



7-1998

Temporal Lobe Transients and Prayer

Donald E. Newberry

Follow this and additional works at: <https://commons.und.edu/theses>

 Part of the [Psychology Commons](#)

Recommended Citation

Newberry, Donald E., "Temporal Lobe Transients and Prayer" (1998). *Theses and Dissertations*. 795.
<https://commons.und.edu/theses/795>

This Dissertation is brought to you for free and open access by the Theses, Dissertations, and Senior Projects at UND Scholarly Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of UND Scholarly Commons. For more information, please contact zeinebyousif@library.und.edu.

TEMPORAL LOBE TRANSIENTS AND PRAYER

by

Donald E. Newberry

Bachelor of Arts, Washburn University, 1984

Master of Arts, University of North Dakota, 1993

A Dissertation

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Grand Forks, North Dakota

July
1998

1998
N423

This dissertation, submitted by Donald E. Newberry, in partial fulfillment of the requirements for the degree Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

Joseph J. [Signature]
(Chairperson)

[Signature]

[Signature]

[Signature]

[Signature]

This dissertation meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

Harvey Knell
Dean of the Graduate School

7-9-98

Date

PERMISSION

Title Temporal Lobe Transients and Prayer
Department Psychology
Degree Doctor of Philosophy

In presenting this dissertation in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the library of this University shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my dissertation work, or in his absence, by the chairperson of the department or the dean of the Graduate School. It is understood that any copying or publication or other use of this dissertation or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my Dissertation.

Signature Donald G. Kenney
Date 7/15/98

TABLE OF CONTENTS

LIST OF
TABLES.....vi

ACKNOWLEDGEMENTS.....viii

ABSTRACT.....ix

CHAPTER

I. INTRODUCTION.....1

 Literature Review.....1

 Brain Areas in Persinger's Theory.....3

 Epilepsy's Relationship to Religious Experiences.8

 Persinger's Theory.....18

 Support for Persinger's Theory.....34

 Applications of the Temporal Lobe Theory.....45

 Summary and Experiment.....52

II. METHOD and Materials.....59

 Subjects.....59

 Procedure.....61

 Prayer and Secular Texts.....65

 Prayer Experiences Questionnaire.....66

 Experimental Experiences Questioner.....67

III. RESULTS.....73

IV. DISCUSSION.....84

TABLE OF CONTENTS (CONTINUED)

Difficulties with the Study.....	85
Individual Responses to the Study.....	88
Recommendations for Future Research.....	89
Conclusion.....	92
APPENDICES.....	93
REFERENCES.....	98

LIST OF TABLES

Table	Page
1. Students Qualifying.....	61
2. PEQ Gender.....	67
3. PEQ High and Low Scorers.....	68
4. Sensed Presence of God.....	69
5. Separated from Surroundings.....	69
6. Hearing God Speak.....	69
7. Loosing Track of Time.....	70
8. High Scorers.....	71
9. Low Scorers.....	71
10. High Scorers.....	72
11. Low Scorers.....	72
12. Eta for Alpha Activity.....	73
13. Eta for Theta Activity.....	74
14. Alpha.....	76
15. Theta.....	77
16. ANOVA follow up for Alpha.....	77
17. ANOVA follow up for Theta.....	78
18. Means and Standard Deviations for Alpha.....	78
19. Means and Standard Deviations for Theta.....	79
20. Alpha for Prayer Condition.....	80
21. Theta for Prayer Condition.....	81

22.	Sensed Presence on PEQ.....	82
23.	Sensed Presence on EEQ.....	83

ACKNOWLEDGEMENTS

The author wishes to thank Joseph Plaud, Ph.D. for his support of this research. The author also wishes to thank Julie Rocksvold, who volunteered her time to teach him to use the electroencephalograph, and Micheal Franklin, who patiently gathered research datum.

ABSTRACT

Persinger (1983) theorized that religious experiences involve the production of brief, micro-seizures that originate in the limbic system and affect the temporal lobes of the brain. According to this theory, ritual behavior could be used by individuals to induce micro-seizure activity. The theory predicted that an increase in alpha and theta activity in the temporal lobes of the brain would occur when subjects had a religious experience.

To test this, male and female Christian college students completed a Prayer Experiences Questionnaire inquiring about their religious experiences during prayer. Individuals scoring in the upper and lower 30 percent of the possible summed scores on this questionnaire then participated in a recording session that measured theta and alpha activity originating from the temporal lobes of their brains. Difficulty was encountered obtaining high scoring males, and the final sample included 16 subjects each for 3 of the groups, but only 6 subjects for high scoring males.

Alpha and theta activity were recorded at two sites over each temporal lobe using the International 10-20 system, and took place during three 460 second intervals. The initial session consisted of baseline data. The

remaining sessions consisted of the subjects reciting, silently to themselves, either a prayer or a secular text. The prayer and secular texts consisted of words matched for their occurrence in the English language. Following the recording session subjects completed an Experimental Experiences Questionnaire, which inquired about what they experienced during the prayer and secular conditions.

MANOVA analysis indicated differences in alpha, Rao \underline{R} (8, 46) = 7.844, $p < .001$, and theta, Rao \underline{R} (8, 46) = 3.245, $p < .005$, activity across the baseline, prayer, and secular conditions. Follow up ANOVAs did not support these findings. No relationship was found between responses on the Prayer Experiences Questionnaire or the Experimental Experiences Questionnaire and brain activity. It was concluded that these results do not support Persinger's theory.

CHAPTER I

INTRODUCTION

Literature Review

The religious experience is a phenomenon common to virtually all of the human race (Smart, 1984). Beliefs based on this experience have influenced codes of ethical behavior, provided explanations for world events, and given rise to both public and private rituals. Examples of such rituals include church attendance and prayer.

The physiological events underlying the religious experience, however, have received little attention (Persinger, 1983). One relationship that has been found between physiological events and religious experiences concerns epilepsy (Landsborough, 1987; Makoto, 1990; Jeremy, Roberts, & Guberman, 1989). Persinger (1983, 1993b) has developed a physiological theory of paranormal, mystical, and religious experiences based on work with epilepsy (Bear & Fedio, 1977).

While religious experiences are not commonly held to be pathological, Persinger's theory fits the diathesis-stress model of physical and mental illness (Davison & Neale, 1993). Persinger (1983) suggested that religious experiences are the result of brief seizure activity in the temporal

lobe and associated structures. The frequency and intensity of this seizure activity was considered by Persinger to vary along a natural continuum. This seizure activity can be considered the diathesis in his theory. Persinger has also theorized that events designed to bring about religious or paranormal experiences can induce seizure activity in the temporal lobe. These events can be considered the stress in his theory. One such stressor is prayer.

Accordingly, one series of events that precede a religious experience, according to Persinger's (1983) theory, can be described as follows. An individual engages in prayer behavior, that is, the repetition of words common to prayer as defined by the individual's cultural background. This prayer behavior results in the production of brain activity, namely, micro-seizure activity within the temporal lobe and its adjacent structures. This brain activity, in turn, results in the experiential phenomenon commonly described as a religious experience.

The following is a review of the functions of the brain areas Persinger (1983) theorized to be involved in religious experiences, a review of work on epilepsy and its relationship to religious experiences, a review of Persinger's theory, and a review of studies that have evaluated Persinger's theory. The review of epilepsy's connection with religious experiences includes a description of the work that has led to Persinger's theory. A section on

how the theory of a relationship between temporal lobe activity and religious experiences has been, and can be, applied is also included. Following these is an experimental test of Persinger's (1983) theory focusing on the ritual of prayer.

Brain Areas in Persinger's Theory

The primary brain areas Persinger (1983) considered to be involved in the production of paranormal or religious experiences are the temporal lobe and the limbic system. The temporal lobe, while referred to singly, actually consists of two lobes, one in each hemisphere. The structures and functions of these brain areas have been summarized by Guyton (1987).

The temporal lobe is located in the lower portion of the cerebral hemisphere. It extends from in front of the ear back toward the rear of the head. The upper half of the forward two thirds of this lobe contains the auditory area. This area detects sounds, interprets word meaning, and is important for music recognition. The temporal lobe also contains Wernicke's area for sensory integration, which receives information from all of the other lobes. This area interprets the ultimate meaning of all types of sensory input, from speech (written or spoken) to private thought. It is usually well developed only in the left hemisphere. The lower half of the temporal lobe stores short term memories, from seconds to weeks. The lower, frontal area of

the temporal lobe is considered to be used for elaboration of thought. This area is involved in concentration for long periods of time, planning for the future, and thinking through deep problems. Restak (1988) summarizes the functions of the temporal lobe as:

"The temporal lobe is important for hearing, memory, and a person's sense of self and time. This is also where dejavu experiences originate. Because it has connections to the limbic system, the temporal lobe also plays an important part in emotional experience." (p. 18)

The limbic system (Guyton, 1987) is a set of brain structures that include portions of the cerebral cortex and parts of the thalamus and hypothalamus. The limbic system is considered to be involved in the control of emotional behavior and motivation. Its structures include the amygdala (located inside the forward end of the temporal lobe), the hippocampus (along the border of the temporal lobe), and the mammillary bodies (behind the hypothalamus).

The function of the amygdala (Guyton, 1987) is considered to be the control of appropriate behavior in social situations. It works very closely with the hypothalamus, and connects to the neocortex of the temporal lobe. Stimulation of portions of the amygdala can produce rage, escape, punishment, fear, and sexual activity. The overall function of the amygdala seems to occur at a

semiconscious level. The amygdala is also considered to control the individual's knowledge of their status in relation to surroundings and thought.

The hippocampus (Guyton, 1987) is located within and along the border of the temporal lobe. It is considered to determine the importance of sensory experiences. One of its functions seems to involve the storage in memory of experiences important to the individual. It has numerous connections to the cerebral cortex, the amygdala, the hypothalamus and the mammillary bodies. If the hippocampus is removed, the consolidation of long term memories, especially verbal ones, does not take place. Stimulation of the hippocampus can produce any of the behavior patterns listed for the amygdala. Guyton (1987) points out that the hippocampus has an unusual property:

"...very weak electrical stimuli can cause local epileptic seizures that persist for many seconds after the stimulation is over, suggesting that the hippocampus can give out prolonged output signals even under normal functioning conditions. During the hippocampal seizures the person experiences odd psychomotor effects, including olfactory, visual, auditory, tactile, and other types of hallucinations that cannot be suppressed even though the person has not lost consciousness and knows these hallucinations to be unreal." (p. 258)

Other areas mentioned in Persinger's (1983) theory include the thalamus, the mammillary bodies, and the hypothalamus. The thalamus is a major relay and integration center for sensory information. The mammillary bodies function in close association with the thalamus, hypothalamus, and brain stem. They are considered to be involved in the control of wakefulness. The hypothalamus plays a vital role in the control of the autonomic nervous system, of the endocrine system, and of the major biological drives. It shows some involvement in fear and punishment, and is a major pathway of the limbic system. It connects to the forward part of the thalamus and the limbic cortex (Guyton, 1987).

Persinger's theory (1983) also mentions the reward and punishment centers of the brain. These structures serve as the physiological basis of reinforcement and punishment (Glietman, 1991). It has been shown, for example, that when rats are given the opportunity to directly stimulate their pleasure centers they will do so almost continuously. This self stimulating behavior is so rewarding that rats will literally starve to death if given a choice between eating and self stimulating.

Reward centers are located along the course of the medial forebrain bundle, especially where it lies in the hypothalamus. The medial forebrain bundle is a collection of fibers that runs through the base of the forebrain and parts

of the hypothalamus. The medial forebrain bundle is hypothesized to be involved in the regulation of dopamine levels. Accordingly, is hypothesized to be involved in producing depression. Other reward centers are located in the hypothalamus, thalamus, and amygdala. The reward centers of these three areas are less potent than those in the hypothalamus. Punishment centers are found in the hypothalamus, thalamus, amygdala, and hippocampus. As their name suggests, the activation of these centers decreases the future likelihood of the behavior that stimulated them.

Persinger's (1983) theory also takes into account hemispheric differences in the brain. In the majority of the population the two hemispheres of the brain are "specialized" to serve different functions (Glietman, 1991). In general, the left hemisphere functions to a greater extent than the right hemisphere in language abilities. The right hemisphere of the brain functions to a greater extent than the left hemisphere in tasks that involve spatial relationships. This "specialization," called lateralization, is related to handedness. Overall, left handed individuals show less lateralization for all brain functions than do right handed individuals. In left handed individuals, who constitute approximately 12% of the population, slightly more than half exhibit speech ability lateralized in the left hemisphere. For the other half language is a function shared by both hemispheres. A gender difference is also

present. Overall, women show less brain lateralization than men (Corsi-Carrera, Herrere, & Malvido, 1989).

Persinger (1993) speculates that the degree to which brain lateralization takes place influences the likelihood of an individual having a religious experience. Accordingly, he suggests that gender and handedness are related to the likelihood of having a religious experience.

Epilepsy and its Relationship to Religious Experiences

Hippocrates was one of the earliest writers to describe a relationship between epilepsy, religious experiences, and personality (Novelly, 1992). Hippocrates wrote about physiological causes for the "sacred" disease of epilepsy. This relationship has come to be an important part of a modern theory of temporal lobe epilepsy and personality (Bear & Fedio, 1977). This theory of epilepsy and personality has provided the basis for Persinger's theory.

Epilepsy is a chronic condition of the brain that predisposes an individual to have seizures (Coulter, 1993). A seizure is a sudden excessive and disorderly discharge of neurons in the brain. Seizures are usually accompanied by alterations in consciousness, motor function, and sensory function. Epilepsy can have many causes, including congenital defects or trauma. In addition, both external and internal stimuli can precipitate seizures in individuals with epilepsy.

Persinger (1993b) theorized that seizure activity can occur as a result of learning. Little is known, however, about the role of learning in inducing seizures (Fenwick & Brown, 1989). Even less is known about the role of internal stimuli, such as performing a mental task, in producing seizures.

Fenwick and Brown (1989) provided a summary of research on these issues. In considering external stimuli and learning they reported that one researcher was able to classically condition seizures in brain damaged cats. They also reviewed a case study of conditioning in a human subject. The human subject in this study experienced seizures in response to flashing light. When the light was paired with a sound stimuli the sound stimuli acquired the ability to elicit seizures.

Fenwick and Brown (1989) also reviewed psychogenic epileptic seizures. They defined these as, "... seizures induced by acts of will or specific functions of the mind" (p. 538). As support that internal processes could induce seizures they cited case studies, including one of a man who used seizures to escape punishment as a child. The process of having seizures induced by learning and internal mental events has been given the name kindling (Putman, 1986). Most of the research supporting the existence of kindling is based on case studies (Putman, 1986). While case studies strongly suggest kindling occurs, they are too limited in

sample size to provide estimates of how prevalent kindling is, or if it is limited to specific populations.

Persinger (1993b) theorized that the religious experience is the result of seizure activity in a limited area of the brain. That seizures can involve limited areas is recognized by the classification system developed to describe the brain areas involved in, and the effects of, seizures. This classification system describes seizures that are partial, that is, focal and involve limited areas. The classification system also notes seizures may, or may not, result in loss of consciousness (Coulter, 1993).

Persinger's (1993b) theory was derived from a theory of temporal lobe epilepsy and personality that originated, for the most part, from work done by Bear and Fedio (1977). Based on case studies of temporal lobe epileptics Bear and Fedio looked specifically for 18 personality traits they expected to be associated with seizures in the temporal lobe. In doing so, they compared temporal lobe epileptics with normal controls as well as with patients who had other neurological diseases.

Bear and Fedio (1977) assessed personality by questionnaire. The questionnaires were given to both subjects and family members of subjects. Eighteen specific personality traits were found that discriminated temporal lobe epileptics from the other groups. These included intense emotional experiences of sadness, anger, and

euphoria; increased aggression; loss of, or unusual, sexual interests; intense guilt and self judgement; hypermoralism; obsessive behaviors; and circumstantiality. Hypermoralism consisted of extreme attention to rules with an inability to distinguish, "significant from minor infractions" (p. 455). Further traits included grandiosity, often with divine guidance; hypergraphagia, excessive writing; religious and philosophical interests, often idiosyncratic and concerned with cosmology; a passive view that of being predestined by fate; humorlessness, and paranoia.

The personality profile described by Bear and Fedio (1977) describes a person given to transcendental experiences who is extreme in his or her affective experiences and expression. The person's learning history is filled with emotionally charged idiosyncratic events. As a result the person attaches importance and causal attributes to events others find meaningless or non sequitur. The person is given to excessive writing and is grandiose. In addition the person sees pre-destiny for themselves, and is given to conversion experiences. Bear and Fedio (1977) pointed out that this most closely matches the disorder paranoid schizophrenia and the personality disorders paranoid and schizotypal.

Results similar to Bear and Fedio's (1977) have been reported by other researchers. Jeremy, Roberts and Guberman (1989), for example, examined the association between

religious beliefs and epilepsy in 57 patients at a neurological epilepsy clinic. Sixty percent of the sample were classified as having abnormal religious, or related, beliefs. The related beliefs category included items such as black magic and astrology. Overall, the authors concluded that the occurrence of epilepsy is associated with abnormal religious beliefs and religious conversion experiences.

Gloor, Oliver, Quesney, Anderman, and Horowitz (1982) examined the effects of electrical stimulation on the experiential effects of temporal lobes seizures. More specifically, Gloor et al. (1982) examined the effect of the site at which seizure activity begins in the temporal lobe. They used 35 patients in their study who were suspected of having temporal lobe seizures. Of these 29 were found to clearly have seizures originating in the temporal lobe. The study was conducted by implanting intracerebral depth electrodes into the limbic system and the temporal neocortex (the part of the temporal lobe covering the limbic system). Stimulation was delivered in the form of .5 millisecond bipolar symmetrical pulses ranging from 500 milliamperes to 4 milliamperes. Both spontaneous and induced seizures were studied.

Gloor et al. (1982) found the following experiential phenomena associated with temporal lobe seizures: fear, illusions of familiarity, memory recalls, forced thinking, auditory and visual hallucinations, anger, bodily

distortion, a "...strange indescribable feeling in the mind..." (p 131), visceral sensations, and floating sensations. The authors commented on the strong emotional content associated with many of these experiences. They further noted that for patients in whom the seizures were found to be of non-temporal lobe origin the experiential phenomenon was not present.

One interesting finding by Gloor et al. (1982) was the influence of wishes and expectancies on what was experienced, with the seizure often serving to fulfill wishes and expectations. An example was given (p. 137) of a woman who had always wanted to attend a hockey game, but had never had the chance to do so. With hippocampal stimulation she experienced a visual hallucination of receiving tickets to the game from a worker at the arena.

Gloor et al. (1982) expanded on the findings of this study by pointing out that the effects of stimulating the limbic system are different from the effects of stimulating the motor cortex of the brain. Stimulation of a specific site in the motor cortex will, generally, result in movement. Furthermore the specific site and the associated movement is common to most individuals. Stimulation of the limbic system will also result in what can generally be described as a set of specific responses. These responses, however, are interpreted and given meaning by what the individual has experienced. As Gloor et al. (1982) put it,

"The fact that stimulating "whom" seems more important than stimulating "where" in the limbic system becomes understandable because the responses reflect at the same time the function of the stimulated area and the patient's past individual experience." (p. 141).

Gloor et al. (1982) reported that in all cases the experiential phenomenon was associated with seizure activity in the limbic system or deep within the neocortex of the temporal lobe where the activity (direct or after discharge) involved the limbic system. The amygdala was the temporal lobe structure from which the largest number of experiential phenomena were obtained. They concluded that if the limbic structures are not stimulated no experiential phenomena occurred.

This finding was surprising in consideration of the role served by the temporal lobe. Gloor et al. (1982), however, explained this by stating there is an intimate connection between the limbic system's function and that of the neocortex. The authors pointed out that both brain areas are essential to a process that bring events to conscious awareness. As they put it, "... The observation that such responses can be more easily elicited by stimulating the limbic system than at the neocortical "end" of this system suggest that limbic activation may be essential for bringing to a conscious level percepts elaborated by the temporal neocortex."

Gloor et al. (1981) also commented on the flashback quality of the experience produced by temporal lobe stimulation, describing the experience and the memory of it as a discrete episode rather than an unfolding story. The authors also pointed out that purely hallucinatory episodes can be as vivid and detailed as those of a true memory flashback. They argued, in fact, that the memories evoked by temporal lobe stimulation are often distorted, and provide a poor picture of past events.

Gloor et al. (1982) also addressed the possibility that the results of their study do not generalize to the population that does not suffer from epilepsy. They pointed out that for this to be true the effect of epilepsy would have to be to remodel the function of the limbic system in the brain. While it is true that structural alteration in the connections between neurons is changed by epileptic seizures (Yehezkel & Represa, 1990), Gloor et al. (1982) pointed out that an overall change in the function of the limbic system due to epilepsy is not supported by either primate or human studies. Accordingly, they concluded that the limbic system of the normal population serves the same function as that of epileptics.

While Gloor et al. (1982) did not report pleasant emotional or sensory experiences as a result of limbic system stimulation, other researchers have found this in temporal lobe epilepsy. One study describing this, and

suggesting gender differences in brain structure and function, has been done by Remillard et al. (1983). These authors provided reviews of 12 case studies in which women experienced sexual arousal, and pleasure, when seizures occurred in the structures of the limbic system. The majority of these occurred in conjunction with seizures that had right temporal lobe foci. The authors reported that men suffering temporal lobe seizures also report sensations that seem to originate from the pelvic region. Men, however, are not reported to find such sensations erotic.

Remillard et al. (1983) has pointed out that sexual dimorphism has been reported in mammalian species other than human, and that the normal brains of female mammals will often exhibit electrical activity similar to seizure activity during the postcoital orgasmic phase. In male humans temporal lobe epilepsy is often associated with a low sex drive and low pleasure during sex. The results of this study suggest that this is not true for women.

One case of particular interest was reported in Remillard et al. (1983). In this case a 55 year old woman developed seizures after the birth of her first child. Before experiencing seizures the woman experienced a sensation of impending orgasm. During the seizure itself, she performed verbal automatism. These automatism consisted of reciting prayers.

While overall change in the function of the limbic system is not reported as a result of temporal lobe epilepsy (Gloor et al., 1982), an increased susceptibility to further seizures along with structural alteration has been reported (Yehezkel & Represa, 1990). These authors report that seizure activity in the hippocampus results in the formation of abnormal synaptic contacts, often by the sprouting of mossy fibers. Mossy fibers are the axons of certain cells in the hippocampus. Further effects include the long term potentiation of synaptic transmission in the affected areas and changes in gene expression. Yehezkel and Represa (1990) made use of autopsy studies of both adults and children, who died of epilepsy, to support their claims.

The results found by (Yehezkel & Represa, 1990) are important to Persinger's (1993b) theory. Persinger theorized that once a temporal lobe micro-seizure takes place the likelihood of further such seizures increases. He has also theorized that seizures occurring early in life are more likely to increase the probability of further seizures than those occurring later in life (Persinger, 1991).

Persinger's application of the temporal lobe theory of epilepsy and personality to the normal population seems to be a logical extension of the theory. The physiological and experiential effects of temporal lobe epilepsy have been documented (Gloor et al., 1982). Epilepsy, however, is an extreme and pathological disorder of the brain. As such, it

should be pointed out that extending the theory may be unwarranted. Describing the religious experience of the normal population as similar in origin to the experiences of temporal lobe epileptics, for example, may be like describing the origin of the experience of sight in the normal population as similar in origin and experience to that produced by a sharp blow to the back of the head.

Persinger's Theory

Persinger (1983, 1993b) has extended the observations of Bear and Fedio (1977) to the "normal" population. Persinger (1983) has theorized that mystical, paranormal, and religious experiences are the result of brief, transient, seizure activity within the temporal lobe and its adjacent structures. According to Persinger, transient seizure activity in the temporal lobe, a temporal lobe transient (TLT), varies along a natural continuum. At the high end of this continuum are the epileptic seizures described in epilepsy cases. The high end of the continuum involves seizure activity that is intense and frequent. At the low end of the continuum seizure activity is minimal or absent in both frequency and intensity. Persinger has attributed this natural lability in seizure activity, in part, to naturally occurring differences in brain structures. This aspect of his theory can be considered to be a diathesis, a natural predisposition to seizure activity in the temporal lobe. While the seizure activity described

by Persinger appears similar to that found in people suffering from anti-social personality disorder (Davison & Neale, 1993), Persinger did not speculate about this similarity.

Persinger has described what the effects of a TLT would be. The functions of the amygdaloid and hippocampal complexes include the production of the sense of self in relation to time and space, the memory-dependent limits of the self in relation to time and space, and emotions. Accordingly, seizure activity in these areas would result in the experience of intense meaningfulness and affect, corresponding to the religious experience of "knowing". Memory function would be altered, resulting in a sense of "timelessness" for the experience. Additional effects would include: vestibular experiences, such as feelings of lifting or floating; auditory experiences, such as hearing ones name called; and proprioceptive experiences, such as an "out-of-body" feeling or sensing the presence of spirits. The inclusion of a reward center in the affected area would result in intense pleasure, such as the religious experience of "release of burden". Alternately, the inclusion of a punishment center would produce intense pain, such as that experienced in "sharing the suffering of Christ". The predicted effects of a TLT closely match descriptions of religious experiences (Smart, 1984).

In addition to considering the role of structures within and adjacent to the temporal lobe, Persinger has speculated about the role of the temporal lobe in inducing, and explaining for the individual, the effects of a TLT. In doing so he has concentrated on the temporal lobe's roles in language and memory. Persinger has pointed out that the amygdaloid and hippocampal complexes are heavily connected to overlying cortices, namely the temporal lobe and its surrounding structures. These connections allow memory and language to affect activity in these areas. As Persinger put it, "Consequently, they can be infused with the details of context and determined by the expectancy of the person" (p. 1256). Expressed alternately, this means that activity in the amygdaloid and hippocampal complexes is influenced by learning, which Persinger believes affects both the interpretation of TLTs, and their occurrence. Here, by the term learning, Persinger referred to alterations in synaptic connections and neurotransmitter release and uptake (Persinger, 1993b) brought about by stimuli ultimately originating outside the body (Skinner, 1974).

In describing an individual's interpretations of the experiences arising from TLTs Persinger used the expectancies of the individual. Persinger considered these expectancies to be the result of the individual's learning history. A Jehovah's Witness, for example, with a history of being taught about people experiencing oneness with God,

would expect a similar experience for him or herself. A Jehovah's Witness would be likely, therefore, to interpret the experience resulting from a TLT as oneness with God. A person not religiously inclined, however, would be more likely to interpret the experiences arising from TLTs as due to non-religious, or non Judeo-Christian, reasons. Possible explanations from such individual's learning history include psychic phenomenon, connection with a cosmic consciousness, or a UFO abduction.

Persinger has theorized that the frequency and intensity of TLTs are a function of three factors: natural lability, drugs, and learning experiences. Natural lability has been described previously in this paper (p. 18) and will be elaborated on later. The other factors can be considered stressors, environmental stimuli that act in combination with natural lability to produce TLTs. Here, Persinger used the word learning to mean the history of experiences that shape an individual's response tendencies.

Stressor stimuli in Persinger's theory can be divided into three categories. One category of stimuli consists of purely physiological stimuli. This class includes disease, physical deterioration, electrical or magnetic stimulation, and drugs. Of the latter, peyote is an example. Another category of stimuli are experiences that represent personal crisis in the individual's life, but are not designed to induce religious or paranormal experiences. These

experiences include life threatening situations, personal loss, change in political or socio-economic status, and similar events. The third category of stimuli consists of cultural or individual practices designed to induce religious or paranormal experiences. This category includes prayer and meditation.

In discussing this third category Persinger cited studies of the learned ability to induce seizures (Efron, 1957). In addition he described physiological changes that are the result of many religious or paranormal rituals. He speculated that these physiological changes may be physiological mechanisms that induce TLTs. These rituals include fasting, dancing, prayer, and meditation. As physiological mechanisms Persinger listed alterations in blood flow and chemical changes in the brain, such as rapid changes in norepinephrine levels.

Persinger has pointed out, a problem with studying TLTs, is that they occur, for the most part, below the cortices and are difficult to observe. In addition, the categories of stimuli are frequently mixed, such as in a peyote ceremony. The result of this is that it can be difficult to study some stimuli apart from the others that usually accompany it. In addition, it should be noted that Persinger has not theorized that all reports of religious, mystical, or paranormal experiences and behaviors are due to temporal lobe activity. He stated that many can be explained

on the basis of socialization, without the experiences he describes as due to TLTs. A teenager attempting to fit in at bible camp, for example, might report a religious experience whether or not one had actually been experienced by the individual.

One element of the religious experience is that of the sensed presence, that is, some entity sensed as being different from the self. Usually this sensed presence is accompanied by feelings of dread and awe (Streng, 1976). Persinger (1993b) has modified his theory to more accurately account for how such experiences take place. In doing so he addressed brain lateralization and gender differences in brain lateralization.

Persinger (1993b) began this modification by pointing out that researchers have theorized that the human sense of self is an aggregate property that emerges from language ability (Silberman & Weingartner, 1986; Skinner, 1974). As such, the sense of self would be localized in the left hemisphere, being as the left hemisphere is specialized for language tasks. Persinger further speculated that the right hemisphere engages in a similar activity, probably being most active before language develops. The self concept of the right hemisphere, however, is theorized to be a non-verbal one, and consists of spatial relationships.

Persinger theorized that under most circumstances the left hemisphere's sense of self is dominant. In stating this

Persinger cited research (Livanov, Gavrilova, & Alanov, 1973) that demonstrated the two hemispheres of the brain differ in their microstructural organization and metabolic activity. He proposed that during the usual functioning of the brain the two hemispheres perform tasks separately, and only exchange information when it is necessary to do so. In other words, the hemispheres are interdependent and rely on each other for functioning, but neither is typically aware of the majority of the tasks the other hemisphere is doing. It has been theorized, in fact, that one function of sections of the normal brain, the corpus callosum for example, is to prevent too great a sharing of information between hemispheres (Edelman, 1989).

Persinger (1993b) proposed that any process that facilitates interhemispheric coherence (essentially the sharing of information) will raise one hemisphere's "knowledge" of what the other is doing. One such facilitating process would be the temporal lobe transient, which involves an increase in the electrical activity of the temporal lobe. Conceptually this could be considered one hemisphere suddenly "screaming" at the other. Another process promoting interhemispheric coherence would be an increase in sensitivity by the other hemisphere, most likely this would occur naturally by the breakdown or malformation of those portions of the brain devoted to preventing excessive sharing between hemispheres.

According to Persinger (1993b), the sense of self is related to the concept of self esteem. Persinger described self esteem as the affective component of the sense of self, and described the sense of self generated by the left temporal lobe to be positive, while the right temporal lobe's sense of self has a negative component. Accordingly, Persinger theorized that a temporal lobe transient originating in the right temporal lobe would present to the left temporal lobe a spatial entity, not recognized by the left temporal lobe as an alternate sense of self. Furthermore the sense of self presented by the right temporal lobe would be infused with the negative emotions described to accompany the religious sensed presence.

Persinger (1993b) has also addressed how differences in lateralization within the population affect the experiencing of TLTs. He speculated that the "barriers" between the two hemispheres is a function of lateralization. Accordingly, individuals showing less lateralization should be more prone to a breakdown in the separation of the hemispheres. The separation would be greatest for right handed men, and weakest for women, left handed individuals, and people suffering from learning disabilities involving speech. The latter would be true due to the difficulty of forming a linguistic self concept.

Persinger's speculation about brain lateralization has allowed him to more clearly define how TLTs originating in a

specific hemisphere would be interpreted. He theorized that TLTs involving intrusions from the right temporal lobe into the left are more likely to result in the traditional religious experience than TLTs originating in the left temporal lobe and intruding into the right temporal lobe.

One advantage of the revision of Persinger's theory is the greater specificity it presents in describing the form a temporal lobe transient would take on the EEG (Munro & Persinger, 1992). The micro-seizure is theorized to show up as a spike, followed by alpha or theta activity. Persinger theorized this on the basis of the neuron structures considered to account for the electrical activity observed by EEG.

The normal waking brain is characterized by beta activity. Beta activity consists of high frequency activity (13 to 50 hertz) of a low amplitude (less than 20 microvolts). This activity is produced by small groups of neurons discharging simultaneously (Munro & Persinger, 1992) and is associated with alertness or mental activity (Cacioppo & Tassinari, 1990). Theta and alpha activity, in comparison, are low frequency, high amplitude, patterns. Alpha activity has a range of 8 to 12 hertz and an amplitude between 30 and 50 microvolts. It is associated with relaxation. Theta activity has a range of 4 to 7.5 microvolts and an amplitude between 20 and 30 microvolts. It is associated with meditation, hypnosis, and low levels of

alertness. The electrical pattern of theta and alpha activity is considered due to "...fewer, but much larger [than those producing beta activity] groups of discharging neurons whose patterns contain paroxysmal [sudden and violent] characteristics" (Munro and Persinger, 1992, p. 899).

Persinger (1992c, 1993b) considered the presence of alpha and theta activity to indicate the basic electrical lability that exists within the temporal lobe. He theorized that because of the high amplitude of these two types of activity, and their characteristic of sudden onset, their presence in the temporal lobe indicates the presence of neuronal structures that promote an electrical imbalance between the hemispheres. In the temporal lobe and the limbic system this imbalance is theorized to encourage the micro-seizure activity that in turn gives rise to paranormal and religious experiences. In other words, the presence of alpha and theta activity on the EEG indicates a basic predisposition to have temporal lobe transients. It also indicates the presence of the neuronal activity that constitutes or follows a temporal lobe transient.

One of the most interesting aspects of Persinger's (1993b) theory is the importance he attached to rituals such as prayer. Persinger (1985, 1993b) considered prayer to be a semantically conditioned pattern of words that encourages

TLTs. Persinger (1985) explained this using classical and operant conditioning.

Classical conditioning (Davison & Neale, 1993) is often referred to as associative learning. In classical conditioning a neutral stimuli is present when another stimuli is eliciting a response. Over time the previously neutral stimuli comes to elicit the response, without the presence of the stimuli that originally elicited the response. The most familiar example is that of dogs learning to salivate when they hear a bell, because the ringing of the bell has been associated with their being fed.

Operant conditioning (Davison & Neale, 1993) refers to changes in the likelihood of an organism performing a behavior based on what occurs when the behavior is performed (contingencies). If someone places two quarters in a candy machine, for example, and receives a candy bar, they are more likely to perform the same behavior in the future. Contingencies that increase the likelihood of a behavior are called reinforcers. Contingencies that decrease the likelihood of a behavior are called punishers. Contingencies can consist of physical events outside the individual's body, or internal bodily states (Skinner, 1964).

Skinner (1964) has theorized that in human beings the ability to use language has resulted in the ability to modify behavior without the actual physical presence of reinforcers or punishers. According to Skinner, humans learn

to associate words with behaviors and contingencies. They are given labels, that is words, by other individuals in the community. Skinner has pointed out that while the words for observable behavior are specific in what they describe, such as throwing a ball, the words for internal bodily states are usually less specific. This is because internal bodily states are usually not directly observable, and must be inferred by the observer. In considering Persinger's (1993b) theory this failure to be specific about labeling internal states can account for why the experiences associated with TLTs are labeled religious, mystical, UFO abduction, or given another label.

Persinger (1985) speculated that classical conditioning of TLT's and prayer takes place when the words common to prayer become associated with TLT's. Individuals are often told, for example, of other people's religious experiences and how prayer has resulted in both the religious experience and improved lives. This encourages individuals to seek out religious experiences, and when such experiences occur the individual is likely to engage in a ritual designed to enhance the experience, such as praying.

The above example, with its reference to seeking an experience for the experience itself and the enhanced life it brings, can be understood as involving operant conditioning as well as classical conditioning. In the above example, the contingencies of a behavior (praying) are

verbally presented to an individual. Accordingly, the individual is not only likely to pray when a TLT occurs, but is likely to pray as a way of inducing a TLT. Given practice, and the naturally occurring feedback that occurs when an individual has a TLT, it seems likely that prayer can become a skill developed for the purpose of producing TLTs.

Persinger expanded further on the use of prayer and its ability to elicit TLTs as an operantly shaped response to the internal states induced by verbal behavior. In doing so he wrote of death anxiety, which can be understood as an internal state brought about through the verbal behavior of considering one's death. Persinger stated that a TLT, and the accompanying experiences, can reduce or remove the anxiety response associated with considering one's own death. Persinger stated the production of a TLT does this by providing an experience that the individual interprets as proof for supernatural forces. As such, the production of a TLT can be understood as being negatively reinforced.

Persinger provided a limited amount of further information about how other rituals designed to alter consciousness result in the production of TLTs. Most of this came from the research studies described below. Persinger found positive correlations, for example, between the reporting of TLT signs and practice at producing psychic phenomenon (Persinger & Fisher, 1990). He has also found

positive correlations between the reporting of TLT signs and meditation (Persinger, 1992c). In addition, susceptibility to hypnosis has been found to be positively correlated with responsiveness to a physical procedure designed to induce TLTs. Persinger did not speculate about a relationship between relaxation techniques, such as progressive muscle relaxation, and TLTs.

EEG studies have been undertaken with hypnosis, and as such, some information is available to try and fit with Persinger's (1993b) theory. Edmonston and Moscovitz (1990), for example, reported in summarizing such work that the production of alpha activity has been found to be related to hypnotic susceptibility. They also reported, however, that this has not been a stable finding. Edmonston and Moscovitz (1990) reported in their study that compared to normal alertness, hypnosis resulted in an altered pattern of activation of the brain hemispheres between two conditions designed to require the abilities of one specific hemisphere. The authors reported not being able to determine the exact nature of the pattern, however, being as they analyzed the ratios of the findings. In addition, Cassioppo and Tassinari (1990) reported that hypnosis has been found to increase theta activity.

Increased production of theta and alpha activity is predicted by Persinger's (1993b) theory, as is an alteration in activity between the two hemispheres of the brain. As

such, the finding that hypnosis has similar effects to what Persinger has theorized occurs with TLTs suggests that hypnosis may be a ritual that can produce TLTs. Another relationship is present, however, between meditation, hypnosis, and prayer. All of these procedures are designed to reduce the awareness of outside stimuli. As such, it is possible that they encourage the expression of natural lability theorized by Persinger (1993b) by removing responsiveness to the outside world.

Persinger (1993b) presented a theory that is elaborate and detailed. As shall be shown, however, empirical research on the theory has mostly been done by Persinger and his associates. Of this, the majority of the supportive work is from correlational research designs.

Overall, Persinger's (1993b) theory seems to have received little in the way of criticism by outside parties. A literature search conducted with PsycLIT (1994), for example, only located three journal references addressing the theory as a whole. Of these, one article cited Persinger's work in clarifying their own research (Kettlewell, Lipscomb, & Evans, 1993). Another stated that an experimental design used by Persinger, involving a dichotic listening task, did not allow for the study of special populations (Roberts, 1993). The third was a review article (Wilfred, 1992) discussing Canadian research in the psychology of religion. As such, the theory as a whole does

not seem to have had the advantage of experimental replication and review by outside parties.

While Persinger's theory as a whole has not been widely criticized, his speculation that the two hemispheres of the brain differ in their affective components has been. Vingiano (1992), for example, wrote that the relationship between hemisphericity, low self esteem, and mystical experiences found by Persinger and Marakec (1992) was most likely the result of the design of the Vingiano Hemispheric Questionnaire (Vingiano, 1989). Vingiano wrote that the determination of hemisphericity by his questionnaire depends, in part, on the individual's endorsement of having low self esteem and mystical experiences. As such, the tests used in determining hemisphericity, mystical experiences, and self esteem measured items in common, and as such, would be consistently correlated. Overall, Persinger (1993b) was unclear as to why the affective components of the two temporal lobes should differ. In explaining this he pointed out that the self concept is defined by language, but did not elaborate.

The application of Persinger's (1993b) theory to practices such as meditation has also been criticized based on experimental findings. Deepak, Manchanda, and Maheshwari (1994), for example, examined the effects of meditation on individuals suffering epileptic seizures. They found that compared to controls, individuals practicing meditation

displayed less seizure activity. Jevning, Wallace, and Beidebach (1992) report that meditation serves to increase EEG synchronicity. Goldberg (1995) in a review of the literature from 1890 to 1989) noted that meditation increases bilateral and homolateral alpha activity in the central regions of the brain. Orme-Johnson (1995) has cited such findings to report that meditation increases coherence of alpha and theta activity while lowering the probability of seizures. Such reviews present a mixed finding. While they support the presence of the activity Persinger has predicted, they do not classify it as seizure activity.

Support for Persinger's Theory

Persinger has gathered support for his theory, both directly and indirectly. The direct evidence for his theory has been gathered through the use of brain stimulation, autopsies, experimentation, and EEG measurement. Indirect support has been gathered through the use of a questionnaire (Persinger, 1984c). This questionnaire, the Personal Philosophy Inventory (PPI), has been the major source of support for Persinger's theory.

A direct test of Persinger's theory has been done by De Sano and Persinger (1987). This study examined the effects of weak magnetic stimulation of the temporal lobe on strength of imagining and hypnotic suggestibility. The imagining variable consisted of subjects imagining, and describing, an encounter with an alien presence. Exposure to

the field was found to increase suggestibility and aspects of imaginings for both men and women.

In a similar study Richards, Koren, and Persinger (1992) examined the effects of left and right temporal lobe stimulation in 12 men and 12 women. They found that when either temporal lobe was stimulated women reported experiencing more vivid images than men and greater perseveration of ideas. Both men and women reported experiencing vibrating sensations. For men this happened more often when the left hemisphere was stimulated than when the right hemisphere was stimulated. For women the opposite was true, with right temporal lobe stimulation leading to more vibrating experiences than left temporal lobe stimulation.

In this study women reported experiencing fear or apprehension when the right temporal lobe was stimulated, while men did not. Women who experienced fear and apprehension described the vibrating sensations as unpleasant. Women who did not experience fear were more likely to describe the describe the vibrating sensation as pleasant than women who did experience fear. These findings are in agreement with the case studies reported by Remillard et al.. (1983) and suggest that the experiences of temporal lobe epileptics can occur in a milder form in the normal population. Richards, Koren, and Persinger (1992) attributed

the findings on fear to the lesser degree of lateralization in the normal female brain.

Persinger has also gained evidence for his theory through case studies using EEG. In an early study Persinger (1984a) reported on brain activity, recorded by EEG, during episodes of transcendental meditation and glossolalia. Glossolalia is commonly known as speaking in tongues.

The first subject reviewed was a 32 year old female with a ten year history of practicing transcendental meditation. Persinger reported that after 19 minutes of meditation by this subject, "...delta frequencies with an aberrant spike and slow wave-like profile emerged for about 15 to 20 seconds on the temporal lobe only" (p. 129). No change occurred on leads attached over the subject's occipital or frontal lobes. The subject reported after the session that she had felt very near to the "Cosmic Whole."

The second subject was a 20 year old female who experienced glossolalia. This subject had a history of proselytizing and reported spontaneous occurrences of glossolalia during her childhood. Persinger reported that spike activity began in the temporal lobe following ten minutes of glossolalia.

Persinger's (1993b) revised theory predicts that TLTs are facilitated by any process that encourages the production of alpha or theta activity within the temporal lobe and it's adjacent structures. One process for doing

this is hypnosis, which is associated with theta activity (Caccioppo & Tassinary, 1990). Persinger has also theorized that TLTs from the right temporal lobe passing into the left temporal lobe result in fear and the experience of a spatial sense of self. In addition, he theorized that the experiences accompanying TLTs are interpreted by the individual on the basis of prior learning, especially expectancies.

To further explore this Lavalley and Persinger (1992) examined EEG recordings of six individuals, five women and one man, who had joined groups to recover repressed memories. Subjects in this study all described themselves as apprehensive individuals who had felt "different" from childhood on. All of the subjects had joined groups that used hypnosis to recover memories. Of the subjects, two were in groups for incest or sex abuse, while the other three were in New Age groups devoted to recovering memories of past lives, spirits, and alien abductions.

All of the subjects in this study reported recovering memories of what they expected to find, and reported relief of anxiety when such memories were "recovered". The EEG recording showed anomalous theta activity involving the right temporal lobe for four of the subjects. For the other two subjects theta activity was present in the temporal lobe of both hemispheres. One individual was found to have activity severe enough to warrant referral to a neurologist.

Lavallee and Persinger (1992) interpreted these results as demonstrating higher than average temporal lobe electrical lability in people actively cultivating the experiences associated with temporal lobe transients. Beyond this there were similarities between what took place for individuals belonging to these groups and what Persinger (1993b) described as the effects of prayer. Both members of religious groups and members of recovered memory groups experienced social reward for cultivating experiences outside of normal experience. They also experienced a reduction in anxiety as a result of cultivating such experiences.

Using a quasi-experimental design Monroe and Persinger (1992) examined the hypothesis that alpha or theta activity in the right hemisphere's temporal lobe is related to the sense of presence and fear. This study used 15 women and 13 men. EEG measurements were taken over the left and right temporal lobe for 30 minutes. During this time subjects were asked to sit quietly and wore dark colored translucent goggles in a darkened room. After measurements had been obtained the subjects filled out an exit questionnaire inquiring about subjective experiences during the experiment. Before EEG measurement was taken subjects completed the Personal Philosophy Inventory (Persinger and Marakec, 1987; Persinger, 1984c). The Personal Philosophy Inventory (PPI) provides measures of temporal lobe epileptic

signs and accompanying experiences. It is described more fully in the correlational studies below.

Monro and Persinger (1992) found that an ego-alien intrusion factor (sensed presence) was positively correlated with right temporal lobe hemispheric activity, but not with left temporal lobe theta activity. A history of having felt a sensed presence was strongly associated with right temporal lobe theta activity. The experience of fear during the recording time was correlated with an dominance of right over left theta rhythms. The authors noted that the majority of the theta rhythms observed in this study consisted of quick bursts lasting 1 to 2 seconds. As such, they are consistent with the TLT hypothesis.

The majority of support for Persinger's theory has been gathered by questionnaire and does not involve experimentation or measurement of brain activity. The primary research instrument has been the PPI (Persinger, 1984c). The PPI is a self report inventory that is divided into clusters of items. One cluster is a temporal lobe sign cluster. This set of questions measures the subject's endorsement of symptoms consistent with temporal lobe seizures, and is derived from research on temporal lobe epilepsy and temporal lobe psychosis. Another cluster is the paranormal cluster. This cluster measures subject's endorsement of experiencing paranormal phenomenon, such as

clairvoyance and precognition. A religion cluster is also included, which measures the endorsement of religious dogma.

To evaluate the truthfulness of subject's responses, The PPI contains three control clusters. These include a mundane psychological functioning cluster, an odd-yes cluster, and a lie detection (infrequency) cluster. The odd-yes cluster consists of extremely unusual experiences. The lie detection cluster is part of the "lie" detection scales of the MMPI.

In developing the PPI, Persinger (1984c) used it to discriminate groups on two variables. These variables were reporting a religious experience the subject "knew" was real and church attendance. Persinger found that subjects who reported religious experiences could be discriminated from those who did not by scores on the temporal lobe cluster. Discriminative power was found for church attendance in one sample, but failed to replicate in a second sample.

Persinger and Marakec (1985) tested the validity of the PPI's ability to measure temporal lobe lability by EEG measurement. In this study electrical activity in the temporal lobe was measured and correlated with the temporal lobe signs, paranormal, and religion clusters of the PPI. The correlation between temporal lobe activity and the control scales of the PPI was also evaluated. As a further test, activity in the occipital lobe was measured and correlated with the PPI clusters.

Persinger's theory holds that lability in the temporal lobe varies along a natural continuum, and predicts that activity in the temporal lobe and religious, mystical, or paranormal experiences vary directly. It was predicted in this study that positive correlations would be found between the religion, temporal lobe signs, and paranormal clusters on the PPI and the degree of electrical activity in the temporal lobe. It was predicted that no relationship would be found between control clusters and temporal lobe activity. It was also predicted that no correlation would be found between the degree of electrical activity in the occipital lobe and the PPI clusters.

Ten women and eight men were used in this study, all were drawn from a third year psychology course. Prior to EEG measurement, all subjects were given the PPI. For each subject measurements of temporal lobe and occipital lobe activity were obtained under different conditions, such as eyes open or closed. Measurements were taken for a sixteen minute period. The results of the EEG (electroencephliography) were coded as zero, indicating no spike activity, or one, indicating spike activity. Spike activity was defined as an increase in amplitude of at least twice the background activity.

As predicted, significant correlations, $p < .01$, were found between spike activity in the temporal lobe and the religious beliefs, temporal lobe signs, and paranormal

clusters. No significant correlations were found between occipital lobe activity and the religious beliefs, temporal lobe signs, or paranormal clusters. No significant correlations were found between activity in either lobe and the control clusters.

Persinger (1984b) has evaluated the relationship between the reporting of paranormal experiences and temporal lobe signs as measured by the PPI. In evaluating this Persinger used two groups of college students, male and female, with a total number of 149. Persinger found positive correlations between the paranormal cluster and the temporal lobe cluster for both groups. For the first group this was $r(108) = .60, p < .001$. For the second group the correlation was $r(41) = .72, p < .001$. Persinger concluded this study provides support that people who report temporal lobe signs also report paranormal experiences.

Persinger and Valliant (1985) replicated the above study using a questionnaire that was separate from the PPI. One hundred and one university students participated in this study. Subjects were administered the PPI, then one week later, they were administered a questionnaire that specifically measured paranormal experiences. Significant correlations were found, $p < .01$, between the paranormal experiences questionnaire and both the temporal lobe cluster and the paranormal cluster on the PPI. No significant correlations were found between the paranormal experiences

questionnaire and the control clusters on the PPI. No significant correlations were found between the paranormal experiences questionnaire and the religious beliefs cluster on the PPI.

The PPI has been used to evaluate the relationship between temporal lobe signs, imaginings, and hypnotic suggestibility. Persinger and De Sano (1986) used the PPI to examine whether the reporting of temporal lobe signs is correlated with a natural inclination for imagining. They also evaluated the extent to which people who report temporal lobe signs are more susceptible to suggestion than those who do not.

Subjects in this study were evaluated for suggestibility using the Hypnosis Induction Profile (Spiegel and Spiegel, 1978). Temporal Lobe Signs were evaluated using the PPI. Childhood and adult imaginings were evaluated using the Wilson-Barber Inventory of Childhood Memories and Imaginings. Twenty seven subjects participated in this study.

Persinger and De Sano found positive correlations for measures of imaginings, temporal lobe signs, and suggestibility. These correlations ranged from .40 to .60. The control clusters in the PPI did not show significant correlations with the above. Results indicated that subjects who reported adult and childhood imaginings were more susceptible to hypnotic induction than those who did not.

Temporal lobe signs and paranormal experiences were correlated with the capacity for adult imaginings. People reporting temporal lobe signs were more likely to report floating responses on the HIP.

The PPI has been used to examine groups who regularly experience paranormal phenomenon. Persinger and Fisher (1990), for example, compared scores on the PPI between members of a "psychic group" and university students. The psychic group consisted of 20 women who regularly participated in a group that met to experience and discuss psychic phenomenon. A group of twenty female college students were used for a comparison group.

Members of the psychic group were found to score significantly higher, $p < .05$, on the paranormal experiences and temporal lobe signs scales of the PPI than the college students. Discriminant analysis indicated that items on the PPI could correctly classify 95% of the college student and psychic groups. These items were, a sense of presence, exotic beliefs, personal writing, depersonalization, and olfactory experiences.

The PPI has also been used to evaluate the relationship between the age of onset of religious experiences and the propensity to display temporal lobe symptoms of seizure. Persinger (1991) compared the PPI scores of 174 students who reported having religious experiences before adolescence with the PPI scores of 694 students who denied having

religious experiences before adolescence. Both male and female subjects were used. Persinger found that subjects who reported preadolescent religious experiences scored higher on the temporal lobe signs, paranormal, and religious clusters of the PPI than those who denied preadolescent religious experiences. He attributed these findings to natural lability in temporal lobe activity.

One aspect of Persinger's theory not clearly explained is his suggestion that the sense of self derived from the right hemisphere is associated with low self esteem (negative affect). Persinger and Makarek (1991) have examined this relationship using the Coopersmith Self-esteem Inventory and the Vingiano Hemispheric Questionnaire (Vingiano, 1989). The Vingiano Hemispheric Questionnaire provides a measure of brain lateralization and dominance. Using a sample of 28 men and 32 women they found that right hemispheric dominance was negatively correlated with self esteem ($r = -.70$, $p < .001$ for men and $r = -.58$, $p < .001$ for women). No gender differences were found, though the correlation for men was higher than for women. As mentioned earlier, however, Vingiano (1989) has called this finding into question.

Applications of the Temporal Lobe Theory

Much like the psychodynamic theories of personality the temporal lobe theory of religious experience and personality has been used to explain the actions of historical figures.

Two such individuals are Saint Paul (Landsborough, 1987) and Vincent Van Gogh (Kivalo, 1990). Persinger's development of this theory, by extending it to the paranormal and religious experiences of the normal population allows the theory to be used to explain the effectiveness of therapeutic interventions based on Twelve Step Groups (Alcoholics Anonymous, 1955). In addition, Persinger's work has been applied to understanding the experiences of people suffering from what is currently understood as mental illness.

Landsborough (1987) offered an examination of Saint Paul based on the temporal lobe theory of personality. Landsborough's examination of Paul compared the descriptions of Paul's works and experiences, as given in the Bible, with what is known about temporal lobe epilepsy. Aside from Paul's conversion experience, which is described as resembling an seizure, Landsborough stated that Paul's experiences and life style closely match the experiences and life styles of many people afflicted with temporal lobe epilepsy. Originally, Paul was involved in the persecution of the early Christian community. Following his conversion experience, however, he became one of Christianity's greatest promoters. His personality can be described as passionate, and he clearly shows an obsession with matching rules to "ultimate" beliefs. All of this, along with tireless effort, has produced the Christianity we know it

today as well as great theological controversy (Meeks, 1972).

The New Testament book of First Corinthians gives evidence of Paul's intense emotional experiences and his devaluation of sexual interest (First Corinthians, 7:1-12). This book also makes clear that Paul considered himself to be receiving Divine guidance (First Corinthians, 9:1-3), his overwhelming focus on religious and philosophical interests, and his view that we are all predestined in our fates once we choose a path (First Corinthians, 6:9-14). The number of books in the New Testament that can reasonably be attributed to Paul can be viewed as evidence that Paul was a prolific writer (Meeks, 1972). Whether or not this was hypergraphagia, however, cannot be proven.

None of this, however, is strong proof that Paul suffered from temporal lobe epilepsy, no matter how similar it is to Bear and Fedio's (1977) profile. Paul, however, wrote that he suffered some physical ailment. In Second Corinthians 12:7-9 Paul wrote, "To keep me from becoming conceited because of these surpassingly great revelations there was given to me a thorn in my flesh, a messenger of Satan to torment me." (p. 662). It is noteworthy that Paul linked this thorn with the revelations God has given him, because this would be expected if the "thorn" was seizure activity involving the temporal lobe. In Galatians 4:13-14 Paul thanked the Galatians for not treating him with

contempt and scorn because of his illness. The word translated as "contempt and scorn", in the original text, means to spit out at. At the time of this writing the act of spitting out was a superstitious response to a seizure, though not always to an epileptic one.

Landsborough found the greatest evidence for temporal lobe seizures afflicting Paul, however, in the conversion experience and the revelations Paul experienced. Paul's conversion is described in Acts 9:1-19; 22:6-13; and 26:9-16, and to a far lesser extent it is described by Paul in Galatians 1:13-17. While the descriptions do not match well, the essential story is that Paul saw a bright light, fell to the ground, heard a voice speaking to him, converted to Christianity, and was blind for a period following the episode.

Landsborough (1987) has pointed out that falling to the ground is characteristic of a seizure extending to the motor areas of the brain. Post seizure blindness, from which the sufferer recovers, has been reported in seizures. Visual and auditory hallucinations are characteristic in seizures involving the hippocampal structures. The only part of the biblical descriptions that does not fit with what is known of seizure activity in the temporal lobe and surrounding structures is the elaborate speech that Paul heard. This speech, however, is the part of the description that varies the most from story to story. This variance can be explained

on the basis of elaboration by those retelling the story (Landsborough, 1987).

In Second Corinthians 12:1-9 Paul wrote of his visions and being caught up into heaven. In doing so he described ecstasy and the "knowing" of secrets. His account describes an out of body experience, though Paul makes it clear that he does not know if this was physical or not. Paul's description of his visions closely matches Persinger's (1983) description of the effects of a seizure in the temporal lobe involving vestibular hallucinations.

The temporal lobe theory of religious experiences and personality offers a naturalistic explanation for many of the religious experiences recorded by history. The same can be said of Persinger's (1993b) theory, being as it is an extension of the temporal lobe theory. In the case of historical examples, however, the truth or falsehood of the theory cannot be easily demonstrated. Saint Paul's body, for example, cannot be exhumed for an autopsy. The following application of Persinger's (1993b) theory is testable in principle, but such a test has not been undertaken. As such, while the following demonstrates the utility of the theory, the theory's applicability in understanding Twelve Step approaches remains unproven.

Persinger's development of the temporal lobe theory is applicable in understanding the effectiveness of a modern day therapy. While originally developed as a treatment for

alcoholism this therapy approach has been extended to include many problems; including overeating, emotional disorders, and sex offenders. This therapy is the Twelve Step method of Alcoholics Anonymous. The Twelve Step approach relies on confession and spiritual awakening. It also involves the prosletizing of new members. None of this is surprising being as it is derived from a Christian prayer group (Alcoholics Anonymous, 1955).

The applicability of Persinger's (1983) theory in explaining the effectiveness of the Twelve Step approach is clearest in its use for the treatment of alcoholism. Alcoholics who stop drinking are prone to seizures, with the greatest risk occurring in a 24 hour period after they stop drinking (Leaton & Kinney, 1987). In consideration of this, the Twelve Step approach can be seen as taking advantage of a natural phenomenon by explaining the effects of focal seizures in the temporal lobe and using it promote personality change. It specifically advises that a spiritual awakening will occur and that a supernatural force will intervene in the persons life. Furthermore, this intervention is described as remaking the person into a new one. For those who do not experience religious awakening as a result of the twelve steps there is a traditional answer of, "Keep coming back, it works." This can be viewed as waiting until a seizure occurs in a context that the twelve step approach can use to therapeutic advantage.

This understanding of the AA approach was given some support by a study done by Twemlow and Bowen (1977). These researchers examined socio-cultural predictors of self actualization as an outcome measure of treating alcoholics with EEG biofeedback. Subjects in this study were taught to produce alpha and theta activity as a way to increase self actualization. Supposedly, the self actualization was an outgrowth of control over their own bodies. Of the socio-cultural indicators measured the one found to be most predictive at post-treatment measurement was a measure of commitment to religiosity, with high religiosity being positively associated with treatment success. In this measure of religiosity the subject was asked to describe themselves on a scale whose end points ranged from not religious to fanatically religious. Other predictors included being a white, well educated male.

Aside from these examples Persinger's (1987, 1993b) theory has been used to explain the greater incidence of phobias in women than in men (Persinger & Richards, 1991). It has been used to explain the experiential phenomena of schizophrenics (Persinger 1993b) and the sudden recovery of false repressed memories (Persinger, 1992a). It has also been used in evaluating the appropriateness of therapeutic interventions for personality disorders (Persinger, 1992).

Summary and Experiment

The writings of Hippocrates were among the first to suggest a relationship between epilepsy and personality. This relationship has been developed into a theory of how seizure activity in the temporal lobe influences personality by Bear and Fedio (1977). The temporal lobe theory has been used to explain the actions of historical figures such as Saint Paul (Landsborough, 1987).

Persinger (1983, 1993b) has expanded on the temporal lobe theory by applying it to the "normal" population. His theory holds that religious, mystical, and paranormal experiences are the result of transient seizure activity in the temporal lobe and its adjacent structures. Persinger's theory can be understood as a diathesis stress model of religious or paranormal experiences.

According to the theory people are born with a natural predisposition, the strength of which varies from person to person, to have TLTs and their accompanying experiences. Situational stressors, especially rituals and environments designed to result in religious or paranormal experiences, raise the probability of TLTs occurring. Prior, and situational learning, influence the individual's interpretation of the experiences accompanying TLTs.

In a later revision Persinger (1993b) more clearly defined the EEG activity that represents electrical lability, the diathesis in his theory, within the human

brain. He also more clearly specified the forms spike activity takes on the EEG, as well as specifying which hemisphere of the temporal lobe is involved in the experiential phenomena common to the religious experience. Persinger (1992) wrote, "...have shown that theta bursts within the right temporal lobe are correlated with experiences of ego-alien intrusions; the proclivity to generate theta rhythms was associated with inferences of the subject's pre-experimental temporal lobe lability." (p. 1309).

While there is support for Persinger's (1983, 1993b) theory, most of this support is indirect. That is, most of it has been gathered by questionnaire instead of the physical measurement of temporal lobe activity during times that a TLT should be likely to occur. Aside from one study, the actual measurement of brain activity has been restricted to measuring electrical lability, again outside of the times a TLT would be likely to take place.

One reason for this is that support for the theory by the physical measurement of temporal lobe micro-seizure activity is difficult to obtain. This difficulty is due to the occurrence of micro-seizures deep within the temporal lobe. Despite this, seizure activity has been observed by EEG and does correlate with the TLT experiences described by Persinger (Persinger, 1983, 1984a).

The environmental stressors in Persinger's theory are of particular interest. If the theory is correct, rituals designed to result in religious or paranormal experiences should result in TLTs and the accompanying religious experience. One such ritual is Christian prayer (essentially a person talking to God), a ritual that Persinger (1985) has described in operant and classical conditioning terms. Christian prayer is predominate in American culture, and as such, offers a way to test Persinger's theory by direct measurement. This study experimentally tested Persinger's theory by taking EEG readings of individuals who were praying.

Ideally, such research would have been a continuance of EEG studies done on prayer. Unfortunately, a search of the literature from 1964 to 1994 (PsyClit, 1994) only turned up one study of such research (Surwillo & Hobson, 1978). This study used EEG measurement, but did not take measurements over the temporal lobe. Interestingly, the authors of this study noted, "In the vast literature dealing with EEG, however, we were unable to locate any studies in which EEGs were recorded during prayer." (p. 135). This neglect, apparently, has continued.

Persinger's theory predicts that words common to prayer elicit a response consisting of micro-seizures within the temporal lobe and its adjacent structures. His theory predicts that these micro-seizures are preceded and followed

by the production of alpha and theta activity within the temporal lobe and the limbic system. This activity is predicted to be accompanied by experiential phenomena typically described as religious. Furthermore, the activity and accompanying experience is predicted to be more pronounced for women than it is for men.

This study performed an empirical test of Persinger's (1993b) theory by using EEG measurements of male and female participants in three conditions. Male and female participants were further divided into two groups, those reporting a history of many religious experiences/temporal lobe signs during prayer and those not reporting a history of many religious experiences/temporal lobe signs during prayer. One of the three conditions in this study consisted of baseline measurement of brain activity. Another condition consisted of the participants reciting a text containing words common to Christian prayer (appendix E). This condition was called the prayer condition. The last condition consisted of subjects reciting words common to the english language, but not common to Christian prayer (Appendix E). This condition was called the secular condition.

Before and after recordings were taken subjects filled out questionnaires inquiring about their subjective experiences. The first questionnaire, the prayer experiences questionnaire (Appendix A) inquired about participant's

endorsement that they experienced temporal lobe signs/religious experiences during prayer. Scores on this instrument were used to divide participants into those reporting a history of many religious experiences/temporal lobe signs during prayer and those not reporting a history of many religious experiences/temporal lobe signs during prayer. The second questionnaire, the experimental experiences questionnaire (Appendix B) inquired about subjective experiences that occurred during reciting the prayer and secular texts.

In accordance with Persinger's (1993b) theory, the following hypothesis were predicted.

1. There would be a positive correlation between the percentages of alpha and theta activity in the temporal lobes during the baseline condition and the reporting of temporal lobe symptoms/religious experiences on the prayer experiences questionnaire. This would reflect the heightened temporal lobe activity of those prone to have TLTs.

2. There would be a negative correlation between reports of temporal lobe symptoms/religious experiences on the prayer experiences questionnaire and the age of onset of the subject's first religious experience. This would reflect the increased susceptibility to TLTs of people who experience TLTs early in life.

3. Subjects in the high scoring group on the prayer experiences questionnaire would show higher percentages of

theta and alpha activity in the temporal lobe during the prayer condition than they would during the secular or baseline conditions. Subjects in the low scoring group on the prayer experiences questionnaire would not show differences in theta or alpha activity between the three conditions. This hypothesis examined whether or not overall production of theta and alpha activity, in people reporting a history of experiencing temporal lobe signs/religious experiences, was influenced by words found in prayer. It also examined if this was present to the same degree for people not reporting a history of temporal lobe signs/religious experiences.

4. Subjects reporting temporal lobe signs/religious experiences during the prayer condition would show higher percentages of theta and alpha activity in the temporal lobe during the prayer condition than they would during the baseline or secular condition. Subjects not reporting temporal lobe signs/religious experiences during the prayer condition would not show differences in theta or alpha activity between the three conditions. This hypothesis examined whether or not the reporting of temporal lobe signs/religious experiences during the experiment was related to theta or alpha activity.

5. For both alpha and theta activity, subjects in a high scoring group on question two (sensed presence) of the prayer experiences questionnaire would show a higher ratio

of right versus left temporal lobe activity during the prayer condition than they would during the text condition. Subjects in a low scoring group on question two of the prayer experiences questionnaire would not show differences in the ratios of either type of activity between the prayer and text conditions. This hypothesis will examine whether or not the ratios of right versus left theta and alpha activity, in people reporting a history of experiencing a sensed presence, differed from people who did not report a history of a sensed presence.

6. Subjects who reported a sensed presence during the prayer condition would show more alpha and theta activity in the right temporal lobe during the prayer condition than they would during the baseline or secular condition. This difference would not be present for the subjects who did not report a sensed presence during the prayer condition. This hypothesis examines whether or not the ratios of right versus left theta and alpha activity, in people reporting experiencing a sensed presence, differed from people who reported a sensed presence.

7. Differences would be found between men and women for hypothesis 1 through 6. While the predicted relationships would be found, they would be stronger for women than they would be for men. This was predicted on the basis of a lesser degree of brain lateralization in women than in men.

CHAPTER II
METHOD AND MATERIALS

Subjects

The majority of the 54 subjects in this study (96%) were students at the University of North Dakota. Subjects were recruited through standard subject pool procedures and given extra credit for participation. This study was reviewed and approved by the Institutional Review Board at the University of North Dakota prior to implementation. For the students recruitment consisted of a two part process.

The first part of the process was screening. Two groups of subjects were selected based on their scores on the prayer experiences questionnaire (Appendix A). These groups consisted of subjects scoring above 25 and those scoring below 10 when their answers to questions one through five on the questionnaire were added. These cut offs selected respondents scoring in the upper and lower 30 percent of the total possible score.

The prayer experiences questionnaire (PEQ) inquired about experiences typical of temporal lobe epilepsy/religious experiences (Persinger, 1993b). Accordingly, it was thought that this would yield a group of people reporting many temporal lobe symptoms/religious

experiences during prayer and a group reporting few temporal lobe symptoms/religious experiences during prayer.

Screening also selected participants on the following criteria. The recruits had to come from a background that practiced a variant of Christian religious faith, they could not have a history of epilepsy, mental illness, or any history of central nervous system trauma, and they could not have a history of being hypnotized. In addition they had to be 18 years of age or older and right handed. The latter restriction was made to ensure subjects of "normal" brain lateralization.

Difficulty was encountered in obtaining high scoring males on the questionnaire. Over a 2 year period, only 12 men were found who qualified. Of these, only three participated in the research. Following this screening was restricted to men, with the result that two more possible subjects were located. Both declined to participate.

Following this an effort was made to recruit community volunteers. An advertisement for volunteers was made on a local news channel. Recruitment posters were placed around campus and at locations where it was thought likely that high scoring males would encounter them. This included 2 local Lutheran churches, a local Catholic church, and an Assemblies of God church, as well as Christian organizations on the University of North Dakota campus. In addition pastors from five local churches, and Christian leaders from

the Campus Crusade for Christ were met with individually and asked to volunteer or assist in finding volunteers. Two professors teaching religion courses at the University of North Dakota were also met with and agreed to ask for volunteers from their classes. This effort resulted in the recruitment of two volunteer pastors and one student. At this time it was decided an adequate high scoring male group was not likely to be obtained. The final sample consisted of 16 subjects each of high scoring females, low scoring females, and low scoring males. Six high scoring males were used. The numbers of possible subjects out of the 823 students screened, is presented in Table 1.

Table 1

Students Qualifying

High		Low	
Male	Female	Male	Female
12	47	108	124

Procedure

Participants in this study were seen individually. Prior to participating students were given a copy of the prayer and secular scripts and asked to memorize them (Appendix G). The volunteers were given the texts after arrival for the study, and also asked to memorize them. All

subjects were also given an informed consent form (Appendix C) to read and sign. The consent form contained a description of the experimental procedure and a description of the restrictions on participants. Also included with the texts and consent form was an expanded description of the experimental procedure (Appendix D).

Upon meeting with the researcher students were asked to fill out the PEQ again. Community volunteers were asked to fill it out for the first, and only time. This was done to ensure the reliability of the PEQ. Scores from the second administration were used in all analysis based on the hypothesis.

Following this subjects were asked to recite the texts to verify that they knew them. The majority of the subjects required time before recording began to refresh their memories of the two texts. After memorization was verified subjects were instructed in the rate they were to repeat them during recording. They were instructed to repeat them one line at a time, using approximately 5 seconds per line, and pausing for two second at the end of each line. Instruction was done by having the participant recite along with the researcher.

Recording of EEG activity was done under three conditions for 460 second intervals. The initial condition consisted of a baseline measurement in which the subjects sat quietly with their eyes closed. The remaining two

conditions consisted of the subjects reciting the prayer or secular texts, while they sat quietly with their eyes closed. The last two conditions, prayer and secular, were performed in alternating order between participants to control for a possible effect due to order of presentation. Between each condition subjects were asked to open their eyes and look around the room for five minutes.

Recording took place in the Psychophysiology Laboratory in Montgomery Hall at the University of North Dakota using a Grass Model 6 Electroencephaliograph. Gold plated electrodes were used, connected to the scalp by a conductive paste. Monopolar recording was used, with connections being made to locations T3, T4, T5, and T6 (International 10-20 system). A reference electrode was connected to each subjects ear to obtain a neutral site for referencing each lobe. Electrodes were also connected above and below the subjects eyes and mouth, to allow the recording of muscle artifact and remove it from the record. Following the application of electrodes each channel was tested to ensure proper reception of the signal.

For all subjects temporal lobe activity was recorded in a band width of .5 to 50 microvolts. Based on descriptions provided by Cacioppo and Tassinary (1990) Alpha activity was defined as activity ranging from 8 to 12 Hz. Theta activity was defined as activity between ranging from 4 Hz up to, but not including, 8 Hz. Beta activity in the record was

screened out, as was artifact due to muscle movement. The removal of muscle artifact resulted in records of unequal length. To correct for this alpha and theta activity was calculated as a percentage of the total usable seconds in the record.

Datum was collected using Codas (1992) acquisition software, by Dataq Instruments, on eight channels at the rate of 50 samples per second. Channels one and two were devoted to recording eye movement. Channels seven and eight were devoted to recording mouth movement. For both eye and mouth movement the channels were set to record simultaneous signals in opposite directions, a requirement of the program used to break the data down into seconds of alpha and beta. Channels three through six recorded data from the temporal lobes. Specifically, channel three recorded the right front temporal lobe site (T4), channel four the right rear site (t6), channel five the left front temporal lobe site (T3), and channel six the left rear temporal lobe site (T5).

The analysis required knowing the total number of seconds alpha and theta activity were present in the record. Programs to do this were available, but the cost (\$5000.00) was prohibitive. Therefore, the determination of the numbers of seconds alpha and theta were present in the record was made using Hertz8, a program written by the author. This program removed eye and mouth movement artifact by screening

the record for signals simultaneously moving in the opposite directions. It removed beta activity, that is activity above 12 Hz on the basis of frequency, and in relation to the amplitude of observed alpha activity.

Adequate performance of Hertz8 was determined through the use of a Coulbourn Bio-System Calibrator (model B68-02) and the generation of data sets with known characteristics. It achieved 100% correct classification on these tests. The program also showed some ability to screen out artifact created by muscle groups other than the eye and mouth by identifying it as below the Hz frequencies under consideration.

Prayer and Secular Texts

The texts recited by subjects are presented in Appendix F. Both were written by the author using the The Teacher's Word Book of 30,000 Words (Thorndike & Lorge, 1944). This allowed for the texts to be matched for the number of times the words in the texts are used in the English Language. In addition the texts were matched for their number of syllables and number of repeating words. Participants indicated they required, $F(1, 52) = 80.49, p < .00$, more trials to memorize the secular text ($M = 23.02, SD = 13.86$) than to memorize the prayer text ($M = 13.06, SD = 9.63$). Further details on the two texts and their similarities are given in Appendix E.

Prayer Experiences Questionnaire

The PEQ was developed using questions derived from Persinger's (1993b) description of the Personal Philosophy Inventory. It also relied on general descriptions of religious experiences provided by Smart (1984). The questionnaire (Appendix A) consisted of a core set of five questions, these being; I usually pray for at least ten minutes a day, while praying I feel the presence of God, while praying I often feel separated from what goes on around me, while praying I can hear God speaking to me, and while praying I often loose track of time. Responses to these questions were made on a Likert type scale ranging from 0 to 7. The questionnaire also inquired about the person's gender, age, and the age of their first religious experience. The PEQ showed adequate reliability between administrations $r(52) = .94$.

The PEQ seemed to have adequate face validity. In addition high and low scorers were found to differ on all the questions. This was examined using 2 factor ANOVAs for each question. In these Anovas high versus low scores on the PEQ served as one factor and gender served as another factor. Gender did not show significant effects on responses for any question (see Table 2). The results of Anovas for high and low scorers are given in Table 3. No significant interaction between gender and high/low score was found on any question.

Table 2

PEQ Gender

	Male		Female		F
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	
Pray ten minutes Daily	2.50	2.65	3.70	2.50	.02
Sensed presence of God	2.50	2.50	4.01	2.60	2.61
Separated from surroundings	2.68	2.40	3.92	1.86	.98
Hear God speaking to me	1.72	2.19	2.05	2.19	2.48
Loose track of time	2.45	2.43	2.80	2.15	2.33

Note. p not significant at $< .05$ for any question. Degrees of freedom are 1 and 50.

Experiential Experience Questionnaire

The experiential experience questionnaire (EEQ) used the last four questions from the core set of questions on the PEQ. Subjects were asked to respond to these questions by describing what they had experienced during the prayer and secular conditions (see Appendix B). Being as it was only administered once its reliability could not be determined. However, it was expected that some suggestion of its validity could be obtained by examining whether or not high and low scoring subjects on the PEQ differed on what they experienced during the prayer and secular conditions.

Table 3

PEQ High and Low Scorers

	High Scorers		Low Scorers		F
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	
Pray ten minutes Daily	6.00	1.51	1.30	1.07	200.38
Sensed presence of God	6.18	1.05	1.48	1.13	194.08
Separated from surroundings	5.23	1.34	2.17	1.69	43.38
Hear God speaking to me	3.91	1.10	.55	.80	78.05
Loose track of time	4.82	1.40	1.17	1.31	93.34

Note. $p < .001$ for all questions. Degrees of freedom are 1 and 50.

To examine this 2 x 2 repeated measures ANOVAs were ran for responses on each question. In these ANOVAs high versus low scores on the PEQ served as an independent factor. Scores in the prayer and secular conditions served as a repeated measures factor. Significant interactions, $p < .05$, were found for each question between high and low scores and the two text conditions. Results of the 2 x 2 repeated measures ANOVAs are presented in Tables 4 through 7.

Table 4

Sensed Presence of God

	<u>F</u> (1, 52)	<u>p</u>
High/Low Score	102.56	.00
Prayer/Secular	162.55	.00
High/Low Score X Prayer/Secular	83.38	.00

Table 5

Separated from Surroundings

	<u>F</u> (1, 52)	<u>p</u>
High/Low Score	5.34	.03
Prayer/Secular	41.65	.00
High/Low Score X Prayer/Secular	10.98	.00

Table 6

Hearing God Speak

	<u>F</u> (1, 52)	<u>p</u>
High/Low Score	42.17	.00
Prayer/Secular	59.00	.00
High/Low Score X Prayer/Secular	41.00	.00

Table 7

Loosing Track of Time

	<u>F (1, 52)</u>	<u>p</u>
High/Low Score	1.78	.19
Prayer/Secular	24.35	.00
High/Low Score X Prayer/Secular	4.48	.04

To examine the differences of high and low scorers on the PEQ as they changed across the prayer and secular text conditions individual repeated measure ANOVAs were ran separately for each question at both levels of the PEQ score. Results for both high and low scorers were significant at $p < .05$ on all questions (see Tables 8 and 9). It was found that for both high and low scorers, on all questions, EEQ scores in the prayer condition were higher than scores in the secular condition. This effect was more pronounced for high scorers on the PEQ than for low scorers (see Tables 10 and 11).

Table 8

High Scorers

	<u>F (1,21)</u>	<u>p</u>
Sensed presence of God	125.90	.00
Separated from surroundings	21.17	.00
Hear God speaking to me	37.43	.00
Loose track of time	13.28	.00

Table 9

Low Scorers

	<u>F (1,21)</u>	<u>p</u>
Sensed presence of God	13.60	.00
Separated from surroundings	14.60	.00
Hear God speaking to me	6.20	.01
Loose track of time	8.02	.00

Table 10

High Scorers

	Prayer		Secular	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Sensed presence of God	4.50	1.34	.91	1.11
Separated from surroundings	5.55	1.88	3.09	2.51
Hear God speaking to me	3.09	2.11	.41	.95
Loose track of time	5.36	1.76	3.41	2.61

Table 11

Low Scorers

	Prayer		Secular	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Sensed presence of God	.75	1.05	.16	.45
Separated from surroundings	3.50	1.98	2.72	2.05
Hear Gcd speaking to me	.31	.64	.06	.25
Loose track of time	4.06	2.17	3.28	2.11

CHAPTER III

RESULTS

The first hypothesis, which predicted heightened temporal lobe activity during baseline measurement for those susceptible to TLT's was examined using the eta correlational ratio. Eta was chosen being as there was no reason to assume a linear relationship between high and low scores on the PEQ and percentages of alpha and theta activity. No significant results were found for alpha or theta activity. The analysis was repeated for both genders, again with no significant findings. Results are given in Tables 12 and 13.

Table 12

Eta for Alpha Activity

	Combined		Males		Females	
	Eta	p	Eta	p	Eta	p
Right Front (T4)	.05	.69	.15	.46	.18	.
Right Rear (T6)	.13	.35	.14	.38	.16	.76
Left Front (T3)	.12	.39	.17	.63	.14	.60
Left Rear (T5)	.00	.99	.17	.63	.15	.70

Table 13

Eta for Theta Activity

	Combined		Males		Females	
	Eta	p	Eta	p	Eta	p
Right Front (T4)	.00	.99	.20	.84	.16	.82
Right Rear (T6)	.09	.54	.10	.69	.17	.93
Left Front (T3)	.06	.65	.09	.18	.15	.72
Left Rear (T5)	.10	.46	.16	.53	.12	.44

The second hypothesis, that people reporting high levels of temporal lobe signs/religious experiences on the PEQ would report younger ages of first religious experience than those reporting low levels of temporal lobe signs/religious experiences was also examined using Eta. A weak correlation in the expected direction was found, $\text{Eta} = .28$, $p < .05$, with subjects in the high scoring group on the PEQ reporting younger ages of first religious experience ($M = 9.41$, $SD = 4.17$) than subjects in the low scoring group ($M = 12.03$, $SD = 4.72$). This relationship was also examined for males and females as separate groups. For males no significant relationship was found ($\text{Eta} = .13$, $p = .60$). For females no significant relationship was found ($\text{Eta} = .35$, $p = .06$).

Hypothesis three stated that subjects in the high scoring group on the PEQ would show higher percentages of

theta and alpha activity in the temporal lobe during the prayer condition than they would during the baseline or text condition. It also stated that this would not be the case for subjects in the low scoring group on the PEQ. Due to a lack of comparable non parametric tests this was examined using 2 x 2 x 3 repeated measures MANOVAs where gender and high/low score on the PEQ served as independent factors. The baseline, prayer and secular conditions served as a repeated measures factor. Two MANOVAs were ran, one for alpha activity and one for theta activity. Results did not support the presence of effects for High/low scores on the PEQ, for gender, or for the expected interactions. However, an effect of the repeated measures factor was indicated. Results of the MANOVAS for alpha and theta activity are given in Tables 14 and 15.

This was followed up on using one factor repeated measure MANOVAs for the baseline, prayer, and secular conditions. For Alpha activity this yielded Rao's R (8, 46) = 7.84, $p < .00$. For theta activity this yielded Rao's R (8, 46) = 3.24, $p < .00$.

These results were in turn followed up on using repeated measures ANOVAs for each temporal lobe site. No significant results were found for any site (see Tables 16 and 17). Examination of the means and standard deviations

Table 14

Alpha

	Rao's R	df1	df2	p
High/Low	.08	4	47	.99
Gender	.84	4	47	.51
BPS	9.37	8	43	.00
High/Low x Gender	.38	4	47	.82
High/Low x BPS	.85	8	43	.56
Gender x BPS	1.42	8	43	.21
High/Low x Gender x BPS	1.76	8	43	.11

Note. BPS = Baseline, prayer, secular.

across baseline, prayer, and secular conditions at each of the sites revealed a pattern of high variance around the means, suggesting the frequency distributions of the variables measured overlapped considerably (see Tables 18 and 19). In such situations MANOVA will often display more power than ANOVA (Tabachnick & Fidell, 1989), which may have accounted for the difference in significant findings. Visual examination of the histograms for the variables revealed the presence overlapping of frequency distributions, as well as the presence of outliers within the distributions and the absence of normal distributions.

Table 15

Theta

	Rao's <u>R</u>	<u>df1</u>	<u>df2</u>	<u>p</u>
High/Low	.22	4	47	.92
Gender	.33	4	47	.86
BPS	2.45	8	43	.03
High/Low x Gender	1.03	4	47	.40
High/Low x BPS	.53	8	43	.83
Gender x BPS	.88	8	43	.54
High/Low x Gender x BPS	.39	8	43	.92

Note. BPS = Baseline, prayer, secular.

Table 16

ANOVA follow up for Alpha

	<u>F</u>	<u>p</u>
Right Front (T4)	.93	.40
Right Rear (T6)	2.62	.08
Left Front (T3)	.27	.76
Left Rear (T5)	1.07	.35

Note. Degrees of freedom 2 and 138

Table 17

ANOVA follow up for Theta

	<u>F</u>	<u>p</u>
Right Front (T4)	.66	.52
Right Rear (T6)	.49	.61
Left Front (T3)	.13	.88
Left Rear (T5)	.77	.47

Note. Degrees of freedom 2 and 106.

Table 18

Means and Standard Deviations for Alpha

	Baseline		Prayer		Secular	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Right Front (T4)	34.09	23.50	54.39	24.67	31.04	25.28
Right Rear (T6)	29.79	28.91	54.77	30.00	44.30	29.11
Left Front (T3)	31.59	25.63	28.60	25.38	46.49	27.57
Left Rear (T5)	47.60	26.62	30.23	31.10	49.63	29.54

Table 19

Means and Standard Deviations for Theta

	Baseline		Prayer		Secular	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Right Front (T4)	24.17	20.53	16.40	20.90	27.89	22.16
Right Rear (T6)	20.36	17.00	15.09	16.94	27.86	13.89
Left Front (T3)	22.37	26.28	27.87	24.37	20.04	29.07
Left Rear (T5)	16.94	21.07	26.12	21.45	19.23	19.58

Hypothesis four stated that subjects reporting temporal lobe signs/religious experiences during the prayer condition would show higher percentages of theta and alpha activity in the temporal lobe during the prayer condition than they would during the baseline or secular condition. This was not expected to be found for those not reporting temporal lobe/religious signs during the prayer condition.

To examine this scores from questions one through four from the section inquiring about experiences during prayer on the EEQ were summed. The summed scores were then classified as high or low, using cutoffs at the upper and lower 30 percent of the possible score. This resulted in 4 male high scorers, 7 male low scorers, 6 female high scorers, and 12 female low scorers. Due to a lack of

comparable non-parametric tests these results were examined using two 2 x 2 x 3 MANOVAs in which the new high/low score and gender served as independent factors. The baseline, prayer, and secular conditions served as a repeated measures factor. Two MANOVAs were used, one for alpha activity and one for theta activity. A significant effect was found for the repeated measures factor when alpha, but not theta, activity was examined. No significant effects were found for gender, the high/low score, or the expected interactions (see Tables 20 and 21).

Table 20

Alpha for Prayer condition

	Rao's R	df1	df2	p
High/Low	.30	4	22	.88
Gender	.16	4	22	.96
BPS	5.69	8	18	.00
High/Low x Gender	.58	4	22	.68
High/Low x BPS	.67	8	18	.71
Gender x BPS	1.32	8	18	.30
High/Low x Gender x BPS	1.11	8	18	.40

Note. BPS = Baseline, prayer, secular.

Table 21

Theta for Prayer Condition

	Rao's R	df1	df2	p
High/Low	.97	4	22	.44
Gender	.32	4	22	.86
BPS	1.82	8	18	.14
High/Low x Gender	.41	4	22	.80
High/Low x BPS	1.34	8	18	.29
Gender x BPS	.30	8	18	.96
High/Low x Gender x BPS	.22	8	18	.98

Note. BPS = Baseline, prayer, secular.

Hypothesis five stated that subjects reporting temporal lobe signs/religious experiences on question two (sensed presence) on the PEQ would show higher ratio's of right versus left theta and alpha activity during the prayer condition than they would during secular condition. This was not expected to be found for those not reporting a sensed presence.

To examine this alpha and theta scores from the right front and rear temporal lobe sites were divided by their left side counterparts (eg. T4/T3). Scores on the sensed presence question were then categorized as high or low,

where high indicated scores above 4.9 on the question and low indicated scores below 2.1. This resulted in 5 high scoring males, 14 low scoring males, 9 high scoring females and 11 low scoring females. Due to a lack of non-parametric tests results for alpha and theta activity were analyzed using a 2 x 2 MANOVA where high/low scores and gender served as independent factors. The four ratios of front and rear alpha and theta activity served as dependent variables. No significant results were found (see Table 22).

Table 22

Sensed Presence on PEO

	Rao's R (4, 32)	p
High/Low	.76	.60
Gender	.90	.48
High/Low x Gender	.25	.91

Hypothesis six stated that subjects reporting temporal lobe signs/religious experiences on question two (sensed presence) on the EEG would show higher ratio's of right versus left theta and alpha activity during the prayer condition than they would during the secular condition. This was not expected to be found for those not reporting a sensed presence.

To examine this alpha and theta scores from the right front and rear temporal lobe sites were divided by their left side counterparts (e.g. T4/T3). Scores on the sensed presence question were then categorized as high or low, where high indicated scores above 4.9 on the question and low indicated scores below 2.1. This resulted in 6 high scoring males, 10 low scoring males, 14 high scoring females and 11 low scoring females. Due to a lack of comparable non-parametric tests results were analyzed using a 2 x 2 MANOVA where high/low scores and gender served as independent factors. Dependent variables consisted of the four ratio scores for alpha and theta activity. No significant results were found (see Table 22).

Table 23

Sensed Presence on EEO

	Rao's R (4, 34)	p
High/Low	1.89	.14
Gender	1.70	.17
High/Low x Gender	.75	.56

CHAPTER IV

DISCUSSION

As shown in the literature review Persinger's (1993b) theory has enjoyed considerable support from correlational studies using paper and pencil tests. Previous EEG studies have shown differences in temporal lobe brain activity in individuals engaging in rituals designed to produce religious or paranormal experiences (Persinger, 1984a). The theory was developed from clinical observation of people suffering temporal lobe epilepsy (Bear & Fedio, 1977), and has shown an explanatory ability for historical religious figures (Landsborough, 1987).

The current study differed from much of the previous work on the theory in that it systematically examined the theory's predictions using a direct measurement of brain activity during a Christian ritual hypothesized to induce the predicted activity. The findings of the current study do not support the theory. This is surprising given the previous evidence in support of it. This failure to find significant results may indicate that the theory cannot explain the common, everyday religious experiences of Christians. However, it is also possible that difficulties

with the study and its design limitations prevented the finding of results.

Difficulties with the Study

The prayer and secular texts used in this study were designed to be as similar as possible in terms of the words used to create them. They were matched on the words frequency of use in the English language, number of syllables, number of words, and number of repeating words. They differed in that one was a prayer while the other was not. While this allowed for the control of possible confounds, such as differing numbers of syllables, it also introduced an element of artificiality to the study, in that individuals were not allowed to pray as they normally would. In addition there is no guarantee that subjects in this study repeated the prayer and secular texts at the same rate. This could not be measured due to the limitations of EEG recording, which is overwhelmed by eye and mouth movement.

The PEQ, which inquired about a history of experiences during prayer, was designed to measure a generic religious experience. It was based on Persinger's (1984c) descriptions of signs of temporal lobe lability and descriptions of religious experiences (Smart, 1984). While the PEQ showed good reliability $r = .94$, its validity was not well established, and essentially limited to "face" validity. Despite this, high and low scorers differed on every

question used on this measurement, suggesting it did measure some psychological construct. Whether this construct is the same as that used by Persinger (1984c) can only be speculated about. The same limitations apply to the EEQ, which inquired about experiences during the study when subjects prayed or recited the secular text.

Another difficulty encountered in the design of this study was the limited descriptions of the changes in brain activity involved, and the limited information about their occurrence in the "normal" population. The lack of sufficient information prevented the determination of the number of subjects needed to establish adequate power. As a result, the number of subjects used was based on the historical number of subjects used in other psychophysiology studies. This may, or may not, have been an adequate number.

In addition no information was available on the length of time needed during the prayer condition for an effect to become present. As a result, the length of time used was based on solicited reports from student of how much time they spent praying daily. The length of time spent praying may, or may not, have been adequate or representative of actual practices.

This study used the number of seconds theta and alpha activity were observed in the temporal lobes as dependent variables. This was chosen over other methods, such as fourier analysis, because it allowed for artifact to be

cleaned from the record. Another reason for choosing to use the number of seconds each type of activity was present was that this was a (relatively) easy test of the theory's predictions. It should be noted, however, that this did not directly look for the presence of micro-seizures. Instead it looked for activity presumed to be caused by micro-seizures when they reached the temporal lobes of the brain. Due to the hypothesized source of the micro-seizures, deep within the brain, it was considered unlikely that the actual micro-seizures would be detectable.

The program used to do count the numbers of seconds alpha and theta activity was present in the record, Hertz8, was developed and tested by the author. Despite the program's passing the tests used on it, the author is not a professional programmer. As such, it is possible that the breakdown of the data provided by the program is not accurate.

The Hertz8 program determined alpha and theta activity by calculating the hertz for one second intervals of the data. In doing so it classified seconds based on the predominate activity in a given second. This may have been problematic, in that alpha and theta activity that occurred part way through a second was not correctly classified. It was also observed during recording that activity often consisted of a mixture of different types of activity. The hertz8 program did not take this into account.

Another difficulty encountered was that of artifact due to eye movement, mouth movement, and general muscle movement. The amplitude of such movement, in comparison to EEG activity, is enormous. It is of sufficient magnitude that recording of EEG data is not possible while such artifact is present. The Hertz8 program dealt with this by excluding contaminated seconds from the record. This resulted in recordings of unequal length, which was dealt with by converting the number of seconds to percentages of the total usable record. However, artifact consisted of up to 38% of the total record for some subjects. The activity present in the temporal lobes could not be observed during the presence of artifact. As such, critical information may have been missed.

Due to a lack of comparable non parametric statistics results in this study were examined using Eta and Manova. Due to the small sample sizes all subjects in this study were utilized. In doing so outlying scores were not excluded from the record. This was a departure from standard psychophysiological procedure, and may have accounted for the absence of findings.

Individual Responses to the Study

When possible, individuals who participated in this study were asked about their experiences. While exact statistics are not available on the results, their responses were of interest. Some, but not all, participants in the

high scoring group reported feeling differences between the prayer and secular conditions. However, so did participants in the low scoring groups.

Individuals who indicated they sensed differences in what they did between they prayer and secular conditions typically stated they felt like they were praying in the prayer condition but not in the secular condition. However, none of the participants were actually able to identify what this meant in terms of personal experience. The majority stated it (prayer) felt like what they were taught to do as children while reciting the secular text seemed like a novel experience. This is predicted by the theory, and suggests the screening instrument used to distinguish high and low scorers may not have been valid for its intended purpose.

Recommendations for Future Research

The difficulties encountered in this research provide some guidance for future efforts. Instruments designed to measure subjective religious experiences should be standardized and validated before research. Unfortunately, instruments designed to measure religious experiences during prayer are not readily available. For the purpose of further research it would be useful to have such an instrument, and to know how it correlates with instruments such as Persinger's PPI.

Furthermore, the exact form of a micro-seizure will have on the EEG is poorly understood. As noted, it may be

evident as actual seizure activity or as the presence of increased theta or alpha activity. If possible professionally designed programs measuring seizure activity should be used. Also, while a source of female Christian subjects seems available in standard research pool of undergraduate research subjects, it may be difficult to obtain Christian males who have religious experiences.

Beyond this, there are populations to consider that this study did not take into account. It would be possible, for example, to compare the brain activities of individuals who have devoted their lives to seeking religious experiences with those of the "normal" population or agnostics and atheists. One way to do this would be to compare the brain activities of agnostics and atheists with those of priests and ministers.

Within Christianity it is possible to examine members of differing denominations. Denominations within Christianity differ widely in their emotional expression during worship and prayer. Accordingly, differences might be found between members of denominations that are not highly emotionally expressive, such as Methodists, and those who are, such as members of the Assemblies of God. Beyond this it would be possible to examine and compare the brain activities of individuals from differing Western faiths.

In addition it is possible to compare the brain activities of those who practice the Eastern faiths with

those of the West. This would involve comparing (Smart, 1984) Christian, Jewish, or Islamic, etcetera, brain activity with that of Hindus and Buddhists. Essentially, this would consist of comparing Western prayer with meditation. As mentioned earlier, meditation is reported to suppress seizure activity, while increasing alpha and theta activity. Commonality in brain activity between the practitioners of Eastern faiths and practitioners of Western faiths would lend support to Persinger's (1993b) theory.

Conclusion

This study tested Persinger's (1993b) theory of religious/paranormal experiences using direct measurement of temporal lobe activity. Results were not supportive of the theory. This may have been due to difficulties with the study and limitations of its design. However, this study provided one of the most rigorous tests of the theory to date. This raises serious questions about the theory's validity in explaining religious experiences in the "normal" population.

Despite this, Persinger's (1993b) theory appears to be the only physiological theory of religious or paranormal experiences. The theory has research possibilities in the comparison of individuals of differing denominations within Christianity, and beyond this, in individuals of differing faiths. The question of whether or not meditation involves

the type of brain activity described by the theory is also an area for research.

APPENDIX A

PRAYER EXPERIENCES QUESTIONNAIRE

The following is a screening questionnaire for participation in research. If you qualify, and are selected, you will be asked to repeat this screening in approximately one week. All results of this screening will be kept confidential. If you do not feel comfortable answering the following questions please exclude yourself from this research by not responding.

What gender are you? M F

What is your age? _____

At what age did you first have a personal, meaningful, religious experience? (Best Guess is ok!)

Please answer the following questions about your prayer activities on the scales below the questions.

1. I usually pray for at least ten minutes a day.

NEVER +---+---+---+---+---+---+---+
 0 1 2 3 4 5 6 7 ALWAYS

2. While praying, I feel the presence of God.

NEVER +---+---+---+---+---+---+---+
 0 1 2 3 4 5 6 7 ALWAYS

3. While praying, I often feel separated from what goes on around me.

NEVER +---+---+---+---+---+---+---+
 0 1 2 3 4 5 6 7 ALWAYS

4. While praying, I can hear God speaking to me.

NEVER +---+---+---+---+---+---+---+
 0 1 2 3 4 5 6 7 ALWAYS

5. While praying, I often loose track of time.

NEVER +---+---+---+---+---+---+---+
 0 1 2 3 4 5 6 7 ALWAYS

What is your Name? (Please Print) _____

What is a phone number you can be reached at? _____

APPENDIX B

EXPERIMENTAL EXPERIENCES QUESTIONNAIRE

Please answer the following questions about what occurred when you recited the text beginning with God in this experiment

1. I felt the presence of God.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
2. I felt separated from what was going on around me.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
3. I could hear God speaking to me.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
4. I lost track of time.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
5. I felt like I was praying.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
6. I felt relaxed.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH

Please answer the following questions about what occurred when you recited the text beginning with day during this experiment

1. I felt the presence of God.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
2. I felt separated from what was going on around me.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
3. I could hear God speaking to me.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
4. I lost track of time.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH
6. I felt relaxed.
 +---+---+---+---+---+---+---+
 NOT AT ALL 0 1 2 3 4 5 6 7 VERY MUCH

APPENDIX C

CONSENT FORM

The UND Psychology department supports the practice of protection of human subjects in experimental research. The following information is provided so that you may decide if you wish to participate or not. You are free at any time during the study to withdraw your participation for any reason whatsoever. Also, if you do decide not to participate, such a decision will not in any way prejudice your future relations with UND or the psychology staff.

All data collected in this experiment will remain confidential and will be used for research purposes only. Your name will not be included on the study materials you fill out, so that no data can be identified with a particular individual. This consent form will be kept separately from the study materials, and both the consent forms and the study materials will be kept in a locked office in Corwin-Laramore Hall.

The purpose of this study is to help provide an understanding of what goes on in a person's brain when they recite. In this experiment you will be asked to have your brain waves recorded while you recite. You will also be asked to fill out questionnaires.

In order to participate in this research you must be over the age of 18, and you must actively practice a Christian faith. You must NOT have a history of epilepsy, mental illness, or brain injury or trauma. In addition you must be right handed.

If you have any questions at any time regarding this study, feel free to contact Don Newberry (777-3212), or Dr. Plaud (777-3412). Your signature below indicates that you have thoroughly read this consent form and agree to participate.

Participant Signature

Date

APPENDIX D

EXPLANATION OF PROCEDURE

The purpose of this study is to help provide an understanding of what goes on in a person's brain when reciting texts. In this experiment you will be asked to fill out questionnaires and have your brain waves recorded while you recite two different texts.

One of the questionnaires inquires about what you experience while reciting. You will be asked to fill this questionnaire out after the experiment ends. The other questioner inquires about experiences during prayer. You have already filled this questionnaire out, but will be asked to do so again before the experiment.

Before the experiment begins you will be connected to the EEG equipment. This will involve putting electrode jelly on your head. The jelly is harmless, but you will need to wash it off after the experiment. After the pickup wires have been connected you will be asked to sit quietly for five minutes while your brain waves are recorded. During this time you should close your eyes and relax, but you should stay awake. Try not to talk during this period. After the five minute period is up the researcher will inform you it is time to begin the experiment.

During the experiment you will be asked to do two things. One is to recite the text beginning with God for five minutes. You are being asked to do this quietly, to yourself, while keeping your eyes closed. When you finish repeating it once, repeat it again, and keep repeating it until five minutes have passed. At the end of five minutes a tone will sound and you will be able to stand up, open your eyes, and stretch for five minutes. After the five minute period you will repeat the procedure using the text that begins with Day. {For some of you this order will be reversed.}

The recording of brain activity will take place before you recite and while you recite. A series of pickup wires will be attached you. These wires do not carry any electricity to you! All they can do is pick up electricity that you give off. As such, there is no risk to your health involved. Do you have any questions?

APPENDIX E

PRAYER AND SECULAR TEXT

Repeating words
and line positions of
Repeating words

me
and I love

me love and your
I your
and

Prayer

God
Please watch over me
and those I love
empty my heart of sin
and fill me with your love
that I may know your will
and serve you on this earth
Amen

Text

Starts
a
to
new to
new starts a child
child to

Day
Starts above many clouds
she fills a world
slowly by time to wake
the new to good life joy
starts a new child type cry
and needs you to hold child
flop

Both prayer and text contain 35 syllables

The following is the word occurrence of words in both prayer and text per million words. All words in both are 100 or greater per million with the following exceptions. Empty/Hate and Slowly/Wake are 50 or greater per million, but less than 100 per million. Both Empty/hate and Slowly/wake are in the same position. The words Amen and Flop occur more than five, but less than six, times per million.

Both Prayer and text have 4 words that repeat twice and one word that repeats three times. These words are:

me me	starts starts
I I	A A
Love Love	child child
your your	new new
and and and	to to to

The repeating words vary in position between prayer and text.

Underlined words have 2 syllables, all others have one. Both prayer and text have 35 syllables total.

REFERENCES

- Alcoholics anonymous. (1955). New York, NY: Alcoholics Anonymous Publishing.
- American Psychiatric Association. (1980). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.
- Bear, D. M., & Fedio, P. (1977). Quantitative analysis of interictal behavior in temporal lobe epilepsy. Archives of Neurology, 34, 454-467.
- Cacioppo, J. T., & Tassinary, L. G. (Eds.). (1990). Principles of psychophysiology: Physical, social, and inferential elements. New York: Cambridge University Press.
- Corsi-Carrera, M., Herrera, P. & Malvido, M. (1989). Correlation between EEG and cognitive abilities: Sex differences. International Journal of Neuroscience, 45, 133-141.
- Coulter, D. L. (1993). Epilepsy and mental retardation: an overview. American Journal on Mental Retardation, 98, 1-11.
- Davison, G. C., & Neale, J. M. (1993). Abnormal psychology (5th ed.). New York: John Wiley and Son's.

Deepak, K., Manchanda, S., Maheshwari, M. (1994). Meditation improves clinicoelectroencephaliographic measures in drug resistant epileptics. Biofeedback and Self Regulation, 19, 25-40.

De Sano, C. F., & Persinger, M. A. (1987). Geophysical variables and behavior: XXXIX. Alterations in imaginings and suggestibility during brief magnetic field exposures. Perceptual and Motor Skills, 64, 968-970.

Edelman, G. M. (1989). The remembered present: A biological theory of consciousness. New York: Basic Books.

Edmonston, W. E., & Moscovitz, H. C. (1990). Hypnosis and Lateralized brain functions. International Journal of Clinical and Experimental Hypnosis. 38, 70-87.

Efron, R. (1957). The conditioned inhibition of uncinata fits. Brain, 80, 251-259.

Fenwick, P. B., & Brown, S. W. (1989). Evoked and psychogenic seizures. I. precipitation. Acta Neurologica Scandanavia, 80, 535-540.

Gleitman, H. (1991). Psychology. (3rd ed.). New York: W. W. Norton and Company Inc.

Gloor, P., Oliver, A., Quesney, L. F., Andermann, F., & Horowitz, S. (1982). The role of the limbic system in experiential phenomena of temporal lobe epilepsy. Annals of Neurology, 12, 129-144.

Goldberg, B. (1995). Slowing down the aging process through the use of altered states of consciousness: A review of the medical literature. Psychology a Journal of Human Behavior, 32, 19-21.

Guyton, A. C. (1987). Basic neuroscience: Anatomy and physiology. New York: W. B. Saunders Company.

Hunsberger, B. (1992). The psychology of religion in canada. International Journal for the Psychology of Religion, 2, 47-55.

Jeremy, K. A., Roberts, M. B., & Guberman, M. D. (1989). Religion and epilepsy. Psychiatric Journal of the University of Ottawa, 14 282-286.

Jeving, R., Wallace, R., Beidebach, M. (1992). The physiology of meditation: A review: A wakeful hypometabolic integrated response. Neuroscience and Biobehavioral Reviews, 16, 415-424.

Kettelwell, N., Lipscomb, S., & Evans, E. (1993). T. Perceptual and Motor Skills, 76, 839-846.

Kivalo, E. (1990). The artist and his illness: Vincent Van Gogh. Psychiatria-Fennica, 21, 139-144.

Lavallee, M. R. & Persinger, M. A. (1992). Left ear (right temporal lobe) suppressions during dichotic listening, ego alien intrusions, experiences, and spiritualistic beliefs in normal women. Perceptual and Motor Skills, 75, 547-551.

Leaton, J., & Kinney, G. (1987). Loosening the grip. St. Louis, MO: Times Mirror/Mosby College Publishing.

Landsborough, D. (1987). St. Paul and temporal lobe epilepsy. Journal of Neurology, Neurosurgery, and Psychiatry, 50, 659-664.

Livanov, M. N., Gavrilnov, N. A., & Aslanov, A. S. (1973). Correlation of biopotentials in the frontal parts of the human brain. In Pribram, K. H., & Luria, A. R. (Eds.). Psychophysiology of the frontal lobes (pp. 91-107). New York: Academic Press.

Makoto, D. (1990). Significance of the affinity of the epileptic to somatesthetic religion. Psychopathology, 23, 176-180.

Meeks, W. A. (1972). The writings of St. Paul. New York, NY: W. W. Norton and Company.

Munro, C., & Persinger, M. A. (1992). Relative right temporal lobe theta activity correlates with Vingiano's hemispheric quotient and the "sensed presence". Perceptual and Motor Skills, 75, 899-903.

Novelly, R. A. (1992). The debt of neuropsychology to the epilepsies. American Psychologist, 47, 1126-1129.

Orme-Johnson, D. (1995). Evidence that transcendental meditation does not produce cognitive kindling: A comment. Perceptual and Motor Skills, 81, 642.

Persinger, M. A. (1983). Religious and mystical experiences as artifacts of temporal lobe function: a general hypothesis. Perceptual and Motor Skills, 57, 1255-1262.

Persinger, M. A. (1984a). Striking EEG profiles from single episodes of glossolalia and transcendental meditation. Perceptual and Motor Skills, 58, 127-133.

Persinger, M. A. (1984b). Propensity to report paranormal experiences is correlated with temporal lobe signs. Perceptual and Motor Skills, 58, 583-586.

Persinger, M. A. (1984c). People who report religious experiences may also display enhanced temporal lobe signs. Perceptual and Motor Skills, 58, 963-975.

Persinger, M. A. (1985). Death anxiety as a semantic conditioned suppression paradigm. Perceptual and Motor Skills, 60, 827-830.

Persinger, M. A. (1991). Preadolescent religious experience enhances temporal lobe signs in normal young adults. Perceptual and Motor Skills, 72, 453-454.

Persinger, M. A. (1992a). Neuropsychological profiles of adults who report "sudden remembering" of early childhood memories: Implications for claims of sex abuse and alien visitation/abduction experiences. Perceptual and Motor Skills, 75, 259-266.

Persinger, M. A. (1992b). Right hemisphereicity, low self esteem, and unusual experiences: A response to Vingiano. Perceptual and Motor Skills, 75, 568-570.

Persinger, M. A. (1992c). Enhanced incidence of "the sensed presence" in people who have learned to meditate: Support for the right hemispheric intrusion hypothesis. Perceptual and Motor Skills, 75, 1308-1310.

Persinger, M. A. (1993a). Paranormal and religious beliefs may be mediated differentially by subcortical and cortical phenomenological processes of the temporal (limbic) lobes. Perceptual and Motor Skills, 76, 247-251.

Persinger, M. A. (1993b). Vectoral cerebral hemisphereicity as differential sources for the sensed presence, mystical experiences and religious conversions. Perceptual and Motor Skills, 76, 915-930.

Persinger, M. A., & De Sano, C. F. (1986). Temporal lobe signs: positive correlations with imaginings and hypnosis induction profiles. Perceptual and Motor Skills, 58, 347-350.

Persinger, M. A. & Fisher, S. D. (1990). Elevated, specific temporal lobe signs in a population engaged in psychic studies. Perceptual and Motor Skills, 71, 817-818.

Persinger, M. A. & Makarec, K. (1985). Temporal lobe signs: electroencephalographic validity and enhanced scores in special populations. Perceptual and Motor Skills, 60, 831-842.

Persinger, M. A. & Makarec, K. (1986). Temporal lobe epileptic signs and correlative behaviors displayed by normal populations. The Journal of General Psychology, 112, 179-195.

Persinger, M. A. & Makarec, K. (1991). Greater right hemisphereicity is associated with lower self-esteem in adults. Perceptual and Motor Skills, 73, 1244-1246.

Persinger, M. A. & Richards, P. (1991). Tobayck's paranormal belief scale and temporal lobe signs: Sex differences in the experiences of ego-alien intrusions. Perceptual and Motor Skills, 73, 1151-1256.

Persinger, M. A., & Valliant, P. M. (1985). Temporal Lobe signs and reports of subjective paranormal experiences in a normal population: a replication. Perceptual and Motor Skills, 60, 903-909.

Putman, F. W. (1986). The scientific investigation of multiple personality disorder. In J. M. Quem (Ed.), Split minds/ split brains. New York, NY: New York University Press.

PsycLIT Data Base (1994). American Psychological Association.

Restak, R. M. (1988) The brain. Toronto: Bantam Books.

Re'millard, G. M., Andermann, F., Testa, G. F., Gloor, P. Aube', M., Martin, J. B. Feindel, W. Guberman, A., & Simpson, C. (1983). Sexual ictal manifestations predominate in women with temporal lobe epilepsy: A finding suggesting sexual dimorphism in the human brain. Neurology, 33, 322-330.

Richards, P. M., Koren, S. A., & Persinger, M. A. (1992). Experimental stimulation by burst firing weak magnetic fields over the right temporal lobe may facilitate apprehension in women. Perceptual and Motor Skills, 75, 667-670.

Roberts, R. J. (1993). Positive associations among dichotic listening errors, complex partial epileptic-like signs, and paranormal beliefs: Commentary. Journal of Nervous and Mental Disease, 181, 668-671.

Rossini, P. M., Desaiato, M. T., Lavaroni, F. & Caramia, M. D. (1991). Brain excitability and electroencephalographic activation: non-invasive evaluation in healthy humans via transcranial magnetic stimulation. Brain Research, 567, 111-119.

Skinner, B. F. (1974). About behaviorism. New York: Alfred A. Knopf.

Silberman, E. K., & Weingartner, H. (1986). Hemispheric lateralization of functions related to emotions. Brain and Cognition, 5, 322-353.

- Smart, N. (1984). The religious experience of mankind. New York: Charles Scribner's Sons.
- Spiegel, H., & Speigel, D. (1987). Trance and treatment: Clinical uses of hypnosis. New York: Basic Books.
- Streng, S. J. (1985). Understanding religious life. Belmont: Wadsworth Publishing Company.
- Surwillo, W. W., & Hobson, D. P. (1978). Brain electrical activity during prayer. Psychological Reports, 43, 135-143.
- The holy Bible new international version. (1987). Grand Rapids, MI: Zondervan Bible Publishers.
- Tabachnick, B. G., & Fidell, L. S. (1989). Using multivariate statistics. New York: Harper and Row.
- Thorndike, E. L., & Lorge, I. (1944). The teacher's word book of 30,000 words. New York: Teachers College Press.
- Tobacyk, J., & Shrader, D. (1991). Superstition and self efficacy. Psychological Reports, 68, 1387-1388.
- Twemlow, S. W., & Bowen, W. T. (1977). Sociocultural predictors of self actualization in EEG-biofeedback treated alcoholics. Psychological Reports, 40, 591-598.
- Vingiano, W. (1989). Hemisphericity and personality. International Journal of Neuroscience, 44, 263-274.
- Vingiano, W. (1992). Hemisphericity and self-esteem. Perceptual and Motor Skills, 74, 825-826.

Yehezkel, B., & Represa, A. (1990). Brief seizure episodes induce long term potentiation and mossy fibre sprouting in the hippocampus. Trends in Neuroscience, 13, 312-318.