AURAS AS PREDICTORS OF PSYCHOPATHOLOGY ASSOCIATED WITH SEIZURE DISORDERS

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BY

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Abstract

Previous research has pointed to the importance of identifying seizure patients who are at risk for the development of psychopathology. Pre-ictal aura experiences have been suggested as phenomena mediated by limbic system involvement which may be related to psychopathology in seizure patients. The present study attempted to identify which seizure patients are at risk for the development of psychopathology, the psychological problems that this subgroup experiences, and to explore the question of whether an aura or set of auras are unique to a high risk group of seizure patients. The present study involved 114 seizure patients, 91 psychiatry patients, 28 dialysis patients, 15 diabetic patients, and 100 nonpatients. All subjects completed the Personal Behavior Inventory (PBI). Seizure patients provided information on aura experiences by completing the Aura Questionnaire. Background and medical information was also collected. Results indicated that seizure patients who were "misclassified" as psychiatry patients [seizure(psych)] by discriminant function analysis of PBI cluster scores reported giving a more philosophical interpretation to their lives, being more depressed, and having a greater variation in mood relative to other seizure patients, the chronic illness contrast groups (i.e., dialysis and diabetic patients), and normal controls. Seizure(psych) patients experienced a unique subgroup of auras with respect to intensity: (a) the perception of formed images; (b) the perception of humming or buzzing sounds; (c) irritability; (d) jamais vu; (e) the perception of time speeding up or slowing down. Data are presented which suggest that these five auras are likely due to seizure induced activation of the limbic system. Neither seizure(seiz) nor seizure(nonp) patients were found to experience a unique aura or subset of auras with respect to frequency and intensity. Background and medical information revealed seizure(psych) patients to be more likely to experience alcohol problems, utilize psychiatric facilities, and attempt suicide. Compulsivity was shown to be part of a sick person syndrome. Seizure diagnosis and anticonvulsant medication effects were shown to be unrelated to seizure patient PBI profiles. Implications of the results are discussed in terms of utilizing reported aura experiences for the identification of seizure patients who are at risk for the development of psychopathology.

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Introduction

The Hippocratic writers described the pathology of epilepsy as a stagnation of the cold humors (phlegm and black bile) within the ventricles of the brain. We now define epilepsy as a seizure disorder characterized by recurrent episodes of cerebral electrical discharge which result in altered states of awareness or consciousness, and/or partial or generalized motor, sensory, autonomic, and affective disturbance. The average prevalence rate in Europe and North America is 4.5 per 1000 people (Thompson and O'Quinn, 1979). Focal seizures (e.g., temporal lobe or psychomotor) are primarily differentiated from generalized seizures (i.e., grand mal, petit mal) in that the epileptic activity is restricted to a specific area of the brain (for example, the temporal lobe in temporal lobe or psychomotor epilepsy).

The concept of an epileptic personality dates far back into the history of medicine. According to Temkin (cited in Thompson and O'Quinn, 1979), the ancient Greeks before Hippocrates called epilepsy the "sacred disease" because they believed a diety had entered the stricken one. The Romans viewed epilepsy in a more negative light. They called the disorder the "falling sickness" or "falling evil". During the late nineteenth and early twentieth century, the idea of an epileptic personality became of major importance due to the fact that studies of epilepsy were dominated by data from institutionalized populations (Stevens, 1975).

For more than a century now, investigators have chronicled the association between psychiatric symptoms and epilepsy (Bear, Levin, Blumer, Chetham, and Ryder, 1982). Kogeorgos and his colleagues (Kogeorgos, Fonagy, and Scott, 1982) found that nearly half (45.5%) of a group of chronic epileptics assessed on the General Health Questionnaire and the Crown-Crisp Experiential Index, which

provides an overall psychiatric profile, were shown to be probable psychiatric cases. The authors reported that this proportion lies between previous estimates (38.8%-50%) of psychiatric morbidity in epileptics. Psychiatric impairment is well known as a possible complication of epilepsy (Kogeorgos et al., 1982). Stevens (1975) proposed that the list of psychiatric disabilities including undesirable personality traits attributed to individuals with epilepsy is "limited only by one's industry in ferretting out fresh derogations".

Research in the area of epilepsy has consistently failed to provide definitive answers to a number of questions dealing with the relationship between epilepsy and psychopathology. A formulation of the exact nature and presentation of psychopathological processes is yet to be established. The following review of the literature demonstrates that psychopathology attributed to epilepsy has varied greatly in terms of type and severity. While some investigators have identified a true "epileptic psychosis" (Flor-Henry, 1969), others have identified characteristic personality traits specific to groups of epileptics (Bear and Fedio, 1977). A comprehensive theory of epilepsy and psychopathology should include which types of epilepsy are more disposed to a particular problem whether it is schizophrenia or an undesirable personality trait. Also, if researchers are to establish a clear relationship between epilepsy and psychopathology they must address the issues of whether these problems are unique to seizure patients and attributable to epilepsy per se rather than a function of suffering from a chronic illness, being on a regime of anticonvulsant medication, or psychosocial factors.

The following review has been organized into sections of seizure type (i.e., temporal lobe epilepsy, generalized epilepsy) or comparisons of seizure types with respect to the problems investigated and theories presented. Although researchers have generally presented studies in terms of seizure type, some of the literature reviewed refers to epilepsy in general.

Epilepsy and Psychopathology

Hermann and Whitman (1984) have presented a comprehensive review of the literature dealing with the relationship between epilepsy and psychopathology. The reviewers presented evidence that suggested that depression and anxiety appear to be among the most frequent concommitants of the epilepsies. Although the exact etiology is unknown, it was concluded that these affective disorders are major interictal behavioral problems associated with epilepsy. Hermann and Whitman cited studies which reported a high incidence of sexual dysfunction, most commonly in the form of hyposexuality, occurring most frequently in temporal lobe epilepsy. The authors suggested that sexual dysfunction in epilepsy has a multifactorial origin. They presented evidence that supported the role of anticonvulsant medications in the lowering of testostorone levels in males. Since depression and anxiety were shown to be of a high incidence in epilepsy, the well-known relationship between these affective disorders and decreased sexual interest was discussed.

Other literature reviewed by Hermann and Whitman revealed that elevated rates of suicide were associated with epilepsy relative to the general population. Although overall temporal lobe and nontemporal lobe differences were not found on measures of aggression in the studies reviewed, other variables were reported by the authors that have been found to be associated with pathologic aggression (e.g., socioeconomic status, sex, age, early environment). However, many of these variables were also found to be related to aggression in the general population.

Under the category of "general psychopathology" the authors concluded that any increased occurrence of psychopathology or psychological risk in epileptics appears to be related to the presence of a chronic disorder per se. That is, studies consistently showed that comparisons to patients with nonneurological chronic illnesses failed to reveal increased psychopathology in epilepsy.

Temporal Lobe Epilepsy and Psychopathology

In recent years there have been a wealth of studies in which a pattern of interictal alterations in behavior, emotionality, and intellectual performances has been described in patients with temporal lobe epilepsy (TLE) (Bear et al., 1982). A large number of undesirable traits first came to be associated with TLE following the reports of the Gibbs and their colleagues of "flat-top" electroencephalograph waves from a high percentage of patients with psychomotor epilepsy and behavior disorders (Gibbs, Gibbs, and Fuster, 1948). Since that time investigators have attempted to clarify the relationship between TLE, a distinct personality type, and the incidence of psychiatric disorders in this group. The existence of a characteristic personality/behavioral profile in TLE has frequently been postulated and described (Hermann and Riel, 1981). In addition, while some investigators have found no difference in the incidence of various psychiatric abnormalities, others have reported a markedly raised incidence of such abnormalities in patients with TLE as compared to those with other types of illness (Shukla, Srivastava, Katiyar, Joshi, and Mohan, 1979; Small, Milstein, and Stevens, 1962). For example, Gibbs (1951) found that psychiatric disorder was more than three times more common in patients with focal activity in the temporal lobe than in cases with a focus in any other cortical area. The author felt that since a high degree of association was found between seizure activity in the temporal region and non-ictal psychiatric symptoms, it seemed reasonable to assume that the temporal lobe is also highly vulnerable to other types of disorder which give rise to non-ictal psychiatric symptoms.

Small and his colleagues (1962) attempted to investigate whether patients with psychomotor epilepsy are more likely to suffer psychopathologic disturbances than patients with equally severe convulsive (nonpsychomotor) disorders. They compared a group of psychomotor epileptics with a group of centrencephalic (i.e.

generalized) epileptics on a series of five personality rating scales. These were anxiety, passivity, depression, hysteria, and impulsivity. Three additional scales measured schizoid characteristics, rigidity, and aggressiveness. A number of psychological tests were administered which included the Wechsler Adult Intelligence Scale (WAIS), the Minnesota Multiphasic Personality Inventory (MMPI), the Rorschach, and the Thematic Apperception Test (TAT). Also, the two groups were compared on a learning task with respect to the ability to learn new material, flexibility of response, and frustration. There were no significant differences found between the psychomotor epileptics and the centrencephalic epileptics. Patients in both groups showed a prevalence of such traits as rigidity, schizoid characteristics, passive-aggressive features, and impulsivity. The authors concluded that their data did not reveal any increased incidence of emotional disorder nor any characteristic psychopathology in subjects with TLE. In fact, a high and equal incidence of psychological difficulties appeared in both groups.

Slater, Beard, and Glithero (1963) concluded that the emergence of psychosis is related to the duration of the epilepsy and to brain damage that is independent of the severity of the epilepsy although related to temporal lobe epilepsy. Flor-Henry (1969) felt that this was a very important conclusion for it implies that epileptic psychoses are fundamentally nonspecific organic psychoses where epilepsy plays a part only in so far as it may lead to organic cerebral damage.

In order to investigate this issue further and explore more correlates of psychosis in TLE, Flor-Henry compared a group of patients with temporal lobe epilepsy and psychosis and a group with temporal lobe epilepsy alone on 71 variables. The variables were designed to evaluate the sociological, electrophysiological, and psychometric characteristics of the two populations and were considered to be of possible etiological relevance. It was found that TLE was associated with affective, paranoid or schizophrenic disorders where a pronounced inverse relationship between convulsive manifestations and psychotic susceptibility was clear. The author related this finding to what Landolt termed "forced

normalization". That is, a phenomenon encountered in schizophrenic psychosis (and confusional psychosis) where the temporal focus (epileptic activity) might disappear for the duration of the psychotic episode. Flor-Henry also found that 58% of nonpsychiatric temporal lobe epileptics showed air encephalogram (AEG) abnormalities. Psychotic epileptics had AEG abnormalities in 52% of the cases. The two groups did not differ significantly on indices of brain-damage, neurological, psychometric, and morbid antecedents. Thus, he concluded that structural cerebral damage, in itself, is not etiological for psychosis in TLE. It was also concluded that neither the age of onset nor the duration of epilepsy are related to the emergence of psychosis in TLE. These two factors did not differ in the two groups. Furthermore, the development of psychotic symptoms was shown to be highly correlated with TLE when the dominant hemisphere was involved and inversely correlated with the severity of temporal seizures. The author discussed the latter two findings in terms of the "antagonism" theories of Glaus and Meduna which describe a phenomenon in which epileptic activity suppresses psychotic symptoms. Frequent psychomotor and psychosensory attacks (TLE) "protect" the individual from psychosis. However, Flor-Henry pointed out that these theories failed to recognize that the presence of epilepsy generally increases the susceptibility of the individual to psychosis. In fact, the probability of psychosis was reported by the author to be ten times greater in temporal lobe than in centreneephalic epilepsy. He concluded that epileptic psychoses are not "organic" psychoses but are truly "epileptic" psychoses fundamentally related to epilepsy rather than associated brain-damage.

According to Flor-Henry, the evidence that TLE predisposes to schizophrenia in such a manner that frequent ictal (temporal) discharges reduce the risk strongly suggests that it is not so much the epilepsy itself, but the underlying pattern of abnormal neuronal activity in the dominant temporal lobe and in its hippocampal-amygdaloid cingular projections which is fundamentally responsible for the schizophrenic syndrome.

In a study using retrospective and prospective techniques, Mignone, Donnelly, and Sadowsky (1970) made a number of psychological and neurological comparisons of psychomotor (TLE) and nonpsychomotor epileptics. The investigators found that MMPI subscale scores failed to differentiate groups of epileptics with respect to age of onset, duration of seizures, frequency of seizures, and type of seizure (psychomotor, nonpsychomotor, generalized seizures in addition to psychomotor seizures). They concluded that their data weakens the notion of a "psychomotor peculiarity" or a prevalence of psychiatric problems in psychomotor epileptics.

In a critical analysis of the research in the area of TLE and its clinical manifestations, Stevens (1975) cited a list of 59 objectionable traits that were formerly applied to individuals with epilepsy but later became restricted to patients with TLE. She concluded that objective evidence for traits specific to patients with TLE is "scanty". In addition, Stevens stated that TLE makes a very small contribution to the pool of psychiatric disturbances. Furthermore, despite the impressive evidence from clinical reports of severe personality disturbance resulting from irritative and ablative lesions of the temporal lobe, amygdala, and hippocampus,

> "... controlled clinical studies in which groups of patients with temporal lobe epilepsy were compared with age and background matched patients suffering from generalized or "centrencephalic" epilepsy failed to confirm the widespread clinical impression that temporal lobe epilepsy patients suffered increased psychopathology." (Stevens, 1975, p.86-87)

In a study of her own, Stevens investigated a group of patients who were being treated privately for epilepsy. It was felt that they were a more representative sample than patients referred to university hospital clinics who for reasons of seizure intractability, indigence, and occupational or psychological failure tend to gravitate toward publicly supported facilities. Generalized and temporal lobe

epileptics were not found to differ on measures of intelligence, employment, history of violence, MMPI scores, or psychiatric status. As a result of her own investigations and a review of the literature, Stevens made a final conclusion that patients with major and psychomotor epilepsy are subject to an increased risk of psychiatric disturbance but that, except for the immediate postictal state, the risk appears to reflect the site and extent of brain-damage and the individual's psychosocial history.

Thus, the existence or absence of behavioral, emotional, and intellectual performance alterations in patients with temporal lobe or psychomotor epilepsy remains a controversial and unresolved area of investigation (McIntyre, Pritchard, and Lombroso, 1976; Geschwind, 1977; Kogeorgos et al., 1982; Stark-Adamec, Adamec, Graham, Hicks, and Bruun-Myer, 1985). This could be due in part to methodological flaws that have been found in some studies. Nonneurological patient controls are not utilized in most of the studies reviewed above. Before conclusions can be made regarding psychopathology in epilepsy, it must first be clear that patients suffering from other chronic illnesses do not experience the form of psychopathology under investigation. There is also a general lack of comparisons made with actual psychiatric populations on the dimensions being measured. Other reviewers of the literature on TLE and psychopathology (Hermann and Whitman, 1984) have concluded that the weight of the evidence clearly suggests that TLE, in and of itself, is not a very important determining variable for the development of psychopathology in epilepsy.

Differences Between Left and Right Temporal Lobe Epileptics

The issue of whether the psychological profiles of epileptics with right temporal lobe foci differ from those with left temporal lobe foci has interested investigators and has been the subject of a number of studies. McIntyre and his colleagues (1976) examined the performance of patients with right and left temporal lobe

epileptic foci on two tasks, each measuring a psychological dimension judged important to the study of disturbed interpersonal relationships. The Kagan Matching Familiar Figures Test (MFF) was used as a measure of cognitive style or conceptual tempo (e.g. the prediposition to respond quickly or delay response in ambiguous problem situations). The MFF also gives a measure of impulsivity, a psychological variable which may be fundamental to the expression of outwardly directed responses. The Davitz-Matis Metaphor Test (DMT) measured a subject's ability to detect emotional meaning from verbal descriptions of common affect states. This showed the subject's ability to decipher verbal-affective messages which was thought to be important in the maintenance of successful interpersonal relationships.

On the MFF subjects with left TLE compared to normal controls tended to exhibit a reflective conceptual tempo while right temporal lobe epileptics tended to show a more impulsive conceptual tempo. These differences in conceptual tempo found between right and left temporal lobe epileptics were thought to possibly imply differences in predisposition to external responses. An asspociation had been previously established between an impulsive conceptual tempo and the tendency to engage in outwardly aggressive behavior. The reflective conceptual tempo was associated with the internalization of aggression.

The elevation of the DMT "nonconsensuality" score among left temporal lobe epileptics was felt by the authors to suggest a predisposition for that group to make unusual interpretations of affect states and to make unusual applications of affect labels. They concluded that this failure to detect the meaning of an emotionally laden message would seem to produce difficulty in the interpersonal (communication) sphere. As a result, such people would be more often considered to be psychologically maladjusted.

Sherwin, Peron-Magnan, Bancaud, Bonis, and Talairach (1982) reported on a retrospective analysis of the psychiatric diagnoses of a group of patients surgically relieved of medically intractable epilepsy. They tested the hypothesis that

patients with left-sided temporal lobe epileptogenic lesions are at greater risk for the development of so called schizophrenic-like psychosis than those with right-sided epileptogenic lesions. The authors suggested that there is doubt with some studies as to the certainty of the laterality of the epileptogenic lesions. These studies based the laterality on neurologic, psychiatric, radiologic, neuropsychologic, and electrophysiologic data. The authors proposed that the most rigorous criterion for covert determination of laterality was the successful relief of epilepsy after surgical excision. This seemed to provide the basis for making the most confident statements about the specificity of the association between psychosis and the laterality of the epileptogenic lesion.

By examining the psychiatric histories and diagnoses of patients with right and left temporal lobe epileptogenic lesions, the authors were able to confirm their principle hypothesis. That is, among patients with epileptogenic lesions in one of their temporal lobes, those patients with left-sided lesions were more likely to have a schizophrenic-like psychosis than those with right-sided lesions. Their data suggested that psychosis is a relatively rare complication of other non-temporal focal epilepsies and thus seems to be relatively specific for patients with temporal lobe epileptogenic lesions.

On the basis of these data and data from other studies; the prevalence of psychosis in patients with poorly controlled TLE was estimated to be approximately 10% to 15% (it was 9% in the Sherwin et al. study).

The results presented by Sherwin et al. (1982) can only be considered relevant for those temporal lobe epileptics who have such poorly controlled seizures that surgical intervention is necessary. A global generalization to other forms of TLE cannot be made on the basis of these data. The prevalence of a schizophrenic-like psychosis was not examined in patients with other medical conditions and therefore, the effects of suffering from a chronic illness were not evaluated. Also, McIntyre and his colleagues (1976) failed to offer concrete evidence to support the suggestion that left temporal lobe epileptics are more prone to psychological

maladjustment than epileptics with a right temporal lobe focus. This is mainly due to the fact that the MFF and the DMT are not direct measures of psycholopathology but rather, measures on which the relationship of an individual's performance to psychopathology is merely implied by a series of associations.

Temporal Lobe Epileptics Versus Generalized Epileptics, Neurological Disorder Patients, and Psychiatric Patients

A number of researchers have made specific attempts to compare temporal lobe epileptics with generalized (non-focal) epileptics, patients with neurological disorders, and psychiatric patients on various psychological measures and on the incidence of psychiatric disorder. Shukla and his colleagues (1979) examined the incidence of psychiatric abnormalities in a group of TLE patients compared with epileptics of the grand mal (generalized) type. There was a significant difference between the overall incidence of psychiatric disorders in the two groups. Approximately 4/5 of the patients in the TLE group manifested some psychiatric disturbance as compared to about 1/2 of the subjects in the generalized group. Neuroses, schizophrenia, and behavior disorder were significantly more prevalent in the TLE group. It was found that two diagnostic groups - epileptic personality and confusional psychosis - were seen more commonly in the grand mal epileptics. In addition, the authors found a significantly higher incidence of early emotional disturbances in the TLE group.

Bear and Fedio (1977) carried out a very significant study to determine the effects of a unilateral epileptic focus on specific psychosocial aspects of behavior. Eighteen traits "putatively" associated with interictal behavior were selected on the basis of prior reports and pilot testing. Traits were assessed by two equivalent questionnaires; one was completed by the subject (Personal Inventory) and the second was completed by a close observer (usually a friend or relative) about the

subject (Personal Behavior Survey). Patients with unilateral (right and left) epileptic foci were compared with normal subjects and patients with neuromuscular disorders.

Based on this assessment it was found that temporal lobe epileptics were differentiated on a number of psychological features from normal controls and neuromuscular disorder patients. Temporal lobe epileptic patients presented a consistent profile of changes in behavior (obsessionalism, circumstantiality), thought (humorlessness, religious and philosophical interest), and affect (anger, emotionality, and sadness) which the authors suggested to be a specific consequence of the seizures.

Within the temporal lobe group there was a significant lateralization effect. Right temporal lobe epileptics tended to deny dysphoric, socially disapproved behavior while exaggerating valued qualities - thus, "polishing" their image. Left temporal lobe epileptics showed an opposite distortion. They emphasized or exaggerated negative behavioral qualities and minimized their extraordinary behavior - thus, "tarnishing" their images relative to observer evaluations.

Bear and Fedio pointed out that this lateralization effect was consistent with prior demonstrations of emotional differences between patients with right and left hemisphere lesions. Further, the authors felt that this type of evidence added some support to the hypothesis that sensory-affective associations are established within the temporal lobes and that in man there exists a hemispheric asymmetry in the expression of affect.

Bear and his colleagues (1982) attempted to determine whether specific behavioral features might distinguish temporal lobe epileptics admitted to a psychiatric hospital from other patients with similar behavioral characteristics; those with aggression, affective disorder, or idiopathic schizophrenia. Temporal lobe epileptics were also contrasted with hospitalized patients suffering from other types of seizure disorders (generalized or focal). They used an interview which

sampled the behavior previously found by Bear and Fedio (1977) to discriminate temporal lobe epileptics from normal subjects and other neurologic patients. They also examined additional behavioral variables concerning aggressive behavior, sexual preference, alteration in mood, and thought disorder.

The traits which most strongly differentiated temporal lobe epileptics from a mixed psychiatric group were excessive interpersonal clinging (viscosity), repetitive preoccupation with peripheral details (circumstantiality), religious and philosophical preoccupations, humorlessness, sobriety, a tendency for paranoid over-interpretation, and moralistic concerns. The most significant distinguishing feature was viscosity. The authors noted the findings of Kraeplin and others regarding the tendency for the epileptic patient to cling to the examiner and to generally draw out social encounters. It was further suggested that, in temporal lobe epileptics, this could be due to a localizable anatomical substrate since specific lesions in the limbic system increase or decrease social cohesiveness in animals.

In addition, the temporal lobe group could not be differentiated from psychiatric patients on features of viscosity, circumstantiality, and obsessionalism. Intellectual preoccupations, religiosity, and philosophical interests were more frequent in the temporal lobe group. Also, deepened affect (a reflection of sadness) was more common in the temporal lobe group.

Bear and his colleagues suggested that their study provided confirmation of an interictal behavior syndrome specific to temporal lobe epilepsy which includes features of affect (deepened emotion, aggressivity), thought (philosophic, religious, and moralistic interests), and behavior (viscosity, circumstantiality). The appearance of these behaviors in concert distinguished the temporal lobe epileptics from other psychiatric patients, as well as from normal and other neurologically impaired subjects.

Stark-Adamec and Adamec (1986) have criticized the work of Bear and Fedio (1977) and their conclusion of the existence of an "18-trait" syndrome specific to patients with TLE. Other researchers (Hermann and Whitman, 1984) have pointed to methodological and interpretative problems associated with the use of the Personal Inventory and the Personal Behavior Survey. Stark-Adamec and Adamec (1986) have specifically highlighted a number of statistical and methodological weaknesses in the Bear and Fedio research which included:

1. Bear and Fedio (1977) used a "true/false" response alternative in constructing their questionnaire. This had been previously shown to be the most unreliable format (Osgoode, Suci, & Tannenbaum, 1958).

2. Items within "traits" on the questionnaires were added to determine scores. This procedure diminished the statistical validity of the scoring system since traits are conceptually derived units.

3. Stark-Adamec and Adamec identified a misinterpretation by Bear and Fedio of the principal components analysis used in their research.

4. The rater and self-report questionnaires were not (46 of the 100 items) parallel. This cast doubt on the conclusion of a left-focus "tarnishing" image and a right-focus "polishing" image since these conclusions were based on discrepancies between rater and self-report information.

5. There was an inappropriate application, and thus inappropriate interpretation, of the discriminant functional analysis used.

6. The group sizes were too small for the scope of generalizations that Bear and Fedio made.

Hermann and Riel (1981) felt that Bear and Fedio's (1977) determination of 18 traits that differentiated temporal lobe epileptics from neuromuscular disease

patients and healthy controls (reviewed earlier) was not complete. They felt that in order to answer the question of whether the profile of behavior changes is specific to TLE, a comparison had to be made between TLE patients and patients with seizure types other than TLE. They asked a group of temporal lobe epileptics and patients with generalized epilepsy to complete Bear and Fedio's Personal Behavior Inventory (PBI) which was designed to measure the 18 traits hypothezied to characterize patients with TLE.

They found that the TLE group scored significantly higher on four of the scales (traits): sense of personal destiny, dependence, paranoia, and philosophical interest. The other 14 traits that had been found to distinguish TLE from non-epileptic subjects failed to distinguish patients with TLE from patients with generalized epilepsy. These 14 traits were deepened emotionality, aggression, altered sexuality, elation, hypergraphia, sadness, hypermoralism, guilt, emotionality, obsessionalism, circumstantiality, and humorlessness. The authors concluded that a certain self-reported pattern of thought (sense of destiny, philosophical interest, paranoia) and behavior (dependence) appeared to be present in patients with TLE but not in generalized seizure patients.

Hermann and Riel (1981) suggested that an additive model of nonpsychopathological personality/behavioral change, incorporating both psychological and specific organic mechanisms, appeared reasonable to explain their results. In addition, they refer to the view that TLE specific traits may reflect progressive limbic structure change as a consequence of a temporal lobe epileptic focus. Bear (1979) explained this phenomenon as an enhanced affective association to previously neutral stimuli or a "sensory-limbic hyperconnection".

Mungus (1982) found even less support for the utility of the Bear and Fedio PBI and the existence of the "18-trait" syndrome. None of the 18 traits were shown to discriminate a group of patients with TLE from a group of patients with concommitant neurological and behavioral-psychiatric disorders and a group with psychiatric but not neurological illness. The author felt that the results of his

investigations suggested that previously reported differences between temporal lobe epileptics and normals on Bear and Fedio's 18 traits reflected underlying differences in nonspecific psychopathology and were not necessarily indicative of a specific behavioral syndrome in TLE. He further stressed that TLE is not a necessary condition for elevations on the Bear and Fedio traits since equivalent elevations were obtained in the absence of TLE.

More recently, Brandt, Seidman, and Kohl (1985) compared temporal lobe epileptics and generalized epileptics on the traits measured by the Bear and Fedio PBI. A normal control group was also involved in the study. They found that patients with complex partial seizures (TLE) originating in the left temporal lobe and patients with a variety of forms of generalized epilepsy were characterized by personality features which distinguished them from normal individuals. They also found that patients with complex partial seizures originating in the right temporal lobe were virtually indistinguishable from normal subjects on the 18 traits measured by the PBI. The authors postulated this to be due to either the fact that right temporal lobe epileptics were less affected by seizures than the left temporal lobe epileptics or that they tended to deny their symptoms which has in fact been found previously (Bear and Fedio, 1977).

Specifically, Brandt and his colleagues found that left temporal lobe epileptics were significantly elevated over normal controls on circumstantiality, humorlessness, viscosity, sadness, dependence, paranoia, and obsessionalism. Left temporal lobe epileptics differed from right temporal lobe epileptics and generalized seizure patients in their personality profile as well. The left temporal lobe epileptics described themselves as brooding, obsessional, and overly concerned with detail. They had difficulty giving succinct responses and instead gave long-winded circumstantial explanations. The generalized seizure patients described themselves as even more detailed and tangential in their speech. They tended to be unhappy, talk at great lengths about their plights, and adopt an external locus of control.

It was concluded that the PBI of Bear and Fedio appeared to have some utility in discriminating groups of epileptic patients with different clinical and encephalographic characteristics. The researchers felt that the finding of elevated trait scores for generalized and left temporal lobe epileptics (with right temporal lobe epileptics not differing significantly from normals) suggested that disruption of left hemisphere mechanisms is a key component in the prevalence of the interictal personality syndrome. They pointed out that their data should not be interpreted as suggesting that the traits that are assessed by the PBI are particular to patients with epilepsy because some of the traits had been found to be elevated in other clinical populations. This observation supports Mungas (1982), who felt that epilepsy was not a necessary prerequisite for elevations on the PBI.

Researchers who have used the PBI which was developed by Bear and Fedio (1977), have failed to recognize the inherent flaws in the inventory that were outlined by Stark-Adamec and Adamec (1986) and others (Hermann and Whitman, 1984). Conclusions made on the basis of PBI score profiles can at best be considered as tentative in light of the demonstrated unreliablility (Osgoode et al., 1958) of the "true/false" format used in the PBI.

Stark-Adamec and her colleagues (1985) administered Bear and Fedio's PBI to three groups; seizure disorder patients, patients undergoing dialysis treatment (chronic illness group), and normal controls. The researchers attempted to overcome the methodological and statistical weaknesses that have been found with research using the PBI (Stark-Adamec and Adamec, 1986). The 100-item questionnaire was altered to include a scale response format rather than a "true/false" format. The complete questionnaire of 101 items was found to be reducible to 26 dimensions or first-order clusters using item cluster analysis (average distance linkage method). Further reduction was carried out to produce 11 second-order clusters: (1) own life story important; (2) religious; (3) elation; (4) emotional; (5) confusion; (6) dependence; (7) anger; (8) humorless; (9) decreased sexual activity; (10) compulsive; (11) writes details.

It was found that seizure patients, as a group, reported a number of psychological problems relative to nonpatients. Their self-reported tendency to record details, to become confused, to consider the story of their life to be of importance and to be dependent on others was as elevated as that reported by psychiatry patients. Compulsivity and humourlessness were identified as being part of a "sick person syndrome" since all patient groups scored higher than nonpatients on these dimensions. This addressed the question of whether there exists symptomology that is produced by the stress of coping with a chronic illness.

Some of the most thought provoking findings of the Stark-Adamec et al. study stemmed from their analysis of group homogeneity of PBI responses. Using discriminant function analysis to investigate the generalizability of results obtained with group means, it was found that the procedure correctly classified 25.7 percent of the seizure patients, 65.2 percent of the psychiatry patients, and 80 percent of nonpatients. The authors pointed out that the seizure patients were the most heterogeneous group in terms of their scores on the PBI. That is, 38.6 percent of seizure patients were "misclassified" as psychiatry patients and 35.7 percent were "misclassified" as nonpatients. It was felt that, based on their data, both sides of the literature appeared to be supported and that any attempts to characterize seizure patients in general are likely to lead to misleading oversimplifications.

The question of diagnostic specificity was examined in two ways - both producing unequivocal results. First, it was found that being a high scorer on the selected criterion variables of the PBI did not predict what group a patient belonged to. A high scorer was just as likely, statistically, to be a psychiatry patient as a seizure patient. Also, high scorers in the seizure group were not restricted to complex partial seizures (CPS) (i.e., TLE) patients.

The second approach revealed that "between diagnosis" differences in the predefined groups (psychiatry and seizure) were unequivocal. In the seizure

disorder group there were three main diagnostic classes: CPS, CPS with secondary generalization, and primary generalized. None of the diagnoses differed significantly on the dimensions measured by the PBI.

Stark-Adamec and her colleagues concluded that a syndrome of sensory-limbic hyperconnection, unique to CPS or to patients with seizure disorders involving the temporal lobe was not substantiated by the data. With their results in mind, the authors maintained that psychosocial problems experienced by seizure patients were not entirely nonspecific. They pointed to a more fruitful approach to this area of research as asking the question of, "How might one predict which seizure patients would likely be at risk for psychological problems and what factors might be responsible for that risk?". This line of questioning was the genesis of the idea that auras experienced by seizure patients may serve as the basis of a srceening procedure for patients at risk for psychological problems. The following section reviews previous research that has supported this approach in addition to the preliminary data presented by Stark-Adamec et al. (1985).

Auras as Predictors of Psychological Problems

It has been argued that those seizure patients whose seizure activity involves activation of limbic system structures would be most susceptible to the development of psychopathology (Stark-Adamec et al., 1985). This argument has been supported by researchers who have shown the human limbic system to be involved in the integration of subjective/emotional states (Gloor, Olivier, Quesney, Andermann, and Horowitz, 1982) and behavioral change (Stevens, Mark, Ervin, Pacheco, and Suematsu, 1969; Mark, Erwin, & Sweet, 1972). Adamec and Stark-Adamec (1986a,b,c) have found similar results with animals. The researchers showed that repetitive limbic discharges produce "...lasting, interictal, emotional behavior changes - in effect, changes in personality." (Stark-Adamec et al., 1985). An indication of the extent of the involvement of limbic system

structures in seizure activity would be useful in understanding further the role of these structures in behavior change associated with seizure activity.

Stark-Adamec and her colleagues (1985) proposed that an aura or set of auras might serve as a marker for degree of limbic system involvement in seizure discharges. This proposal was based on previous research that revealed that a large number of reported aura experiences are reproducible by electrical stimulation of the human limbic system (Stevens et al., 1969; Mark et al., 1972; Halgren, Walter, Cherlow, and Crandall, 1978; Gloor et al., 1982). To date, however, there has been little research carried out to examine the relationship between aura experiences and psychopathology (Hermann and Whitman, 1984). Nevertheless, preliminary data do suggest a relationship between auras and psychopathology. Hermann and his colleagues (Hermann, Dikmen, Schwartz, and Karnes, 1982) found that TLE patients who experienced ictal fear - that is, an aura of fear - showed more psychopathology (measured by the MMPI) than two control groups.

More recently, Stark-Adamec and her colleagues (1985) investigated this question using a more complete inventory of aura experiences. In order to establish an inventory of aura experiences, the researchers developed the Aura Questionnaire. The questionnaire is based on pre- and para-ictal events reported in the literature. The 33 items included aura experiences involving changes in vision, changes in smell, emotions, changes in taste, somatic sensations, balance changes or sensations of movement, and thoughts and memories. The questionnaire assessed the frequency and intensity of these aura experiences (see method section and Appendix B).

Stark-Adamec et al. (1985) have presented some encouraging but very preliminary results. The data were based on questionnaire responses of 34 subjects. They found that the pattern of aura experiences reported by seizure patients was considerably more complex than expected from examination of the available literature and patients' medical records. Also, the auras tended to

cluster (item-cluster analysis) into groups which made sense conceptually. As an example, pre-seizure experiences of unpleasant smells were associated with pre-seizure experiences of unpleasant tastes. Also, pre-seizure experiences of sadness and anxiety, and anger and hatred clustered together. The authors noted that the frequency of aura experiences was highly correlated with the intensity of aura experiences.

An examination of the potential association between auras and psychological problems revealed that those seizure patients who, on the basis of their pattern of scores on the PBI, were "misclassified" as psychiatry patients were more likely, than those "misclassified" as nonpatients or those correctly classified as seizure patients, to experience a particular subset of auras: (a) changes in brightness of light; (b) perception of formed images; (c) alteration in loudness, pitch, or quality of sounds; (d) hatred as an emotion which "just comes out of the blue"; (e) dizziness; (f) mind becomes stuck on a single idea. Quite striking is the fact that Halgren and his colleagues (1978) showed that all but the last of these aura experiences are reproducible by direct electrical stimulation of the human limbic system. Stark-Adamec and her colleagues suggested that the predictive relationship is not between seizure severity and psychopathology, but between aura severity (frequency, intensity) and psychological risk.

Present Study

It is apparent from a review of the literature that past research in this area has generally attempted to prove (Bear and Fedio, 1977) or refute (Stevens, 1975) the claim that individuals with epilepsy have a greater than normal chance of suffering from some form of psychopathology. Most studies compare different seizure disorder diagnostic groups on various dimensions and attempt to draw conclusions in terms of these diagnostic groups. Researchers have, in many cases, overlooked the importance of possible common characteristics or factors which a

number of diagnostic groups may share - thus, resulting in conclusions that may be true for a whole range of seizure disorder patients. Aura experiences is one such factor which can be examined in most seizure diagnostic groups.

The results reported by Stark-Adamec et al. (1985) are preliminary. It remains necessary to clarify the relationship between aura experiences and psychopathology in epilepsy. Thus, the utility and validity of the Aura Questionnaire must be established if it is to be considered in the future as a device for detecting seizure patients who are at risk for the development of psychopathology and as a tool to aid in gaining a clearer understanding of the nature of psychopathology associated with seizure disorders.

The present investigation replicated the general methodology used by Stark-Adamec et al. (1985). The number of subjects was increased in order to provide a larger sample in which the relationship between PBI responses and aura experiences could be examined. A major weakness in previous research using the PBI (Bear and Fedio, 1977) has been small sample sizes. The aura data presented in the Stark-Adamec et al. (1985) study was only based on the responses of 34 seizure patients. In addition, the justification of the present study was emphasized by Hermann and Whitman (1984) who, after reviewing the literature, pointed to the fact that aura experiences were hardly ever considered and that they might reasonably be considered to be among the factors that underlie or predispose to the development of emotional difficulties in seizure disorders.

In order to identify psychological problems that may be related to an aura or set of auras, those psychological problems that are a function of suffering from a chronic disease must be identified and distinguished from those that may be considered as specific to seizure patients. Therefore, the issue of identifying a "sick person syndrome" must be further pursued since it is generally assumed that any chronic illness will have some impact on psychological adjustment (Burish and Bradley, 1983a). Stark-Adamec et al. (1985) identified humorlessness and compulsivity as being attributable to suffering from a chronic illness. They

used a group of dialysis patients as a chronic illness contrast group since they represented a non-central nervous system disorder. It was necessary to use a medical contrast group that had no neurological pathology.

In the present study, a group of diabetic patients was selected as a non-central nervous system, chronic illness contrast group. This group was chosen for the following reasons. It has been demonstrated (Skenazy and Bigler, 1985) that psychological adjustment in diabetics is influenced, not by the diabetes itself but rather, by the feature of having a chronic illness. Moreover, Skenazy and Bigler (1985) reported diabetics to be as elevated on the Hypochondriasis, Depression, and Hysteria subscales of the Faschingbauer Abbreviated MMPI (FAM) as other chronic illness patients relative to healthy nonpatients. Also, the results showed a negligible effect of poor adjustment (on the basis of FAM results) on neuropsychological performance in diabetic patients.

The current literature does not appear to provide information concerning the question of whether seizure patients, when asked directly, perceive their neurological condition (i.e., epilepsy) as influencing their personality. In the past this has been done indirectly. It would be useful to gain some knowledge of how seizure patients perceive the dimensions assessed by the PBI as being related to their seizure condition and, more specifically, the degree to which the presence of seizures has influenced these dimensions. The diabetic contrast group was also used in this respect to help identify how the presence of a chronic illness could be perceived by an individual as influencing his or her PBI responses.

Demographic and medical information (see method section) was collected in order to control for the possible confounding effects of such variables. For example, anticonvulsant medication has been shown to adversely effect behavioral and cognitive functioning (Hermann and Whitman, 1984). The possible role of these variables in the difficulties experienced by seizure patients must be ruled out before conclusions regarding seizure disorders and psychopathology can be made. In addition, background information such as the incidence of drug dependency,

suicide attempts, and psychiatric treatment was considered to be of great import with respect to the possible behavioral concomitants of psychological difficulties experienced by seizure patients.

In summary, the study described herein was carried out in order to address the following issues associated with the relationship between epilepsy and psychopathology:

Identification of a high risk seizure group.

It is expected that a subgroup of seizure patients will be identified who, on the basis of their PBI responses, are indistinguishable from psychiatry patients. Since these seizure patients report psychological problems similar to a psychiatric population, they can be identified as being at a high risk, relative to other seizure patients, for the development of psychopathology. A subset of self-reported psychological problems should emerge that is unique to this high risk group. A distinction must be made between those personality traits and psychological problems that are attributable to epilepsy and those that are a function of suffering from a chronic illness (i.e., the sick person syndrome).

Auras as predictors of psychopathology.

It is expected that a subset of aura experiences will be found to be characteristic of seizure patients who are identified as being at a high risk for the development of psychopathology. This assumption is made on the basis of the findings presented by Stark-Adamec et al. (1985) in which a subset of aura experiences was shown to be unique to the high risk seizure patients. These aura experiences might then serve as predictors that could conceivably form the basis of a srceening test for the detection of seizure disorder patients who are susceptible to psychopathology. Moreover, the type of auras that distinguish seizure patients at risk for the development of psychopathology may lead to insights into the psychopathophysiology of behavioral disturbance.

Method

Subjects

A total of 114 seizure patients, 91 psychiatry patients, 28 dialysis patients, 15 diabetic patients, and 100 nonpatients took part in the investigation. Table 1 shows mean age and sex distribution in each group. The seizure disorder group was in part made up of 34 seizure patients selected from a population of outpatients being treated through the Neurology Department of the General Hospital, Health Sciences Center in St. John's, Newfoundland and 10 patients being screened for temporal lobectomy at University Hospital in London, Ontario. Diabetic patients were selected from an outpatient population being treated through the Division of Endocrinology and Metabolism of the General Hospital in St. John's, Newfoundland.

Data from the seizure disorder, haemodialysis, psychiatry, and nonpatient subject groups who took part in the Stark-Adamec et al. (1985) study were integrated into the present investigation. Thus, the remaining seizure disorder patients included 70 who were selected from the Convulsive Disorders Clinic (outpatients) and the Neurology Service (inpatients) of the Wellesley Hospital in Toronto, Ontario. The seizure disorder patients were grouped according to six clinical diagnoses: complex partial seizures (CPS) (24.56%), CPS with secondary generalization (19.3%), primary generalized (38.59%), pseudoseizures (0.88%), no seizures (4.38%), and no diagnosis (12.28%). Psychiatry patients were recruited from the inpatient and outpatient services of the Wellesley Hospital (Toronto). The psychiatry patients were grouped according to the DSM-III classification system into major categories of schizophrenic disorders (DSM-III 295; 7.69%), affective disorders (DSM-III 296; 24.18%), anxiety disorders (DSM-III 300; 19.78%), personality disorders (DSM-III 301; 30.77%), substance abuse disorders

Table 1: Mean age and sex distribution for each subject group.

Subject Group	Mean Age	SD	No. Females	No. Males
Seizure	30.8	10.7	71	43
Psychiatry	39.4	13.6	58	33
Dialysis	53.4	12.6	11	17
Diabetic	41.9	20.7	8	7
Nonpatient	31.9	9.0	50	50

(DSM-III 303/305; 7.69%), and adjustment disorders (DSM-III 309; 9.89%). Haemodialysis patients were selected from the Renal Unit at the Wellesley Hospital (Toronto). The nonpatient group was made up of members from the Shelbourne Health Club in Toronto.

Measures

Personal Behavior Inventory (PBI).

The revised version of the Bear and Fedio (1977) questionnaire utilized by Stark-Adamec et al. (1985) was employed (Appendix A). Specifically, the "true/false" format, which has been shown to be unreliable (Osgoode et al., 1958), was changed to a 7-point "not at all applicable", through to "extremely characteristic" since the questionnaire items are scalable (Stark-Adamec et al., 1985). One item relating to sleep disturbance was also added to the questionnaire. The 34 seizure patients and 15 diabetic patients from Newfoundland filled out a scale appended to the PBI which asked them to consider how characteristic each item was of them before the onset of their respective illnesses.

Background information (e.g., age, sex, education, marital status) was collected from patients on a form attached to the PBI. Table 2 details all background information collected.

Aura Questionnaire.

The questionnaire used by Stark-Adamec et al. (1985) is based on pre- and para-ictal events or aura experiences (Appendix B). The 33-item questionnaire includes aura experiences involving changes in vision (3 items), changes in smell (3 items), emotions which "come out of the blue" just before a seizure (8 items), changes in taste (3 items), stomach sensations just before a seizure (1 item), other bodily sensations (2 items), balance changes or sensations of movement (2 items), and

Table 2: Subject background information.

Variable	Information Format
Sex	male/female
Age	years
Alcohol Problem	yes/no
Drug Addictions	yes/no
Education	highest grade; some university; university degree
Handedness	right/left
If Left Handed, Others In Family	yes/no
Co-inhabitants	alone; spouse; parent(s); other
Area of Residence	country; small town; or city
Marital Status	married; married equivalent; divorced; separated; single
History of Trouble With Police	yes/no
Type of Trouble With Police	nil; against person(s); against property; other
Attempted Suicide	yes/no

thoughts and memories (7 items). The frequency and intensity of these aura experiences were assessed by 5-point scales ("never" through to "always" and "very mild" through to "very intense" respectively).

Procedure

Patients were contacted by mail and given the option of participation in the study (see Appendix C for covering letters). Informed consent forms (Appendix D) were received from each participating patient. The consent form assured confidentiality and the patient's anonymity. Patients were also asked to provide the name of a person whom they would allow to complete a questionnaire concerning the patient's behavior.

Consent for both groups consisted of returning the signed consent form with the name of a "rater" specified and the completed questionnaires which were enclosed. Nonconsent consisted of returning the consent form and enclosed questionnaires uncompleted or simply by not returning the consent form and questionnaires. Subjects in all patient groups completed a PBI. Only seizure patients were administered the Aura Questionnaire.

Medical information.

Diagnostically significant medical information (e.g., diagnosis, medications, electroencephalograph information) was obtained from patient medical records and the information form attached to the PBI. Tables 3 and 4 show all medical information collected.

Statistical Procedures

BMDP Item cluster analyses (average distance linkage method) (Dixon, 1985) were

Table 3: Subject medical information.

Variable	Information Format
Age When Seizures (or medical condition) Started	years
Chronicity of Seizures (or medical condition)	years
Received Psychiatric Treatment	yes/no
Psychiatric Hospital Involvement	yes/no
Number of Times in Psychiatric Hospital	number
Presence of Seizures	yes/no
Seizures Per Month	number
EEG Abnormalities	yes/no
Focal Dysrythmia	left; right; left and right; nil
Focal Spiking	left; right; left and right; nil
Generalized Dysrythmia	yes/no
Generalized Spiking	yes/no

Table 4: Subject medical information (continued).

Variable	Information Format
Locus of Epileptogenic Focus	left temporal only; right temporal only; left and right; left temporal plus others; right temporal plus others; left and right plus others; unknown
Temporal Lobe Involvement	temporal only; temporal plus others; other areas only; nil; unknown
Final Diagnosis	complex partial seizures (CPS); CPS with secondary generalization; primary generalized; pseudoseizures (symptomology of seizures present but no EEG abnormality); no seizures (patient suspected of having seizures but no seizures are identified)
Current Medication:	
Dilantin	alone, with other drugs, or nil
Mysoline	alone, with other drugs, or nil
Phenobarbitol	alone, with other drugs, or nil
Tegretol	alone, with other drugs, or nil
Valproic Acid	alone, with other drugs, or nil

used to reduce PBI (and Aura Questionnaire) data to dimensions that would make statistical and conceptual sense. The conservative jackknifed discriminant function analysis was then used to predict accuracy of group inclusion on the basis of PBI cluster scores using data from seizure patients, psychiatry patients, and nonpatients. Three seizure groups were created from this procedure: (1) properly classified seizure patients; (2) seizure patients misclassified as psychiatry patients; (3) seizure patients misclassified as nonpatients. Multivariate Analyses of Variance (MANOVAs) were used to test for group differences among the three seizure patient groups, psychiatry patients, dialysis patients, diabetic patients, and nonpatients with respect to PBI cluster scores. MANOVAs were also used to test for group differences among the three seizure patient groups (generated by the discriminant function analysis) with respect to Aura Questionnaire scores. Duncan's multiple-range test was used for mean contrasts as suggested by Davis and Gaito (1984). Finally, Pearson chi-square analyses were used with the three discriminant function seizure groupings to test for the independence of background and medical information with respect to the seizure patient groupings.

Results

PBI Cluster Analysis

An item cluster analysis was carried out using data obtained from the 101 item PBI. Data from the seizure, psychiatry, and nonpatient groups were used in the analysis as in the Stark-Adamec et al. (1985) study. Table 5 shows the PBI items which make up each of the clusters. This produced 16 cluster items which were statistically and conceptually related: (1) philosophical (attribution of special meaning to one's life and illness; being influenced by supernatural forces); (2) elation (mania and increased interest in sex); (3) core depression; (4) related depression (other depressive feelings); (5) emotional (powerful, easily triggered emotions); (6) moody (emotional lability); (7) cognitive rigidity; (8) verbal perseveration; (9) dependence (reliance on others); (10) temper; (11) hotheadedness; (12) humorlessness; (13) sees too much foolishness in the world; (14) decreased sexual activity; (15) compulsiveness; (16) diary important.

Stepwise Discriminant Function Analysis tested the accuracy of inclusion in predetermined seizure, psychiatry, and nonpatient diagnostic groups based on the composite PBI cluster scores. The conservative jackknifing procedure was used in order to reduce the bias in the group classifications. Table 6 shows the 10 clusters used in the discriminant function and the associated canonical variables. The 10 clusters are in order of their inclusion in the discriminant function. It can be seen that core depression was included into the function first since it was the cluster which added the most (i.e. core depression had the largest F value) to the separation of the groups with respect to the discriminant function.

Table 5: PBI clusters.

Cluster Name	PBI Items (composite score equal to mean of scores)
Philosophical	1, 11, 12, 13, 17, 24, 27, 32, 37, 41, 46, 48, 51, 62, 72, 76, 94, 97, 98, 99
Elation	7, 10, 31, 59,79
Core Depression	38, 73, 85, 92
Related Depression	3, 4, 22, 55, 61, 63, 80
Emotional	9, 23, 54, 89
Moody	69,90
Cognitive Rigidity	26, 42, 60, 67, 71
Verbal Perseveration	44, 78, 81
Dependence	15, 28, 39
Temper	20, 36
Hotheadedness	25, 43, 56, 68, 82, 87, 91, 96
Humorlessness	29, 88
Sees Too Much Foolishness	66, 100
Decreased Sexual Activity	52, 84
Compulsiveness	19, 50, 58, 75, 83
Diary Important	6, 18, 53

Table 6: Discriminant function analysis: canonical variables.*

Variable	Coefficient 1	Coefficient 2
Core Depression	0.43293	-0.47755
Compulsiveness	0.13685	0.19008
Dependence	0.04084	0.35014
Elation	-0.23061	-0.40249
Decreased Sexual Activity	0.12179	-0.05392
Verbal Perseveration	0.09076	0.27445
Philosophical	0.16476	0.12865
Temper	0.08589	-0.10129
Moody	0.02967	-0.21810
Hotheadedness	-0.03491	0.27624
Eigenvalues	0.70838	0.10901
Proportion of Total Dispersion	0.86663	1.00000
Canonical Correlation	0.64393	0.31352
Constant	-2.70968	-0.31043

* The additonal six clusters did not have high enough F values to be included in the discriminant function.

The discriminant function procedure correctly classified 47.4 percent of the seizure patients, 58.2 percent of the psychiatry patients, and 73 percent of the nonpatients (see Table 7). The seizure patients were the most heterogeneous. Within the seizure group, 24.6 percent and 28.1 percent were "misclassified" as psychiatry patients and nonpatients, respectively.

Group Differences with PBI Clusters

Comparisons of PBI cluster scores were carried out using the ten clusters that were involved in the discriminant function analysis reported above: philosophical, elation, core depression, moody, perseveration, dependence, temper, hotheadedness, decreased sexual activity, compulsiveness.

A MANOVA (Table 8) was done in which the seizure group was subdivided with respect to the discriminant function analysis classifications, thus, producing seven groups in total: (1) seizure patients properly classified as seizure patients [seizure(seiz)]; (2) seizure patients misclassified as psychiatry patients [seizure(psych)]; (3) seizure patients misclassified as nonpatients [seizure(nonp)]; (4) psychiatry patients; (5) dialysis patients; (6) diabetic patients; (7) nonpatients. Psychiatry patients were not subdivided in the same manner as the seizure patients because Stark-Adamec et al. (1985) had previously shown that there were no significant differences on PBI clusters between the six diagnostic subgroups within this patient group. Group, Sex, and Group x Sex effects on PBI cluster scores were examined. A significant Group effect was revealed. No significant Group x Sex interaction was found and therefore, the significant Sex effect was not considered in detail. The Group effect was defined by examining univariate analyses of variance and mean contrasts using Duncan's multiple range test. These analyses revealed that seizure(psych) patients scored as high as psychiatry patients and higher than all other groups on a particular subset of the PBI dimensions. In particular, seizure(psych) patients scored as high as psychiatry

Table 7: Stepwise discriminant function analysis: jackknifed classification.

	Percent Classified As:		
Diagnostic Group	Seizure	Psychiatry	Nonpatient
Seizure	47.4	24.6	28.1
Psychiatry	31.9	58.2	9.9
Nonpatient	24.0	3.0	73.0

Table 8: PBI clusters: MANOVA with seizure groups, other patient groups, and nonpatients.

Overall MANOVA

Source	DF	F	P
Group	60, 1707.83	7.92	0.0
Sex	10, 325	3.33	0.0004
Group x Sex	60, 1707.83	0.92	0.6564

Univariate Analyses of Group Effects

Cluster	SS	DF	F	P
Core Depression	607.53	6, 334	61.73	0.0
Compulsiveness	58.12	6, 334	6.07	0.0001
Dependence	224.80	6, 334	17.78	0.0001
Elation	52.23	6, 334	4.62	0.0002
Decreased Sexual Activity	291.06	6, 334	15.55	0.0001
Verbal Perseveration	223.66	6, 334	18.40	0.0001
Philosophical	76.01	6, 334	9.90	0.0001
Temper	279.50	6, 334	16.05	0.0001
Moody	233.38	6, 334	12.99	0.0001
Hotheadedness	158.66	6, 334	14.25	0.0001

patients and higher than all other groups on the core depression, philosophical, and moody clusters (Table 9). On the core depression dimension seizure(seiz) patients, dialysis patients, and nonpatients scored equally high and higher than seizure(nonp) patients. Dialysis patients, nonpatients, and diabetic patients were equal while seizure(seiz) patients scored higher than diabetic patients. Nonpatients, diabetic patients, and seizure(nonp) patients did not differ on this dimension. The other groups did not differ on the philosophical and moody dimensions.

Seizure(seiz) patients, seizure(psych) patients, and psychiatry patients scored equally high on verbal perseveration, temper, and hotheadedness. In addition, these three groups had significantly higher means than the other groups which did not differ on these dimensions. Also, seizure(seiz) and seizure(psych) patients scored equally as high as psychiatry patients and higher than all other groups on dependence (Table 10).

Table 11 shows Duncan's multiple-range test results for elation and decreased sexual activity. On the elation dimension it can be seen that all groups scored equally higher than the dialysis patient group. Seizure(psych) patients, psychiatry patients, and dialysis patients scored equally high on decreased sexual activity and higher than all of the remaining groups which did not differ on this dimension.

Table 12 shows Duncan's multiple-range contrasts of means for compulsiveness. Seizure(seiz) patients, seizure(psych) patients, psychiatry patients, dialysis patients, and diabetic patients all scored higher than nonpatients. Seizure(nonp) patients scored equally as low on this dimension as nonpatients but also equally as high as all of the other patient groups except the dialysis group. Table 13 shows that when the three seizure patient groups were collapsed into one group and the data were analysed in the same manner (MANOVA and Duncan's multiple-range test), all patient groups scored equally higher than the nonpatient group on the compulsiveness dimension.

Table 9: Core depression, philosophical, and moody: Duncan's multiple-range test.

(Means with the same letter are not significantly different.)

Cluster	Duncan Grouping	Mean	Group	MSE
Core Depression	A	5.14	seizure (psych)	1.64
	A	4.68	psychiatry	
	B	2.54	seizure (seiz)	
	C B	2.43	dialysis	
	C B D	1.90	nonpatient	
	C D	1.85	diabetic	
	D	1.65	seizure (nonp)	
Philosophical	A	3.84	seizure (psych)	1.28
	A	3.52	psychiatry	
	B	2.86	seizure (seiz)	
	B	2.83	diabetic	
	B	2.69	seizure (nonp)	
	B	2.58	dialysis	
	B	2.53	nonpatient	
Moody	A	5.28	psychiatry	2.99
	A	5.27	seizure (psych)	
	B	3.81	seizure (seiz)	
	B	3.80	diabetic	
	B	3.77	seizure (nonp)	
	B	3.65	nonpatient	
	B	2.89	dialysis	

Table 10: Verbal perseveration, temper, hotheadedness, and dependence: Duncan's multiple-range test.

(Means with the same letter are not significantly different.)

Cluster	Duncan Grouping	Mean	Group	MSE
Verbal Perseveration	A	4.25	seizure (psych)	2.03
	A	4.07	seizure (seiz)	
	A	3.90	psychiatry	
	B	2.53	nonpatient	
	B	2.42	diabetic	
	B	2.31	dialysis	
	B	2.21	seizure (nonp)	
Temper	A	4.36	seizure (psych)	2.90
	A	4.15	psychiatry	
	A	3.50	seizure (seiz)	
	B	2.66	dialysis	
	B	2.40	diabetic	
	B	2.22	nonpatient	
	B	2.03	seizure (nonp)	
Hotheadedness	A	3.98	seizure (psych)	1.86
	A	3.73	psychiatry	
	A	3.59	seizure (seiz)	
	B	2.59	diabetic	
	B	2.46	nonpatient	
	B	2.29	seizure (nonp)	
	B	2.21	dialysis	
Dependence	A	4.24	seizure (psych)	2.11
	B A	3.54	psychiatry	
	B	3.41	seizure (seiz)	
	C	2.33	diabetic	
	C	2.12	dialysis	
	C	2.08	nonpatient	
	C	1.84	seizure (nonp)	

Table 11: Elation and decreased sexual activity: Duncan's multiple-range test.

(Means with the same letter are not significantly different.)

Cluster	Duncan Grouping	Mean	Group	MSE
Elation	A	3.69	seizure (psych)	1.89
	A	3.60	nonpatient	
	A	3.47	psychiatry	
	A	3.43	seizure (nonp)	
	A	3.09	seizure (seiz)	
	A	3.04	diabetic	
	B	2.21	dialysis	
Decreased Sexual Activity	A	4.59	dialysis	3.12
	A	4.22	psychiatry	
	A	4.21	seizure (psych)	
	B	3.07	seizure (seiz)	
	B	3.07	diabetic	
	B	2.27	seizure (nonp)	
	B	2.27	nonpatient	

Table 12: Compulsiveness: Duncan's multiple-range test

(Means with the same letter are not significantly different.)

Cluster	Duncan Grouping	Mean	Group	MSE
Compulsiveness	A	4.69	dialysis	1.60
	B A	4.48	psychiatry	
	B A	4.44	seizure (seiz)	
	B A	4.25	diabetic	
	B A	4.21	seizure (psych)	
	B C	3.96	seizure (nonp)	
	C	3.57	nonpatient	

Table 13: Compulsiveness: MANOVA and Duncan's multiple-range test with seizure patients as one group.

Overall MANOVA (10 clusters)

Source	DF	F	P
Group	40, 1249.38	6.82	0.0001

Univariate Analysis

Source	SS	DF	F	P
Group	53.48	4, 338	8.39	0.0001

Duncan's Multiple-Range Test

(Means with the same letter are not significantly different.)

Duncan Grouping	Mean	Group	MSE
A	4.69	dialysis	1.59
A	4.48	psychiatry	
A	4.25	seizure	
A	4.25	diabetic	
B	3.57	nonpatient	

Seizure Patients: Examination of Aura Data

The seizure group was subdivided with respect to the discriminant function analysis classifications: (1) seizure(seiz); (2) seizure(psych); (3) seizure(nonp). MANOVA was used to examine Group effects, Sex effects, and Group x Sex interactions with aura experiences that were reported on the Aura Questionnaire. Table 14 shows MANOVA results for reported intensity of aura experiences. There were overall Group and Sex effects and a Group x Sex interaction. The Group effect and the Group x Sex interaction was defined by examining univariate analyses of variance and mean contrasts using Duncan's multiple-range test. Seizure(psych) patients reported higher intensities on five of the 33 aura experiences than seizure(seiz) and seizure(nonp) patients. The five aura experiences were the only auras that produced significant group effects on the univariate analyses of variance. The perception of formed images, the perception of humming or buzzing sounds, irritability, jamais vu (a familiar scene suddenly seems strange or unfamiliar), and the perception of time suddenly speeding up or slowing down were all aura experiences reported as more intense by the seizure(psych) group as defined by Duncan's multiple-range test mean contrasts. (Figure 1, in table format in Appendix E).

A main Sex effect was due to the fact that female seizure patients reported alterations in the loudness, pitch, or quality of sounds to be more intense than male seizure patients ($F(1, 50) = 5.08$, $p < .05$). The MANOVA Group x Sex interaction was due to the preseizure experience of hearing voices or music. The interaction was defined by examining the univariate analyses of variance and mean contrasts using Duncan's multiple-range test. Male seizure(psych) patients reported this aura to be equally as intense as male seizure(nonp) patients and more intense than male seizure(seiz) patients. Female seizure(seiz), seizure(psych), and seizure(nonp) patients experienced this aura with equal intensity. Male

Table 14: Aura intensity data: MANOVA.

Overall MANOVA

Source	DF	F	P
Group	66, 36	1.94	0.0163
Sex	33, 18	7.64	0.0001
Group x Sex	66, 36	4.12	0.0001

Univariate Analyses of Group Effects

Aura	SS	DF	F	P
Perception of Formed Images	16.89	2, 50	6.69	0.0027
Perception of Humming or Buzzing	37.62	2, 50	8.92	0.0005
Irritability	22.81	2, 50	5.28	0.0083
Jamais Vu	25.51	2, 50	5.59	0.0065
Time Speeded Up or Slowed Down	23.10	2, 50	4.45	0.0167

Univariate Analysis: Group x Sex Interaction

Aura	SS	DF	F	P
Hearing Voices or Music	8.89	2, 50	3.72	0.0313

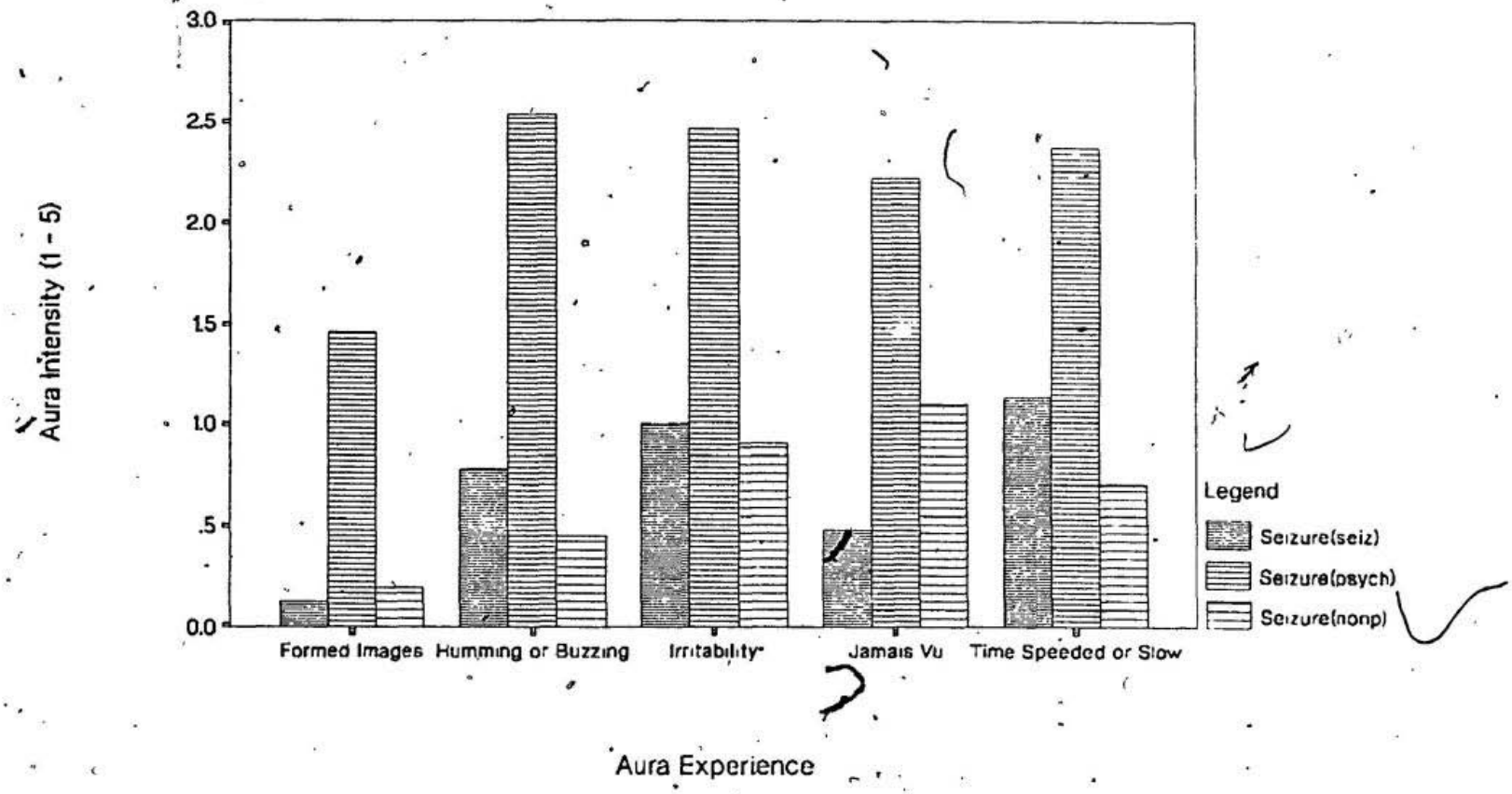


Figure 1: Aura intensity means: formed images, humming or buzzing sounds, irritability, jamais vu, and time speeded or slowed.

seizure(psych) reported higher intensities than female seizure(psych) and female seizure(nonp) patients. Female seizure(seiz) patients reported the aura to be of equal intensity to male seizure(psych) patients. Male seizure(seiz), male seizure(nonp) patients, female seizure(seiz), female seizure(psych), and female seizure(nonp) patients all reported equal intensities (Figure 2; in table format in Appendix F).

Table 15 shows MANOVA results for reported frequency of aura experiences. Significant Sex and Group x Sex interactions were found. The Group x Sex interaction was due to the preseizure experience of hearing voices or music. The reported intensity of this aura also produced a Group x Sex interaction (reported above). The Group x Sex interaction was analyzed as was the same interaction for intensity. Male seizure(psych) patients reported experiencing this aura equally as frequently as male seizure(nonp) patients and more frequently than male seizure(seiz) patients. Female seizure(seiz), seizure(psych), and seizure(nonp) patients reported equal frequencies. Male seizure(psych) reported higher frequencies than female seizure(nonp) patients. Male seizure(seiz), male seizure(nonp), female seizure(seiz), female seizure(psych), and female seizure(nonp) patients all reported equal frequencies with this aura (Figure 2; in table format in Appendix F).

Although the overall MANOVA showed no Group effect, it is interesting to note that four of the auras that were reported as being experienced more intensely by seizure(psych) patients than seizure(seiz) and seizure(nonp) patients were also reported by this group to be more frequent when the univariate results and Duncan's multiple-range test mean contrasts are examined. The perception of formed images, the perception of humming or buzzing sounds, irritability, and the perception of time speeding up or slowing down were aura experiences reported as occurring more frequently by seizure(psych) patients.

An item cluster analysis was carried out with all aura intensity responses in order to examine the conceptual and statistical relationship between the five aura

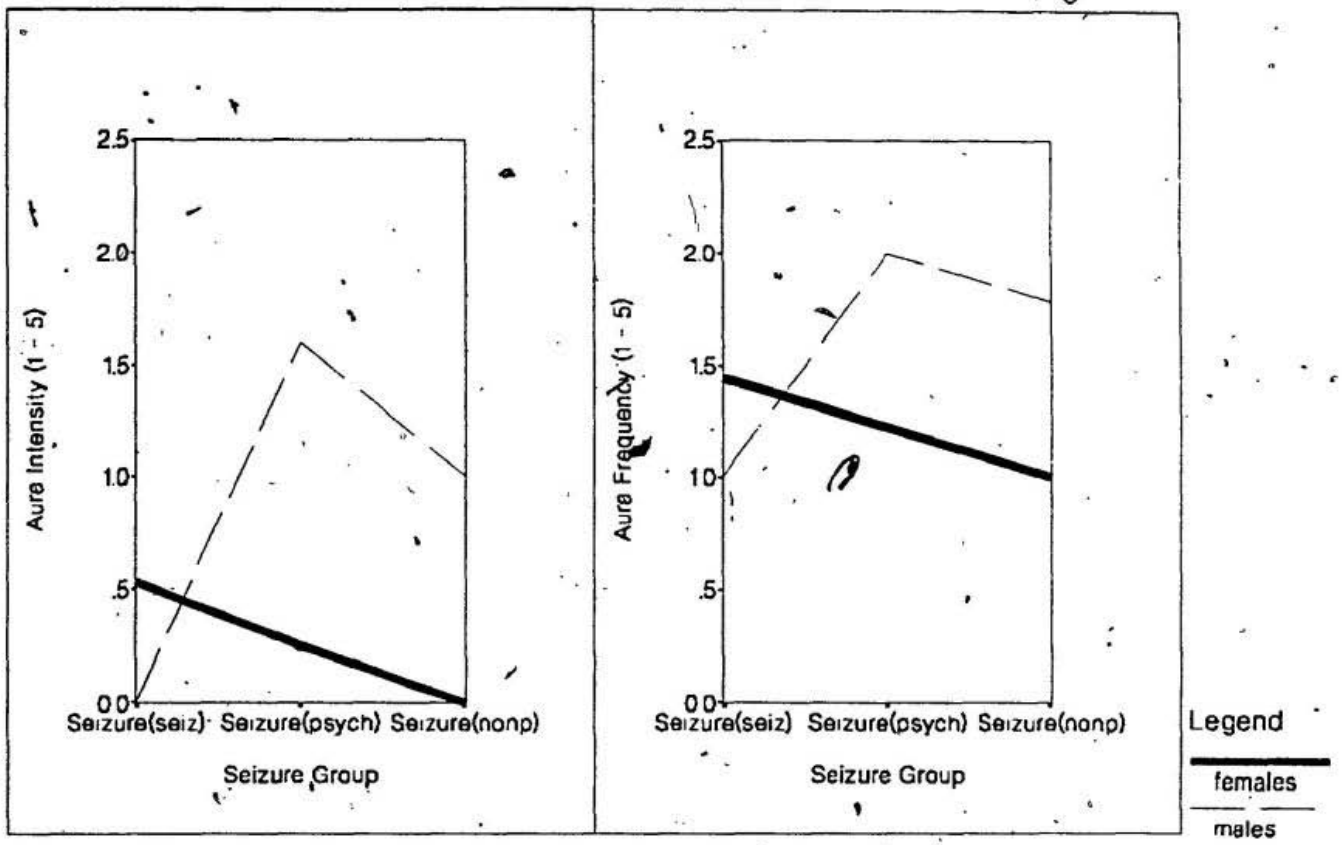


Figure 2: Hearing voices or music (intensity and frequency means): Group x Sex interaction.

Table 15: Aura frequency data: MANOVA.

Overall MANOVA

Source	DF	F	P
Group	66, 44	1.35	0.1454
Sex	33, 22	2.13	0.0332
Group x Sex	66, 44	2.21	0.0030

Univariate Analysis: Group Effects

Aura	SS	DF	F	P
Perception of Formed Images	7.22	2, 54	5.72	0.0056
Perception of Humming or Buzzing	21.46	2, 54	5.73	0.0055
Irritability	11.06	2, 54	3.50	0.0371
Pleasure	1.05	2, 54	3.21	0.0480
Mind Stuck on One Idea	14.28	2, 54	3.50	0.0371
Time Speeded Up or Slowed Down	17.34	2, 54	4.04	0.0231

Univariate Analysis: Group x Sex Interaction

Aura	SS	DF	F	P
Hearing Voices or Music	5.04	3, 48	3.48	.0378

experiences that were reported as being more intense by the seizure(psych) patients relative to seizure(seiz) and seizure(nonp) patients. The five auras, the perception of formed images, the perception of humming or buzzing sounds, irritability, jamais vu, and the perception of time speeding up or slowing down, were included in four separate first-order clusters (Table 16). Jamais vu formed a first-order cluster with the perception of formed images. The perception of time speeding up or slowing down formed a completely separate first-order cluster with the feeling of strangeness or unreality. Alterations in loudness, pitch, or quality of sounds made up a first-order cluster with the perception of humming or buzzing sounds. And finally, irritability formed a first-order cluster with the sensation of tingling or numbness.

Analysis of Background and Medical Information

Pearson Chi-square analyses were carried out with the discriminant function analysis seizure patient groupings in order to determine if the differences on the PBI cluster scores could be attributed to background or medical variables. Table 17 shows the distribution of seizure patients within the classification categories used with the background variables with which the Pearson Chi-square statistic was found to be significant: (1) history of psychiatric treatment; (2) history of visits to a psychiatric hospital; (3) history of attempted suicide; (4) history of an alcohol problem. Seizure(psych) patients were found to be more likely than seizure(nonp) patients and seizure(seiz) patients to have received some form of psychiatric treatment ($X^2 = 12.3$, df $= 2$, $p < .005$) and to have been to a psychiatric hospital ($X^2 = 7.9$, df $= 2$, $p < .05$). Seizure(psych) patients represented 12.6% and 9.8% of the total seizure patient sample on each of these variables respectively.

Seizure(psych) patients were also found to be more likely to report attempting suicide ($X^2 = 21.4$, df $= 2$, $p < .001$) and having an alcohol problem ($X^2 = 12.3$,

Table 16: Aura intensity first-order clusters.

Cluster No.	Aura Experiences in Cluster
1	(a) Changes in the appearance of objects (b) Sadness/depression
2	(a) Dizziness (b) Sensation of rotation, floating, or moving backward/forward or sideways
3	(a) Alteration in loudness, pitch, or quality of sounds (b) Humming or buzzing sounds
4	(a) Fear (b) Anxiety/tension
5	(a) Sensation of strangeness or unreality (b) Time appears to speed up or slow down
6	(a) Perception of formed images (b) Jamais vu
7	(a) Mind becomes stuck on one idea (b) Flood of ideas
8	(a) Anger (b) Hatred
9	(a) Irritability (b) Tingling or numbness in part or all of body
10	(a) Change in the taste of food (b) Unpleasant taste while not eating or drinking
11	(a) Hearing voices or music (b) Changes in the feeling of body parts
12	(a) Sudden change or strengthening of an odour (b) Pleasant smell
13	(a) Pleasure/well-being (b) Nausea

Table 17: Background variables which revealed a significant Pearson chi-square statistic: Seizure patient distribution. *

Psychiatric Treatment

	seiz	psych	nonp	Total
Yes	14	14	4	32
No	40	14	25	79
Total	54	28	29	111

Psychiatric Hospital

	seiz	psych	nonp	Total
Yes	10	11	3	24
No	44	17	27	88
Total	54	28	30	112

Suicide Attempt

	seiz	psych	nonp	Total
Yes	3	11	1	15
No	51	17	28	96
Total	54	28	29	111

Alcohol Problem

	seiz	psych	nonp	Total
Yes	0	4	0	4
No	54	24	29	107
Total	54	28	29	111

* Data was not available on the complete seizure patient sample.

df = 2, $p < .005$) than seizure(seiz) and seizure(nonp) patients. The MANOVA analysis of PBI cluster scores was repeated with the seizure(psych) patients who reported having a alcohol problem removed from the sample. This procedure did not alter the MANOVA results reported above. The seizure(psych) patients constituted 9.9% and 3.6% of the total seizure patient sample on each of the two background variables described above respectively.

Although seizure(nonp) patients were found to be more likely to exhibit a normal electroencephalograph (EEG) recording ($X^2 = 6.5$, df = 2, $p < .05$. N = 105) than seizure(seiz) and seizure(psych) patients, the three groups did not differ on the incidence of specific EEG abnormalities. These included EEG readings of generalized dysrythmia, generalized spiking, focal dysrythmia, and focal spiking (X^2 range 1.0 to 5.9, df = 2(spiking) and 6(dysrythmia), N range 103 to 104, $p > .1$).

In addition to EEG information, seizure patients were grouped with respect to their diagnoses: complex partial seizures (CPS)(24.56%), CPS with secondary generalization(19.3%), primary generalized(38.59%), pseudoseizures(0.88%), no seizures(4.38%), and no diagnosis(12.28%). The frequency of these diagnoses were not found to differ ($X^2 = 6.3$, df = 8, $p > .05$, N = 100) between the seizure(seiz), seizure(psych), and seizure(nonp) groups.

The type of anticonvulsant medications (i.e. Dilantin, Mysoline, Phenobarbitol, Tegretol, Valproic Acid) that seizure patients were currently being administered were not found to differ significantly between the seizure(seiz), seizure(psych), and seizure(nonp) groups [X^2 range 1 to 4.8, all df = 4 (except for Phenobarbitol where df = 2), all N = 90, all $p > .05$]. Pearson chi-square analyses on all of the remaining background and medical information revealed that the three seizure groupings were independent of these variables.

Rater Data and Perceived Influence of Condition on PBI Items

The response for the rater questionnaires and the additional scale added to the PBI which asked subjects to indicate their perception of how their condition (i.e. epilepsy or diabetes) effected each of the items on the PBI was not high enough to warrant an analysis of these data.

Discussion

The present study showed that seizure patients who scored similarly to psychiatry patients on the Personal Behaviour Inventory (PBI) reported a unique subset of psychological problems. These patients also reported a characteristic set of aura experiences. The incidence of a number of background variables was shown to be higher in this group. The high incidence of some of these variables can possibly be explained in terms of psychosocial concomitants of seizure disorders.

It was intended that the present study would add some insight to the question of which seizure patients are at a high risk of developing psychopathology. It is quite logical to propose that those seizure patients misclassified as psychiatry patients on the basis of their PBI responses [seizure(psych)] would be at greater risk relative to other seizure patients, for the development of psychological problems or maladaptive behavior. The task at hand was to begin to identify some of these problems of functioning and to delineate characteristic markers for this high risk group. Specifically, self-reported psychological problems and reported pre- and para-ictal events (i.e. auras) were the focus of the study. The role of other relevant background and medical variables was considered with respect to their possible confounding of PBI profiles.

PBI Clusters

The cluster analysis procedure with the PBI responses was found to yield 16 indices or dimensions which made sense both statistically and conceptually. It was determined that the 26 dimensions created by Stark-Adamec et. al (1985),

using the same procedure, could be further reduced to form more meaningful and concise dimensions. This was made possible largely because of the increase in the number of seizure patients. There were 70 in the Stark-Adamec et al. (1985) study compared to 114 in the present study.

Identification of a High Risk Seizure Patient Group

Seizure patients who may be at risk for the development of psychopathology - that is, seizure(psych) patients - reported a unique subset of psychological problems relative to seizure(seiz) patients, seizure(nonp) patients, and controls. By their own report, they scored equally as high as psychiatry patients and higher than the other two seizure groups and the normal and chronic illness controls on three dimensions: (a) core depression; (b) philosophical interpretation of life (philosophical); (c) moody.

Core depression describes a depressed mood state in which life seems to be a strain much of the time. This may also be accompanied by suicidal ideation and feelings of hopelessness. The philosophical dimension is an interpretation of life in which the individual attaches special meaning to his or her life and illness. This may also include having a high degree of spirituality and religiosity, a belief that one has a unique understanding of the order and purpose of life and the world around him or her, a feeling that one is being influenced by supernatural forces, or a personal belief on the individual's part that he or she is often the only one to stand up for what is right. Moody describes a transient mood state in which the individual may be bothered for extended periods of time by a particular rumination or undergo dramatic mood swings.

The psychological problems that were found in the present study to characterize seizure(psych) patients could be labelled as being part of a general depression and anxiety syndrome. There are several reasons for this conclusion. First, the

discriminant function analysis results in the present study indicate that the core depression dimension was the PBI dimension that was the most powerful discriminator used to identify seizure(psych) patients. Moreover, the core depression and moody dimensions found to be characteristic of seizure(psych) patients can be considered as symptoms of depression and anxiety, respectively, using DSM-III criteria (American Psychiatric Association, 1980). Second, recent research indicates that depression and anxiety are the most common psychological problems in patients with epilepsy (Trimble and Perez, 1980; Betts, 1981; Hermann and Whitman, 1984). For example, Trimble and Perez (1980) found epileptics to be higher than controls on depression and anxiety as measured by the Middlesex Hospital Questionnaire. Epileptics did not differ from psychiatry patients on these measures. Third, Adamec and Wishart (1987) administered the revised PBI, the Beck Depression Inventory (BDI), the State-Trait Anxiety Inventory (STAI) at normal anxiety levels and the STAI after induced anxiety. Seizure patient BDI scores correlated quite highly with the PBI core depression composite score ($R = .75$, $F(1, 13) = 16.81$, $P < .01$). Also the mean score of the trait scales on the two anxiety measures were found to be highly correlated with the core depression score ($R = .71$, $F(1, 13) = 13.38$, $P < .05$). These results added considerable support to the validity of the revised PBI since the seizure patients who scored high on core depression on the PBI were actually shown to have high scores on the well-standardized BDI. The reported association between anxiety and depression (Roth, Gurney, Garside, and Kerr, 1972) is consistent with the high correlation between the measures of anxiety and the core depression dimension.

It was shown in the present study that the seizure(psych) patients share additional psychological problems with a second subgroup of epileptics. Seizure(psych) patients and seizure(seiz) patients were shown to score equally as high as psychiatry patients and higher than all other groups on four of the PBI dimensions: (a) verbal perseveration; (b) temper; (c) hotheadedness; and (d) dependence. Verbal perseveration describes an individual's speaking style which

is characterizd by circumstantiality. The individual may also be aware of impatience on the part of others because of his or her way of maintaining conversations for long periods of time. The temper dimension is characterized by an individual's tendency to get angry because of relatively minor incidents and lose control of his or her anger frequently. Hotheadedness describes an individual's tendency to possess an explosive and intense temper which may cause the individual to break things or hurt people on occasion, thus getting him or her into trouble. The individual may be aware that others perceive him or her in this way. A person who is descibed as hotheaded may have quite intense feelings of persecution by others and feelings of revenge. Dependence includes an individual's belief that he or she depends on others for many things. This may be attributed to the individual's feelings of helplessness. The individual may also be aware of anger on the part of others because of this continual dependent relationship.

Since the discriminant function analysis showed no statistical association between seizure(seiz) patients and psychiatry patients on PBI scores, this could be an indication of a more general or subtle association among the three groups with respect to these PBI dimensions. The fact that seizure(nonp) patients did not share unique elevated PBI clusters with seizure(seiz), seizure(psych), and psychiatry patients indicates that seizure(seiz) patients might be more closely related in personality traits to the psychiatry patients and the seizure(psych) patients than the seizure(nonp) patients.

A number of comparisons can be made with the Stark-Adamec et al. (1985) results and the present data. However, the researchers did not analyze the seizure patient PBI profiles with respect to discriminant function analysis subgroups and it is therefore difficult to make specific group comparisons between the two studies. Stark-Adamec et al. found seizure patients, as a group, reported their tendency to consider their life story to be of importance to others to be as elevated as psychiatry patients relative to dialysis patients and normal controls.

The philosophical cluster in the present study incorporated the items that made up the "one's own life important" dimension in the Stark-Adamec et al. study. The present data showed that the seizure(psych) patients were as elevated on the philosophical dimension as psychiatry patients relative to the chronic illness contrast groups and normal controls. This implies that the seizure(psych) patients might represent a subgroup in the Stark-Adamec et al. study that was responsible for the elevation of the "one's own life important" dimension. Stark-Adamec and her colleagues (1985) found seizure patients as a group reported their dependence on others to be as elevated as psychiatry patients relative to dialysis patients and normal controls. In the present study seizure(seiz) and seizure(psych) were found to be as elevated on dependence as psychiatry patients relative to the chronic illness contrast groups and normal controls. This could be due to the fact that the seizure(seiz) and seizure(psych) groups collectively make up 72% of the seizure patient sample and thus, resembled the seizure population used in the Stark-Adamec et al. study.

The results of the present study showed no diagnostic specificity with respect to self-reported psychological problems experienced by epileptics despite previously reported studies which specifically identified patients with temporal lobe epilepsy (complex partial seizures) as being at a high risk for the development of psychopathology (Flor-Henry, 1969; Bear and Fedio, 1977; Shukla et al., 1979; Hermann and Reil, 1981; Bear et al., 1982). This confirms the Stark-Adamec et al. (1985) finding that seizure patients who reported experiencing more psychological problems are not restricted to any single seizure diagnosis (i.e. complex partial seizures (CPS), CPS with secondary generalization, primary generalized). These findings are also in agreement with Mungus (1982) who concluded that temporal lobe epilepsy is not a necessary condition for the elevation of PBI scores. In addition, other researchers have strongly challenged the notion of psychological problems or psychopathology being specific to temporal lobe epileptics (Small et al., 1962; Mignone et al., 1970; Stevens, 1975). In a recent review, Hermann and Whitman (1984) concluded that there was little

evidence to support the notion that TLE is an important determining variable for the development of psychopathology in epilepsy.

Thus, the present results support the belief that seizure patients experience a number of psychological problems that can be partially placed in the category of depression/anxiety. This is consistent with previous research (discussed above). However, while other researchers have attributed psychological difficulties to seizure patients in general, to include all patients with epilepsy in such a theory would be very inaccurate. The incidence of psychological problems seems to be high for a specific group of seizure patients who are at risk for the development of psychopathology. It could be suggested that the seizure(psych) patients represent a subgroup of the epileptic population that accounts for the reported prevalence of depression and anxiety in epilepsy. Since seizure diagnosis cannot be used to identify those seizure patients who are at risk for the development of psychopathology, the question remains as to whether there are other variables that might be reliably used for this purpose. Reported aura experiences may be one such variable.

Auras as Predictors of Psychopathology

Seizure(psych) patients experienced a particular subset of auras: (a) the perception of formed images; (b) the perception of humming or buzzing sounds; (c) irritability; (d) jamais vu; (e) the perception of time speeding up or slowing down. These aura experiences were reported as being experienced with greater intensity within this group than with seizure(seiz) and seizure(nonp) patients. Seizure(seiz) and seizure(nonp) patients were not found to report any aura experiences that were unique to either group with respect to frequency and intensity.

Only one of the aura experiences in the present study, the perception of formed images, corresponded to the six found by Stark-Adamec et al. (1985) to be more likely experienced by seizure patients who were indistinguishable from psychiatry patients on the basis of their PBI scores. Changes in the brightness of light, alterations in loudness, pitch, or quality of sounds, sudden hatred, and mind gets stuck on a single idea made up the other five auras. The auras that emerged in the present study are of considerable interest. Hermann et al. (1982) have stressed the possible significance of the intensity of aura experiences in determining the nature and severity of psychopathology associated with seizure disorders. The perception of formed images, the perception of humming or buzzing sounds, and irritability have been shown by other researchers (Mark et al., 1972; Halgren et al., 1978) to be reproducible by direct electrical stimulation of the human limbic system. In addition, the perception of buzzing sounds and irritability have been produced in humans by limbic system activation using procaine hydrochloride (Stark-Adamec, Adamec, Graham, Bruun-Meyer, Perrin, Pollock, and Livingston, 1982).

Although the aura experiences of jamais vu and the perception of time speeding up or slowing down were not found by a review of the literature to be reproducible by stimulation of the human limbic system, the aura intensity cluster analysis results showed that both of these pre-seizure experiences formed first-order clusters with aura experiences that are produced by limbic stimulation (feeling of strangeness or unreality and the perception of formed images, respectively) (Mark et al., 1972; Halgren et al., 1978). The first-order clustering pattern of jamais vu and the perception of time speeding up or slowing down indicates a strong statistical, and possibly conceptual, association with auras that have been shown to be reproducible by limbic stimulation. These findings contribute statistical support for grouping the perception of formed images, irritability, the perception of humming or buzzing sounds, and possibly jamais vu and the perception of time speeding up or slowing down into the category of "limbic auras".

The implication of this line of investigation is that particular pre- and para-ictal experiences which have been experimentally reproduced by stimulation of the human limbic system could be used as markers for limbic system involvement associated with seizure disorders. In fact, affective auras have been defined as direct products of abnormal activity at or near the epileptiform focus, most likely in the mediotemporal lobe (Gloor et al., 1982). This evidence does not strictly apply to only temporal lobe epilepsy because generalized epilepsy is known to involve neuronal activity through many brain structures, including the deep limbic structures of the temporal lobe (Hermann and Whitman, 1984). Thus, the determination of limbic system involvement in epileptiform activity could provide useful information on behavioral and emotional concomitants of seizure disorders.

The association of limbic auras with the psychological disturbances of seizure(psych) patients suggests that involvement of limbic tissue in seizure discharge may predispose to psychological disturbance. A number of lines of evidence support this conclusion. Adamec and Stark-Adamec (1985) suggested that reported "limbic seizures" in humans would have interictal behavioral consequences. This suggestion stems from the fact that it has been established that the human limbic system is involved in the integration of emotion and affect in perception and memory processes (Mignone et al., 1970; Gloor, 1986). Moreover, lasting interictal behavioral and emotional change as a result of electrical stimulation of limbic structures has been demonstrated by previous researchers in animals (Adamec and Stark-Adamec, 1985) and humans (Mark et al., 1972; Stevens et al., 1969). Furthermore, Adamec and Stark-Adamec (1983a) proposed the idea of a kindling-like process to explain the relationship between psychological disturbance and seizure disorders. They presented evidence that long-lasting post-tetanic potentiation (LTP) in limbic structures may be the cause of behavioral changes in animals. Related to this, Flor-Henry (1969) had previously suggested that a long duration of epilepsy associated with an early onset does not predispose to psychosis but to personality and character disorders and disturbed interpersonal relations.

These data suggest that individuals who suffer from seizure activity involving limbic system structures would be expected to experience alterations in behavior and emotion or affect. The present study was able to demonstrate specific personality dimensions (discussed earlier) that are associated with seizure patients who are considered to be at risk for the development of psychopathology. And, given the relationship between limbic structures and psychological problems, it can be postulated that seizure patients who present in the clinical setting with an aura or set of auras that are so-called limbic auras, would also display the personality dimensions that were found to be characteristic of seizure patients at risk for the development of psychopathology (i.e., core depression, philosophical, and moody).

Sick person syndrome.

The sick person syndrome was considered to be those personality characteristics or psychological problems that are common to individuals suffering from a chronic illness per se. The findings of the present study showed that the tendency for seizure patients to be compulsive is more a function of having a chronic illness (i.e., sick person syndrome) than having a seizure disorder per se. The dialysis and diabetic contrast groups were used to more accurately define the PBI clusters that were elevated in all of the patients groups relative to the nonpatient sample. Seizure patients, psychiatry patients, dialysis patients, and diabetic patients were found to be equally more compulsive than nonpatients. The compulsivity dimension was defined as an individual possessing a desire to devote excessive attention to details when conveying information to others or when making a decision. It also reflected a personal desire to, and the expectation for others to, strictly conform to rules and laws.

Stark-Adamec et al. (1985) found compulsivity, humorlessness, and hyposexuality to be elements of a sick person syndrome. In the present study, humorlessness was not one of the 10 PBI clusters used in the discriminant

function analysis to differentiate between seizure patients, psychiatry patients, and nonpatients, and was therefore not used in the later statistical procedures. Hyposexuality was not found to be elevated in all of the patient groups relative to nonpatients in the present study. Therefore, the present results suggest that compulsiveness is the only PBI cluster to be a function of suffering from a chronic life-disturbing illness.

It has been suggested that there are certain aspects of coping with a chronic disease that are consistent across various types of illness while others are not (Burish and Bradley, 1983a). The common problems associated with dealing with a chronic illness remain as a separate area of investigation that demands immediate attention by researchers in light of evidence that 8 of the 10 most common causes of death are chronic diseases (Burish and Bradley, 1983b).

Background and medical data.

A number of background variables were found to discriminate seizure(psych) patients from seizure(seiz) and seizure(nonp) patients. There was a higher likelihood of individuals in this group reporting past suicide attempts and having a problem with alcohol. This would seem to be more a function of maladaptive coping strategies than due to the direct effects of epilesy. It has been reported that approximately 50% of people with epilepsy who seek specialist medical attention experience frank psychological and social difficulties (Rodin, Shapiro, and Lennox, 1977). Dodrill and his colleagues (Dodrill, Breyer, Diamond, Dubinsky, and Geary, 1984) reported that in a sample of seizure disorder patients, 53% experienced definite to severe psychosocial problems. These included emotional, interpersonal, financial, and vocational concerns as well as difficulties in dealing with seizures. Furthermore, since seizure(psych) patients are expected to be at a higher risk for the development of psychopathology, it follows that a high proportion of these patients should be found to have sought some form of psychiatric treatment. This was found in the present investigation.

Seizure(psych) patients were found to be more likely to have visited a psychiatric hospital and to have received some form of psychiatric treatment relative to the other seizure groups. This indicates that a certain proportion of seizure patients who are at risk for the development of psychopathology do indeed develop problems which require psychiatric intervention.

Several negative findings that emerged from the background and medical variables warrant discussion. The results indicated that the three discriminant function groupings were not independent of the presence of abnormal EEG recordings. However, a closer investigation of more specific EEG abnormalities (i.e., generalized dysrythmia, generalized spiking, focal dysrythmia, and focal spiking) showed that seizure patient groupings were independent of all the specific EEG abnormalities. Related to this was the finding that the groupings were independent of the locus of epileptogenic foci (i.e. left temporal; right temporal; left and right temporal; left plus other areas; right plus other areas). These findings indicate that being indistinguishable from psychiatry patients on PBI dimensions (i.e. at risk for the development of psychopathology) is not related to any particular form of EEG abnormality or seizure focus.

The finding that the seizure patient groupings were independent of current medication regimes suggests that the psychological problems reported by seizure patients, and thus their similarity to psychiatry patients, was not an effect of medication. Though there are side-effects related to most anticonvulsant medications (Canadian Pharmaceutical Association, 1987) and behavioral and cognitive functioning have been shown to be adversely affected by anticonvulsant medication (Hermann and Whitman, 1984), these 'side-effects' cannot account for the present findings.

Perceived influence of epilepsy on personality.

It was not possible to address the issue of how seizure patients perceive their seizure disorder as influencing the dimensions measured by the PBI. This was largely due to the low response rate with this scale on the PBI forms. If this measure is to be used in conjunction with the PBI in future research, it would be useful for subjects to be fully aware of the importance of filling out the scale. It is also possible that the form of presentation of the two scales on the PBI form confused subjects. Future users of the PBI with the additional scale should consider presenting the two scales in a clearer fashion in order for subjects to more clearly understand what is required of them.

All subjects received the questionnaires used in the present study by mail. Although subjects were provided with a telephone number that they could call if they required assistance filling out the forms, the presence of a researcher would probably have contributed to a higher response rate for the scale which was added to the PBI and for all of the questionnaires in general.

Conclusions

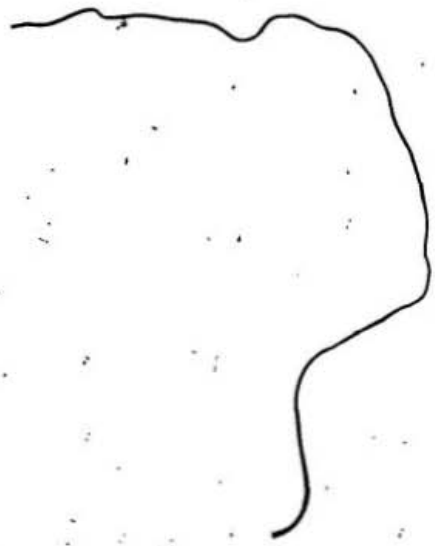
It would be inaccurate to make the assumption that all patients suffering from seizure disorders, or a particular diagnostic group of seizure disorder patients, are at risk for the development of psychopathology. On the other hand, it would also be inaccurate to assume that no risk exists. The present study has endeavored to identify which seizure patients are at risk for the development of psychological problems and more severe psychopathology and, further, to identify factors that may be associated with this risk. Specifically, seizure patients who were misclassified as psychiatry patients [seizure(psych)] by discriminant function analysis on the basis of PBI scores reported being more depressed, philosophical, and moody than other seizure patients, dialysis patients, diabetic patients, and

nonpatient controls. Seizure patients who were properly classified as seizure patients [seizure(seiz)] and seizure(psych) patients, together, reported experiencing problems with verbal perseveration, hotheadedness, temper, and dependence on others. The seizure(nonp) patients did not show any pattern of psychological disturbance. This finding supports the contention that there is a subgroup of seizure patients which doesn't experience psychological problems and is probably quite normally adjusted.

Seizure(psych) patients were found to report a unique subset of aura experiences that were experienced more intensely by them than by other seizure patients. Neither seizure(seiz) nor seizure(nonp) patients were found to report a unique set of auras with respect to frequency and intensity. The fact that seizure(seiz) patients shared a number of psychological problems with seizure(psych) patients might lead to the conclusion that they would also experience auras that are common to both groups or unique to them. Since this was not found, no clear predictive variable (i.e., auras) for all seizure patients who experience psychological problems could be established. However, the aura data indicate that the seizure(psych) patient subgroup may possess a specific pathophysiology associated with seizure activity and that certain aura experiences are a product of this. Specifically, the five auras found to be characteristic of seizure(psych) patients can be associated with limbic system activity and placed in the category of limbic auras. Given the reported relationship between limbic system activity and psychopathology, limbic auras could serve as predictors for seizure patients at risk for the development of psychopathology. Core depression, philosophical, and moody, psychological problems found to be characteristic of seizure(psych) patients, could be considered as emotional and behavioral products of limbic system pathophysiology. Verbal perseveration, temper, hotheadedness, and dependence, found to be problems shared by seizure(psych) and seizure(seiz) patients, were not associated with any aura experiences indicative of limbic activity. This may suggest that these problems are not "limbic" in nature or reported aura experiences are not a sensitive enough indicator of limbic system activity.

In view of the present findings, self-reported psychological characteristics and pre- and para-ictal experiences could conceivably serve as the basis for a "quick" screening test to be used in the clinical setting for some of the psychological problems associated with epilepsy. One use of such a high risk screening test would be the early detection of seizure patients who could potentially go on to develop serious life-disturbing psychopathology. Preventive treatment measures involving disciplines such as clinical psychology, psychiatry and social work could then be implemented.

The data relating to aura experiences in the investigation described herein suggest that limbic system involvement in seizure activity may play a key role in psychopathological processes. Tentative theories regarding the possible neurophysiological substrates of these phenomena has created a need for researchers to pursue rigorous testing of hypotheses. The existence of instrumentation such as nuclear magnetic resonance (NMR) and positron emission tomography (PET) has opened new routes of investigation that could provide a much clearer understanding of the involvement of neurophysiological mechanisms in the problems experienced by some seizure disorder patients.



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Appendix A

Personal Behavior Inventory

Personal Behaviour Inventory

We are studying the relationship between certain medical disorders and personal habits, preferences, feelings and beliefs. We are now asking for your help in this study.

On the following pages there are statements of personal attitudes and opinions. For each statement there is a corresponding 7-point scale for your response. Please indicate, on the scale, the extent to which each statement applies to you.

Example Statement a) "I never read the newspaper." If this statement is true, that you NEVER read the newspaper, then you would put your mark in the EXTREMELY CHARACTERISTIC space like this:

NOT AT ALL APPLICABLE (UNTRUE)							EXTREMELY CHARACTERISTIC (TRUE)
	:	:	:	:	:	X	

If, on the other hand, you always read the newspaper, then you would put your mark in the NOT AT ALL APPLICABLE space as the statement is completely untrue of you, like this:

NOT AT ALL APPLICABLE (UNTRUE)							EXTREMELY CHARACTERISTIC (TRUE)
X	:	:	:	:	:	:	

If you read the newspaper about 50% of the time, then you would put your mark in the middle space, halfway between NOT AT ALL APPLICABLE and EXTREMELY CHARACTERISTIC, like this:

NOT AT ALL APPLICABLE (UNTRUE)							EXTREMELY CHARACTERISTIC (TRUE)
	:	:	X	:	:	:	

and so on.

Example Statement

b) "My weight has changed in the past six months."

If you have lost or gained A LOT of weight in the past six months, then you would put your mark in the EXTREMELY CHARACTERISTIC space.

If this statement is NOT TRUE of you, if your weight has been steady for the past six months, then you would put your mark in the NOT AT ALL APPLICABLE space.
If you have lost or gained VERY LITTLE then you could put your mark here:

NOT AT ALL APPLICABLE (UNTRUE)							EXTREMELY CHARACTERISTIC (TRUE)
	:	X	:	:	:	:	

There are no "right" or "wrong" answers to this Inventory; what is most important is the honesty of your answers.
Because some of the items deal with highly personal areas, we can assure you of the confidentiality of your responses. Each form will be given a computer code number and will be processed statistically without your name.

We plan to share with the medical community any findings from this study that would be helpful in future treatment. We hope that in this way your participation will prove rewarding for you and other patients with similar illnesses in the future.

Below the rating scales for each statement in the questionnaire are four choices:

SAME MORE LESS NOT APPLICABLE

If you feel that the statement was more characteristic of you before you started to have seizures, then circle "MORE".
If you feel that the statement was less characteristic of you before you started to have seizures, then circle "LESS".
If you would have answered the question in the same way you did now, then circle "SAME".
If for any reason you feel that you cannot make a judgement of "SAME", "MORE", or "LESS", then circle "NOT APPLICABLE".

PERSONAL BEHAVIOUR INVENTORY

All information is strictly confidential

Name:_____ Sex:_____ Age:_____

Highest grade you completeed in school:_____

Occupation:_____

Hand used for writing:_____

If left handed, are you the only one in the family?_____

Do you have seizures?_____ Age when seizures started:_____

Number of seizures, on the average, per month:_____

Are you: Married Married Equivalent Divorced
Separated Single (Circle one)

With whom do you live? Alone With Spouse Parents
Other_____

Do you live in: The country Small town City

Have you been in trouble with the police?_____

If so, what kind?_____

Have you had a problem with alcohol?_____

Have you been addicted to drugs?_____
If so, which ones?_____

Have you attempted suicide?_____

Have you been in a psychiatric hospital?_____
If so, how many times?_____

Have you had psychiatric treatment?_____
If so, what type?_____

PERSONAL BEHAVIOUR INVENTORY

1. I think people would learn a lot from the story of my life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

2. I have stronger feelings of happiness than most people.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

3. I feel like a pawn in the hands of others.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

4. I can never forgive myself for some of the things I have done.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

5. I have a habit of counting things.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

6. It makes good sense to keep a detailed diary.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

7. Recently more of my thoughts have something to do with sex.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

8. I never get angry.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

9. For me, feelings often take the place of thinking.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

10. Things which never attracted me before have become sexually attractive.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

11. I think that I have a special mission in life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

12. I interpret things more deeply than most people.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

13. My religious beliefs have undergone major changes.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

14. I am more sensitive to distractions than most people.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

15. I have gotten people angry by asking them to do so much for me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

16. I never gossip.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

17. Powerful forces outside my control are working with my life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

18. I keep a diary.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

19. It makes me personally furious to see people disobeying the law.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

20. Little things make me angrier than they used to.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

21. If things are not just right, it upsets me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

22. Fate appears to be working against me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

23. Almost everything triggers some emotional reaction in me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

24. The Bible has special meaning which I am beginning to understand.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

25. My temper has gotten me into trouble.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

26. Sometimes I get terribly confused by little details.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

27. Powerful forces are acting through me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

28. I seem to depend on other people for many things.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

29. Few things are really funny.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

30. My table manners are just as good at home as when I am out in company.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

31. Often I get in to such a good mood that I do foolish things.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

32. I am sure there is a significant meaning behind my suffering.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

33. I have had periods of weeks or months when I could not get going.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

34. I am open to attack from many sides.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

35. I cannot get off the point sometimes.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

36. I am losing control of my temper more frequently.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

37. Nothing is more important than trying to understand the forces that govern this world.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

38. Life is a strain for me much of the time.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

39. Sometimes I feel so helpless that I want people to do everything for me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

40. I never put off until tomorrow what I ought to do today.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

41. Often I am the only one to stand up for what is right.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

42. Sometimes my mind gets stuck on so many different ideas that I cannot make a decision or do anything.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

43. When I get angry, I often explode.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

44. Once I start to talk to someone, I have trouble breaking off.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

45. People do not seem to appreciate me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

46. I spend a lot of time thinking about the origins of the world and life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

47. At elections I never vote for men or women about whom I know very little.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

48. I have had some very unusual religious experiences.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

49. Almost every day I am infuriated by cases where justice has not been done.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

50. It is useless to tell someone something without giving them all the details.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

51. I have come to place my faith in astrology, meditation or other spiritual ways of relating myself to the universe.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

52. My sexual activity has decreased.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

53. I write down or copy things.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

54. Emotions control my life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

55. Much of the time I feel as if I have done something wrong or harmful.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

56. My feelings of hatred can be very intense.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

57. I like everyone I know.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

58. Before I make a decision, I need to know every detail.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

59. Sometimes I feel so good that ideas come into my mind faster than I can handle them.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

60. Sometimes my mind gets stuck on one idea so that I cannot make a decision or do anything.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

61. I have not lived the right kind of life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

62. I try to keep track of special details about my life and thinking.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

63. People tend to take advantage of me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

64. I always tell the truth.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

65. I have had periods when I felt so good that sleep did not seem necessary for several days.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

66. People should think about the points of many jokes more carefully instead of just laughing at them.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

67. I need more details than most people before I understand something.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

68. I have a tendency to break things or hurt people when I get angry.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

69. I am subject to big shifts in mood - from very happy to very sad.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

70. When I accidently hurt someone's feelings, I cannot forgive myself for a long time.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

71. I tend to get bogged down with little details.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

72. Finally I am beginning to understand the real meaning or nature of this world.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

73. I really am down in the dumps most of the time.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

74. I never laugh at a dirty joke.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

75. I would go out of my way to make sure the law is followed.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

76. I have more of a feeling than most people for the order and purpose of life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

77. I am strongly attracted to members of my own sex.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

78. Sometimes I keep at a thing so long that others may lose their patience.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

79. Sometimes without any reason or even when things are going wrong I feel excitedly happy, on top of the world.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

80. I really make myself suffer after even a small mistake.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

81. People sometimes tell me that I have trouble getting to the point because of all the details.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

82. I would like to rip some people to shreds.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

83. I despise people who try to break the rules.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

84. I have trouble becoming sexually aroused.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

85. I have often felt so bad that I was close to ending my life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

86. I read every editorial in the newspaper every day.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

87. The thought of revenge burns inside me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

88. Most jokes do not seem funny to me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

89. My emotions have been so powerful that they have caused trouble.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

90. Sometimes a particular thought will run through my mind and bother me for days.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

91. I am often said to be hotheaded.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

92. The future seems hopeless to me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

93. I am fortunate to receive so much help from people around me.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

94. I am very religious (more than most people) in my own way.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

95. I never feel like swearing.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

96. When I think of some of the things people have done to me, it makes me absolutely furious.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

97. Sometimes I think an illness has been given to me so that I would meet certain people at the right time.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

98. I would like to write a book about my life.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

99. Religion and God are more personal experiences for me than for most people.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

100. There is too much foolishness in the world these days.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

101. I have trouble getting a good night's sleep.

NOT AT ALL APPLICABLE (UNTRUE) ___ : ___ : ___ : ___ : ___ : ___ : ___ EXTREMELY CHARACTERISTIC (TRUE)

SAME MORE LESS NOT APPLICABLE

Thank you for your honest and patient completion of the Inventory. Would you please check to be sure that all questions were answered.

Appendix B

Aura Questionnaire

Aura Questionnaire

On the following pages are listed various perceptual changes which some individuals experience 'just prior to ' or 'at the onset of' seizure activity. For some people these serve as a cue or a warning that a seizure is going to happen. For each of these 33 statements there are two 5-point scales indicating the FREQUENCY and INTENSITY of your experiences, respectively.

First, we would like you to indicate the FREQUENCY (ranging from NEVER to ALWAYS) with which you personally experience each of the perceptual changes. And then, for those sensations which you experience 'just prior to' or 'at the onset of' seizure activity, we would like you to indicate the intensity of each sensation on a scale ranging from VERY MILD to VERY INTENSE. Obviously, for those experiences which you never have just prior to a seizure you will not have to indicate the intensity.

Example Statement for Frequency:

a) The perception of dark clouds

If you NEVER experience the perception of dark clouds just before your seizures, then you would put a check mark or an X in the space marked NEVER on the frequency scale.

FREQUENCY	X				
	never	rarely	sometimes	often	always

If, on the other hand, you ALWAYS experience the perception of dark clouds just before seizure activity, then you would put your mark in the ALWAYS space of the FREQUENCY scale, like this

FREQUENCY					X
	never	rarely	sometimes	often	always

In those cases where you have experienced the perceptual change either 'rarely', 'sometimes', 'often', or 'always', we would like you to indicate the INTENSITY of your experience on the INTENSITY scale.

Example Statement for Intensity:

b) The odour of roses

Assuming that you experience the odour of roses 'rarely', 'sometimes', 'often', or 'always' prior to seizure activity, then indicate the strength or vividness of this experience on the INTENSITY scale.

If the smell is very strong or vivid you would place your mark in the VERY INTENSE space like this

INTENSITY					
	very mild	mild	moderate	intense	X very intense

If, on the other hand, the smell is typically mild, then you would place your mark on the MILD space of the INTENSITY scale, like this

INTENSITY					
	very mild	X mild	moderate	intense	very intense

VISION CHANGES

1. Changes in the appearance of objects. For example, just before a seizure things appear to grow larger or smaller, appear to become nearer or farther away, or the shape of things appears to be distorted.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. Changes in the brightness of light. Just before a seizure things appear to be brighter or darker than they were previously.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

3. Perception of whirling, moving, and/or coloured lights just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

4. Perception of formed images (e.g. geometric shapes, humans, plants, objects, etc.) which actually aren't there, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

HEARING CHANGES

1. Alterations in the loudness, pitch, or quality of sounds just before a seizure. Sounds may appear louder or fainter; sounds may appear to rise or fall in pitch (e.g. a low hum rising to a high scream; a high whistle dropping to a low roar and then rising again); sounds may take on an echoing quality.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. Perception of humming or buzzing sounds just before a seizure. The sounds may have no apparent environmental source.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

3. "Hearing" voices or music just before a seizure. The voices and/or music have no apparent environmental source.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

CHANGES IN SMELL

1. Sudden change or strengthening of an odour just before a seizure. The smell is originating from an identifiable source, but it is unusually strong, has an unusual quality or is inappropriate.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. The sensation of a PLEASANT smell, which may be either familiar or unfamiliar, just before a seizure. The smell cannot be attributed to anything in the immediate surroundings.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

3. The sensation of an UNPLEASANT smell, which may be either familiar or unfamiliar, just before a seizure. The smell cannot be attributed to anything in the immediate surroundings.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

EMOTIONS WHICH COME "OUT OF THE BLUE"
JUST BEFORE A SEIZURE

1. Fear

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. Pleasure/well-being

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

3. Sadness/depression

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

4. Anger

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

5. Unpleasant feelings/complex, indescribable unpleasant emotions

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

6. Anxiety/tension

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

7. Hatred

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

8. Irritability

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

CHANGES IN TASTE

1. Sudden changes in the taste of food just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. While not eating or drinking, experiencing a PLEASANT taste, which may be either familiar or unfamiliar, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

3. While not eating or drinking, experiencing an UNPLEASANT taste, which may be either familiar or unfamiliar, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

STOMACH SENSATIONS JUST BEORE A SEIZURE

1. Feelings of nausea; feeling the need to vomit.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

BODILY SENSATIONS

1. Changes in the feeling of body parts just before a seizure. For example, an arm or a leg may feel 'larger' or 'smaller' than usual; a limb may feel detached from the body.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. Tingling or numbness in part or all of the body just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

BALANCE CHANGES/SENSATION OF MOVEMENT

1. Dizziness just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. Just before a seizure, a sensation of rotation, sensation of 'floating' or sensation of moving forward/backward or sideways (in the absence of any such movement).

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

THOUGHTS AND/OR MEMORIES

1. Deja vu (a new experience feels as if it has somehow occurred before) just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

2. Jamais vu (a familiar scene suddenly becomes strange or unfamiliar) just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

3. A sense of strangeness or unreality although the surroundings remain familiar; a sense of remoteness; a sense of detachment from all that is happening, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

4. A sudden reminiscence or remembering of past experiences, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

5. Mind becomes stuck on a single idea, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

6. A 'flood of ideas' pouring through the mind, just before a seizure.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

7. Just before a seizure time appears to be speeded up or slowed down.

FREQUENCY _____ : _____ : _____ : _____ : _____
never rarely sometimes often always

INTENSITY _____ : _____ : _____ : _____ : _____
very mild mild moderate intense very intense

****

NAME: _____
(Note: Your name will be removed when the questionnaire is returned and a computer number has been assigned to your questionnaire)

Appendix C

Covering Letters for Seizure and Diabetic Patients

MEMORIAL UNIVERSITY OF NEWFOUNDLAND
St. John's, Newfoundland, Canada A1B 3V6

Faculty of Medicine
Health Sciences Centre

Dear

The researchers who are carrying out the study described by the enclosed information have asked my permission to contact you. I feel that Dr. Robert Adamec and Dean Perry are carrying out a study which will make a significant contribution to our present knowledge of certain medical conditions.

While your participation in the study is completely optional and choosing not to take part will have no effect on the treatment that you receive at the Health Sciences Centre, your cooperation would be very much appreciated. I also stress that your anonymity and privacy will be maintained at all times.

Myself or the researchers would be pleased to answer any questions that you may have. We can be contacted at the telephone numbers listed below. If you choose to participate in the study, please read and fill out the consent form and return it along with the completed questionnaire in the enclosed self-addressed stamped envelope as soon as possible. If you choose not to participate, do not send the form back.

Sincerely yours,

R.M. Sadler, M.D., F.R.C.P.(C).,
Assistant Professor of Medicine,
(Neurology).

RMS/ll
Phone: Dr. M. Sadler 737-7215 (office)
Researchers: Dean Perry 737-7516 (office) 753-4378 (home)
Dr. R. Adamec 737-8771 (office)

MEMORIAL UNIVERSITY OF NEWFOUNDLAND
St. John's, Newfoundland, Canada A1B 3V6

Faculty of Medicine
Health Sciences Centre

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Sincerely yours,

N.R. Farid, M.B.B.S., M.R.C.P.(U.K.), F.R.C.P.(C), F.A.C.P.,
Professor of Medicine
Chief, Division of Endocrinology and Metabolism.

NRF/ll
Phone - Researchers: Dean Perry 737-7516 (office) 753-4378 (home)
Dr. R. Adamec 737-8771 (office)

Appendix D

Consent Form

CONSENT FORM

It has been explained to me that a study is being conducted at the Health Sciences Centre by Dr. Robert Adamec and Dean Perry (investigators) to investigate the relationship between certain medical conditions and behavior (personal habits, preferences, feelings and beliefs). The purpose of the study is to establish a standardization sample: that is, the questionnaire is being administered to large groups of people with different medical conditions. It is hoped that this study will result in a greater understanding of the problems experienced by many people.

My participation will involve approximately 1 - 1½ hours completing two questionnaires: the first questionnaire has 101 items and the second has 33 items.

I understand that whether or not I participate in or withdraw from the study, my present treatment or any future treatment at the Health Sciences Centre will be unaffected.

I also give permission to Dr. R. Adamec and Dean Perry to contact my husband/wife/sister/brother/mother/father/friend (underline one)

_____
name

_____
address

and to ask his/her cooperation in completing a questionnaire. I understand that this latter questionnaire will concern his/her perception of my behavior. I understand that the researchers will have access to my medical records.

I understand that all responses to these questionnaires and information from my medical records will be kept confidential during this study and my anonymity will be preserved in any information that may be published or presented at scientific meetings as a result of this study.

Dated this _____ day of _____, 19____.

_____ _____
witness signature

_____
name (please print)

Appendix E

Aura intensity means: the perception of formed images, the perception of humming or buzzing sounds, irritability, jamais vu, and the perception of time speeding up or slowing down.

(These data are presented in Figure 1.)

	Seizure Group			
Aura	seiz	psych	nonp	MSE
Formed Images	0.13	1.46	0.20	1.26
Humming or Buzzing	0.78	2.54	0.45	2.11
Irritability	1.00	2.46	0.90	2.16
Jamais Vu	0.48	2.23	1.10	2.26
Time Speeded or Slowed	1.13	2.38	0.70	2.60

Appendix F

Hearing voices or music: intensity and frequency aura means for females and males.

(These data are presented in Figure 2.)

Intensity

Sex	Seizure Group			MSE
	seiz	psych	nonp	
Females	0.53	0.25	0.00	1.21
Males	0.00	1.60	1.00	

Frequency

Sex	Seizure Group			MSE
	seiz	psych	nonp	
Females	1.44	1.22	1.00	0.72
Males	1.00	2.00	1.78	

Appendix G

Background and Medical Information:

Seizure Patient Distribution *

* Data was not available for the complete seizure patient sample for some variables.

Sex

	seiz	psych	nonp	Total
Female	37	18	18	73
Male	17	10	14	41
	54	28	32	114

Age

	seiz	psych	nonp	Total
Under 21	10	2	5	17
21-30	20	13	14	47
31-40	19	7	7	33
41-50	4	4	2	10
Over 50	1	2	4	7
Total	54	28	32	114

(Mean = 30.77, SD = 10.7)

Education (Grade Level)

	seiz	psych	nonp	Total
Under 7	0	1	1	2
7-12	40	22	18	80
Over 12	13	5	11	29
Total	53	28	30	111

Handedness

	seiz	psych	nonp	Total
Right	42	25	27	94
Left	10	3	4	17
Total	52	28	31	111

If Left Handed, Others in Family

	seiz	psych	nonp	Total
Not Applicable	42	25	27	94
Yes	5	2	3	10
No	5	1	1	7
Total	52	28	31	111

Co-inhabitants

	seiz	psych	nonp	Total
Alone	6	6	2	14
Spouse	23	11	14	48
Parent	17	5	11	33
Other	7	6	3	16
Total	53	28	30	111

Area of Residence

	seiz	psych	nonp	Total
Country	6	3	2	11
Small Town	8	6	11	25
City	40	18	18	76
Total	54	27	31	112

Marital Status

	seiz	psych	nonp	Total
Married	24	13	15	52
Married Equiv.	0	1	1	2
Divorced	2	4	0	6
Separated	2	3	0	5
Single	26	7	15	48
Total	54	28	31	113

History of Trouble With Police

	seiz	psych	nonp	Total
Yes	5	4	1	10
No	49	24	30	103
Total	54	28	31	113

Type of Trouble With Police

	seiz	psych.	nonp	Total
Nil	48	25	29	102
Against Person(s)	1	1	0	2
Against Property	2	0	1	3
Other	3	2	1	6
Total	54	28	31	113

Age When Seizures Started

	seiz	psych	nonp	Total
Under 5	11	1	5	17
6-10	11	4	0	15
11-20	22	11	15	48
21-30	5	4	5	14
31-40	3	5	4	12
41-50	0	1	0	1
Over 50	1	0	0	1
Total	53	26	29	108

(Mean = 16.55, SD = 10.65)

Chronicity of Seizures (Years)

	seiz	psych	nonp	Total
under 11	19	14	15	48
11-20	17	8	6	31
21-30	10	1	3	14
31-40	5	3	3	11
over 40	2	2	4	8
Total	53	28	31	112

(Mean = 19.15, SD = 22.03)

Number of Times in Psychiatric Hospital

	seiz	psych	nonp	Total
Under 3	52	27	29	108
3-5	2	0	0	2
6-10	0	1	0	1
Over 10	0	0	1	1
Total	54	28	30	112

(Mean = 0.46, SD = 1.68)

Presence of Seizures

	seiz	psych	nonp	Total
Yes	50	28	31	109
No	4	0	1	5
Total	54	28	32	114

Seizures Per Month

	seiz	psych	nonp	Total
Under 11	30	20	15	65
11-20	6	5	4	15
21-30	1	1	1	3
31-50	1	0	0	1
51-60	1	0	0	1
Over 60	0	0	3	3
Total	39	26	23	88

(Mean = 11.57, SD = 24.78)

EEG Abnormalities

	seiz	psych	nonp	Total
Yes	44	26	20	90
No	5	2	8	15
Total	49	28	28	105

Focal Dysrythmia

	seiz	psych	nonp	Total
Left	11	6	4	21
Right	4	2	1	7
Left and Right	5	3	2	10
Nil	28	17	21	66
Total	48	28	28	104

Focal Spiking

	seiz	psych	nonp	Total
Left	11	6	5	22
Right	10	3	1	14
Left and Right	3	2	3	8
Nil	24	17	19	60
Total	48	28	28	104

Generalized Dysrythmia

	seiz	psych	nonp	Total
Yes	19	11	7	37
No	29	17	21	67
Total	48	28	28	104

Generalized Spiking

	seiz	psych	nonp	Total
Yes	17	9	7	33
No	30	19	21	70
Total	47	28	28	103

Locus of Epileptogenic Focus

	seiz	psych	nonp	Total
Left Temporal	4	3	4	11
Right Temporal	1	1	3	5
Left and Right	5	1	3	9
Left Plus Others	5	3	1	9
Right Plus Others	4	0	0	4
Left/Right Plus Others	5	6	5	16
Unknown	24	14	12	50
Total	48	28	28	104

Temporal Lobe Involvement

	seiz	psych	nonp	Total
Temporal Only	10	7	10	27
Temporal Plus Others	17	9	6	32
Other Areas Only	8	6	3	17
Nil	14	6	8	28
Unknown	0	0	1	1
Total	49	28	28	105

Final Diagnosis

	seiz	psych	nonp	Total
CPS	11	6	11	28
CPS/Secondary Generalization	12	5	5	22
Primary Generalization	19	14	11	44
Pseudoseizures	0	1	0	1
No Seizures	3	1	1	5
Total	45	27	28	100

Current Medication

Dilantin

	seiz	psych	nonp	Total
Alone	11	2	6	19
With Other Drugs	13	10	6	29
Nil	19	10	13	42
Total	43	22	25	90

Mysoline

	seiz	psych	nonp	Total
Alone	3	1	2	6
With Other Drugs	4	5	3	12
Nil	36	16	20	72
Total	43	22	25	90

Current Medication (continued)

Phenobarbitol

	seiz	psych	nonp	Total
Alone	0	0	0	0
With Other Drugs	7	4	1	12
Nil	36	18	24	78
Total	43	22	25	90

Tegretol

	seiz	psych	nonp	Total
Alone	8	3	6	17
With Other Drug	11	7	6	24
Nil	24	12	13	49
Total	43	22	25	90

Valproic Acid

	seiz	psych	nonp	Total
Alone	4	1	0	5
With Other Drugs	4	5	5	14
Nil	35	16	20	71
Total	43	22	25	90