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The present study was undertaken to determine the relation of the amplitude of occipital lobe evoked cortical potentials to handedness, eye dominance , and visual field.

Twenty-four naive female undergraduates served as subjects. Potentials evoked by a small flashing red stimulus presented alternately to each eye were recorded from the right and left occipital lobes.

Significant relations were shown between evoked potential amplitude and visual field, lobe, field x lobe interaction, eye dominance,and alobe x eyedness interaction. These results generally demonstrated a greater right than left lobe response.

The results were discussed in terms of alternative viewpoints: 1) a lack of specific hemispheric dominance; 2) the fixed hemispheric dominance theory.

The Evoked Cortical Potential
And Its Relation To Eye Dominance,
Handedness, And Visual Field

by

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APPROVAL SHEET

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Handedness and Ocular Dominance

Over the years numerous investigators have been concerned with the relationship of the left and right sides of the body. Studies have varied in their focus ranging from sweeping analyses of laterality to more fractionated inquiries of sidedness. The former type of inquiry involved the extent and direction of preference in a number of paired body structures, while the latter type of study is concerned with the preference for one of a pair of body parts, e.g. handedness or eye dominance. Various ideas and hypotheses have been offered as potential explanations for the observed phenomena, most of which have been disproven by scientific investigation.

A Darwinian approach to handedness is the primitive warfare theory. The high incidence of present day right handedness is said to be a result of the use, earlier in man's history, of the left hand to hold a shield while the right wielded a sword. With the shield thus covering the heart there were fewer fatal blows struck, and hence over a few thousand years of primitive warfare, left handedness was reduced in frequency by natural selection.

Another interesting handedness theory concerns the influence of the nursing position. Briefly stated, this theory argues that a right handed mother will hold her child so that its head will be on her right side. This of course leaves the child's right hand and arm free, thereby allowing it to become better developed (Schiller, 1935).

In 1934 Wile proposed a theory of heliocentrism based on the rotational force of the earth and the position of the sun. He felt that an interaction of these factors determined eye dominance, which itself was responsible for the preference in handedness.

Another theory, referred to as the training theory, presupposes that perfect symmetry of lateralization is present at birth, and that preferential sidedness for all paired body structures occurs as a result of strong exogenous influence. Although it is generally agreed that environment does exert some mediacy in the determination of sidedness and laterality, it is thought unreasonable to assume that it is the sole factor, especially in view of the findings of Peterson (1934) and other investigators (Wentworth, 1938 and 1942) that, at least in the rat, spontaneous preferential sidedness does occur. Thus, as Rife (1951) has pointed out, it seems that in the mature organism both environment and underlying organic predispositions play important roles in the determination of sidedness.

Parson (1924) has devised a theory of ocular dominance and handedness in which he feels that the dominant eye is always the sighting eye, whether vision is monocular or binocular. He believes that whenever it is possible, the homolateral hand also becomes functionally dominant. However, this theory has been attacked on the basis of experimental findings that handedness and eye dominance are independent and unrelated (Peterson, 1934; Merrell, 1957).

Cerebral Dominance and Interhemispheric Communication

K.U. Smith (1945, pp 39-40) has summarized the general theory of cerebral dominance in postulate form: "1) One side of the cerebrum controls the opposite side of the body. 2) The activity of the two sides of the body are mirrored in structure and functions, hence the two hemispheres have corresponding structural and functional characteristics. 3) In unilateral and bilateral performance the suppression of the non-dominant side of the body is brought about by suppression of function in the subordinate hemisphere (presumably via the corpus callosum. 4) Sidedness is normally a unitary trait, due to the dominance of one hemisphere, but it may be modified by training. 5) Incoordination of activity, especially with respect to language functions, results from the lack of definite cerebral dominance and sidedness."

Postulates 2 and 3 however, have not attained general acceptance. Von Bonin (1962) has demonstrated that the two hemispheres are structurally identical, but work by Milner (1958) and Penfield and Roberts (1959) has shown that functional asymmetries (e.g. speech predominantly localized in left hemisphere) do exist.

Concerning the third postulate that subordination of the non-dominant body side occurs as a result of subordination of the non-dominant hemisphere by the dominant one via the corpus callosum, Smith (1942) pointed out that after partial or complete sectioning of the corpus callosum, and complete sectioning of the anterior, and hippocampal commissures there was no significant alteration in the individual's bilateral motor organization. He concluded that, "the commissural pathways connecting homologous regions of the pallium are of little or no significance in determining the bilateral balances of function critical to the manifestation of dominance." He feels that subcortical levels are basic to laterality.

Concerning this third postulate then is the role of the corpus callosum, the major mass of fiber tracts passing between the cortices of the two cerebral hemispheres. Numerous studies have been executed over the years to determine how the corpus callosum and other commissural fibers in the brain are related to hemispheric functioning.

One of the foremost types of investigations in this area is the split-brain study in which some or all commissural pathways are severed, and the ensuing behavior, whether peripheral or central, is studied.

In separate studies Myers (1955) Sperry, et al, (1956), Schrier and Sperry (1958), and Meikle and Sechzer (1960) demonstrated that a monocularly learned pattern discrimination will transfer readily in cats which have had the optic chiasma sectioned. But, if in addition the corpus callosum is sectioned, performance falls to a near chance level. Sperry, et al, (1956) interpreted the findings to indicate that visual learning and memory proceed independently in the right and left hemispheres of the cat brain.

Myers and Sperry (1958) reported that, in the cat, interhemispheric communication via the corpus callosum was sufficiently developed to establish independent memory traces in the opposite hemisphere if the problem involved relatively simple integrations. Per cent chance of failure increased as a function of increasing complexity.

Meikle and Sechzer (1960) besides demonstrating that callosum sectioned cats were unable to transfer pattern discriminations, reported that an interocular transfer of brightness discrimination will occur if the stimulus is of a suprathreshold intensity. This suggested to them that the corpus callosum may be essential only for the transfer of near threshold brightness discriminations, while an extracallosal pathway might mediate suprathreshold discriminations. Sechzer (1963), in studying cats, reasoned that if an extracallosal pathway exists for brightness discriminations, it is also possible that other non-callosal pathways could conceivably mediate interocular transfer of pattern discriminations. She noted that prior to making her study, all work in this area had been done using food-approach motivation. She thus suggested the possibility that shock-avoidance motivation, involving the pain pathways, might bring in extracallosal mechanisms. The results of her study supported this hypothesis, and thus indicated the possibility of subcortical commissures effecting the transfer in much the same way as the transfer of a suprathreshold brightness discrimination seems to occur.

Sheridan (1965) conducted a study dealing with interocular transfer in albino rats. He found that callosum sectioned rats showed less interocular transfer of a brightness discrimination than did split-brain cats. He said that a possible explanation for this contrasting performance might be attributable to amount of training. He noted that his "overtrained"animals received somewhat less practice than the trained cats in the Meikle and Sechzer (1960) study.

In another study dealing with split-brain cats, Voneida (1963) demonstrated that if the optic chiasm, corpus callosum, mass intermedia, hippocampal, habenular, anterior, posterior, and superior collicular commissures are sectioned prior to training, there will occur no transmission of the visual signal from the side of input to the opposite hemisphere. However, if all the above pathways are severed, except the superior colliculus, transfer will occur. Voneida also noted that a pronounced effect on performance occurred when lesions were made in the left as compared to the right cortex. This led him to speculate, as have the previous authors, about subcortical structures which would permit the system to function when input was restricted to the right brain half.

Electroencephalographic Studies. The electroencephalogram has been used extensively in the study of hemispheric function. Knott and Tjossem (1943) found that, as a group, stutterers tended to have a higher per cent time alpha present in the left than in the right occipital lobe during silence, while for non-stutterers a smaller per cent time alpha occurred in the left than in the right occipital area. Since the speech area is predominantly localized in the left hemisphere, the authors felt that their study indicated a "pathophysiological subsoil" in the speech dominant hemisphere. Also published in that year was a study by Strauss, et al (1943) who reported that bilateral differences in electrical activity recorded from homologous cerebral areas was relatively small with a slight tendency for increased alpha activity in the non-dominant hemisphere. They concluded that the lower occurrence of alpha activity in the left parietal lobe implicated it as the dominant lobe. These results contrast with those of Lindsley (1940) who reported that neither phase relations of alpha nor amount of unilateral blocking selectively differentiated the dominant from the non-dominant hemisphere.

The relation of occipital alpha activity and laterality was the topic of a study by Glanville and Antonitis (1955). They reported finding no significant relation between alpha EEG activity and sidedness. However, in a later study by Lansing and Thomas (1964) involving photic driving (Walker, et al, 1944) and its relation to laterality, it was found that for most subjects driving was greater over the left hemisphere regardless of mode or frequency of stimulation.

Berlucchi (1966) and Liske, et al, (1967) conducted EEG studies on cats and humans respectively. Both studies found a high degree of EEG synchrony between homologous cerebral areas in their respective subjects. The authors of the latter study qualified their statement by saying that essential synchrony occurred when waves were averaged over a minute or two. They also reported that a surprising degree of right sided alpha phase leading was seen (more so than in left sided alpha phase leading), and interpreted this as support for the general dominance theory that dominance for alpha rhythm more often resides in the right hemisphere of normal humans, a finding supported by other investigators (Knott and Tjossem, 1943; Strauss, et al, 1943; Freedman, 1963). In another study dealing with photic driving in humans and its relation to laterality, Freedman (1963) found that no matter which hemisphere was stimulated at 8 flashes/sec. the right hemisphere always produced more 8 cps. waves than the left. He suggested that this lack of symmetry of unilateral driving supports the classical interpretation of cerebral dominance.

Giannitrapani, et al (1966) studying laterality preference and EEG phase activity found no demonstration of phase leading activity contralateral to the laterality preference. In fact, their data implied a change in the functional role of the hemispheres asleep and awake. They concluded that theories of dominance should be avoided, and that more attention should be given to a description of behavioral events at this stage of our knowledge.

A study conducted by Mulholland and Evans (1966) underscored the need for caution in interpreting results of the type of investigations mentioned above. They reported that subjects could control their alpha activity by voluntary regulations of oculomotor functions. They therefore feel that modification of the EEG does not necessarily accurately reflect the level of arousal of a subject, especially since noting that in no previous studies was oculomotor function ever excluded as the cause of the EEG phenomenon supposedly associated with attention.

The Evoked Potential. In 1954 Dawson published a paper in which he described a technique for averaging cerebral action potentials. This new method allowed investigators to obtain clear pictures of the form of sensory responses which had hitherto been obscured by relatively large spontaneous brain potentials. The new technique entailed manually measuring the height of several different ordinates above an arbitrary baseline for each of a number of single oscillograms, and then adding and averaging the corresponding ordinates from all records. His work and that of others (Barlow and Brazier, 1954) led to the development of electronic averaging devices which could extract these evoked potentials from ongoing background activity. Since that time numerous investigators have studied the relation of the evoked cortical potential to a variety of stimulus variables in an attempt to assess its physiological and behavioral significance.

Confusion about waveform has apparently arisen because of differences in recording procedures, electrode placement, and stimulus conditions. However, the type of potential of interest to the present author is described as a sinusoidal oscillation of 8-12 cps., which is evoked by brief light flashes subtending a visual angle of one degree. A preliminary positive component generally appears between 80-120 msec., and is then followed by alternating negative and positive waves of approximately 100 msec. duration for periods of up to 500 msec. (White and Eason, 1966; Eason and White, 1967). Dustman and Beck (1963) have noted that the components of an individual's evoked cortical potential, at least during the first 300 msec. of the response, were highly reliable and closely resembled each other over long periods of time.

In some earlier work Curtis (1940a) noted that the largest and most readily detected potentials are those obtained when the stimulus and recording electrodes are placed on symmetrically situated parts of the two cortices. However, he could find no indication of strength of callosal connection as noted by size of the evoked potential. Regarding the corpus callosum, he also reported (1940b) that the ascending fibers of the callosum produced the surface positive component while the descending internuncial fibers produced the surface negative component.

The evoked potential has been shown to vary as a function of a number of different variables including apparent brightness and duration of the stimulus (Cobb and Dawson, 1960), flash intensity and wavelength (Cobb and Dawson, 1960; Shipley, _et_ _al_, 1965; White and Eason, 1966), and attention (Haider, _et_ _al_, 1964; Spong, _et_ _al_, 1965; Lehmann and Fender, 1967). In this regard Eason, _et_ _al_ (1964) demonstrated that both the amplitude and latency of response varied as a function of activation. In a later study, Eason and White (1967) and Eason, _et_ _al_ (1967b) showed that the response of the right lobe to flashes on the nasal retina of the right eye was smaller than a right lobe response when flashes were directed to the temporal retina of the right eye. They concluded that the larger temporally stimulated right eye right lobe response was a result of direction of those impulses via the classical visual pathways rather than the cerebral commissures. This same type of mechanism was thought to account for the results of a later study by Eason, et al (1967a) which showed a greater primary lobe response (impulses arrive by way of the classical pathways) at all times coupled with a later reaction of the secondary lobe (impulses arrive via the cerebral commissures).

Lehmann and Fender (1967) found that by increasing the amount of structure in a steadily illuminated target presented to one eye, the amplitude of a potential evoked by a flashing light presented to the other eye would decrease. These authors felt that the increased complexity of the "other eye" stimulation absorbed more cortical capacity and left less to participate in the evoked response. Bartlett, et al (1968) reported in their study that larger amplitude evoked potentials were produced when ganzfeld stimulation was binocular rather than monocular. The results were interpreted as supporting a binocular summation hypothesis based on the idea of a common sensory path for the two eyes central to the optic chiasma.

A study by Eason, Groves, White, and Oden (1967b) investigated the relation of the evoked potential to visual field and handedness. Their results showed that for left handed subjects evoked potentials of greater amplitude were obtained from the right lobe when primary than from the left when primary. No consistent differences were demonstrated for the right handed subjects. Handedness however, was not able to be predicted from evoked potential amplitude due to overlap in the relative magnitude of response obtained from the two lobes of the two handedness groups.

Purpose. The studies cited above indicate that numerous investigations have been done concerning the two sides of the body and their relation to hemispheric function. The latter mentioned research demonstrates that the evoked cortical potential can be utilized as a reliable indicant of various levels of this function. It was with this thought in mind that the present author hoped to demonstrate an amplitude relation of the evoked potential to handedness and visual field in support of previous findings. In addition, it was hoped that sighting dominance would reflect a relation to the evoked potential as well.

CHAPTER II

METHOD

Subjects. Twenty four female undergraduates enrolled in introductory psychology courses at the University of North Carolina at Greensboro served subjects.

Experimental Design. The total experiment consisted of three separate phases. In the first phase, the experimenter (hereafter referred to as E) had all students in introductory psychology sections take a simple pencil and paper "handedness" test en masse. The test was a questionairre comprised of fourteen items relating to handedness, which the students were requested to answer as best they could (Fig. 1). Nine of the questions required "dominant hand" responses, while five required "non-dominant" answers. These five "reversals" were helpful in deciding if the students took the test in a serious manner since they required additional thought before being answered. Thus, some assurance was provided that the students were not responding capriciously.

After scoring the questionairres, E requested all "left handers" and an equal number of randomly selected "right handers" to participate in the second phase of the experiment. This phase was itself, composed of two parts. First, E determined the visual acuity of the subjects without, and (if needed) with correction by means of a Bausch & Lomb Modified Ortho-Rater, Cat. No. 71-21-31-02. This was done to determine if the subjects would be able to see the visual stimulus used in phase three of the experiment. It should be noted that all subjects used in phase three were, in fact, able to see the visual stimulus clearly.

Answer the following questions carefully. Imagine yourself performing the activity described before answering each question. Answer by drawing a circle around the appropriate set of letters at the left of each question.

Ra if the right hand is used always
Rm if the right hand is used most of the time
E if both hands are used equally often
Lm if the left hand is used most of the time
La if the left hand is used always
X if you do not know which hand is used

1. Ra Rm E Lm La X is used to write with
2. Ra Rm E Lm La X to hold nail when hammering
3. Ra Rm E Lm La X to throw a ball
4. Ra Rm E Lm La X to hold bottle when removing top
5. Ra Rm E Lm La X is used to draw with
6. Ra Rm E Lm La X to hold potato when peeling
7. Ra Rm E Lm La X to hold pitcher when pouring out of it
8. Ra Rm E Lm La X to hold scissors when cutting
9. Ra Rm E Lm La X to hold the knife when cutting food
10. Ra Rm E Lm La X to hold needle when threading
11. Ra Rm E Lm La X to hold drinking glass when drinking
12. Ra Rm E Lm La X to hold tooth brush when brushing teeth
13. Ra Rm E Lm La X to hold dish when wiping
14. Ra Rm E Lm La X. holds tennis racket when playing

Figure 1. Handedness Questionairre

The second part of phase two of the experiment consisted of E's determining eye dominance of each subject at four feet (near) and twenty feet (far) by means of the Miles Test (1929) and also,a sighting test. In the latter test each subject was instructed to fixate (with both eyes open) on E's right eye. The subject was then asked to manually raise a pencil so that it was in a direct line of sight with E's right eye. This was done three times for the preferred hand and three times for the non-preferred hand at the "near" and also at the "far" distances. Also, while in the "near" position, E ascertained whether the subject saw single or double images, or a combination. Only subjects who demonstrated perfect constancy of eye dominance were asked to participate in phase three of the experiment.

Based on the records obtained from the first two phases of the experiment, each subject was put into one of four categories: left handed-left eyed, left handed-right eyed, right handed-left eyed, or right handed-right eyed, with six subjects in each category.

Phase three consisted of stimulating the nasal and temporal retinas of the right and left eyes with a flashing red light, and recording the evoked responses from the right and left occipital lobes. Each trial consisted of 200 flashes with the right eye being stimulated during the first and fourth trials and the left eye being stimulated on the second and third trials. Each trial was broken up into eight 25 flash blocks in which the order of presentation was ABAB-BABA, thus giving a total of 100 flashes directed to the nasal retina and 100 flashes directed to the temporal retina of the eye being stimulated. Subjects were given a five minute rest between trials.

Since electroencephalographic recordings were being made from the right and left occipital lobes, two separate amplification systems were utilized. The potentials recorded from each lobe were balanced across the two amplifiers, thereby preventing any systematic error due to equipment differences.

Preparation of Subjects and Electrode Placement. In order to reduce skin resistance to less than 10,000 ohms, all electrode placement sites on each subject were rubbed with Burdick Electrode Paste. The scalp sites were determined by measuring one inch above the inion, and then one inch to the right and left of that point. The commercial silver disc electrodes (8 mm. in diameter) were then filled with electrode paste and place against the sites. They were held firmly in place with electrical tape. The reference electrode for each cortical electrode was a silver clip electrode (whose cups were filled with electrode paste) attached to the corresponding ear lobe.

Instrumentation, Recording Procedure, and Apparatus

Polygraph Calibration. Two channels on a Grass Model 7 Polygraph were used to record each subject's EEG. Each channel consisted of one, model 7P5A, Wide Band A.C. EEG Preamplifier and one, model 7DAC D.C. Driver Amplifier. Calibration was accomplished by feeding a known signal through the system, and then noting the amount of pen deflection, which was 2.8 cm./30 microvolts.

Recording Procedure. Electrical signals from each subject's occipital lobes were amplified with the system mentioned above. The outputs of this system were then summated by a Mnemotron 400B Computer of Average Transients (CAT), whose analysis time during recording was 0.5 sec. After the CAT had summated the signals, a Moseley X-Y Recorder-Model 2D-2, produced permanent records.

Throughout each trial, white noise, generated by a Grason-Stadler Model 901B Noise Generator, was used to mask the clicking sounds of the CAT and also the light flash programmer. All lights in the experimental room were turned off to maintain a low level of background illumination.

Apparatus. The subjects were placed in an electrically shielded cubicle in order to attenuate electrical interference. A Grass PS2-Photo Stimulator, set at intensity position number eight, controlled the brightness of the 10 microsec. flash, while a randomly programmed tape dictated its onset. A small tubular light guide transmitted the light through a Kodak Wratten filter (number 29) onto the center of an opaque screen in the subject's room.The flashes were presented at irregular intervals, the average interstimulus interval being three sec.

The opaque screen was shaped like a hemisphere, with the subject viewing the light from the concave side. The viewing side of the screen was painted white and had a luminance level of approximately two mlam.

The distance from the subject's eyes to the center of the screen was approximately 40 cm. This distance was maintained as a relative constant, since each subject had to place her chin on a permanent chin rest.

In order to stimulate one eye at a time, a small occluder was permanently placed a few cm. in front of the visual stimulus. When the subject was in position only one eye at a time could see the flashing red light, thereby allowing monocular stimulation with both of the subject's eyes open.

The subject's task entailed looking at a fixation point located twenty degrees to the right or to the left of the visual stimulus upon E's command.

CHAPTER III

RESULTS

The Evoked Potential

Fig. 2 illustrates the form of evoked potentials typically obtained when the eye is stimulated with a one degree spot of light. These tracings were obtained by superimposing all the right lobe responses, and then separately superimposing all the left lobe responses of subject no. four. These tracings are highly supportive of the findings of investigators (Dustman and Beck, 1963) that the components of one individual's evoked potential, at least during the the first 300 msec., are highly reliable and closely resemble one another.

These tracings indicate that the form of this subject's evoked potential was a sinusoidal wave of 8-12 cps. Eason and White (1967) reported similar potentials recorded from the occipital lobe of various subjects, indicationg that this is an intersubject characteristic of occipital lobe evoked potentials.

The potentials in Fig. 2 show that a small positive component (downward deflection) begins approximately 90 msec. after the stimulus onset and continues up to about 150 msec. It is at this point that a relatively large negative component (upward deflection) begins and continues through to approximately 190 msec. A new positive component begins here and terminates at about 230 msec. A final major deflectipn (negative) starts at this point and continues until about 280 msec. Following this time period are successive positive

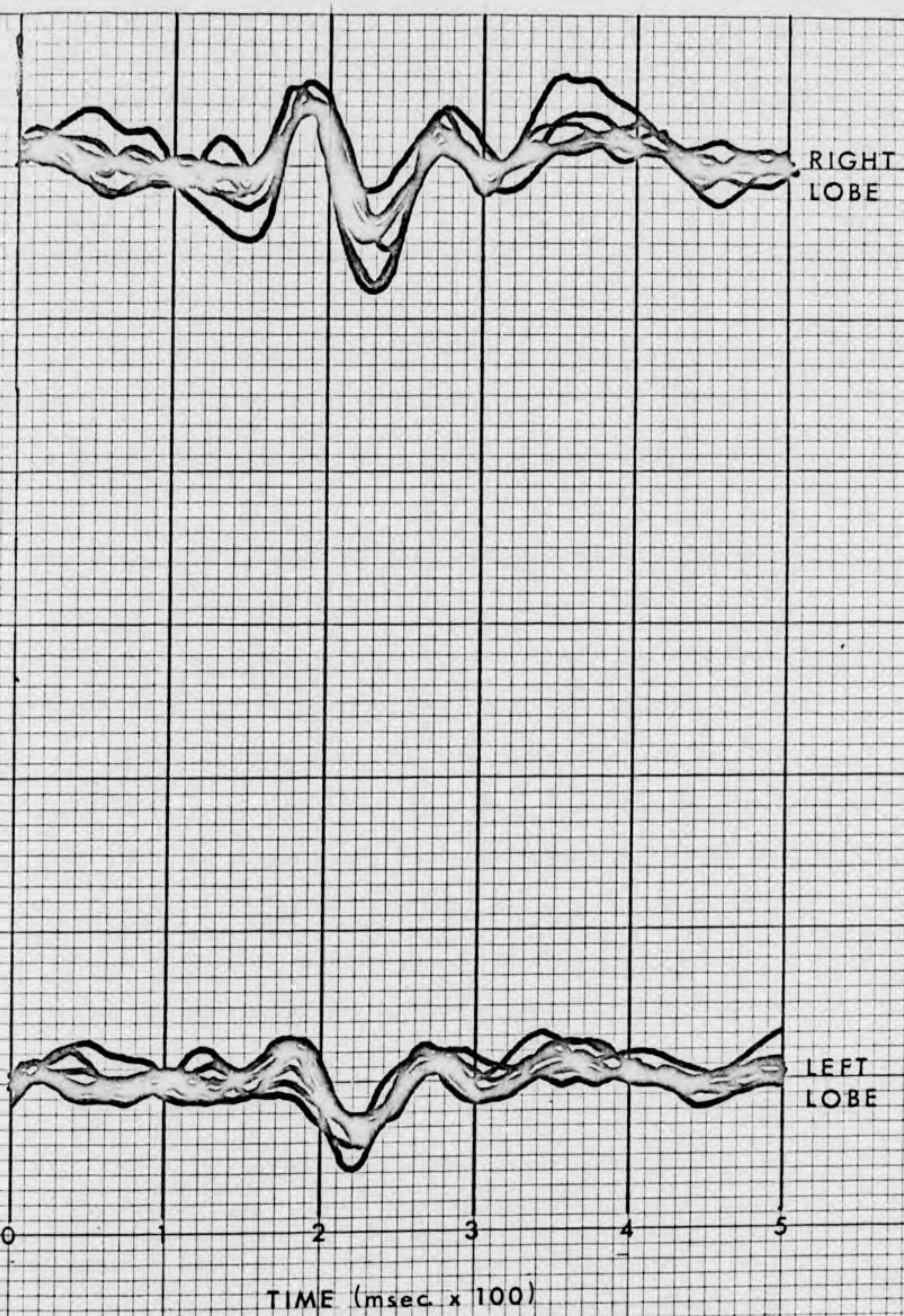

Figure 2. Superimpositions of all right and left lobe responses of subject no. four.

and negative deflections which occur about every 50 msec. These general results are comparable across lobes although the amplitudes are not equal.

Measurement of Amplitudes. When printing out permanent records of the evoked potential with the X-Y Recorder, gain controls were adjusted so that the permanent record would be exactly five inches long, with one inch of paper corresponding to 100 msec. of time. This conveniently divided the evoked potential into five 100 msec. intervals.

Measuring the amplitudes of the evoked potential first required that a "best fit" horizontal line be drawn through each record (Fig.3).

Next, E then measured (in cm.) the length of the largest deflection from the "best fit" line, whether positive or negative, for each 100 msec. interval, thereby obtaining five scores for each potential. Illustrative of this procedure is Fig. 3 which shows one vertical line, for each 100 msec. interval, drawn from the "best fit" line to that particular interval's largest deflection. These scores were the raw data for the analysis and can be found in Tables I-IV.

Analysis of Amplitudes. An analysis of variance was performed on the data presented in Tables I-IV. This analysis is summarized in Table V. The amplitude of the evoked cortical potential was found to vary significantly as a function of visual field (F=11.9; df=1, 145; $p < .001$). In other words, whether the subject was being stimulated from the right or left made a difference in the amplitude of the resultant evoked potential. The significant differences revealed by the analysis reflects the fact that larger evoked potentials resulted when the subjects were stimulated from their left visual field

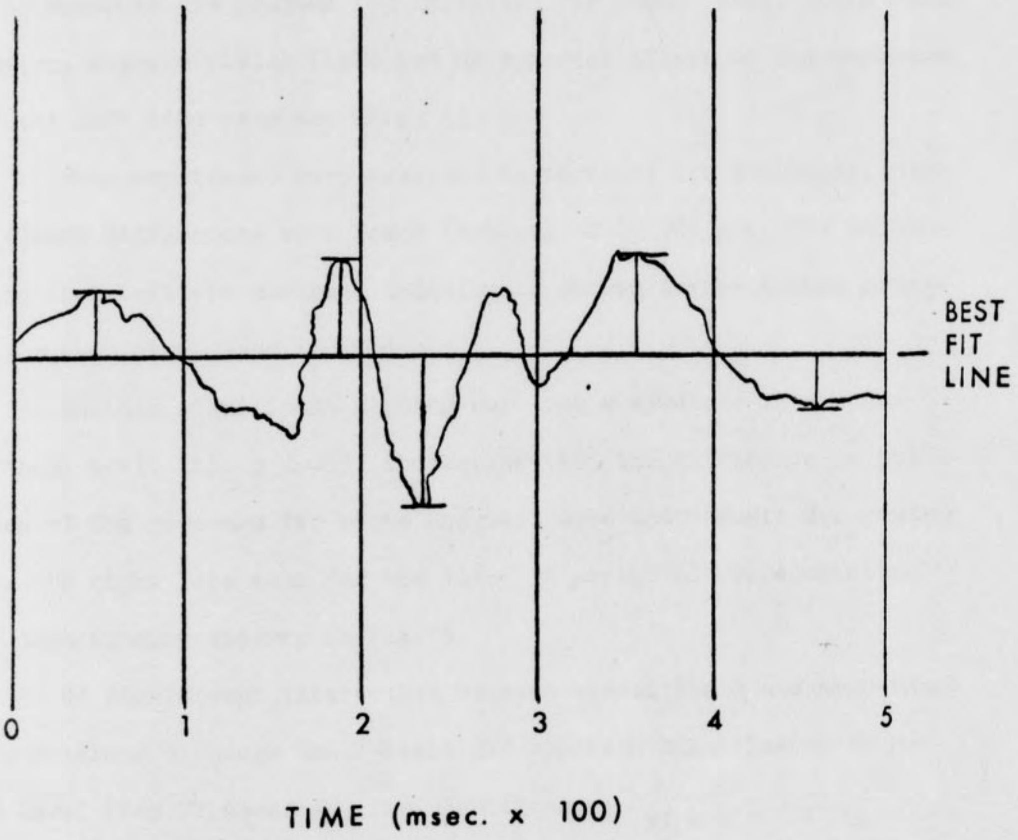

Figure 3. Illustration of method of determining largest deflection per interval.

than when stimulated from the right visual field.

Lobular differences were found to be significant ($F=23.4$; $df=1, 145$; $p < .001$), with the right lobe generally producing significantly larger evoked potentials than the left. There was also a significant visual field x lobe interaction ($F=16.7$; $df=1, 145$; $p < .001$). This significant finding reflected the fact that the amplitude of the right lobe response was greater for left than for right visual field stimulation, whereas visual field had no apparent effect on the amplitude of the left lobe response (Fig. 4).

When amplitudes were analyzed in terms of eye dominance, significant differences were found ($F=11.8$; $df=1, 20$; $p < .005$) indicating that left eye dominant individuals showed larger evoked potentials than right eyed individuals.

Another significant finding was lobe x eyedness interaction ($F=4.3$; $df=1, 145$; $p < .05$), indicating that the difference in amplitude of the response for right and left eyed individuals was greater for the right lobe than for the left. A pictorial representation of this finding appears in Fig. 5.

No significant interaction between visual field and handedness was obtained although the F-Ratio did approach significance at the 5% level ($F=3.92$ necessary for significance; $F_{vf \times h} = 3.7$)

Since an earlier handedness study by Eason, et al (1967b) expressed the amplitude of right lobe responses relative to those of the left lobe, it was thought advisable to analyze this study's data using comparable ratio scores so that a direct comparison could be made between the two.

Primary Lobe Analysis. The ratio analysis mentioned above was

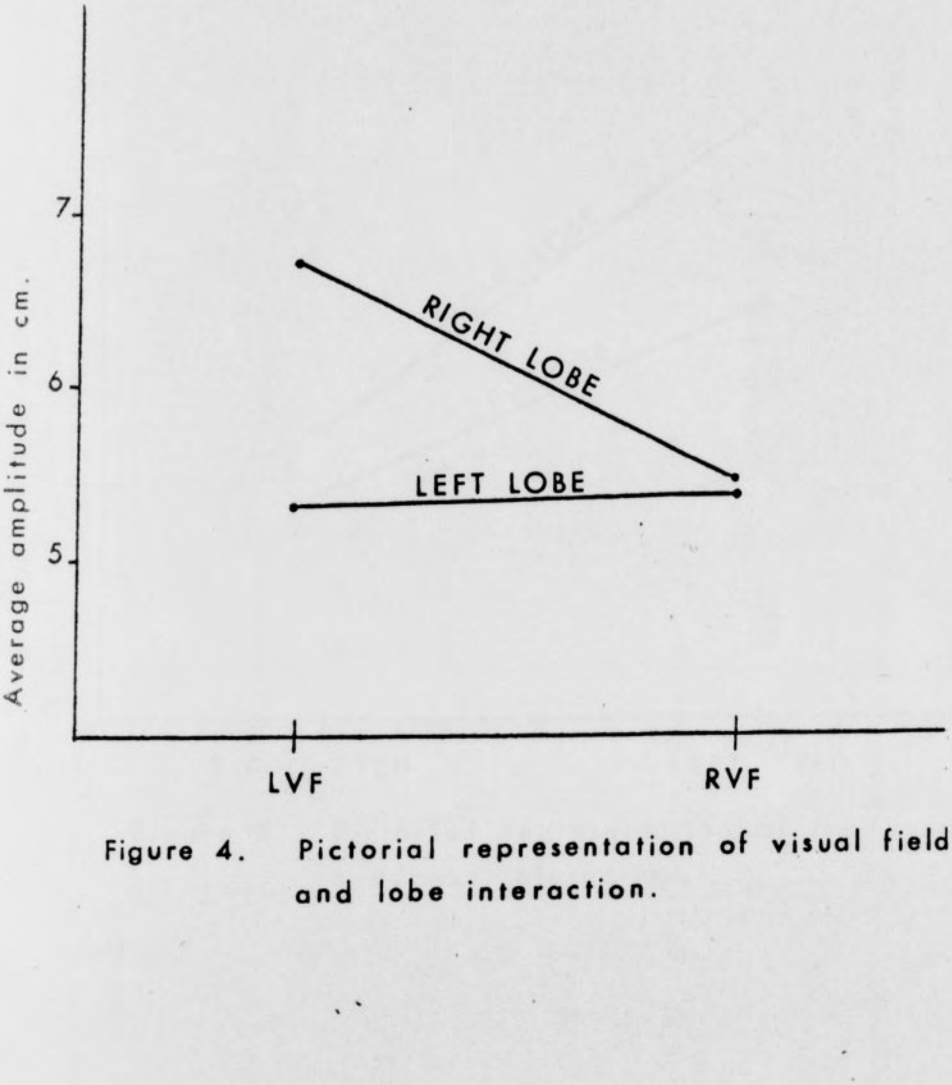

Figure 4. Pictorial representation of visual field and lobe interaction.

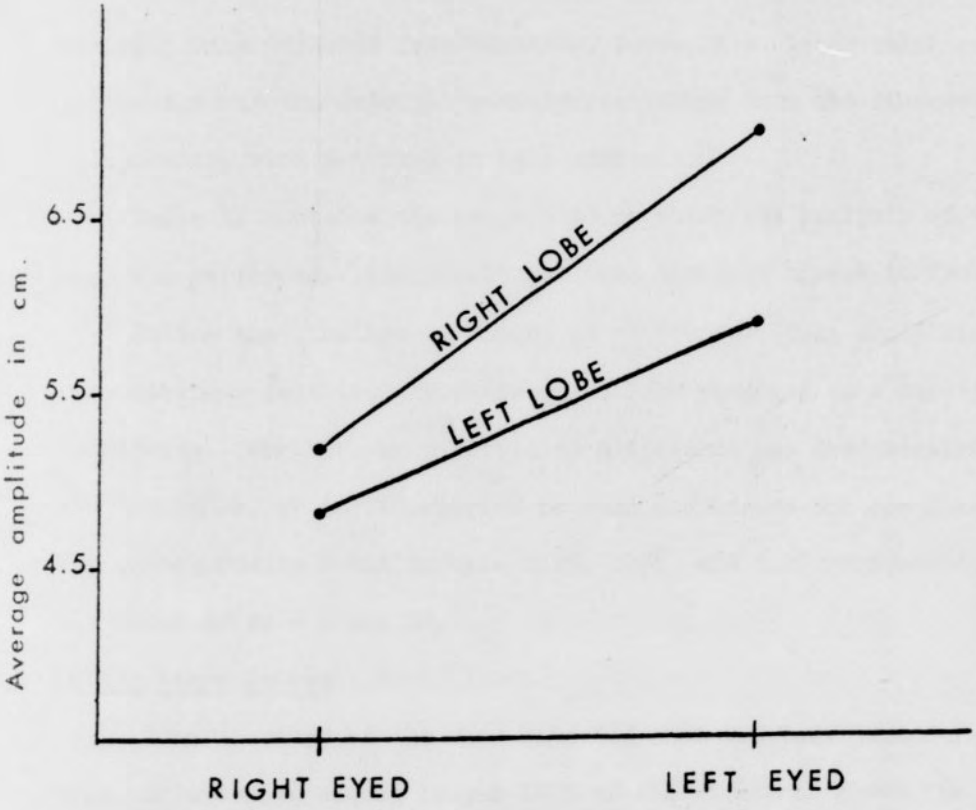

Figure 5. Pictorial representation of lobe and eyedness interaction.

performed, as in the earlier study, only on data acquired separately from the right or left lobe when either was a primary lobe, i.e. whenever that particular lobe received impulses by way of the classical visual pathways. In order for the right lobe to be primary, stimulation must occur in the left visual field. Conversely, stimulation must occur in the right visual field in order for the left lobe to be primary. Data obtained from secondary lobes, i.e. lobes which receive information via the cerebral commissures rather than the classical visual pathways, were not used in this analysis.

Table VI contains the ratio data on which the analysis of variance was performed. The results of this analysis appear in Table VII.

Unlike the findings of Eason, et al (1967b), this study did not demonstrate a relatively greater right lobe response as a function of handedness. Further, no significant difference was demonstrated for eye dominance, or an interaction between handedness and eye dominance. The corresponding F-Ratios were 0.25, 0.08, and 0.25 respectively. In all cases df were 1 and 20.

Double Image Scores

Careful study of the data revealed that all left handed-left eyed subjects saw double images 100% of the time when given the sighting test described in Chapter II. In none of the three other hand-eye categories did all subjects always see double images. Culver made a similar observation in an unpublished study (1968).

CHAPTER IV

DISCUSSION

Relation of Present Findings to Other Investigations

Relations of Visual Field to the Evoked Potential. The results of the present study indicated that larger cortical potentials were evoked when the subjects were stimulated from their left visual field than when stimulated from the right visual field (Table V, $p < .001$). This finding is in agreement with that of Eason, et al (1967c) who reported that greater evoked responses were obtained from both lobes of two of the three subjects in their experiment when the stimulus appeared in the left rather than right visual field. They concluded that more study was required in order to ascertain the factors responsible for the amplitude relation.

Another finding of the present study related to visual field was the significant interaction between visual field and lobe (Table V, $p < .001$). It revealed that the amplitude of the right lobe response was greater for left than for right visual field stimulation, whereas visual field had no apparent effect on the amplitude of the left lobe response (Fig. 4). In two separate studies Eason, et al (1967a) and Eason, et al (1967b) found similar results concerning the amplitude of the right lobe response. Their interpretation was based upon the fact that the right lobe receives impulses directly via the classical visual pathways when stimulation occurs in the left visual field. However, impulses reaching the right lobe travel by way of the cerebral commissures and/or subcortical connections whenever the stimulus appears in the right visual field. The possibility of subcortical structures contributing to interhemispheric response has been noted by other authors as well (Meikle and Sechzer, 1960; Sechzer, 1963; Voneida, 1963; Sheridan, 1965), and thus lends support to the above interpretation.

Relations of Eye Dominance and Lobe to Evoked Potentials. The present study demonstrated that larger cortical potentials were evoked in left eye dominant individuals than in right eyed individuals (Table V, $p < .005$). Another significant finding was a lobe x eyedness interaction (Table V, $p < .05$) which showed that the differences in amplitude of the response for right and left eyed individuals was greater for the right lobe than for the left (Fig. 5). The finding that the right lobe generally produced significantly larger evoked potentials than the left, is additional evidence that differential evoked potential amplitude is in the direction of a greater right lobe response (Table V, $p < .001$).

Two Interpretations of the Results. 1)The general finding of a larger evoked response from the right lobe than from the left is dissonant, at least superficially, with the textbook notion that in normal human beings the left hemisphere is dominant (Knott and Tjossem, 1943; Strauss, *et al*, 1943; Gottlieb, *et al*, 1964; Cernacek, *et al*, 1966; Liske, *et al*, 1967). One would expect on a priori basis that the dominant lobe would produce the larger evoked potential. If the left hemisphere is, in fact, the dominant hemisphere, an interpretation of the present finding seems difficult to make. However, the general notion of cerebral dominance theory does afford a possible explanation.

In his summary of dominance theory Smith (1945) noted the possibility of a lack of definite cerebral dominance with respect to coordinated activity. This simply means that the left hemisphere is not always decidedly the dominant hemisphere, and this state of affairs may be reflected behaviorally. To understand how this relates to the present findings, it is necessary to consider the four different subject categories used in the present study, viz., left handed-left eyed, left handed-right eyed, right handed-left eyed, and right handed-right eyed. These four hand-eye combinations, and their relations to hemispheric dominance are, at best, obscure (Lindsley, 1940; Knott and Tjossem, 1943; Walls, 1951; Glanville and Antonitis, 1955; Gottieb, et al, 1964; Giannitrapani, et al, 1966; Smith and Burklund, 1966).

The most widespread explanation of dominance employs a contralateral hemispheric dominance theory based on behavioral observations. For example, if after careful observation it is decided that an individual is "right handed", it is then assumed that the left hemisphere is responsible for this right hand dominance. In other words, dominance of one hemisphere in this kind of an analysis is inferred from peripheral information with actual observation of cerebral activity lacking. This type of analysis thus permits a breakdown of the four hand-eye categories in terms of hemispheric dominance. Reasoning as was done above, right handed-right eyed is related to left hemispheric dominance for these functions, while left handed-left eyed apparently is a function of right hemispheric dominance. Evidence for this kind of one to one relation of peripheral function to cerebral dominance is provided by Gottlieb, et al (1964) and Gottlieb and Wilson (1965). The former study reported that right handed-right eyed deaf children consistently earned higher speech grades than any other hand-eye group. The authors felt that these findings indicated that speech acquisition by deaf children is facilitated when both hand and sighting preference reflect left lobe dominance, assuming predominant localization of the speech area in the left hemisphere(Milner, 1958; Penfield and Roberts, 1959).

Regarding hemispheric localization of speech, Gottlieb and Wilson (1965) demonstrated that patients who underwent electroconvulsive shock treatment to the left hemisphere only were significantly slower on a verbal recall test than two other groups who received shock to the right and both hemispheres respectively. An interpretation of this finding is that it is further evidence for predominant localization of speech functions in the left hemisphere.

Applying the notion of contralateral cerebral dominance to the present study then, it appears that the left lobe is functionally dominant for right handed-right eyedness, while the right lobe seems to be dominant for left handed-left eyedness. However, difficulty in assigning functional hemispheric dominancearises when the remaining two hand-eye combinations are considered, viz. right handed-left eyed and left handed-right eyed. Based on the type of analysis outlined above, the left lobe dominates right sidedness, and the right lobe, left sidedness, thus resulting in a crossed cerebral dominance for each member of these two final groups. If this is interpreted as a lack of definite cerebral dominance, as posited by Smith (1945), a possible explanation for the present finding of a generally greater right than left lobe response is offered. If, as some previously mentioned authors feel, the left hemisphere is dominant in normal human beings, the amplitude of the left lobe evoked response should be greater than for the right hemisphere. But, if there appears a lack of definite cerebral dominance, as demonstrated by the crossed dominance of the right handed-left eyed and left handed-right eyed groups, then there seems to be no reason to expect a large response from the left lobe when it is not truly dominant. This is not to say that there occurs a corresponding increase in right lobe response, but rather, only a decrease in the left lobe response. Of course, if this interpretation is accepted, it means that the left lobe response must fall to a level significantly below that of the right lobe in order for the right lobe to consistently show larger evoked potentials than the left.

2) A second interpretation of the findings of the present study is based on the theory of fixed hemispheric dominance (FHD). This theory holds that motor dominance is fixed in the left hemisphere while sensory-perceptual dominance is located in the right brain half. Support for this position derives from the work of Teuber (1962, pp. 135-138) who reported that in human brain damaged patients there occurs significantly more impairment of sensory-perceptual function when lesions appear in the right than left hemisphere. He also noted a greater impairment of motor functions when lesions were in the left than in the right hemisphere. Of prime regard to the present study is Teuber's observation that visual defects are reflected in right hemispheric lesions. His observation is especially relevant to the results obtained.

It will be noted in Table V of the present work that all significant findings, except those for lobe differences, are directly related to visual function, viz. visual field, field x lobe interaction, eyedness, and lobe x eyedness interaction, with all of these results in the direction of a larger amplitude evoked potential from the right than left occipital lobe.

Since the FHD position argues that sensory-perceptual (visual) dominance is located in the right lobe, and since the significant findings of the present work, which are all involved in visual function, indicate a greater right than left lobe response, an interpretation of the present results can be made from the FHD position. In other words, if larger amplitude evoked responses are expected from the dominant lobe, and since according to FHD theory the right lobe is visually dominant, the larger right than left lobe responses are easily explained.

Since FHD theory is grounded more in scientific fact than the first interpretation, it would seem that the FHD position provides a more legitimate explanation of the present results. The findings of this study are thus considered further evidences for the theory of fixed hemispheric dominance.

Primary Lobe Results and Explanation. The present study did not demonstrate a significant relation between visual field and handedness. However, this interaction did approach significance at the 5% level (F=3.92 necessary for significance; $F_{vf \times h} = 3.7$). As mentioned in Chapter III, it was decided to remove all secondary lobe effects, and conduct an analysis dealing only with the amplitude of the evoked potential in relation to the right and left lobes when each was primary. Unlike the findings of Eason, et al (1967b) the present investigation did not demonstrate a relatively greater right than left primary lobe response as a function of handedness. Further, no significant difference was demonstrated for eye dominance, nor was there an interaction between handedness and eye dominance (Table VII). The F-Ratios of this latter analysis were grossly insignificant, whereas the analysis based on the responses of primary and secondary lobes combined approached significance. It appears therefore, that the secondary lobe contributed heavily to the nearly significant handedness effect obtained in the initial analysis of variance. Further study is required to more precisely evaluate this secondary lobe response in relation to handedness.

Evoked Potential Records. When the evoked potential records of all subjects were superimposed, it was noted that intersubject variability of response was greater than one would expect based on the results of other experiments (Dustman and Beck, 1963; Cernacek and Podivinsky, 1966; Lifshitz, 1966; Eason, et al, 1967a; Bartlett, et al, 1968). Also, the magnitude of the responses obtained from most subjects were smaller than those reported in other experiments. A possible explanation for these findings centers about the degree of attentiveness of the naive subjects to the stimulus flashes. It is a well documented fact that in order for a repeatable evoked response to be demonstrated, the subject must attend strictly to the stimulus (Eason, et al, 1964; Haider, et al, 1964; Spong, et al, 1965; Lifshitz, 1966; Lehmann and Fender, 1967). Although the subjects were told to be attentive, it is possible that the naive subjects employed in this study were not aware of this necessity for attention, and consequently allowed themselves to become involved in cognitive activity in varying degrees. Such activity could account for the small evoked potentials obtained from most subjects, as well as the differences between subjects.

If the present experiment were replicated with more precise control of attention, the effects of handedness and eyedness on the evoked response may manifest themselves more clearly.

CHAPTER V

SUMMARY

The present study dealt with the relation of the amplitude of the evoked cortical potential to eye dominance, visual field, and handedness.

A low intensity red stimulus flash subtending a visual angle of one degree was used to evoke cortical potentials from the two occipital lobes. Significant relations were obtained between the amplitude of the evoked response and visual field, lobe, field x lobe interaction, eye dominance, and a lobe x eye dominance interaction. In general, these results were indicative of a greater right than left lobe response.

Two general interpretations of the findings were offered, one assuming a lack of definite cerebral dominance, while the other (preferred) considered the results in terms of the fixed hemispheric dominance theory. It was concluded that further work in this area is necessary to permit a fuller understanding of the evoked potential and its relation to different phenomena.

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TABLE Ia
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR LEFT HANDED-LEFT EYED SUBJECTS

RIGHT EYE STIM.

LEFT VF

	Subjs.	TRIAL 1 Millisecond Intervals 1	2	3	4	5	Σx	TRIAL 2 Millisecond Intervals 1	2	3	4	5	Σx	ΣΣx
RIGHT LOBE	1.	2.5	9.0	9.0	4.5	7.0	32.0	2.5	5.5	5.0	2.5	2.0	17.5	49.5
	2.	4.5	8.0	10.0	5.0	6.0	33.5	4.0	6.0	10.0	5.0	10.0	35.0	68.5
	3.	9.5	9.5	10.5	6.0	5.5	41.0	2.0	10.0	6.5	7.5	9.0	35.0	76.0
	4.	8.0	8.0	27.0	11.0	5.0	59.0	6.0	14.0	11.5	8.0	4.0	44.5	102.5
	5.	3.5	12.5	5.5	4.0	6.0	31.5	3.0	9.5	12.0	12.0	9.0	45.5	77.0
	27.	7.0	7.0	16.0	13.5	11.0	54.5	6.0	9.0	13.5	13.5	12.5	54.5	109.0
	Σx	35.5	54.0	78.0	44.0	40.5	251.5	23.5	54.0	58.5	48.5	46.5	231.0	482.5
LEFT LOBE	1.	4.0	7.0	10.0	5.5	7.0	33.5	4.5	3.5	6.0	5.0	5.5	24.5	58.0
	2.	7.0	5.5	5.5	5.0	5.0	28.0	6.0	7.0	10.0	7.0	15.0	45.0	73.0
	3.	8.0	10.0	10.5	7.0	5.0	40.5	6.0	5.5	5.0	7.5	7.5	31.5	72.0
	4.	4.5	10.0	13.0	6.5	4.5	38.5	2.0	5.0	7.5	4.0	6.0	24.5	63.0
	5.	3.5	4.5	3.5	4.0	6.0	21.5	4.0	3.0	5.0	3.5	5.5	21.0	42.5
	27.	10.0	7.0	12.0	11.0	8.5	48.5	7.5	3.5	7.5	10.0	8.0	36.5	85.0
	Σx	37.0	44.0	54.5	39.0	35.5	210.5	30.0	27.5	41.0	37.0	47.5	183.0	393.5
RIGHT VF	1.	2.0	4.5	4.0	4.0	3.5	18.0	6.0	3.5	7.0	3.0	4.5	24.0	42.0
RIGHT LOBE	2.	4.0	4.5	3.0	6.5	3.5	21.5	8.0	7.0	11.0	8.0	12.0	46.0	67.5
	3.	4.0	12.0	10.0	8.0	6.5	40.5	4.5	6.5	7.0	7.5	7.5	33.0	73.5
	4.	6.0	8.5	15.5	7.0	2.0	39.0	4.5	9.5	7.0	6.0	2.5	29.5	68.5
	5.	3.0	8.0	9.5	11.0	8.0	39.5	2.0	7.0	9.5	10.0	7.5	36.0	75.5
	27.	4.5	3.0	9.0	4.5	10.0	31.0	9.0	8.5	6.0	5.0	7.5	36.0	67.0
	Σx	23.5	40.5	51.0	41.0	33.5	189.5	34.0	42.0	47.5	39.5	41.0	204.5	394.0
LEFT LOBE	1.	3.0	4.0	2.0	4.5	3.5	17.0	5.0	4.5	2.5	5.0	5.0	22.0	84.5
	2.	5.0	6.0	3.5	3.0	5.0	22.5	11.0	6.0	7.5	7.0	11.0	42.5	65.0
	3.	8.0	11.5	10.0	7.0	8.5	45.0	5.0	5.5	5.0	6.0	5.0	26.5	71.5
	4.	4.5	6.5	17.0	6.5	3.0	37.5	3.5	7.5	8.0	6.5	3.0	28.5	66.0
	5.	2.5	5.0	7.5	4.0	8.0	27.0	4.0	4.0	4.5	6.5	6.5	25.5	52.5
	27.	4.0	5.5	14.5	8.5	9.5	42.0	6.0	11.0	12.0	7.0	6.5	42.5	84.5
	Σx	27.0	38.5	54.5	33.5	37.5	191.0	34.5	38.5	39.5	38.0	37.0	187.5	378.5

TABLE Ib
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR LEFT HANDED-LEFT EYED SUBJECTS

LEFT EYE STIM.
LEFT VF

	Subjs.	Millisecond Intervals						Millisecond Intervals						
		1	2	3	4	5	Σ x	1	2	3	4	5	Σ x	ΣΣ x
RIGHT LOBE	1.	2.0	8.0	4.0	6.0	4.5	24.5	3.0	5.5	8.0	5.0	7.5	29.0	53.5
	2.	9.0	9.0	9.0	7.0	7.0	41.0	9.0	6.0	5.0	5.5	7.5	33.0	74.0
	3.	5.0	5.0	9.0	5.5	7.0	31.5	4.0	6.5	6.0	5.0	7.0	28.5	60.0
	4.	3.0	13.0	19.5	5.0	6.0	46.5	4.0	10.5	15.5	6.0	7.0	43.0	89.5
	5.	10.5	11.0	10.0	3.0	2.0	36.5	9.0	13.0	10.0	11.0	10.0	53.0	89.5
	27.	6.0	6.5	12.0	9.0	12.5	46.0	5.0	9.5	18.5	12.0	8.5	53.5	99.5
	Σ x	35.5	52.5	63.5	35.5	39.0	226.0	34.0	51.0	63.0	44.5	47.5	240.0	466.0
LEFT LOBE	1.	2.0	4.0	6.5	3.5	2.5	18.5	4.5	7.0	6.0	3.0	4.5	25.0	43.5
	2.	6.5	7.0	10.5	9.0	10.0	43.0	11.0	5.0	5.5	5.0	9.5	36.0	79.0
	3.	7.0	9.0	6.5	7.0	6.0	35.5	5.0	6.0	5.0	5.0	6.5	27.5	63.0
	4.	3.0	3.0	7.5	4.0	7.0	24.5	2.5	4.5	6.0	3.0	3.0	19.0	43.5
	5.	7.5	7.5	5.0	3.0	3.0	26.0	5.5	6.0	5.5	5.5	6.0	28.5	54.5
	27.	10.0	5.5	8.0	4.5	5.5	33.5	4.5	4.5	10.0	8.0	7.5	34.5	68.0
	Σ x	36.0	36.0	44.0	31.0	34.0	181.0	33.0	33.0	38.0	29.5	37.0	170.5	351.5
RIGHT VF	1.	2.5	4.0	2.5	4.0	4.5	17.5	3.0	5.0	5.5	4.0	4.5	22.0	39.5
	2.	5.0	7.0	10.0	10.0	12.0	44.0	3.0	7.0	6.0	8.0	8.0	32.0	76.0
	3.	5.5	7.5	7.0	6.5	6.0	32.5	5.0	7.0	5.0	8.0	6.0	31.0	63.5
RIGHT LOBE	4.	2.5	9.0	11.0	3.0	4.5	30.0	1.5	11.0	9.0	6.0	3.5	31.0	61.0
	5.	4.0	9.5	9.5	8.0	6.0	37.0	5.0	7.0	5.0	6.5	4.5	28.0	65.0
	27.	4.5	7.5	13.0	7.5	9.0	41.5	3.5	4.5	9.5	6.0	9.0	32.5	74.0
	Σ x	24.0	44.5	53.0	39.0	42.0	202.5	21.0	41.5	40.0	38.5	35.5	176.5	379.0
LEFT LOBE	1.	3.0	3.5	5.0	2.0	3.5	15.0	2.0	4.5	3.0	4.0	5.0	18.5	33.5
	2.	8.5	9.0	11.0	5.0	9.0	42.5	5.5	15.5	11.0	2.5	4.0	38.5	81.0
	3.	7.0	6.5	10.0	7.0	7.0	37.5	4.5	4.0	4.5	9.0	5.0	27.0	64.5
	4.	2.0	5.5	12.0	4.0	6.0	29.5	3.0	7.0	11.5	3.0	3.0	27.5	57.0
	5.	6.0	7.0	7.0	5.5	2.5	28.0	2.5	5.0	5.0	2.5	3.5	18.5	46.5
	27.	5.0	5.0	19.5	12.0	11.0	52.5	2.0	8.5	19.0	9.5	10.0	49.0	101.5
	Σ x	31.5	36.5	62.5	35.5	39.0	205.0	19.5	44.5	54.0	30.5	30.5	179.0	384.0

TABLE IIa
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR RIGHT HANDED-RIGHT EYED SUBJECTS

RIGHT EYE STIM.

LEFT VF

		TRIAL 1						TRIAL 2						
	Subjs.	Millisecond Intervals						Millisecond Intervals						
		1	2	3	4	5	Σx	1	2	3	4	5	Σx	ΣΣx
	6.	2.5	11.5	7.5	6.5	4.0	32.0	5.0	15.0	15.5	8.5	8.5	52.5	84.5
RIGHT LOBE	7.	4.0	4.0	7.0	6.0	9.5	30.5	8.0	7.0	5.0	4.0	3.5	27.5	58.0
	8.	4.5	11.0	4.0	5.0	3.5	28.0	3.5	9.5	3.0	3.0	2.5	21.5	49.5
	9.	2.0	7.5	8.5	4.5	4.5	27.0	3.5	5.0	3.5	3.5	4.5	20.0	47.0
	10.	2.5	4.5	3.0	4.5	2.5	17.0	3.0	2.5	6.5	3.5	3.5	19.0	36.0
	11.	3.5	6.5	4.0	5.0	1.0	20.0	3.5	4.0	4.0	2.5	2.5	16.5	36.5
	Σx	19.0	45.0	34.0	31.5	25.0	154.5	26.5	43.0	37.5	25.0	25.0	157.0	311.5
	6.	3.0	5.0	5.0	5.0	3.5	21.5	5.0	7.0	7.5	5.5	5.0	30.0	51.5
	7.	3.0	3.0	4.0	3.0	3.5	16.5	9.0	5.5	3.5	3.0	2.0	23.0	39.5
LEFT LOBE	8.	2.0	6.0	2.5	4.0	3.5	18.0	3.0	4.5	4.5	3.5	2.5	18.0	36.0
	9.	2.5	5.0	7.0	9.0	2.5	26.0	3.5	4.0	3.5	2.5	2.0	15.5	41.5
	10.	2.5	3.0	2.5	4.0	1.5	13.5	2.5	1.0	3.5	2.5	2.5	12.0	25.5
	11.	5.5	3.0	4.0	5.5	2.0	20.0	5.0	5.0	5.0	4.0	3.0	22.0	42.0
	Σx	18.5	25.0	25.0	30.5	16.5	115.5	28.0	27.0	27.5	21.0	17.0	120.5	236.0
	6.	2.5	6.0	3.0	3.0	4.0	18.0	3.0	7.5	5.5	4.0	4.0	24.0	42.0
RIGHT VF	7.	6.0	7.0	7.0	5.0	7.0	32.0	5.5	5.0	5.5	4.0	2.0	22.0	54.0
	8.	3.0	6.0	5.0	2.0	2.5	18.5	3.5	5.0	5.0	2.5	1.5	17.5	36.0
RIGHT LOBE	9.	4.0	4.0	5.0	4.5	4.5	22.0	4.5	5.0	7.0	6.5	6.0	29.0	51.0
	10.	2.0	4.5	2.5	2.5	2.5	14.0	1.5	3.5	2.5	4.0	5.5	17.0	31.0
	11.	2.5	5.0	5.5	2.5	2.0	17.5	2.5	6.0	6.0	3.5	3.5	21.5	39.0
	Σx	20.0	32.5	28.0	19.5	22.5	122.0	20.5	32.0	31.5	24.5	22.5	131.0	253.0
	6.	3.5	7.0	3.5	4.0	5.5	23.5	5.0	13.0	4.0	5.0	5.0	32.0	55.5
	7.	6.5	7.5	3.0	4.5	4.5	26.0	4.0	6.0	6.0	3.0	3.0	22.0	48.0
LEFT LOBE	8.	4.0	9.0	4.5	2.5	2.5	22.5	3.5	8.0	4.0	2.5	2.0	19.5	42.0
	9.	3.5	8.5	9.0	6.5	5.5	33.0	4.0	3.5	3.5	4.5	4.0	19.5	52.5
	10.	3.0	4.5	3.0	4.0	4.0	18.5	2.0	3.5	4.0	4.0	4.5	18.0	36.5
	11.	2.0	6.5	5.5	1.5	2.5	18.0	3.5	7.0	7.0	1.5	2.0	21.0	39.0
	Σx	22.5	43.0	28.5	23.0	24.5	141.5	22.0	41.0	28.5	20.5	20.5	132.0	273.5

TABLE IIb
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR RIGHT HANDED-RIGHT EYED SUBJECTS

LEFT EYE STIM.

LEFT VF

		TRIAL 1						TRIAL 2						
	Subjs.	Millisecond Intervals						Millisecond Intervals						
		1	2	3	4	5	Σx	1	2	3	4	5	Σx	ΣΣx
RIGHT LOBE	6.	6.5	23.0	16.5	8.5	4.0	58.5	3.5	8.0	7.5	6.5	8.0	33.5	92.0
	7.	6.5	5.0	3.0	5.0	2.5	22.0	4.5	5.0	4.5	4.5	3.0	21.5	43.5
	8.	6.0	8.0	7.5	7.0	3.5	32.0	5.0	11.5	6.5	2.0	6.5	31.5	63.5
	9.	4.0	7.0	7.5	7.5	2.0	28.0	6.0	7.0	6.0	5.0	4.5	28.5	56.5
	10.	2.5	2.5	5.5	7.0	2.0	19.5	1.5	4.0	3.0	2.0	2.5	13.0	32.5
	11.	3.0	5.0	4.5	2.0	1.5	16.0	4.5	7.0	2.5	4.5	4.0	22.5	38.5
	Σx	28.5	50.5	44.5	37.0	15.5	176.0	25.0	42.5	30.0	24.5	28.5	150.5	326.5
LEFT LOBE	6.	6.5	11.5	7.0	7.0	5.0	37.0	2.0	3.5	3.5	4.5	5.0	18.5	55.5
	7.	5.5	3.5	4.0	3.5	3.5	20.0	4.0	4.5	5.5	5.0	4.0	23.0	43.0
	8.	4.0	8.0	2.5	2.5	2.0	19.0	3.0	7.0	5.0	1.5	2.5	19.0	38.0
	9.	2.0	7.5	7.0	5.5	3.5	25.5	3.5	7.5	6.0	3.5	3.0	23.5	49.0
	10.	2.0	3.5	3.5	4.5	4.5	18.0	2.5	2.5	1.5	1.5	3.5	11.5	29.5
	11.	3.5	3.0	5.0	4.0	2.0	17.5	2.5	7.0	3.0	2.5	3.5	18.5	36.0
	Σx	23.5	37.0	29.0	27.0	20.5	137.0	17.5	32.0	24.5	18.5	21.5	114.0	251.0
RIGHT VF	6.	3.0	10.0	6.0	3.0	5.0	27.0	2.5	5.5	2.0	4.0	6.0	20.0	47.0
RIGHT LOBE	7.	3.0	3.5	7.5	3.0	5.5	22.5	3.5	5.5	5.5	4.0	2.0	20.5	43.0
	8.	3.0	4.0	3.5	3.5	2.5	16.5	2.5	5.0	3.5	2.0	2.5	15.5	32.0
	9.	3.5	6.5	9.0	7.0	4.0	30.0	3.5	6.0	7.0	5.5	4.0	26.0	56.0
	10.	1.5	2.0	2.5	2.0	1.5	9.5	4.0	1.5	3.0	4.5	2.5	15.5	25.0
	11.	7.0	5.0	9.0	3.0	3.0	27.0	1.5	4.0	5.0	3.0	4.5	18.0	45.0
	Σx	21.0	31.0	37.5	21.5	21.5	132.5	17.5	27.5	26.0	23.0	21.5	115.5	248.0
LEFT LOBE	6.	3.5	18.0	8.0	5.0	5.5	40.0	2.0	8.0	3.5	6.0	7.5	27.0	67.0
	7.	3.5	5.0	5.5	2.5	3.5	20.0	5.5	4.0	5.5	3.0	3.5	21.5	41.5
	8.	3.0	5.5.	3.5	3.5	2.0	17.5	2.0	8.0	4.0	3.0	3.5	20.5	38.0
	9.	4.5	5.0	7.0	6.0	4.0	26.5	3.5	5.5	5.0	6.0	3.0	23.0	49.5
	10.	2.0	1.5	2.0	1.5	1.0	8.0	3.5	3.5	3.0	4.0	2.0	16.0	24.0
	11.	5.5	7.0	10.0	2.0	5.0	29.5	3.5	4.0	4.0	5.0	3.5	20.0	49.5
	Σx	22.0	42.0	36.0	20.5	21.0	141.5	20.0	33.0	25.0	27.0	23.0	128.0	269.5

TABLE III a
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR LEFT HANDED-RIGHT EYED SUBJECTS

RIGHT EYE STIM.

	Subjs.	TRIAL 1 Millisecond Intervals 1	2	3	4	5	Σ x	TRIAL 2 Millisecond Intervals 1	2	3	4	5	Σ x	ΣΣ x
LEFT VF RIGHT LOBE	12.	5.0	7.0	8.5	4.5	8.5	33.5	2.5	6.0	5.5	5.0	10.5	29.5	63.0
	13.	6.5	7.5	5.5	6.5	5.0	31.0	3.5	5.5	6.0	5.5	3.5	24.0	55.0
	15.	3.0	8.5	11.0	5.5	7.5	35.5	7.5	10.0	13.5	13.0	6.0	50.0	85.5
	17.	7.0	8.0	10.0	7.0	6.5	38.5	3.0	8.5	10.5	4.5	5.0	31.5	70.0
	18.	2.5	11.5	9.5	5.0	6.5	35.0	6.5	9.0	5.0	6.0	8.0	34.5	69.5
	19.	3.0	3.0	10.0	4.0	8.0	28.0	5.0	4.0	4.5	5.0	3.0	21.5	49.5
	Σ x	27.0	45.5	54.5	32.5	42.0	201.5	28.0	43.0	45.0	39.0	36.0	191.0	392.5
LEFT LOBE	12.	4.0	10.5	8.5	4.0	6.0	33.0	4.0	8.0	4.0	5.5	9.0	30.5	63.5
	13.	4.0	3.0	2.5	2.0	2.5	14.0	4.0	2.5	3.5	4.0	1.5	15.5	29.5
	15.	3.0	3.5	10.0	5.5	9.0	31.0	3.5	3.5	10.5	6.0	4.0	27.5	58.5
	17.	6.0	8.0	8.0	7.5	5.5	35.0	2.5	8.5	9.0	5.5	5.0	30.5	65.5
	18.	2.0	8.0	4.5	5.0	2.0	21.5	8.0	10.0	10.5	10.0	10.5	49.0	70.5
	19.	6.0	3.5	4.0	5.0	6.5	25.0	4.5	8.5	4.0	6.5	2.5	26.0	51.0
	Σ x	25.0	36.5	37.5	29.0	31.5	159.5	26.5	41.0	41.5	37.5	32.5	179.0	338.5
RIGHT VF RIGHT LOBE	12.	2.0	4.0	4.5	7.0	5.5	23.0	4.5	4.5	10.5	3.5	6.5	29.5	52.5
	13.	3.5	3.0	2.5	4.5	3.5	17.0	2.0	3.5	1.5	2.5	4.0	13.5	30.5
	15.	4.5	1.5	5.5	2.5	3.5	17.5	4.5	4.5	6.0	6.0	2.5	23.5	41.0
	17.	5.0	8.0	3.0	4.0	6.0	26.0	3.5	5.0	6.0	3.0	3.5	21.0	47.0
	18.	2.0	6.0	6.5	6.0	4.5	25.0	6.0	10.0	4.0	8.0	8.5	36.5	61.5
	19.	5.5	5.5	5.5	8.0	4.0	28.5	4.5	4.0	4.0	6.0	2.5	21.0	49.5
	Σ x	22.5	28.0	27.5	32.0	27.0	137.0	25.0	31.5	32.0	29.0	27.5	145.0	282.0
LEFT LOBE	12.	5.5	7.0	7.5	4.0	3.0	27.0	2.0	5.0	13.0	2.5	3.5	26.0	53.0
	13.	3.5	3.0	4.0	4.0	4.0	18.5	3.5	5.0	2.0	4.0	7.0	21.5	40.0
	15.	2.5	4.5	9.5	2.5	3.5	22.5	0.5	5.0	9.0	3.0	3.0	20.5	43.0
	17.	3.0	5.0	3.0	3.5	6.0	20.5	3.0	2.5	4.0	3.0	5.5	18.0	38.5
	18.	2.0	3.5	5.0	5.5	5.0	21.0	9.0	7.5	7.0	9.0	8.0	40.5	61.5
	19.	6.0	7.0	5.5	4.0	4.0	26.5	4.0	2.5	7.0	2.5	2.5	18.5	45.0
	Σ x	22.5	30.0	34.5	23.5	25.5	136.0	22.0	27.5	42.0	24.0	29.5	145.0	281.0

TABLE IIIb
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR LEFT HANDED-RIGHT EYED SUBJECTS

LEFT EYE STIM.

	Subjs.	TRIAL 1 Millisecond Intervals 1	2	3	4	5	Σ x	TRIAL 2 Millisecond Intervals 1	2	3	4	5	Σ x	ΣΣ x
LEFT VF														
RIGHT LOBE	12.	6.0	5.5	4.0	3.5	5.0	24.0	5.5	9.0	5.0	7.0	4.0	30.5	54.5
	13.	3.0	11.0	7.0	9.0	4.5	34.5	3.5	5.0	7.5	6.5	6.5	29.0	63.5
	15.	8.0	11.5	15.0	7.0	6.5	48.0	6.0	8.0	13.5	6.5	6.0	40.0	88.0
	17.	6.5	4.0	8.5	6.0	9.5	34.5	5.5	6.5	7.5	6.0	4.5	30.0	64.5
	18.	2.0	12.0	3.5	6.0	4.5	28.0	5.0	11.0	5.0	6.5	6.5	34.0	62.0
	19.	2.0	4.0	4.0	4.5	4.0	18.5	3.5	6.5	7.0	8.0	7.5	32.5	51.0
	Σ x	27.5	48.0	42.0	36.0	34.0	187.5	29.0	46.0	45.5	40.5	35.0	196.0	383.5
LEFT LOBE	12.	7.0	7.0	3.5	3.0	4.0	24.5	4.0	10.5	6.0	3.5	4.5	28.5	53.0
	13.	3.0	4.5	4.0	5.0	2.0	18.5	3.0	4.0	2.5	2.0	2.0	13.5	32.0
	15.	5.5	5.5	12.5	6.5	4.5	34.5	4.5	4.5	10.0	3.0	3.0	25.0	59.5
	17.	4.5	4.5	6.0	6.0	4.0	25.0	4.5	5.0	8.5	3.5	3.5	25.0	50.0
	18.	2.0	11.5	8.5	8.0	3.5	33.5	6.5	10.5	10.5	11.0	11.5	50.0	83.5
	19.	2.5	2.0	2.5	4.0	5.0	16.0	2.5	6.0	1.5	5.5	6.0	21.5	37.5
	Σ x	24.5	35.0	37.0	32.5	23.0	152.0	25.0	40.5	39.0	28.5	30.5	163.5	315.5
RIGHT VF														
RIGHT LOBE	12.	4.5	7.0	8.5	5.5	4.5	30.0	6.0	8.0	9.0	4.5	6.0	33.5	63.5
	13.	3.0	4.5	1.5	3.0	1.5	13.5	3.5	3.5	4.5	4.0	4.5	20.0	33.5
	15.	5.5	5.5	6.5	3.0	4.0	24.5	3.5	1.5	5.5	3.5	3.0	17.0	41.5
	17.	3.5	4.0	8.0	3.0	6.0	24.5	3.0	7.0	8.0	3.0	6.5	27.5	52.0
	18.	4.0	6.0	6.0	6.5	5.0	27.5	3.5	5.5	8.5	5.0	7.0	29.5	57.0
	19.	7.0	6.5	4.5	4.0	3.5	25.5	4.5	5.0	8.5	4.0	3.0	25.0	50.0
	Σ x	27.5	33.5	35.0	25.0	24.5	145.5	24.0	30.5	44.0	24.0	30.0	152.5	298.0
LEFT LOBE	12.	3.5	10.0	7.5	5.5	5.5	32.0	3.5	13.0	10.0	4.0	5.5	36.0	68.0
	13.	6.5	6.5	4.5	4.5	3.5	25.5	6.0	6.5	5.5	4.0	5.0	27.0	52.5
	15.	5.0	4.5	8.5	2.0	3.0	23.0	4.5	4.0	8.0	5.5	1.0	23.0	46.0
	17.	2.5	9.0	6.5	6.5	5.5	30.0	4.0	5.0	6.0	4.5	9.5	29.0	59.0
	18.	3.5	5.5	8.0	8.5	6.5	32.0	5.0	5.5	4.0	4.5	6.0	25.0	57.0
	19.	4.0	5.0	7.0	2.5	4.0	22.5	5.0	7.0	7.0	4.5	2.5	16.0	38.5
	Σ x	25.0	40.5	42.0	29.5	28.0	165.0	28.0	31.0	40.5	27.0	29.5	156.0	321.0

TABLE IVa
AMPLITUDES (in cm.) OF EVOKED POTENTIALS
FOR RIGHT HANDED-LEFT EYED SUBJECTS

RIGHT EYE STIM.

LEFT VF

	Subjs.	TRIAL 1 Millisecond Intervals						TRIAL 2 Millisecond Intervals						
		1	2	3	4	5	x	1	2	3	4	5	x	x
	20.	7.5	8.0	5.5	4.0	9.0	34.0	7.5	17.5	16.0	8.5	16.5	66.0	100.0
	21.	5.0	6.5	9.5	3.0	6.5	30.5	6.5	10.0	13.5	10.5	7.0	47.5	78.0
RIGHT LOBE	22.	3.0	7.0	7.5	7.0	5.5	30.0	4.5	6.5	7.5	5.0	6.5	30.0	60.0
	24.	1.5	8.0	8.0	2.5	6.0	26.0	3.0	12.5	13.0	2.5	2.5	33.5	59.5
	25.	3.5	7.0	7.5	8.0	3.5	29.5	4.5	7.0	10.5	8.0	7.5	37.5	67.0
	26.	6.0	3.5	5.5	3.0	2.0	20.0	3.0	9.5	11.0	4.0	4.0	31.5	51.5
	x	26.5	40.0	43.5	27.5	32.5	170.0	29.0	63.0	71.5	38.5	44.0	246.0	416.0
	20.	5.5	5.5	8.0	3.0	8.0	30.0	5.0	3.0	6.0	2.0	3.0	19.0	49.0
	21.	5.0	1.5	4.0	2.5	5.0	18.0	5.0	5.0	10.0	3.5	3.5	27.0	45.0
LEFT LOBE	22.	4.5	5.5	5.5	7.0	5.5	28.0	4.0	9.5	3.0	7.0	5.0	28.5	56.5
	24.	2.0	6.0	6.0	2.5	4.0	20.5	4.0	3.5	6.0	3.0	3.0	19.5	40.0
	25.	4.0	6.5	8.5	4.5	2.0	25.5	4.5	5.0	10.0	10.5	6.0	36.0	61.5
	26.	5.5	7.0	6.0	3.0	2.0	23.5	3.0	5.5	11.0	3.0	2.5	25.0	48.5
	x	26.5	32.0	38.0	22.5	26.5	145.5	25.5	31.5	46.0	29.0	23.0	155.0	300.5
RIGHT VF	20.	7.0	7.0	6.0	3.5	4.5	28.0	9.5	12.0	9.5	9.5	12.0	52.5	80.5
	21.	3.5	4.0	5.5	1.5	2.0	16.5	5.0	5.0	7.0	6.0	6.5	29.5	46.0
RIGHT LOBE	22.	4.0	8.5	8.5	9.5	3.0	33.5	2.5	9.0	9.5	6.5	6.5	34.0	67.5
	24.	2.5	5.0	5.0	3.0	3.5	19.0	4.0	6.0	7.5	2.0	3.0	22.5	41.5
	25.	5.0	8.5	12.5	4.5	5.0	35.5	5.5	12.0	15.0	7.5	6.0	46.0	81.5
	26.	5.0	6.5	7.5	6.5	7.5	33.0	3.0	6.0	9.5	4.0	5.0	27.5	60.5
	x	27.0	39.5	45.0	28.5	25.5	165.5	29.5	50.0	58.0	35.5	39.0	212.0	377.5
	20.	8.5	8.0	8.0	4.5	6.5	35.5	3.5	9.0	7.5	3.5	3.0	26.5	62.0
	21.	4.0	6.5	6.0	2.5	2.0	21.0	3.5	3.0	2.5	3.0	3.0	15.0	36.0
LEFT LOBE	22.	4.5	9.0	8.0	9.0	3.0	33.5	4.0	4.5	3.5	5.5	4.5	22.0	55.5
	24.	2.5	3.5	12.0	3.0	4.0	25.0	4.0	11.5	11.0	2.5	4.5	33.5	58.5
	25.	5.0	7.0	8.5	4.5	4.0	29.0	4.0	9.5	13.0	6.0	4.5	37.0	66.0
	26.	4.5	7.5	6.0	4.0	2.0	24.0	2.5	8.5	7.5	5.5	3.0	27.0	51.0
	x	29.0	41.5	48.5	27.5	21.5	168.0	21.5	46.0	45.0	26.0	22.5	161.0	329.0

TABLE IVb
AMPLITUDES (in cm.) OF EVOKED POTENTIALS FOR RIGHT HANDED-LEFT EYED SUBJECTS

LEFT EYE STIM.

			TRIAL 1 Millisecond Intervals						TRIAL 2 Millisecond Intervals						
		Subjs.	1	2	3	4	5		1	2	3	4	5	x	x
LEFT VF	RIGHT LOBE	20.	10.0	12.0	8.5	13.5	10.5	54.5	11.0	12.0	8.0	8.5	11.5	51.0	105.5
		21.	9.0	8.0	13.5	11.0	11.0	52.5	3.0	6.5	11.0	7.5	7.0	35.0	87.5
		22.	2.5	6.0	6.5	4.5	4.0	23.5	3.5	4.5	5.0	5.5	4.5	23.0	46.5
		24.	2.0	12.0	11.5	5.0	7.0	37.5	3.0	13.0	14.0	3.5	3.5	37.0	74.5
		25.	5.0	5.0	7.0	5.5	6.5	29.0	3.0	5.0	8.0	8.5	8.0	32.5	61.5
		26.	8.0	4.0	7.5	5.5	5.5	30.5	1.5	7.5	8.0	3.5	5.0	25.5	56.0
		x	38.5	47.0	54.5	45.0	44.5	227.5	25.0	48.5	54.0	37.0	39.5	204.0	431.5
	LEFT LOBE	20.	5.0	5.5	7.5	5.5	4.5	28.0	6.0	6.5	4.5	2.0	2.5	21.5	49.5
		21.	3.5	3.0	5.5	6.0	5.5	23.5	4.5	5.0	6.0	4.5	2.0	22.0	45.5
		22.	3.5	7.0	2.5	7.0	8.5	28.5	4.0	4.5	5.5	6.0	4.0	24.0	52.5
		24.	6.5	16.0	15.5	8.5	10.5	57.0	2.5	11.5	11.5	4.0	2.5	32.0	89.0
		25.	3.5	3.0	7.5	3.5	7.5	25.0	4.0	4.5	9.0	6.0	4.5	28.0	53.0
		26.	7.0	6.5	7.0	6.0	4.0	30.5	2.0	7.0	10.5	4.0	5.0	28.5	59.0
		x	29.0	41.0	45.5	36.5	40.5	192.5	23.0	39.0	47.0	26.5	20.5	156.0	348.5
RIGHT VF	RIGHT LOBE	20.	10.0	16.5	16.5	7.5	7.0	57.5	19.0	17.0	3.5	9.0	4.0	52.5	110.0
		21.	3.5	5.5	10.5	7.5	7.0	34.0	3.0	3.0	7.5	4.0	4.0	21.5	55.5
		22.	6.0	9.5	8.0	7.0	5.5	36.0	2.5	7.5	7.5	4.0	5.0	26.5	62.5
		24.	5.0	7.0	9.0	5.5	6.0	32.5	3.5	6.0	4.5	6.0	7.5	27.5	60.0
		25.	3.0	6.0	11.0	5.0	5.5	30.5	1.5	7.0	7.0	6.0	6.0	27.5	58.0
		26.	3.0	8.0	10.0	8.0	6.0	35.0	4.0	6.5	10.5	4.0	3.5	28.5	63.5
		x	30.5	52.5	65.0	40.5	37.0	225.5	33.5	47.0	40.5	33.0	30.0	184.0	409.5
	LEFT LOBE	20.	7.5	9.5	9.0	7.0	7.0	40.0	6.5	6.5	2.0	4.0	4.0	23.0	63.0
		21.	3.5	4.5	5.5	6.0	4.0	23.5	2.0	6.0	5.0	5.0	5.5	23.5	47.0
		22.	4.0	7.0	6.0	8.0	3.0	28.0	2.5	6.5	6.0	7.0	6.0	28.0	56.0
		24.	6.5	7.5	7.0	7.5	4.5	33.0	3.5	13.5	11.5	4.0	5.5	38.0	71.0
		25.	5.0	5.0	7.5	4.0	6.0	27.5	5.5	5.5	6.5	4.0	7.5	29.0	56.5
		26.	2.5	8.0	7.5	2.0	6.0	26.0	4.0	9.0	7.0	5.5	4.0	29.5	55.5
		x	29.0	41.5	42.5	34.5	30.5	178.0	24.0	47.0	38.0	29.5	32.5	171.0	349.0

TABLE V
SUMMARY OF ANALYSIS OF VARIANCE OF AMPLITUDE OF EVOKED POTENTIALS

SOURCE OF VARIATION	SS	df	MS	F
1. Between Columns	63.5	7	9.1	
A. Eye Stimulated	0.5	1	0.5	0.4
B. Visual Field	14.3	1	14.3	11.9*
C. Lobe	28.1	1	28.1	23.4*
D. Eye x Field	0.4	1	0.4	0.3
E. Eye X Lobe	0.0	1	0.0	0.0
F. Field x Lobe	20.0	1	20.0	16.7*
G. Eye x Field x Lobe	0.1	1	0.1	0.1
2. Between Rows	306.8	23	13.3	
A. Handedness	26.6	1	26.6	3.0
B. Eyedness	103.6	1	103.6	11.8**
C. Handedness x Eyedness	1.6	1	1.6	0.2
D. Pooled Within Groups	175.0	20	8.8	
3. Columns x Rows	198.5	161	1.2	
A. Eye Stim. x Handedness	1.7	1	1.7	1.4
B. Visual Field x Handedness	4.4	1	4.4	3.7
C. Lobe x Handedness	0.5	1	0.5	0.4
D. Eye Stim. x Visual Field x Handedness	1.7	1	1.7	1.4
E. Eye Stim. x Lobe x Handedness	0.0	1	0.0	0.0

TABLE V (Continued)

SUMMARY OF ANALYSIS OF VARIANCE OF AMPLITUDE OF EVOKED POTENTIALS

SOURCE OF VARIATION	SS	df	MS	F
F. Visual Field x Lobe x Handedness	0.1	1	0.1	0.1
G. Eye Stim.x Visual Field x Lobe x Handedness	0.8	1	0.8	0.7
H. Eye Stim. x Eyedness	0.0	1	0.0	0.0
I. Visual Field x Eyedness	0.0	1	0.0	0.0
J. Lobe x Eyedness	5.2	1	5.2	4.3***
K. Eye Stim. x Visual Field x Eyedness	1.1	1	1.1	0.9
L. Eye Stim. x Lobe x Eyedness	0.0	1	0.0	0.0
M. Visual Field x Lobe x Eyedness	1.2	1	1.2	1.0
N. Eye Stim. X Visual Field x Lobe x Eyedness	0.0	1	0.0	0.0
O. Visual Field x Handedness x Eyedness	1.6	1	1.6	1.3
P. Lobe x Handedness x Eyedness	0.6	1	0.6	0.5
Q. Residual	179.6	145	1.2	
Total	568.8	191		

*Significant at $p < .001$
**Significant at $p < .005$
***Significant at $p < .05$

TABLE VI

RATIO TABLE OF TELATIVE AMPLITUDE (in cm.) OF LEFT LOBE (Primary) vs RIGHT LOBE (Primary)

	LEFT LOBE	RIGHT LOBE	RATIO
Left Handed Left Eyed	7.3	10.4	1.42
	14.6	14.3	0.97
	13.7	13.6	0.99
	12.3	19.3	1.56
	10.0	16.7	1.67
	18.7	20.9	1.11
Left Handed Right Eyed	12.1	11.8	0.97
	9.3	11.9	1.27
	8.9	17.4	1.95
	9.8	13.5	1.37
	11.9	13.2	1.10
	8.4	10.1	1.20
Right Handed Left Eyed	12.4	20.6	1.66
	8.3	16.6	2.00
	11.2	10.7	0.95
	13.0	13.5	1.03
	12.3	12.9	1.04
	10.7	10.8	1.00
Right Handed Right Eyed	12.3	17.7	1.43
	9.0	10.2	1.13
	8.0	11.4	1.42
	10.3	10.4	1.00
	6.1	6.9	1.13
	8.9	7.6	0.85

TABLE VII

SUMMARY OF ANALYSIS OF VARIANCE OF RATIO OF RELATIVE AMPLITUDES

SOURCE OF VARIATION	SS	*df*	MS	*F*
1. Between Columns	0.07	3		
A. Handedness	0.03	1	0.03	0.25
B. Eyedness	0.01	1	0.01	0.08
C. Handedness x Eyedness	0.03	1	0.03	0.25
2. Residual	2.29	20	0.12	
3. Total	2.36	23		