29 is:
20. Explain: A bird in the hand is worth two in the bush.
21. Imagine that you are traveling from Las Vegas to Dallas. Which states do you pass through:
22. Solve: Subtract 12 from the product of 13 times 7.
23. Explain: They that are mute want to talk the most.
24. Imagine the Great Lakes area. What are the states that border the Great Lakes?
25. Explain: What saddens a wise man gladdens a fool.
26. Visualize the map of the United States. What are the states that border Nebraska?
27. Solve: $\frac{4}{7}$ of 182 is:
28. Solve: The cube of $\frac{1}{7}$ is:
29. Visualize your library card. Where is your student number on it relative to your name?
30. Explain: Don't judge a book by it's cover.

TEST FORM "A" - SECTION "b"

1. Explain: A poor worker blames his tools.
2. Solve: $\frac{3}{8}$ of 720 minus 13 is:
3. Imagine the Liberty Statue in the Columbia movies. Is it facing to it's right or to it's left?
4. Explain: Words cut more than swords.
5. Solve: The square of 43 is:
6. Imagine George Washington on a nickel. Which direction does he face, to your right or to your left?
7. Solve: 24 plus 98, minus 17 is:
8. Imagine yourself standing in front of an ice-cream vending machine. Is the money slot to your right or to your left?
9. Explain: Don't throw good money after bad.
10. Explain: A stitch in time saves nine.
11. Visualize the map of the United States. Which city is closer to New York, Boston or Cleveland?
12. Solve: $\frac{3}{8}$ of 104 is:
13. Solve: $424 + 727$ is:
14. Imagine "The Doctor's Bag" column of the State News. Is Dr. Werner's picture to your right or to your left?
15. Explain: He that lies on the ground can not fall.
16. Imagine the campus as a clock where the Men's IM is the center and the Administration Building is 12 o'clock. In what hour approximately will the Union Building be?
17. Explain: Where there is a will, there is a way.

18. Solve: 82 times 14 is:
19. Explain: A rolling stone gathers no moss.
20. Visualize sitting in front of a type-writer. Where is the letter "J" in relation to "C"?
21. Solve: $\frac{2}{7}$ of 630 is:
22. Solve: The cube of 11 is:
23. Explain: Riches serve a wise man, but command a fool.
24. Imagine the campus as a clock where the stadium is the center and the Administration building is the hour 12, on what hour approximately is the Auditorium?
25. Imagine you are up at bat with a man on second. You line out deep to the third base man, who tries to double the man off second. Does the third baseman throw to his left or to his right?
26. Explain: He who pleased everybody died before he was born.
27. Solve: 934 minus 561 is:
28. Visualize a telephone dial. Where does the area code appear relative to the number?
29. Explain: If you can not bite don't show your teeth.
30. Solve: 45 times 18 divided by 9 is:

TEST FORM "B" - SECTION "c"

1. Solve: 1626 minus 789 is:
2. Visualize you are at Jacobson's Department store on Grand River, you are walking toward the Student Book store. Name one store that you will pass on your way.
3. Explain: All's well that ends well.
4. Explain: As you make your bed so you must lie in it.
5. Solve: 768 minus 383 is:
6. Imagine the lion's head in the MGM movies. Is it tilted to it's right or to it's left?
7. Explain: It is better to have a good enemy than a bad friend.
8. Visualize sitting in front of a type-writer. Where is the letter "L" in relation to "K"?
9. Solve: 268 plus 869 is:
10. Visualize the front page of the State News. Is the date to your right or to your left.
11. Solve: The square of 26 is:
12. Explain: It never rains, but it pours.
13. Solve: 72 times 12 is:
14. Explain: The hardest work is to go idle.
15. Imagine the Great Lakes area. Above what state is the western part of the upper penninsula in Michigan?
16. Imagine the campus as a clock where the library building is the center and Beaumont tower is 12 o'clock. In what hour approximately will the Administration building be?

17. Solve: $\frac{2}{3}$ of 114 is:
18. Explain: When the cat's away the mice will play.
19. Explain: Too many cooks spoil the broth.
20. Imagine you are at bat with a man on first base. You line out to the second base man who then tries to double the runner off first. Does the second base man throw to his left or to his right?
21. Solve: $\frac{3}{5}$ of 400 is:
22. Solve: The cube of $\frac{1}{9}$ is:
23. Imagine yourself standing in front of a coffee vending machine. Is the money slot to your right or to you left?
24. Explain: The more cost, the more honor.
25. Explain: Better happy than wise.
26. Solve: The cube of 13 is:
27. Imagine that you are traveling from Denver to Minneapolis, which states do you pass through?
28. Solve: $\frac{8}{9}$ of 720 minus 12 is:
29. Explain: Call no man happy until he is dead.
30. Visualize your social security card. Where is your number on it relative to your name?

TEST FORM "B" - SECTION "d"

1. Imagine Lincoln on a penny. Which direction does he face, to your right or to your left?
2. Solve: The square of $86-13$ is:
3. Explain: Strike while the iron is hot.
4. Explain: Great bodies move slowly.
5. Solve: $3/7$ of 196 is:
6. Imagine the map of the United States, where is Detroit relative to Chicago?
7. Explain: He who laughs last laughs best.
8. Solve: The square of 39 is:
9. Imagine the campus as a clock where the Administration building is the center and the Union building is the hour 12. On what hour approximately is the campus police?
10. Explain: Lend your money and loose your friend.
11. Visualize sitting in front of a type-writer. Where is the letter "D" in relation to "O"?
12. Solve: 35 times 14 divided by 7 is:
13. Explain: Don't count your chickens before they are hatched.
14. Solve: The cube of $1/14$ is:
15. Visualize a telephone. Where is the metal part which stops the finger relative to the number?
16. Solve: 35 times 14 is:
17. Imagine driving a car and approaching an intersection with a traffic light. Where is the red light relative to the green light?
18. Explain: The worst spoke of the wheel breaks first.
19. Solve: Subtract 13 from the product of 14 times 8.

20. Visualize the map of the United States. What are the states that border Illinois?
21. Explain: It is better to have a bad peace than a good war.
22. Explain: A watched pot never boils.
23. Solve: 34 plus 78 minus 19 is:
24. Imagine a circle rotating around it's diameter. What shape do you get?
25. Solve: $2/9$ of 540 is:
26. Visualize your I.D. card. Where is your signature on it, relative to the picture.
27. Explain: He is rich who has few desires.
28. Visualize the map of the United States. Which city is closer to San Francisco, Los Angeles or Salt Lake City.
29. Solve: 79 times 16 is:
30. Explain: Easy come, easy go.

APPENDIX B

Questionnaire on hand preferences

First, state whether you regard yourself as right-handed (R), left-handed (L), or ambidextrous (A) _____.

GENERAL INSTRUCTIONS: The main body of the questionnaire falls into two parts:

PART A is designed to find out which hand you habitually use, or would prefer to use, for certain acts requiring the use of one hand only. It is expected that habitual tendency and preference will, for the most part, coincide, but if there is any case where they differ, you are asked to add a note to that effect.

PART B is designed to find out which hand plays the leading role in certain acts requiring the use of both hands. Indicate in the column provided, R, if you use your right hand, L, if you use your left hand, or E, if you are aware of no special preference in either direction, i.e. if you are just as likely to use one hand as the other. When in doubt, you should try to settle the issue by experimenter, for example, by going through the motions or by trying to visualize yourself performing the action.

A.

1. With which hand do you throw? _____
2. With which hand do you write? _____
3. With which hand do you draw? _____
4. With which hand do you play games such as tennis, squash, and badminton, and paddle ball? _____
5. With which hand do you use a pair of scissors (e.g., for cutting paper)?

6. With which hand do you use a razor? (state type of razor) _____
7. With which hand do you use a comb? (state side on which you part your hair) _____
8. With which hand do you use a toothbrush? _____
9. With which hand do you use a knife for purposes other than eating? (e.g., cutting string, sharpening a pencil) _____
10. With which hand do you use a spoon for eating? _____

11. With which hand do you use a hammer? _____
12. With which hand do you use a screw-driver? _____
- B.
13. With which hand do you use a knife for cutting, in conjunction with a fork? _____
14. On which side of your body do you swing a baseball bat? _____
15. On which hand do you hold the top of a broom when sweeping? _____
16. With which hand do you unscrew the lid of a jar? _____
17. With which hand do you hold the top of a rake when raking? _____
18. With which hand do you strike a match? _____
19. With which hand do you deal cards? _____
20. With which hand do you guide the thread through the eye of a needle, or the needle onto the thread, as the case may be? _____

APPENDIX C

APPENDIX C

A. Masculinity - femininity

1 2 3 4 5

B. Size of male drawing.

1. larger
2. same size
3. smaller

C. Male sexual anatomy

1. no waist
2. no buttocks (if side view)
3. no fly

D. Female sexual anatomy, with clothes on

1. no waist
2. no buttocks (if side view)
3. no breasts

E. Body parts missing

- | | |
|---------------------|---------------------|
| 1. no ears | 2. no eyes |
| 1. no pupil in eyes | 2. no hands or feet |
| 2. no nose | 3. no arms or legs |
| 2. no mouth | |

F. Body vs. head detail

3. adequate head detail and no body detail

G. Body detail, nude

1. no pant line or dress line
2. pant line but no other clothing detail
2. no clothes but no breasts on female
3. no neckline, but other clothing detail
4. no clothes but no genitals

H. Transparency

3. body through arm
4. body through clothing

I. Car vs. human figure

3. adequate car detail vs. little human detail

J. Kinesthetic enlivenment

- 0. definite motion
- 1. weak motion
- 2. no motion

K. Effective use of space

- 1. less than half vertical dimension
- 2. less than $1/3$ of vertical dimension

L. Graphic indicators of ego involvement

- 1. no erasure
- 1. no reinforcement
- 1. no shading
- 1. no emphasis lines

M. Distortion, including illogical placement and poorly delineated parts

- 1. minor
- 2. moderate
- 3. bizarre

N. Car

- 0. Phallic-aggressive
- 1. sedan, ordinary
- 3. feminized

O. Position on paper

- 2. on either side, nearer margin than center

P. Orientation

- 3. back view

APPENDIX D

D M I

DO NOT MAKE ANY MARKS ON THIS BOOKLET

INSTRUCTIONS: Read carefully.

On each of the following pages is a short story. Following each story are four questions with a choice of five answers for each. The four questions relate to the following four kinds of behavior: actual behavior, impulsive behavior in fantasy, thoughts, and feeling. Of the four, it is only actual behavior which is outwardly expressed; the other three take place only in the privacy of one's mind and, therefore, have no external repercussions.

What we want you to do is to select the one answer of the five which you think is the most representative of how you would react, and mark the number corresponding to that answer on the attached answer sheet, with a plus (+) sign. Then select the one answer which you think is least representative of how you would react and mark it with a minus (-) sign. For example, let us assume that out of the five possible answers to a question (e.g., numbers 236, 237, 238, 239, 240), response number 237 is the one you consider most representative of the way you would react, and response number 240 is the least representative. In this case, the corresponding part of the answer sheet would look like this:

236	_____
237	_____ + _____
238	_____
239	_____
240	_____ - _____

Read all the five answers following the question before you make your selections. In marking your answers on the answer sheet, be sure that the number of the statement agrees with the number on the answer sheet.

There are no right or wrong answers here; the only thing that should guide your selections is your own knowledge of yourself. Allow your mind to imagine for a moment that the event described in the story is really happening to you, even though you may never have experienced such an event. When you select your responses remember we are not asking which answer you like most and like least, but rather the answers which would best and least represent the way you would act and feel in these situations.

If you have no questions, please turn to the next page and begin.

c David Ihilevich and Goldine Gleser, 1968

42569

You are waiting for the bus at the edge of the road. The streets are wet and muddy after the previous night's rain. A car sweeps through a puddle in front of you, splashing your clothing with mud.

What would your ACTUAL reaction be?

1. I would note the car's license number so that I could track down that careless driver.
2. I'd wipe myself off with a smile.
3. I'd yell curses after the driver.
4. I would scold myself for not having worn at least a raincoat.
5. I'd shrug it off, after all things like that are unavoidable.

What would you IMPULSIVELY (in fantasy) want to do?

6. Wipe that driver's face in the mud.
7. Report that incompetent driver to the police.
8. Kick myself for standing too close to the edge of the road.
9. Let the driver know that I don't really mind.
10. Let that driver know that bystanders also have rights.

What THOUGHT might occur to you?

11. Why do I always get myself into things like this?
12. To hell with that driver!
13. I'm sure that basically that driver is a nice fellow.
14. One can expect something like this to happen on wet days.
15. I wonder if that fellow splashed me on purpose?

How would you FEEL and why?

16. Satisfied, after all it could have been worse.
17. Depressed, because of my bad luck.
18. Resigned, for you've got to take things as they come.
19. Resentment, because the driver was so thoughtless and inconsiderate.
20. Furious that he got me dirty.

In the army you hold a post of responsibility for the smooth operation of an important department which is constantly under great pressure to meet deadlines. Because things haven't been running as smoothly as they should lately, despite your initiative and resourcefulness, you have planned some changes in personnel for the near future.

Before you do so, however, your superior officer arrives unexpectedly, asks some brusque questions about the work of the department and then tells you that he is relieving you of your post and assigning your assistant to your place.

What would your ACTUAL reaction be?

21. I'd accept my dismissal gracefully, since the superior is only doing his job.
22. I'd blame my superior for having made up his mind against me even before the visit.
23. I'd be thankful for being relieved of such a tough job.
24. I'd look for an opportunity to undercut my assistant.
25. I'd blame myself for not being competent enough.

What would you IMPULSIVELY (in fantasy) want to do?

26. Congratulate my assistant on his promotion.
27. Expose the probable plot between my superior and my assistant to get rid of me.
28. Tell my superior to go to hell.
29. I'd like to kill myself for not having made the necessary changes sooner.
30. I'd like to quit, but one can't do that in the army.

What THOUGHT might occur to you?

31. I wish I could come face to face with my superior in a dark alley.
32. In the army it is essential to have the right man in the right job.
33. There is no doubt that this was just an excuse to get rid of me.
34. I'm really lucky that I only lost my job and not my rank as well.
35. How could I be so dumb!

How would you FEEL and why?

36. Resentful, because he had it in for me.
37. Angry, at my assistant for getting my job.
38. Pleased that nothing worse had happened.
39. Upset that I am a failure.
40. Resigned, after all, one must be satisfied with having done the best one can.

You are living with your aunt and uncle, who are helping to put you through college. They have taken care of you since your parents were killed in an automobile accident when you were in your early teens. On a night that you have a late date with your "steady," there is a heavy storm outside. Your aunt and uncle insist that you call and cancel your date because of the weather and the late hour. You are about to disregard their wishes and go out the door when your uncle says in a commanding tone of voice, "Your aunt and I have said that you can't go, and that is that."

What would your ACTUAL reaction be?

- 41. I would do as my uncle said because he has always wanted what was best for me.
- 42. I'd tell them, "I always knew you didn't want me to grow up."
- 43. I would cancel my date, since one must keep peace in the family.
- 44. I'd tell them it was none of their business and go out anyway.
- 45. I'd agree to remain at home and apologize for having upset them.

What would you IMPULSIVELY (in fantasy) want to do?

- 46. Knock my head against the wall.
- 47. Tell them to stop ruining my life.
- 48. Thank them for being so concerned with my welfare.
- 49. Leave, slamming the door in their faces.
- 50. Keep my engagement, rain or shine.

What THOUGHT might occur to you?

- 51. Why don't they shut up and let me alone?
- 52. They never have really cared about me.
- 53. They are so good to me, I should follow their advice without question.
- 54. You can't take without giving something in return.
- 55. It's all my own fault for planning such a late date.

How would you FEEL and why?

- 56. Annoyed, that they think I am a baby.
- 57. Miserable, because there is nothing much I can do.
- 58. Grateful for their concern.
- 59. Resigned, after all you can't get your own way every time.
- 60. Furious, because they interfere with my business.

You are extremely eager to do well in sports, but of all those at which you have tried your hand, only in basketball have you been able to achieve a measure of success. However, until now, whenever you have applied for membership in a team or sports club, although the judges have appeared impressed with your initial performance, their final decision has always been the same -- they tell you that you've just missed making the grade.

One afternoon your car breaks down and you are forced to take a bus home during the rush hour. As you stand in the crowded bus, you hear your wife's voice. She is seated together with the manager of the team to which you have just applied. You overhear the manager tell her, "Your husband has a nice style of play, we're thinking of asking him to join our club." Then you hear your wife laugh and reply, "Take it from me, he hasn't got what it takes in the long run."

What would your ACTUAL reaction be?

61. I'd tell her off when we got home.
62. I would greet her affectionately, as usual, when I arrived home because I know she really appreciates me.
63. I'd be quiet and withdrawn for the rest of the evening, not mentioning what I had overheard.
64. I'd take it in my stride, for women's talk is never taken seriously.
65. I'd tell her that I wasn't surprised by what I'd overheard because I had always thought she was two-faced.

What would you IMPULSIVELY (in fantasy) want to do?

66. Tell my wife that I overheard her, and was proud of her frankness.
67. Break her neck.
68. Tell her that men expect loyalty from their wives.
69. Let her know that I'd always suspected her of talking behind my back.
70. Stop off somewhere so I wouldn't have to face her.

What THOUGHT might occur to you?

71. I bet she talks about me that way to everybody.
72. What could I have done that makes her feel this way about me?
73. I'm sure she's only kidding.
74. One shouldn't be bothered by such talk.
75. She needs to be taught a lesson.

How would you FEEL and why?

76. Worthless, because I'd realize what a failure I was as a husband.
77. Furious at her for speaking about me that way.
78. Unconcerned, because women are like that.
79. Outraged, because her gossip has probably contributed to most of my past failures.
80. Serene, because I know the manager will realize that she doesn't know what she is saying.

At your job you want to impress upon your foreman the fact that you are more skilled than your fellow workers. You are eagerly awaiting an opportunity to prove yourself.

One day a new machine is brought into the factory. The foreman calls all the workers together and asks whether anyone knows how to operate it. You sense the chance you have been waiting for, so you tell the foreman that you have worked with a similar machine and would like a chance to try your hand at this one. But he refuses, saying, "Sorry, we can't take a chance," and calls a veteran worker to come over and try to get the machine started.

No sooner has the veteran worker pulled the starter, than sparks begin to fly and the machine grinds to a halt. At this point the foreman calls and asks you if you still want a chance to try and start the machine.

What would your ACTUAL reaction be?

81. I'd say that I doubt if I could do it either.
82. I'd tell my fellow workers that the foreman wants to hold me responsible for the machine's crack-up.
83. I'd tell the foreman that I appreciated his giving me the chance.
84. I'd decline, cursing the foreman under my breath.
85. I'd tell the foreman that I would try because one must never back down from a challenge.

What would you IMPULSIVELY (in fantasy) want to do?

86. Tell that foreman that he'll not make me the scapegoat for a broken machine.
87. Thank the foreman for not letting me try it first.
88. Tell the foreman that he should try to start a broken machine himself.
89. Point out to the foreman that experience doesn't guarantee success.
90. Kick myself for talking myself into an unbearable situation.

What THOUGHT might occur to you?

91. That foreman is really a pretty decent guy.
92. Damn him and his blasted machine.
93. This foreman is out to get me.
94. Machines are not always reliable.
95. How could I be so stupid as to even think of operating that machine.

How would you FEEL and why?

96. Indifferent, because when one's abilities are not appreciated one's enthusiasm is lost.
97. Angry that I was asked to do an impossible job.
98. Glad that I didn't wreck the machine.
99. Annoyed that I was purposely put on the spot.
100. Disgusted with myself because I risked making a fool of myself.

On your way to catch a train, you are hurrying through a narrow street lined with tall buildings. Suddenly a piece of masonry comes crashing down from a roof where repairmen are working. A piece of brick bounces off the sidewalk, bruising you in the leg.

What would your ACTUAL reaction be?

- 101. I'd tell them I ought to sue them.
- 102. I'd curse myself for having such bad luck.
- 103. I'd hurry on, for one should not permit oneself to be diverted from one's plans.
- 104. I'd continue on my way, grateful that nothing worse had happened.
- 105. I'd try to discover who the negligent persons are.

What would you IMPULSIVELY (in fantasy) want to do?

- 106. Remind the men of their obligation to public safety.
- 107. Assure those men that nothing serious had happened.
- 108. Give them a piece of my mind.
- 109. Kick myself for not having watched where I was going.
- 110. See to it that those careless workers lose their job.

What THOUGHT might occur to you?

- 111. Those men don't know how to do their job right.
- 112. I'm lucky that I wasn't seriously hurt.
- 113. Damn those men!
- 114. Why do these things always happen to me?
- 115. One can't be too careful these days.

How would you FEEL and why?

- 116. Angry, because I was hurt.
- 117. Furious, because I could have been killed by their negligence.
- 118. Calm, for one must practice self control.
- 119. Upset by my bad luck.
- 120. Thankful that I'd gotten away with no more than a scratch.

Driving through town in the late afternoon, you arrive at one of the busiest intersections. Although the light has changed in your favor, you see that pedestrians are not obeying the "wait" sign and are blocking your path. You attempt to complete your turn with due caution before the light turns against you. As you complete the turn, a traffic policeman orders you over to the side and charges you with violating the pedestrian's right-of-way. You explain that you had taken the only possible course of action, but the policeman proceeds to give you a ticket nevertheless.

What would your ACTUAL reaction be?

- 121. I'd blame myself for having been careless.
- 122. I'd go to court and bring counter charges against the policeman.
- 123. I'd ask the policeman why he has such a grudge against drivers.
- 124. I'd try to cooperate with the policeman, who, after all, is a good guy.
- 125. I'd take the ticket without question, since the policeman was just doing his duty.

What would you IMPULSIVELY (in fantasy) want to do?

- 126. Tell the policeman he can't use his position to push me around.
- 127. Kick myself for not having waited for the next green light.
- 128. Thank the policeman for saving me from a possible accident.
- 129. Stand up for my rights as a matter of principle.
- 130. Slam the door in his face and drive off.

What THOUGHT might occur to you?

- 131. He's doing the right thing, actually I ought to thank him for teaching me an important lesson.
- 132. Each man must carry out his job as he sees it.
- 133. This guy ought to go back to pounding a beat.
- 134. How could I be so stupid!
- 135. I bet he gets a kick out of giving tickets to people.

How would you FEEL and why?

- 136. Boiling anger, because he's making trouble for me.
- 137. Resentment, because he's picking on me.
- 138. Ashamed, because I was negligent.
- 139. Indifferent, after all, this sort of thing happens all the time.
- 140. Relieved, because I'd been prevented from getting into worse trouble.

You return home after spending two years in the army. At the time you joined you had had a choice between enlistment and a position in your father's business. You preferred the army despite parental advice. Now that you are home again, you find that your range of opportunity hasn't widened appreciably. You can either join your father's business or get a job as an untrained worker. You would like to open a coffee shop, but you lack the capital necessary to carry out such an enterprise. After a great deal of hesitation, you decide to ask your father to put up the money. After listening to your proposal, he reminds you that he had wanted you to take a job with his firm instead of joining the army. Then he tells you, "I'm not prepared to throw away my hard-earned money on your crazy schemes. It's time you started helping me in my business."

What would your ACTUAL reaction be?

- 141. I'd accept his offer, since everyone depends on everyone else in this world.
- 142. I would admit to him that I guess I am a bad risk.
- 143. I'd tell him off in no uncertain terms.
- 144. I'd tell him that I'd always suspected that he had a grudge against me.
- 145. I'd thank him for holding a job open for me all these years.

How would you IMPULSIVELY (in fantasy) want to react?

- 146. Go to work for him and make him happy.
- 147. Give up trying and end it all.
- 148. Take my father's offer since offers like that don't grow on trees.
- 149. Let him know what a miser everyone thinks he is.
- 150. Tell him that I wouldn't work for him if he were the last man on earth.

What THOUGHT might occur to you?

- 151. He'll get what's coming to him one day.
- 152. Family considerations can't enter into business decisions.
- 153. Why was I so stupid as to bring the subject up.
- 154. I must admit that my father is acting for my own good.
- 155. This proves what I've suspected all along, that my father has never believed in me.

How would you FEEL and why?

- 156. Angry, because he doesn't want me to succeed on my own.
- 157. Grateful for his offer of a job with a future.
- 158. Resentful that he is sabotaging my future.
- 159. Resigned, since you can't have everything you own way all the time.
- 160. Hopeless, because I couldn't get my father's support.

One afternoon while you and a close friend are cramming for exams, your girlfriend drops by unexpectedly. Although you and she have been going steady for over a year, you have not been able to see much of each other lately; therefore you are very happy she has come. You invite her in and introduce her to your friend and the three of you spend a pleasant hour together.

A few days later you ring her up and invite her to go out on the town to celebrate the end of exam week, but she tells you that she has come down with a bad cold and thinks that it is best for her not to leave the house. After dinner you feel sort of let down and decide to go to the movies by yourself.

Coming out of the movie theater, you come upon your pal arm-in-arm with your girlfriend.

What would your ACTUAL reaction be?

- 161. I'd tell my girl she could have told me it was over instead of cheating behind my back.
- 162. I'd greet them politely as a civilized person should.
- 163. I'd make sure they both knew I wanted nothing more to do with them.
- 164. I'd tell them that I am delighted that they have become friends.
- 165. I'd duck out of sight to avoid facing them.

What would you IMPULSIVELY (in fantasy) want to do?

- 166. Go home and have a good cry.
- 167. Knock him out and grab the girl away.
- 168. Show them that I really don't mind their being together.
- 169. Tell them if that's the way they want it they can have each other.
- 170. Indicate that it takes more than one battle to win a war.

What THOUGHT might occur to you?

- 171. This wouldn't have happened if I had been more attentive to her.
- 172. All's fair in love and war.
- 173. They certainly are a pair of double-crossers.
- 174. I hope they get what they deserve.
- 175. I was getting tired of her, anyhow.

How would you FEEL and why?

- 176. Relieved that I was free again.
- 177. Upset, because I shouldn't have been so trusting.
- 178. Resigned, because you've got to take life as it comes.
- 179. Disgusted, because of their dishonesty.
- 180. Furious, because they behaved as they did.

You and an old school friend are competing for a newly vacated executive position in the firm where you work. Although both your chances seem about equal, your friend has had more opportunity to show resourcefulness in critical situations. Recently, however, you have successfully pushed through some excellent deals. In spite of this, the board of directors decides to promote your friend rather than you.

What would your ACTUAL reaction be?

- 181. I'd try to find out which director "blackballed" me.
- 182. I'd continue to do my duty as a responsible person must.
- 183. I'd accept the outcome as proof that I'm not executive material.
- 184. I'd protest the decision of the board most vehemently.
- 185. I'd congratulate my friend on the promotion.

What would you IMPULSIVELY (in fantasy) want to do?

- 186. Ask the board to reconsider, since a mistake would be detrimental to the company.
- 187. Kick myself for having aspired to a job for which I wasn't qualified.
- 188. Show the board how biased they've been in their unjust treatment of me.
- 189. Help my friend make a success at the new job.
- 190. Break the neck of each and every member of the board of directors.

What THOUGHT might occur to you?

- 191. I guess I just don't have what it takes.
- 192. I probably wouldn't enjoy an executive position as much as the one I have now.
- 193. There certainly is something fishy about the board's decision.
- 194. One must take a blow such as this in one's stride.
- 195. Damn that board of directors.

How would you FEEL and why?

- 196. Happy that I still have the job I am used to.
- 197. Upset because my inadequacy was made public.
- 198. Furious at the directors because of their treatment of me.
- 199. Resigned, for that's the way it goes in the business world.
- 200. Angry, because I have been the victim of an unjust decision.

APPENDIX E

APPENDIX E

MINNESOTA SPATIAL RELATIONS TEST

NATURE OF THE TEST: The Minnesota Spatial Relations Test, consisting of four form boards containing 58 cut-outs each, is designed to measure speed and accuracy in discriminating odd sizes and shapes. This test is relatively independent of verbal intelligence and is a reasonable valid test of mechanical ability. There is evidence that performance in the Spatial Relations Test is relatively free from the influence of previous mechanical experience.

DIRECTIONS FOR ADMINISTERING: This test can be used only as an individual test. The four form boards are given in the following order: Board A, Board B, Board C, and Board D. The test is so constructed that one set of blocks is used for Boards A and B, and another set for Boards C and D.

Board A is placed on the table, directly in front of the subject and flush with the edge of the table. The board is arranged so that the edge labeled A is the one farthest from the subject. The blocks are placed just beyond the empty board in the positions they have in Board B. This arrangement is most easily secured by placing Board B directly beyond A (i.e., from the standpoint of the subject), arranging the blocks in Board B and picking up Board B, leaving the blocks on the table.

The following directions are read to the subject: "Put these blocks in their proper places on this board. They fit easily; do not force any of them. Use one hand. You may have to turn some of the blocks around, but do not turn any of them over. Keep the green side of the blocks up. Go as fast as you can and get all of the blocks in the board. Ready! Go!"

When the subject has placed the blocks in Board A, this board is pulled back from the subject and the board removed in the manner described above. Board B is then presented. Boards C and D are presented in the same manner as Boards A and B. In every case, the edge of the board which bears the distinguishing letter must be away from the subject and toward the examiner.

Trials. One trial is given for each board. A rest period of 30 seconds between trials is recommended.

DIRECTIONS FOR SCORING: The score is the sum of the time in seconds taken to put the blocks in the holes in each of the four boards.

APPENDIX F

APPENDIX F
SYMPTOM QUESTIONNAIRE

This questionnaire consists of some numbered statements. Read each statement carefully. If it is true as applied to you, mark T on the answer sheet and if false mark F. Please answer all statements as accurately as you can.

1. I do not often feel bothered.
2. I have never been paralyzed or had any unusual weakness of any muscle.
3. I have never had asthma.
4. I go to sleep without thoughts or ideas that make me feel guilty.
5. I frequently notice my hand shakes when I try to do something.
6. At times I am on the brink of having a feeling or impulse but am at a loss to know what it is.
7. I hardly ever feel pain in the back of my neck.
8. I have pains in the heart or chest.
9. When something goes wrong, I generally feel that I am the blame.
10. I never wake up at night frightened.
11. Sometimes I feel as if I must injure either myself or someone else.
12. I am never ashamed of my thoughts and of the things that I do.
13. I am bothered by a persistent cough.
14. Parts of my body often have feelings like burning, tingling, or crawling.
15. I often notice that my body is tense and I have difficulty in relaxing.
16. Once a week or oftener I feel hot suddenly all over without apparent cause.
17. There have been times when I felt like jumping off when on a high place.
18. I often feel as if things were not real.
19. At times I feel as if something dreadful is about to happen.
20. I am often sick to my stomach.
21. I am not usually afraid of things or people which I know cannot hurt me.

22. I practically never blush.
23. Sometimes I have strange, unnatural feelings which are hard to describe.
24. At times I have a strong urge to do something harmful or shocking.
25. At times when things are going particularly well for me, I become suddenly depressed.
26. Often, even though everything is going fine for me, I feel that I don't care about anything.
27. Has a doctor ever said that you had stomach ulcers?
28. There are very few periods when I am on edge.
29. There are persons who envy my thoughts and ideas and would like to call them their own.
30. I have never had attacks in which I could not control my movements or speech but in which I knew what was going on around me.
31. I hardly ever notice my heart pounding.
32. There are some people who seem to have it in for me.
33. Sometimes without any reason or even when things are going wrong, I feel excitedly happy, "on top of the world."
34. Even though I know I do not have arthritis or rheumatism, I often have soreness in some of my joints.
35. I deserve severe punishment for my sins.
36. There are never times when I lose my bearings and am at a loss to know where I am.
37. At times my eyelid twitches for no accountable reason.
38. I feel weak all over much of the time.
39. My thoughts have raced ahead faster than I could speak them.
40. My mind seems to be divided into two parts which appear to be struggling with one another.
41. Sometimes I have a loss of feeling of numbness in a part of my body.
42. Sometimes I break out in a sweat even though it is not hot.
43. There have been times in my life when I felt panic or terror without any accountable reason.

44. I never had a fainting spell.
45. My sleep is fitful and disturbed.
46. I sometimes develop hives or rash for no apparent reason.
47. I love my parents dearly and wish that I could live up to their expectations.
48. I am seldom short of breath.
49. I do not suffer from frequent, severe headaches.
50. I seldom or never have dizzy spells.
51. In the presence of friends and familiar surroundings, I sometimes feel as if the people around me were strangers and the setting unfamiliar.
52. My mouth feels dry much of the time.
53. I have noticed on occasion that parts of my body have felt detached as if they were not a part of me.
54. There are periods during which I have abdominal cramps for no apparent reason.
55. I often feel irritated or annoyed without any particular reason for it.
56. At times I have problems with either constipation or diarrhea.
57. I feel anxious almost all the time.
58. I never feel that all my friends and loved ones will abandon me.
59. I have periods of great restlessness.
60. I am bothered by acid stomach several times a week.
61. I have never had strange and peculiar thoughts.
62. At times I become depressed and think that I am no good at all.
63. I have little or no trouble with my muscles twitching or jumping.
64. I hardly ever feel like smashing things.
65. I am easily frightened.
66. Are you bothered by severe itching?
67. I hardly ever become upset without knowing why.

68. There are times that I suddenly become aware that I have been gritting my teeth.
69. At times I feel I lose control over my mind.
70. Has a doctor ever said your blood pressure was too high or too low?
71. I never have had blackouts.
72. I feel frustrated much of the time.
73. I often notice that I am fidgety.
74. During sad moments, I never find myself laughing out loud or having the urge to do so.
75. I never get the jitters.
76. I sometimes feel that I am about to go to pieces.
77. Are you often troubled with bad spells of sneezing?
78. There are times when I don't have any emotions or feelings at all, even though I wish I had.
79. I am aware of the presence of certain thoughts or ideas which I am unable to grasp.
80. I am not bothered by people outside, on buses, in stores, etc., watching me.

APPENDIX G

APPENDIX G

THE STRONG VOCATIONAL INTEREST BLANK

Table 9. Means of the Three Group of Ss on Each of the Strong Vocational Interest Blank Basic Interest Scales.

Scale	Left Movers N = 13	Right Movers N = 8	Bidirectionals
Public Speaking	57.61	51.13	48.25
Law/Politics	56.31	54.63	55.63
Business Management	44.15	50.13	44.75
Sales	52.46	52.63	44.50
Merchandising	47.46	51.50	45.74
Office Practices	46.38	48.88	45.75
Military Activities	42.31	50.38	45.13
Technical Supervision	43.85	45.50	44.88
Mathematics	45.08	43.00	42.63
Science	54.62	47.38	46.38
Mechanical	46.08	50.00	46.13
Nature	53.51	44.63	48.50
Agriculture	54.00	51.38	51.13
Adventure	53.54	64.63	61.50
Recreational Leadership	52.31	54.00	49.13
Medical Service	53.23	52.25	48.88
Social Service	60.23	54.63	58.88
Religious Activities	49.46	44.13	42.00
Teaching	57.08	46.88	51.50
Music	57.15	52.75	53.50
Art	58.77	52.00	54.38
Writing	58.08	53.25	54.75

Table 10. Analysis of Variance of Three Groups of Ss (Left-Movers, Right-Movers, and Bidirectionals) on the Twenty Two SVIB Scores.

Source	SS	df	MS	F
Between Groups (LM, RM, BD)	531	2	266	.59
Between <u>Ss</u> Within Groups	11787	26	453	
Total Between <u>Ss</u>	12318	28		
Between Measurement (22 SVIB Variables)	12948	21	617	7.61*
Interaction Group X Measurements	4019	42	96	
Interaction <u>Ss</u> X Measurements	44039	546	81	1.19
Total Within <u>Ss</u>	61006	609		

* $p < .01$

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