

The Assessment, Meaning and
Amelioration of Everyday Memory
Difficulties in People with Epilepsy

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THE ABSTRACT

The project was inspired by a frequent, if rather paradoxical, clinical observation. While patients with epilepsy frequently reported disruptive memory difficulties, neuropsychological testing often failed to confirm the serious nature of the patients' complaints. It had previously been assumed that patients were overstating their difficulties. However, the same anomalous pattern has been noted elsewhere, notably in elderly and head-injured samples. This investigation was therefore undertaken to assess further the nature and degree of everyday memory difficulties in people with epilepsy.

The first study assessed subjects' beliefs about the incidence of memory failures using self-report techniques. Seven hundred and sixty patients with epilepsy and one hundred and forty-six subjects without epilepsy participated in the study. The level of patients' complaints was explored with respect to epilepsy, treatment and psychological factors. Findings demonstrated significantly more perceived memory failures in the subjects with epilepsy. Factors which were related to this increased vulnerability to failures included later onset of the condition, elevated levels of negative moods and, to a lesser extent, perhaps a less efficient use of preventative memory strategies.

In study two the relationship between subjects' beliefs and the prospective recording of memory failures was examined. Results indicated that subjects with epilepsy are underestimating the level of memory failures on the retrospective questionnaire.

Study three examined the relationship between memory complaints and actual test performance in a subsample of patients with epilepsy, thirty of whom were classified as complainers and thirty non-complainers. Relationships between performance measures and beliefs were weak. Only two memory tests were predictive of self-report indices. Contrary to expectation, tests of planning and organisation were not found to be sensitive to prospective memory performance.

Finally, two small scale interventions aimed at ameliorating memory difficulties in this population were conducted. Results were promising though variable with motivational factors contributing greatly.

Table of Contents

Page No.

Title Page

1

Abstract

2-3

Table of Contents

4-6

List of Tables

7-13

List of Figures

13-14

Part A: The Literature Review.

Chapter One. Epilepsy: The Condition and
Seizure Classification.

15-26

Chapter Two. The Meanings of Memory.

27-40

Chapter Three. Memory and Epilepsy.

41-56

Chapter Four. Memory, Seizure Types and
Epilepsy Classification.

57-68

Chapter Five. Temporal Lobe Epilepsy and
the Lateralisation of Memory Functions.

69-84

Chapter Six. The High Risk Triad: The
Roles of Seizure Frequency, Age of Onset
and Duration of Epilepsy.

85-96

Chapter Seven. The Role of Subclinical
Discharges and Transient Cognitive
Impairment.

97-102

Chapter Eight. The Effects of Anticonvulsant
Drugs on Memory Functions.

103-125

	<u>Page No.</u>
<u>Chapter Nine.</u> The Study of Everyday Memory in Cognitive and Neuropsychology.	126-148
<u>Chapter Ten.</u> Epilepsy, Mood and Memory: A Neglected Relationship?	149-163
<u>Chapter Eleven.</u> The Use of Memory Aids and Mnemonics: Examining and Altering Memory Behaviour.	164-169
<u>Part B:</u> The Studies.	
<u>Study A.</u> The Questionnaire Survey.	170-248
<u>Study B.</u> The Memory Checklist Study.	249-279
<u>Study C.</u> Neuropsychological Tests and Everyday Memory.	280-311
<u>Study D(i).</u> Memory Training Techniques. The Outpatient Method.	312-338
<u>Study D(ii).</u> Memory Training Techniques. The Memory Group.	339-361
<u>Discussion</u>	
I. Interpreting the Findings.	362-389
II. Suggestions for future work.	390-399
III. Conclusion.	400-402
Acknowledgements.	403
References.	404-461

	<u>Page No.</u>
List of Appendices:	462-463
Appendix I	464
Appendix II	465
Appendix III	466
Appendix IV	467
Appendix V	468-469
Appendix VI	470
Appendix VII	471-472
Appendix VIII	473-474
Appendix IX	475
Appendix X	476
Appendix XI	477-478
Appendix XII	479-489
Appendix XIII	490-494
Appendix XIV	495-499
Appendix XV	500-503
Appendix XVI	504-506
Appendix XVII	507
Appendix XVIII	508-509
Appendix XIX	510

List of Tables

Page No.

<u>Table One.</u> Anticonvulsants of Choice According to Seizure Type.	24-25
<u>Table Two.</u> The Metamemory Questionnaires.	133
<u>Table Three.</u> The eight most frequently used external memory aids.	177
<u>Table Four.</u> The eight most frequently used internal mnemonic strategies.	178
<u>Table A1.</u> Demographic Details and Epilepsy Patient Categories of the Samples (Frequencies and approximate percentages).	187
<u>Table A2.</u> Summary statistics of MQ total, RMQ total and frequency of nuisance ratings for epilepsy and non-epilepsy groups.	191
<u>Table A3.</u> Kendall's Tau correlations between self and observer scores and subjective nuisance ratings for epilepsy and non-epilepsy groups.	192
<u>Table A4.</u> Demographic details of epilepsy and non-epilepsy educational attainment subgroups.	194
<u>Table A5.</u> The top five problems of epilepsy and non-epilepsy groups.	196
<u>Table A6.</u> The neuroepileptic and treatment characteristics of the epilepsy subgroups and whole sample.	198-200

<u>Table A7.</u> Median MQtots and nuisance ratings for the two age of onset groups.	201
<u>Table A8.</u> Median MQtots and nuisance ratings of the two duration groups.	202
<u>Table A9.</u> Median and ranges of MQtot according to presence/absence of the six seizure types.	204
<u>Table A10.</u> Nuisance ratings of subjects with and without primary generalised, secondarily generalised and complex partial seizures.	205
<u>Table A11.</u> Median and range MQtot according to seizure frequency within seizure type.	207
<u>Table A12.</u> Median and range MQtot and nuisance ratings for subjects with one, two or three seizure types.	210
<u>Table A13.</u> Median and range MQtot and nuisance ratings of subjects with no focus, temporal, frontal or focal onset elsewhere.	211
<u>Table A14.</u> Median and range MQtot and nuisance ratings of subjects with left, right or bilateral temporal lobe epilepsy.	212
<u>Table A15.</u> Median and range MQtot and nuisance ratings of subjects taking phenytoin, carbamazepine or sodium valproate monotherapy.	213

<u>Table A16.</u> Median and range MQtot and nuisance ratings of subjects taking 0-4 anticonvulsant drugs.	215
<u>Table A17.</u> Percentage use of external and internal memory aids by both groups.	217
<u>Table A18.</u> Pattern of diary use in epilepsy and non-epilepsy groups.	218
<u>Table A19.</u> Means and s.ds. of external, internal and grand total aid use in both groups.	218
<u>Table A20.</u> Kendall's Tau correlations between use of memory aids and MQtot in the two groups.	219
<u>Table A21.</u> Percentage use of diaries, mental retracing of events and rhymes in epilepsy and non-epilepsy groups divided according to nuisance ratings.	222
<u>Table A22.</u> Median mood scores and percentages of subjects scoring at or above the cut-offs for the scales.	226
<u>Table A23.</u> Subjects classified according to mood on the HAD scale.	227
<u>Table A24.</u> Kendall's Tau correlations between MQtot and mood scale scores.	228
<u>Table A25.</u> Median and range MQtot for the groups divided according to presence or absence of negative moods.	229

	<u>Page No.</u>
<u>Table A26.</u> Median and range BDI and HAD scale scores for subjects divided according to memory nuisance rating.	230-231
<u>Table A27.</u> Median and range MQtot for subjects with epilepsy classified by mood on the HAD scale.	232
<u>Table B1.</u> The demographic and medical characteristics of the checklist subjects.	253-254
<u>Table B2.</u> Median and range scores of the memory scales for those with and without epilepsy divided according to sex.	258
<u>Table B3.</u> Medians and ranges of CLtot and RCLtot. Kendall's Tau correlations between CLtot and RCLtot.	259
<u>Table B4.</u> Kendall's Tau correlations between questionnaire scales of memory beliefs and prospectively recorded failures.	261
<u>Table B5.</u> Summary statistics of the adapted three month CLs and MQs.	262-263
<u>Table B6.</u> Median and range CLtot scores according to nuisance ratings.	264
<u>Table B7.</u> Comparing the modal MQ responses to the median CL responses.	265
<u>Table B8.</u> The top five daily failures reported on the CL and MQ by the epilepsy and non-epilepsy groups.	266-267

<u>Table B9.</u> Kendall's Tau correlation between CLtot and age of onset. Median and range CLtot for the two onset groups.	268
<u>Table B10.</u> Median and range CLtots in those with complex partial seizures of varying frequencies.	269
<u>Table B11.</u> Kendall's Tau correlations between use of external and internal memory strategies and CLtot. The use of aids by groups split at the median CLtot score.	271
<u>Table B12.</u> Kendall's Tau correlations between mood and CLtot. The median and range CLtots for groups divided according to mood scale cut-offs.	272
<u>Table C1.</u> Demographic, epilepsy and treatment characteristics of the two test subject groups.	284
<u>Table C2.</u> The MQ and RMQ data for the two groups of test subjects.	294
<u>Table C3.</u> Descriptive statistics of the memory test scores of complainers and non-complainers.	295-296
<u>Table C4.</u> Kendall's Tau correlations between MQtot and the memory tests.	296-297

<u>Table C5.</u> Details of daily word finding difficulties and Boston Naming Test scores in complaining and non-complaining groups.	298
<u>Table C6.</u> The frequency of daily prospective memory failures with corresponding performance on the belonging test.	299-300
<u>Table C7.</u> The frequency of daily prospective memory failures in the two test groups and corresponding performance on the WCST and Maze test.	300-301
<u>Table C8.</u> Numbers of subjects reporting daily and less frequent prospective memory problems with corresponding performance (time in seconds) on the WCST and Maze test.	302
<u>Table C9.</u> Use of memory aids and mood summary scores for complainers and non-complainers.	304
<u>Table D(i)1.</u> Completion rates for the four intervention groups.	320
<u>Table D(i)2.</u> Details of the nine intervention and five control subjects, CLtotals and frequencies of the five major problems.	323

	<u>Page No.</u>
<u>Table D(i)3.</u> Case studies: Summary responses.	335
<u>Table D(ii)1.</u> Demographic and medical information of the memory group participants.	342
<u>Table D(ii)2.</u> Number of subjects who report using each memory support strategy before and after intervention.	350
<u>Table D(ii)3.</u> Summary of the MGQ responses for each subject.	353
 <u>List of Figures</u>	
<u>Figure One.</u> The Working Memory Model.	30
<u>Figure A1.</u> % nuisance ratings within seizure types according to seizure frequency.	209
<u>Figure B1.</u> Profiles of daily memory failures: Epilepsy and non-epilepsy groups.	260
<u>Figure D(i)1.</u> The Outpatient Method: Experimental design.	319
<u>Figure D(ii)1.</u> External, internal and total use of memory aids and strategies pre- and post intervention.	349
<u>Figure D(ii)2.</u> Subjects scores on written story recall before and after intervention.	352

Figure Two. The variables associated with memory complaints in people with epilepsy and their inter-connections.

PART A: The Literature Review

CHAPTER ONE

EPILEPSY: THE CONDITION AND SEIZURE
CLASSIFICATION

Incidence and Prevalence

Epilepsy is one of the most common neurological conditions. The incidence has been estimated at 20-50 cases per 100,000 per year (Shorvon 1984). Males are apparently more prone to developing the condition with the first 10 years of life being particularly critical. Rates then decrease consistently until later life when again an increase is evident in the elderly population. Estimated prevalence rates vary widely from source to source and this reflects the use of differing definitions, sampling and selection techniques (see Sander and Shorvon 1987). The usual quoted prevalence rate is about 5 or 6 per 1000 of the population (Gunn 1977; Neugebauer and Susser 1979).

Definition

Perhaps the most useful current definition of epilepsy is an operational one where it is said that to have epilepsy is the equivalent of suffering from recurrent seizures. Marsden (1976), for example, defines epilepsy as a disorder "where there are recurrent fits caused primarily

by cerebral disturbances". The functional definition is preferred because there is still a great deal of uncertainty as to what exactly epilepsy is and what biochemical factors cause seizures to occur.

Hughlings Jackson (1835-1911) reported that seizures were the clinical manifestations of an "occasional, an excessive, and a disorderly discharge of nerve tissue" (Marsden 1976). This description has remained tenable through years of considerable technical advance and increased theoretical understanding in neurology. However, the definition is inadequate on two counts. First, the characteristic synchronous discharges which occur during a seizure can also occur under 'normal' conditions without concomitant seizures. Second, the definition will remain superficial until the biochemical factors underlying the discharge itself are described. To account for the first difficulty, Laidlaw and Laidlaw (1981) and others have proposed individual differences in the brain's sensitivity to discharges, suggesting that those with very low thresholds for seizures will generally suffer from epilepsy regardless of whether or not there is related brain damage.

Aetiology of Epilepsy

In a significant proportion of people with epilepsy no adequate cause can be established and in these cases, the epilepsy is commonly referred to as 'idiopathic'. However, Shorvon (1984) suggests that the term

'idiopathic' be reserved for cases of clear primary generalised epilepsy. He prefers that seizures of unknown or unclear origin be referred to as 'cryptogenic'. Primary generalised epilepsy is now considered by most to be a hereditary condition, possibly involving the inheritance of the lower threshold for seizures.

With advances in technology and more searching neurological examination, the diagnosis of 'cryptogenic' epilepsy is diminishing steadily. 'Symptomatic' epilepsy is more readily recognised these days. Here recurrent seizures are considered to be the clinical manifestation of disorders of the nervous system resulting from, for example, tumours, head injury, perinatal complications and many other conditions.

Causes of epilepsy tend to vary with the age at which the symptoms present. Seizure onset during the first six months of life is usually due to birth injury, congenital, metabolic disorders or infection. True idiopathic epilepsy is inclined to present after the age of three years. Adult onset on the other hand is typically caused by head injury, brain tumour, cerebral abscess and vascular disease.

Classification of Seizure Types

For many years three main seizure types have been recognised. These are:-

- i. Major/grand mal or tonic-clonic attacks.
- ii. Minor or petit mal attacks, e.g. absence, myoclonus and akinetic attacks.
- iii. Psychomotor seizures. These are generally associated with epileptogenic foci in the temporal lobes or, less frequently, in frontal areas.

Classificatory revisions have been proposed by the International League Against Epilepsy, notably in 1969 and 1981. These take account of significant advances in neurological recognition and treatment considerations. The 1981 revision will be used in this text. It should be noted, however, that patients are generally not familiar with the updated terminology.

The system proposes the establishment of four categorical seizure types:-

I. Partial Seizures

Partial seizures are those in which the first clinical and EEG signs suggest that original activation is limited to a 'system' of neurons within a particular part of the cerebral hemisphere(s). Partial seizures are referred to as 'simple partial' when consciousness is not impaired and 'complex partial' when it is. It may happen that the first clinical signs are those of a simple partial nature which progress into the complex with the onset of impaired consciousness. Simple partial seizures can be

characterised by motor signs, somatosensory or special sensory symptoms, autonomic signs or symptoms and, rarely, by 'psychic disturbance'. Complex partial seizures may be accompanied by psychic disturbance and aberrations of behaviour known as 'automatisms'. With regard to hemispheric involvement, it appears that simple partial seizures rarely involve both hemispheres while complex partial seizures frequently involve bilateral hemispheric activation. The origins of the epileptic activity tend to be within the temporal lobes and sometimes within the frontal lobes or fronto-temporal region. Both types of partial seizure may terminate and therefore remain only focal in activity, or, both may spread and progress to a generalised motor seizure. This spreading process is termed 'secondary generalisation' and the seizures are referred to as 'secondarily generalised' seizures which may be tonic-clonic, tonic or clonic in nature.

II. Generalised Seizures (Convulsive or Non-Convulsive)

In generalised seizures consciousness may or may not be impaired, motor activity is bilateral and the ictal EEG indicates initial diffuse bilateral activity. Several different types of generalised seizures exist and combinations of different types may occur within one patient. The following are recognised as generalised seizures:-

(i) Absence Seizures

The clinical characteristics of the absence attack are its sudden onset with disruption of foregoing behaviour. The patient will usually be unresponsive if spoken to. The spell lasts from a few seconds to half a minute whereupon normal activity resumes as quickly as it was interrupted. Thus, in this simple form, consciousness only is impaired. However, in some cases clonic, atonic and tonic components may be manifested as well as automatisms at times. With these 'atypical' absence seizures, changes in muscle tone tend to be more dramatic and onset and/or cessation is generally not as abrupt. In these cases the EEG tends to be more irregular and heterogeneous than the 3/second spike-and-slow-wave complexes characteristic of the typical absence seizure. Typical absences are generally seen in childhood while the atypical form can manifest at any age. Both may occur many times a day.

(ii) Tonic-Clonic Seizures

These are the most common form of generalised seizure. In primary tonic-clonic seizures, consciousness is lost without warning. Clinical manifestations are a sudden contraction of the muscles causing the patient to fall to the ground, lying rigid. Often there is cyanosis during this tonic phase with the contraction of muscles inhibiting respiration. This phase gives way to clonic convulsive movements with respiration generally remaining impaired. This stage lasts for a variable length of time and then progresses to a period of deep relaxation during

which time the patient remains unconscious. Following the seizure, the patient may sleep deeply.

Generalised tonic-clonic convulsions are common in both childhood and adult life. Their frequency is very variable from one a day to as few as one a year or less. These seizures are usually well controlled by anticonvulsant drugs.

(iii) Myoclonic Seizures

Myoclonic jerks can occur singularly or may be multiple. These are sudden, brief contractions of muscles which may be generalised or confined to the face, trunk or one or more extremities. Myoclonus can often occur at times prior to sleep or on waking. During the seizure, the EEG is typically characterised by polyspike and wave.

(iv) Clonic Seizures

Clonic seizures are generalised convulsive seizures which do not entail a tonic phase. They are characterised by repetitive clonic jerks which decrease in frequency but not in amplitude as the seizure progresses. EEG seizure characteristics are fast activity and slow waves with occasional spike-and-wave patterns.

(v) Tonic Seizures

These seizures involve a violent contraction of the

muscles causing limbs to be fixed in strained, often bizarre, positions. Deviation of the eyes and head to one side is usual and sometimes the whole body rotates. Features are distorted and rigid, colour is lost and then the face reddens due to impaired respiration which progresses to cyanosis. The EEG is characterised by low voltage, fast activity which decreases in frequency and increases in amplitude during the seizure.

(vi) Atonic Seizures

Atonic seizures involve a slackening of muscle tone which may evolve gradually and can be prolonged or may be sudden. Extremely brief and sudden loss of muscle tone will result in a 'drop attack'. Consciousness may be lost briefly during atonic seizures. The loss of muscle tone in the head and trunk during the fall may result in injury from protruding objects. The resulting injuries are often considered to be the major handicap of atonic seizures. During the seizure, the EEG is characterised by polyspikes and wave or flattening or low voltage fast activity.

III. Unclassified Epileptic Seizures

This section includes seizures which cannot be classified into the above types because of inadequate data and also those which do not fit any presently described type. This includes some of the neonatal seizures. The category should reduce in size and importance given

further experience with and advances in diagnostic techniques and equipment.

IV. Status Epilepticus and Repeated Seizures

Status epilepticus is a state of prolonged or repeating seizures which persist for a sufficient length of time or repeat in a manner such that recovery between attacks is not possible. Consciousness remains disrupted and muscular impairments persist. As a result, generalised tonic-clonic status is treated as a medical emergency. Absence and partial status can also occur but the repercussions are not as serious. The specific name of 'epilepsia partialis continua' is reserved for very localised motor status.

The Treatment of Epileptic Seizures

By far the most common treatment of epileptic seizures is the use of drugs which have been an established form of treatment for over 2,500 years (Shorvon and Hart 1990). Bromides were the first widely accepted useful anticonvulsant but with the discovery of the anticonvulsant effects of phenobarbitone in 1912, these fell out of use. Perhaps the most important first line drugs currently in use are carbamazepine, phenytoin, phenobarbitone, sodium valproate and ethosuximide.

The choice of initial anticonvulsant medication is

generally dependent upon seizure type since most of the drugs have been found to be more efficacious for specific types. It is, therefore, particularly important to establish precise seizure classification before starting drug treatment. Table One shows suggested drugs for the different seizure types. First choice drugs are shown in the first column.

Table One: Anticonvulsants of choice according to seizure types.

Seizure Type	Drugs in suggested order of choice
<u>Primary</u>	Carbamazepine)
<u>Generalised</u>	Sodium Valproate)Clobazam
	Phenytoin)Clonazepam
	Phenobarbitone)Vigabatrin
	Primidone)
<u>Absence Seizures</u>	Sodium Valproate
	Ethosuximide)Clonazepam
<u>Myoclonic Seizures</u>	Sodium Valproate)Clobazam
	Clonazepam)Ethosuximide
)Nitrazepam
<u>Tonic/Atonic Seizures</u>	Any of the above are suitable

<u>Complex & Simple</u>	Carbamazepine)Clobazam
<u>Partial Seizures</u>	Phenytoin)Clonazepam
<u>with or without</u>	Phenobarbitone)	Sodium
<u>Secondary</u>		Valproate
<u>Generalisation</u>	Primidone)Vigabatrin

(Adapted from Thompson and Shorvon, in press).

In order to ensure maximal anticonvulsant efficacy with minimal negative side effects, blood serum levels of anticonvulsants should be carefully monitored. Guidance for appropriate levels is given by therapeutic ranges. These are only approximate figures and some individuals may respond best to levels above or below these ranges. Indeed, serum levels may change within individuals over time for several reasons.

During the initial stages of treatment, first line drugs should be used as monotherapy and substituted by others if effective seizure control is not achieved. Polytherapy should be used only as a last resort (Shorvon and Reynolds 1977, 1979; Shorvon et al 1978). In approximately 70% of patients with newly diagnosed epilepsy anticonvulsant therapy should achieve complete control of seizures (Shorvon 1984).

Patients with chronic drug-resistant epilepsy often require careful multidisciplinary care as they frequently have additional neurological and/or psychological difficulties. For these patients, other forms of

treatment are becoming increasingly possible. With advances in diagnostic equipment such as depth EEGs, CT and MRI scans, surgical treatment is now an option for larger numbers of those with refractory epilepsy. Temporal lobe surgery has grown steadily since the 1930s and its efficacy in the control of seizures is improving. Reports of this vary considerably, however, depending upon the exact definition of improvement and also upon the length of follow-up since intervention. Other forms of invasive treatments which are conducted less frequently and typically with rather less success include frontal, parietal, occipital lobe surgery and corpus callosotomy.

Finally, psychological treatment of epileptic seizures employing behavioural or cognitive behavioural principles have been shown to be effective for some patients with refractory epilepsy (e.g. Dahl et al 1985, 1988; Gillham 1990).

CHAPTER 2 : THE MEANINGS OF MEMORY

i) The Nature of Memory

The multisystem nature of human memory is exemplified by Baddeley (1990) who states:-

"The systems range in storage duration from fractions of a second up to a lifetime, and in storage capacity from tiny buffer stores to the longterm memory system that appears to far exceed in capacity and flexibility the largest available computer"

(Baddeley 1990 p4)

Perhaps more than any other 'psychological realm', memory has produced countless applications of the experimental method. Many models and theories have been tested, replicated and refuted over the past one hundred years or so beginning with Hermann Ebbinghaus and his introspective approach. The result of this plethora of generally high quality experimental work, is that there is now quite widespread agreement as to the component processes and stores which make up the memory system. Some of these have been established for many years while others are scientifically still very young.

ii) The Component Processes and Storage Systems

a. The Processes

There are essentially two processes in human memory. The first of these is learning. Learning is a very flexible process which allows us to adapt information to suit different situations. It involves the registration and storage of information into the memory system. If either of these break down, learning will be impaired. Many factors contribute to the efficiency of the learning process such as rehearsal, saliency, motivation, effort, attention, organisation, imagery and so on.

The second process essential to memory is forgetting. This ensures that the memory store is not full of useless or irrelevant details which do not profit us. As such, it is a very useful, if much maligned, process. As with learning, several factors influence the rate of forgetting. Perhaps the most robust of these is the emotional nature of the items themselves and the context in which they are learned (Bower 1980).

Both of these processes operate upon the large and permanent long-term memory stores. However, the existence of several memory stores which differ widely in their capacity and duration of storage is now generally recognised (Baddeley 1990).

b. Sensory Memory

The briefest form of memory lasts only a fraction of a

second and is regarded as part of the perceptual process. This sensory memory allows the interpretation of stimuli entering the sensory organs. This kind of system, no doubt, exists for all senses but experimental evidence is most extensive for iconic and echoic memory (Neisser 1967). These systems set up memory traces which last a few seconds only. The significance of this kind of memory trace was pointed out by Coltheart (1983) who suggested that it provides the sensory systems some minimal amount of time in which to process incoming stimuli.

As well as these very brief sensory-specific types, short-term and long-term sensory memory stores are also believed to exist (Posner, Boies, Eichelman and Taylor 1969; Phillips and Baddeley 1971; Nickerson 1965; Cowan 1984; White 1960).

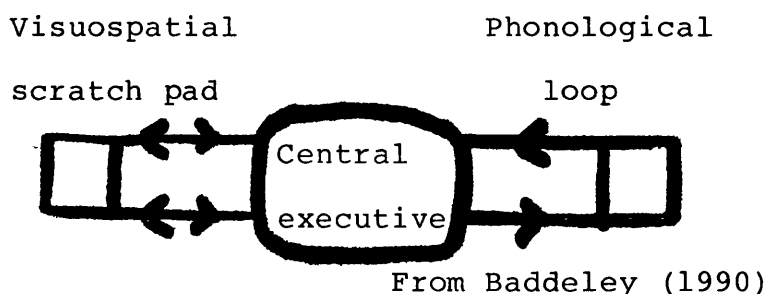
c. Working Memory

Perhaps the most influential model of a 'general' short-term memory is Baddeley and Hitch's (1974) model of working memory. This system integrates all the information from the sensory short-term stores along with information from other sources. As an integrated and active system it plays a crucial role in many cognitive tasks such as reasoning, reading and understanding conversation.

The experimental evidence generated in connection with this model is extensive and convincing, mostly making use

of dual-task paradigms (e.g. Baddeley and Hitch 1974; Baddeley, Lewis, Eldridge and Thomson 1984). From the available evidence, Baddeley and Hitch proposed a model of working memory which, unlike Atkinson and Shiffrin's (1968) modal model, played no role in retrieval functions. The model proposes a multiple system comprising an attentional controlling structure called the central executive which co-ordinates a number of subsidiary systems. Two of these 'slave' systems have been extensively researched and have been called the articulatory/phonological loop, responsible for the uptake and manipulation of speech based information and the visuospatial scratchpad assuming responsibility for visual images. Figure 1 gives a simplified diagrammatic representation of the working memory model.

Figure 1 : The Working Memory Model



Neuropsychological evidence also exists to support the model and its three features. In respect of the phonological loop which is presented as comprising two components, a phonological store holding speech based information and an articulatory control process which is based on inner speech, the evidence is most compelling.

Two cases are recognised as presenting evidence of impaired phonological loop. The first, an Italian Lady, PV was tested extensively by Vallar and Baddeley (1984) and was found to have deficits best explained as arising from some partial disruption of the phonological storage component of the articulatory loop. The second case was reported by Baddeley and Wilson (1988). TB is a 55 year old mathematician who requested help for memory problems following a generalised tonic-clonic seizure of 2-3 minutes in length. Prior to this, TB had suffered a number of 'small' seizures over a period of several years. Epilepsy was reported as developing following general anaesthetic. TB's long-term memory is described as 'patchy' but digit span and sentence span are both severely limited (2 and 3 respectively). The recency effect, considered to be an indication of working short-term memory, was absent for auditory presentation. Baddeley and Wilson interpreted TB's deficits as indicating a severely disrupted phonological store. They concluded thus in spite of the fact that there was no obvious evidence of impairment in the left perisylvian area, the region typically associated with verbal short-term memory deficits. TB's CT scan did, however, suggest some temporal lobe damage.

The visuospatial scratchpad is the slave system which governs the establishment and use of visuospatial images. The model is tested experimentally by dual-task procedures so that various relevant skills are tested when performed concurrently with tasks such as matrices or pursuit rotor

which rely heavily on visuospatial STM (e.g. Baddeley et al 1975 and Baddeley and Lieberman 1980). Results indicate that the visuospatial scratchpad can be fed either through perception or through the generation of images. The system seems to be particularly important in the setting up and use of visual imagery mnemonics (Baddeley 1990).

According to regional blood flow and event related potential studies, the use of visual imagery involves activation of the occipital lobes and the posterior parietal and temporal regions. Neuropsychological evidence for the visuospatial scratchpad comes from colour blind patients who are unable to answer questions based upon semantic knowledge of colour, for example, what colour is a banana? (de Renzi and Spinnler 1967). There is also, evidence from some patients with agnosia who are incapable of recognising objects from their visual characteristics but retain the ability to identify things when supplied the meaning of the word (Wilson 1987). Finally, Farah, Hammond, Levine and Calvanio (1988) presented the case of a minister who had suffered a road traffic accident 18 years earlier. He was left with severe damage to the temporal and occipital lobes but his parietal region was intact. This man's performance on various visual and spatial STM tasks suggests involvement of two regions in generation of visual images and the use of the scratchpad. The first area in the occipital lobe is primarily concerned with the visual aspects of the task, while the second area within the parietal lobe is

involved with spatial coding.

The evidence for the visuospatial scratchpad is not as strong as that for the articulatory loop. It is, at times, unclear whether the neuropsychological evidence is not better regarded as a reflection of long-term visuospatial memory, for example, de Renzi and Spinnler's colour blind subjects and Wilson's agnosic patients.

The functioning of the central executive is even less refined than the visuospatial sketchpad. The central executive is assumed to be a short-term attentional system which guides cognition and behaviour in the appropriate way according to the demands of the situation. It is proposed to function in much the same way as the Supervisory Activating System (SAS) proposed by Norman and Shallice (1986). This deals with the control of actions and explains both its breakdown in everyday slips of action and also in cases of 'frontal lobe syndrome'. The SAS comprises two parts. The first deals with the control of well-learned actions. The authors regard the second part of SAS as functionally equivalent to that of will. It is a system capable of interrupting ongoing behaviour by systematically biasing the probabilities of adopting one course of action over another. The perseveration of patients with frontal lobe damage reflects their inability to stop and change ongoing activity, that is, the breakdown of the subsystem within the SAS. It may also explain 'utilisation behaviour' (Lhermitte 1983; Shallice et al 1989) and the limited

fluency of these patients.

The evidence surrounding the working of the central executive is sparse. However, dual-task procedures using the generation of random numbers, a task assumed to be heavily reliant upon central executive functions, have been performed. Furthermore, Oakhill and colleagues were able to argue for the importance of the central executive in the comprehension of prose in children (Oakhill 1982, 1984; Oakhill, Yuille and Parkin 1986).

d. Long-Term Memory

Two long-term stores are generally recognised. These are event memory consisting of autobiographical and episodic memory and semantic memory. Autobiographical memory was originally investigated by Galton (1883) but has been relatively neglected until recently. This probably reflects the difficulties involved in objectively assessing the type of memory which stores those personal experiences of a life time which combine to define 'self'. Since the accuracy of personal experiences can seldom, if ever, be verified, autobiographical memory has rarely been the focus of experimental study. There has, however, been a recent revival of interest in the area and an autobiographical memory schedule has been developed by Kopelman et al (1990). This probes personal information and events from various life periods in a standardised manner.

The retrieval of autobiographical memories is usually an active process referred to as 'recollection'. Techniques for studying autobiographical memory include the Galton cueing technique, structured inquiries and diary studies (e.g. Galton 1883; Wagenaar 1986). Generally, the techniques demonstrate the preference for gist recall of autobiographical events although cueing, increased saliency, rehearsal and positive compared to negative emotional context can all increase the precision of autobiographical recall (e.g. Linton 1975).

Neuropsychologists have studied recollection in patients with retrograde amnesia. In these cases, however, there is usually heavy reliance upon recollection of public events as opposed to personal experience that is, episodic rather than autobiographical skills which are assumed to reside within the same storage system known as 'event memory'. These studies have tended to demonstrate the gradient of retrograde amnesia with those recollections closest to the time of the injury/damage being most disrupted (Butters and Cermak 1986). The case of PZ (ibid), an eminent though alcoholic scientist who became amnesic through Korsakoff's syndrome late in life, seemed to suggest that the retrograde portion of memory had simply been destroyed through damage to the hippocampus and mamillary bodies. However, Warrington and McCarthy (1987) suggested a retrieval deficit of personal memories in retrograde amnesia. The suggestion was made on the basis of test results of a man who had become densely amnesic following encephalitis. What appears to be most

typical in cases of retrograde amnesia is to find 'clouded' autobiographical memory. Thus details are very difficult to recollect and patterns of retrieval will tend to differ across testing occasions (Baddeley and Wilson 1986).

The other long-term store is the semantic memory store. This is the system within which we store knowledge of the world. It is this which is added to through conventional learning and education. It is, however, rather an impoverished area of memory research in spite of its obvious importance. The fields of semantics and semantic memory have gathered multidisciplinary interest and, resulting models/theories owe much to philosophy, artificial intelligence and linguistics. Typical of these are the semantic network theories which arrange meaning in a hierarchical manner from specific example to superordinate concept, for example, dog-mammal-animal. Examples include Collins and Quillian's (1969) model.

Schema theories have also developed to more readily address the nature and processes of semantics in an everyday framework. The notion of a schema as a structure which encapsulates knowledge and expectations about aspects of the world, was first introduced by Bartlett (1932). It has since produced some useful semantic memory theories which attempt to deal with complex areas of comprehension. For example, Rumelhart (1975) applied the concept of schemata to the understanding of stories, while Schank and Abelson (1977)

used schemata which they termed 'scripts' to explain the comprehension of social situations.

However, perhaps the most exciting developments in research on semantic memory have come from cognitive neuropsychology where evidence is accruing in relation to the organisation of the stores. Data has been gathered from patients with aphasia, anomia and agnosic deficits. It has been demonstrated, for example, that some agnosic patients may fail to identify an object presented through one sensory modality but may be successful in another (e.g. Beauvois et al 1978). This suggests that semantic memory is divided into subcomponents and governed by the modality through which the information is presented.

In the case of anomia, it has been shown that some patients have intact semantic knowledge, demonstrable through their ability to describe and categorise the object/picture, but are simply unable to access the word. Other patients with naming difficulties appear to have depleted semantic stores (e.g. Kay and Ellis 1987; Howard and Orchard-Lisle 1984).

Finally, just as autobiographical/episodic and semantic memory have been identified as components of long-term memory (although the distinction is imprecise, as all knowledge is necessarily semantic; e.g. de Renzi et al 1987), separate subcomponents of semantic memory have also been identified. Warrington and Shallice (1984) presented evidence from four post-encephalitic patients.

All four cases had difficulty understanding words relating to animate things. Inanimate objects, on the other hand, were defined quite adequately. Evidence suggests a double-dissociation since cases exist who are impaired on inanimate objects but whose understanding of living things is intact (e.g. Nielsen 1946). Indeed, more recent studies have shown even finer divisions of specific impairments (e.g. Hart et al 1985).

The complexity of coding in the semantic memory system is emphasised by Warrington and Shallice's (1984) proposal that semantic memory may be divided into subcomponents on the basis of the nature of the sensory dimensions involved in the discrimination of the stimuli. Food, for example, may be understood and divided in semantic memory in terms of sweet and savoury by the information received from taste and smell. The neuropsychological evidence seems to favour the network models of semantic memory. It is, however, a little difficult to extend this kind of model to the acquisition of more specialised, abstract knowledge, the storage of which also, of course, involves the semantic memory system.

e. Memory and the Medial Temporal Lobe

In 1957, Scoville and Milner examined, at autopsy, the brains of several patients who had undergone temporal lobectomy and had become amnesic as a result. They found a strong relationship between memory loss and the extent of damage to the hippocampus. Several studies examining

the patient H.M. who underwent bilateral hippocampectomy and became densely amnesic following surgery confirmed the relationship between the hippocampus and memory functions (e.g. Milner 1966). Further studies of patients post unilateral temporal lobectomy (e.g. Milner 1978) suggested that the hippocampus and hippocampal gyrus were associated with incidental learning and that deficits in learning arose for specific material according to the side of the resection (i.e. left = verbal and right = non-verbal skills). Furthermore, impairment of longterm memory was indicated by the impoverished primacy effects of these patients.

Evidence suggesting the role of the hippocampus in memory is still accruing with studies such as Halgren's (1978) depth electrode recording of hippocampal activity during recall on memory tests and Sass et al's (1990) which demonstrated relationships between pyramidal cell density in the left hippocampus and performance on a verbal selective reminding test (Buschke 1973; but see Loring et al 1991). Furthermore, evidence from animal and human research suggests that the hippocampus specifically controls the consolidation or storage of information (e.g. Huppert and Piercy 1979; Squire 1981; Winocur 1984). Winocur (1984) has further stressed the very disruptive effects of interference on humans and animals with hippocampal damage. It seems, therefore, that unlike amnesia resulting from thalamic damage which appears to act upon early encoding stages (Victor et al 1971; Winocur 1984), amnesic deficits resulting from hippocampal

damage or dysfunction arise from impairments of consolidation or storage of information. This interpretation is not without challenge however. For example, Hirsh (1974, 1980) argues that the hippocampus acts to mediate selective processes which determine which subset of memories should guide behaviour at any time. Nevertheless, there does seem to be general consensus that the hippocampus (and perhaps the amygdala) is an important structure in determining the efficiency of mnemonic functions. Given the sensitivity of the hippocampi to epileptogenic disturbance, and the prevalence of Ammon's Horn sclerosis in patients who have had early onset febrile seizures, there can be little doubt that dysfunctioning medial temporal lobe structures will lead to some degree of memory difficulty. This may be comparable to, or more debilitating than, the effects of unilateral temporal lobectomy (Soloman et al 1983).

CHAPTER THREE

MEMORY AND EPILEPSY

(a) Historical Background

Impairment of memory, occurring as a consequence of the epileptic seizure disorders has been recognised for over two centuries. In 1770, Tissot reported that he had never seen a person with epilepsy whose fits were at least reasonably common not complaining of a weakening memory. Somewhat later, Sieveking (1861) wrote of the gradual failure of intellectual faculties in his own patients with epilepsy. He described problems of memory in some depth:-

"Unless the disease be arrested and the habit broken.... we soon discover that the intellectual faculties begin to fail. The memory is one of the first that shows impairment; it becomes less precise and tenacious.... the patients themselves often complain that they can no longer retain their recollection of past events; circumstances at times that they happened the same day, and the day before are more difficult to remember than others of a much earlier date; thus one man stated that he could scarcely recollect anything of the previous day, but remembered things that had happened 'years back' much better".

Thus, according to this rather gloomy account, it is

problems of memory on a daily basis that arise, memories of perhaps minor but nevertheless recent events.

In the same year, Reynolds (1861) conducted a prevalence study of memory failure in his own patients with epilepsy. In this entirely independent project, Reynolds reached the same conclusion as Sieveking, stressing that in the majority of those affected, the memory problems were "limited to the occurrence of recent and trifling events, the memory for events long since past being intact ...". Of the prevalence, Reynolds stated:-

"... it appears that it is more common to find a defective than a normal memory".

He went on to describe the nature of the impairment thus:-

"... when memory is defective, its more frequent condition is that of slight but general impairment".

Reynolds related memory deficit to just one variable. Memory functioning, he argued, had "a constant and direction relation" to the frequency of attacks. He found no relationships between diminished memory capacity and family history; age of onset; duration of the disorder or the total number of attacks. Interestingly, Reynolds reported a sex difference in the prevalence of memory deficits. Women, he suggested, tended to be more affected than men.

Gowers (1901) was largely in accord with these earlier accounts, considering that cognitive deterioration was a frequent consequence of epilepsy. Again, defective memory was specified as being an early recognisable sign. He suggested that such memory problems represented only the 'slighter form' of general intellectual deterioration. However, unlike Reynolds, Gowers did not find any relationship between seizure frequency and mental deterioration. He considered it more likely that early age of onset and long duration of the disorder were the causative factors.

Such early observations upon the existence of memory problems in people with epilepsy and the debates surrounding the causes of these problems, anecdotal as they are, are still of some value. Memory failure was clearly recognised as part of the whole epileptic complex at a time when modern anticonvulsant medication was not available.

It should be noted that a typical characteristic of these early accounts is their belief that memory problems were intrinsically connected to later mental deterioration. In Reynold's view, it was more usual to find poor memory than in intact one. If deterioration was inevitably to follow poor memory, it would of course be far more prevalent within the condition than seems to be the case today. Neuroepileptic variables and their relationship to memory function have provoked an enormous amount of research in more recent years. The reviews which follow

present and discuss this work which will be dealt with according to the variable studied.

(b) Studies Comparing Epilepsy and Control Groups

In a comparatively early study, Scott et al (1967) measured the non-verbal memory performance of patients with epilepsy. Results were compared to a group of sixteen male controls matched for age and non-verbal intelligence. Of the patients, sixteen had temporal lobe epilepsy, six were considered to have generalised epilepsy and two had epilepsy of frontal lobe- origin. Memory measures included non-verbal short-term serial recognition in visual and auditory modalities and visual and tactile non-verbal learning.

These authors found no significant differences in the performance on any of the measures although a slight trend towards impairment within the epilepsy sample was noticed. To account for the failure to find differences, the authors suggested that the learning and recognition tests may not have been sensitive enough to highlight the differences. They also argued that by matching non-verbal IQ, which was found to correlate significantly with learning ability, differences between learning and recognition between the two groups may have been sampled out. It is clear that measuring learning and recognition in the short term is not sufficient. Longterm measures may be more effective in revealing difficulties, as some

later studies suggest. Furthermore, the tests used may be inappropriate in that they seem to examine rather 'under-used' forms of memory in everyday life.

In another study which emphasises the importance of IQ in determining memory performance, Mohan et al (1976) examined performance on the Boston Memory Scale. They examined fifty patients with generalised seizures and thirty normal controls matched for age, sex, occupation and income. According to these findings, patients with epilepsy had poorer memory quotients but they also had significantly lower IQs. Unfortunately, the use of a memory quotient score to describe impairment is inadequate. Memory quotients are gross descriptive measures which should be used only to summarise an overall picture. Such indices say nothing about where problems arise and the degree of individual deficits. The study emphasises the crucial role of IQ in determining memory performance. The relationship is likely to be complex and is little understood. Given this, perhaps studies should attempt to use IQ measures which do not rely directly upon memory skills and indeed also to use memory tasks which, as far as possible, do not reflect variables considered important in determining IQ scores, for example, education and cultural biases.

In 1980, Loiseau et al reported findings on verbal and visual short-term memory (digit span and graphic reproduction) and verbal list learning. One hundred patients with epilepsy were compared to a matched group of

controls. Results suggested that the subjects with epilepsy performed less well generally than the control group. Impairments of immediate memory appear in this study but delayed memory was not assessed. It is difficult to argue on the basis of results derived from three tests that memory functions per se are impaired. Decrements in other skills could have caused these results. For example, deficient concentration, attention and levels of motivation could underlie apparent immediate memory deficits. Similarly, poor organisational skills could explain difficulties with list learning.

Later, the same authors (1983) reported findings using the above tests and also a verbal recognition task with a group of two hundred patients with epilepsy without defined cerebral lesions. Again, data from one hundred normal controls, matched for age and level of education, was collected. The study examined functioning in relation to cultural as well as seizure related variables. Global group comparisons suggested that the control subjects performed better than those with epilepsy on the memory measures. Three occupational subgroups were examined, manual workers, intellectual professionals and university students. When experimental versus control comparisons were made within these groups, a general trend was noted for subjects with epilepsy to perform more poorly on the measures than their control counterparts. The authors argued that given larger numbers within each subgroup, differences would have reached significance. However, numbers in two of the subgroups were in fact

quite large when compared to numbers used in other studies where statistically significant results were obtained. Between subgroup comparisons produced some interesting findings. For instance, memory impairments were more marked in university students than in manual workers with epilepsy. This kind of finding may argue against the simple idea that memory abilities increase directly with IQ. Another finding of some interest was that while manual worker controls did not differ from the other control groups in their learning ability, manual workers with epilepsy suffered a large fall in their learning scores. Such revealing findings based upon socio-cultural differences may demonstrate the interactional nature of non-cognitive variables in influencing memory functions.

In an ambitious study examining a range of cognitive functions, Brittain (1980) compared the performance of 157 adults with epilepsy of normal IQ range to 80 controls matched for age, sex, socio-economic status, years of education and other variables. The memory task used was forced-choice recognition of faces and words. The author conducted comparisons between the total epilepsy and control groups and also compared performance of subsamples of subjects who had benefited from longer periods of education. Experimental versus control comparisons made globally, and with the more highly educated subgroups, showed that subjects with epilepsy performed significantly less well on both recognition

tasks. Unfortunately though, few conclusions can be drawn about the nature of a memory difficulty on the basis of results from two recognition tests. However, there is one positive feature about using forced-choice recognition tasks. Warrington (1981) reported that they are not as sensitive to the adverse effects of depression as some other memory tests are. Thus, this possible contaminating variable is excluded.

In the same year Delaney and his colleagues, examined immediate and delayed memory function in focal epilepsy using tests of prose recall and visual reproduction in immediate and delayed conditions. Recognition and recall of learned verbal lists was also assessed. The authors compared the performance of subjects with unilateral temporal and frontal lobe epilepsy with that of a closely matched control group which included a control for current rates of hospitalisation. This procedure represents a significant advance. There are, of course, many difficulties inherent in studies where comparisons are made between 'ill' experimental groups and 'healthy' control groups. No amount of careful matching on other variables can make up for the difficulties suffered by chronically ill subjects. Controlling for current rates of hospitalisation is not a perfect method but it nevertheless implies the realisation that these factors are important. More adequate control groups would comprise people with other chronic conditions but, gathering data from these populations is of course more difficult to arrange.

The value of this study is further increased because steps were taken to rule out possible interfering effects of perceptual deficits. Subtle perceptual difficulties can interfere with performance on visual memory tests. Data revealed impaired performance by the group with temporal lobe epilepsy compared to the group with frontal lobe epilepsy and the control group for delayed recall particularly. Lateralised deficits were noted and are described in the relevant section.

A further study by Delaney and colleagues (1982) examined short-term retention and forgetting rates of verbal and visual material in twenty-six patients with unilateral temporal lobe epilepsy (thirteen left and thirteen right). Performance was compared to thirteen 'normal' controls matched for age, sex and education. Verbal material consisted of word triads of A and AA frequency on the Thorndike-Lorge Scale (1944) and visual material was made up of twenty nonsense figures. Procedures followed those initially described by Peterson and Peterson (1959) with verbal and visual distractor tasks used for 0,3,9 and 18 second periods before recall. Results showed that short-term retention of non-verbal material did not differ between the groups but, verbal short-term retention was impaired in the temporal lobe groups. Both left and right groups, whose performance did not differ, had forgotten more of the verbal material at 9 and 18 seconds compared to controls. Interestingly, patients with temporal lobe epilepsy made significantly less omissions

and more perseverative errors. This suggests more adverse effects from proactive interference for these patients. This finding of short-term verbal memory deficits in both right and left groups agrees with the 1980 study but, the authors stress that inadequate encoding and/or rapid information loss cannot account totally for the memory deficits evident in patients with focal epilepsy.

Tomlinson et al (1981) reported a pilot investigation of forced-choice recognition of visually presented verbal material in a group of 20 heterogeneous subjects with epilepsy. Performance was compared to that of 16 control subjects. Matching was not adequate however, and verbal IQ differences were marked. The test involved the subject in a letter search task which was experimenter-paced. 'Normal' subjects will recognise both positively encoded words and those seen more than once most readily. Overall, the authors found that control subjects recognised more words than the epilepsy subjects. However, when the effects of verbal IQ differences were partialled out, the difference in the number of words recognised disappeared. The authors were able to conclude that "factors such as encoding conditions and repetition rates influence memory processes in epileptic subjects in the same manner and to the same extent as they do normal subjects". No important qualitative or quantitative differences emerged between the two groups in this study. This pilot study once more emphasises the importance of IQ in determining apparent

differences in memory between the experimental and control groups.

In 1985, Mungas and colleagues examined verbal learning and the effects of laterality of temporal lobe foci (n = 11 left; n = 10 right). The study included comparisons with a control group of 11 matched for age and education. The list for learning included high and low frequency abstract and concrete words and results suggested equivalent performance by the three groups for immediate recall learning trials. However, delayed recall differentiated the groups. The left temporal lobe epilepsy group performed more poorly than either the right temporal lobe epilepsy group or the control group. Again, in this study, only delayed testing procedures revealed a deficit in people with temporal lobe epilepsy.

A similar study was performed by Hermann et al (1987). These authors examined verbal learning in a group with complex partial seizures, all of whom were awaiting temporal lobectomy. A 'matched' control group was included. The authors found that patients with left temporal lobe epilepsy (n = 15) performed significantly more poorly on the measures of verbal learning and immediate memory than did the other two groups. This group also experienced increased difficulty with the delayed retrieval of verbal material. Furthermore, the left temporal lobe group had difficulty organising the verbal material semantically, suggesting the possibility of other deficits as well as, or determining, the memory

problem.

Rates of forgetting were examined by Martin et al (1988) within the delayed recall condition of a selective reminding test. Subjects numbered 13 temporal lobe epilepsy and 13 age-matched controls. The groups were matched on a pair-wise basis for initial learning on the selective reminding test. The authors found that the temporal lobe epilepsy patients performed significantly more poorly on delayed recall in spite of the equivalent immediate retrieval scores, showing that these patients tended to forget at a disproportionately rapid rate compared to normal controls over a thirty minute period. Again, this study implicates deficient delayed recall as opposed to immediate recall and suggests therefore that either retrieval or storage functions are impaired.

The final studies to be examined in this section examine 'metamemory' and adaptive memory functions in temporal lobe epilepsy. In the first study, Prevey et al (1988a) examined knowledge of encoding functions by studying the prediction of memory span and the self-monitoring of retrieval functions using the 'feeling of knowing' phenomenon. The authors argued that failure to monitor memory functions efficiently can give rise to an over-estimation of abilities which would influence memory function by promoting an insufficient reliance upon strategies aimed at helping memory. The notion that subjects can exert some control over their own functions is a significant advance in the area.

Verbal and non-verbal metamemory was examined in 13 right and 13 left temporal lobe epilepsy subjects as well as in a group of 13 neurologically normal controls matched for age, sex and level of education. Results showed that the temporal lobe subjects did indeed over-estimate their memory span abilities compared to the control group. Retrieval abilities were also exaggerated. Of some interest is the finding that the self-monitoring tended to be less accurate for the material associated with the side of lesion. This kind of finding again suggests the possibility that memory difficulties may simply represent an easily measured and recognisable symptom of impairment of a more general cognitive nature. Linguistic abilities may be widely affected in those with left temporal lobe involvement and general visuo-spatial abilities may suffer in those with right temporal lobe foci.

In their second study, Prevey et al (1988b) investigated gist recall in temporal lobe epilepsy. The performance of eleven right and eleven left temporal lobe epilepsy subjects was compared to a group of age, sex, education level and IQ matched controls. Gist recall of the Wechsler Memory Scale stories (Wechsler 1945) was found to be deficient in subjects with temporal lobe epilepsy of whom, the left focal group performed least well. The authors suggest that a subtle linguistic deficit can explain their findings most adequately (see section on lateralisation of function for further discussion).

Comments upon the studies

The findings in this area are difficult to interpret. Studies have employed a multitude of different tests to investigate memory impairment in heterogeneous groups of subjects with epilepsy. Straightforward conclusions suggesting impaired memory may be superficial for a number of reasons. First, comparisons between people with epilepsy and healthy matched control groups is inadequate because of the possible effects of having any chronic condition upon cognitive functions. Impaired concentration and attention, depression, anxiety, reduced opportunities and elevated levels of dependency are just some factors which may underlie apparent differences in the cognitive functions of 'sick' and healthy groups. Second, there is a tendency to argue for memory impairment on the basis of results from only a few tests. In order to disprove the existence of memory difficulties in epilepsy or to elaborate upon the nature of these problems, many more than one or two tests must be used. These must cover all aspects of learning, delayed and immediate recall, recognition, forgetting and the effects of interference. Third, many other variables can underlie poor performance on neuropsychological memory tests and when only a few tests are used the effects of these factors will be rather difficult to recognise. Amongst these contaminating variables are low motivation, poor attention and concentration, negative mood, poor organisational skills,

IQ differences and verbal and perceptual deficits. Only the latter have been considered and even then by few authors. It is of consequence that these factors may play a larger part in delayed recall conditions where the time lapse may allow for their greater influence. It seems that the difficulties involved in attempting to examine one skill to the exclusion of others, as well as the exclusion of motivational and emotional factors have been overlooked. Neuropsychological tests are not perfect devices for measuring memory abilities in isolation.

A final point to note which may bias test results in favour of the control subjects is the use of experimenter-paced tasks. Most memory test procedures are timed, allowing the experimenter to control the amount of time spent in study of the items. Such conditions may not suit certain people with epilepsy. Thompson (1981) has argued that speed of information processing may be adversely affected by certain anticonvulsant medication, notably phenytoin. Timed testing procedures may unduly bias results and this should be considered whenever cognitive tests are experimenter-paced.

Summary of the Findings

Giving full consideration to the comments outlined above, a few conclusions can be drawn from the studies reviewed in this section. These are listed below:

1. The majority of the studies comparing the memory test performance of groups of subjects with and without epilepsy do, to an extent, demonstrate deficits in those with epilepsy.

2. Delayed recall conditions appear to be the most sensitive indices of impairment.

3. It is possible that the rate of forgetting is more rapid in people with epilepsy compared to healthy 'controls' (Delaney et al 1982; Martin et al 1988).

4. Given that deficits in immediate recall are infrequently demonstrated while delayed recall is frequently performed poorly, it is likely that the storage, maintenance and/or retrieval of information is deficient in patients with epilepsy.

CHAPTER FOUR: MEMORY, SEIZURES TYPES AND

EPILEPSY CLASSIFICATION

Most studies examining the influence of type of epilepsy on memory functioning have tended to compare primary generalised epilepsy with temporal lobe epilepsy. This is so for two main reasons. First, these are perhaps the most common and readily recognised types of epilepsy. Second, it has been considered for some time that the temporal lobes, particularly the hippocampal areas are crucial to memory functioning. This conclusion has been drawn largely on the basis of findings obtained with individual amnesic patients, for example, H.M. who became densely amnesic following bilateral temporal lobectomy for relief of severe epilepsy (Milner 1966). Penfield's various studies have also provided evidence favouring the connection of memory to the hippocampi and temporal lobes (Penfield and Mathieson 1974). However, the assertion that the hippocampal formations are heavily involved in mnesic processes is not without its critics (Horel 1978).

Some of the studies reviewed in this section also consider laterality differences. These will be discussed in Chapter 5.

In an early investigation, Quadfasel and Pruyser (1955) compared the effects of having temporal lobe epilepsy with those of generalised tonic-clonic seizures. Nineteen patients had temporal lobe epilepsy and anterior spike

foci, bilateral in many, and 19 had generalised seizures. The groups were matched for IQ. Performance on the Wechsler Memory Scale was compared, and the authors found that both groups showed degrees of impairment on tests of short-term memory, learning and supraspan recall of verbal and non-verbal material. More severe difficulties were, however, noted in the temporal lobe group. This was particularly so for the verbal measures. This led the authors to conclude, rather surprisingly considering that impairment was noticed in both groups, that "memory impairment cannot be said to characterise all epileptics but that there are factors exclusive to the psychomotor group which produce a memory impairment".

In 1960, Mirsky and colleagues reported on the Wechsler Memory Scale scores of 39 subjects with temporal lobe epilepsy, 18 patients with foci in the parietal lobes, and 19 patients with generalised epilepsy. No significant differences between the three groups were detected. However, according to the memory quotients, patients with bi-temporal epileptic foci were more impaired. The study also reported a finding suggesting impairment of sustained attention in the generalised group. This finding gains further support from later studies.

This investigation exemplifies some of the difficulties involved in these kinds of studies. Some of the subjects in the temporal lobe group were described as temporal 'questionable' because, although the EEG showed signs of paroxysmal focal epileptiform activity, the subjects did

not display clinical signs which were typical of temporal lobe seizures. Similarly, some subjects in the generalised group were described as frontal, some as 'supplementary motor' and others as 'central'. Later studies, on the whole, attempt to group subjects in a more discerning manner. The groups were not matched for the types of anticonvulsants taken but, all subjects were described as being on 'small maintenance doses'. Otherwise the groups were matched for intelligence, age, duration of illness, seizure frequency and amount of EEG abnormality. To claim matching on the latter variable is probably rather optimistic and somewhat meaningless on the basis of one recording. However, it is clear that any attempt to examine one epilepsy-related variable to the exclusion of others is extremely difficult.

In the study reported in the previous section, Scott et al (1967) found no significant differences between groups of subjects, matched broadly for seizure frequency, amount of EEG abnormality and anticonvulsant medication as well as non-verbal IQ. The 16 subjects with temporal lobe epilepsy performed equivalently on the non-verbal learning and immediate memory tests to six subjects with generalised epilepsy and two with frontal lobe epilepsy.

Fedio and Mirsky (1969) however were able to detect clear differences in their study on a sample of children with temporal lobe and generalised epilepsy. Immediate and delayed verbal and non-verbal memory was tested in auditory and visual modalities. Short term memory was

found to be intact in both groups. However, after delay of only five minutes, differences were detected in the performance of the groups of children. The generalised group demonstrated memory abilities within the normal range. The children with temporal lobe epilepsy however were found to be impaired, with deficits attributable to side of focus (see Chapter 5). On the whole, subjects with epilepsy of left temporal lobe origin were considered to be the most impaired. It seems from this evidence that the children with temporal lobe epilepsy tended to forget more rapidly than those with generalised epilepsy. This finding is consistent with the later study by Martin et al (1988). Had delayed recall been tested at intervals longer than five minutes then subjects with generalised epilepsy may also have displayed impairment.

Glowinski (1973) also demonstrated increased memory impairment in adults with temporal lobe epilepsy. The study made use of the Wechsler Memory Scale and paid particular attention to overall performance and to the performance on two individual subtests which he felt were particularly implicated in temporal lobe epilepsy. These were the Associate Learning subtest and the Logical Memory subtest. Subjects were described as having 'chronic and severe' epilepsy and included 30 patients with unilateral temporal lobe epilepsy and 30 patients with generalised epilepsy. The groups were matched for variables such as medication, seizure frequency, severity of epilepsy, age of onset and level of education. The groups were not however matched for duration of illness. Differences in

IQ were taken into account by using IQ memory quotient deviation measures such that each subject's MQ is related to his/her own IQ. This kind of measure implies a near perfect understanding of the relationship between these two variables. It probably gives only a gross indication of this relationship however and is therefore likely to be quite inexact. Results indicated that the temporal lobe subjects were significantly more impaired in terms of their memory quotient scores compared to the generalised group. However, only the immediate recall of narrative texts differentiated significantly between the two groups where the generalised group performed consistently better. Delayed recall in this task was impaired in both groups but trends in the data again suggested more impairment in the temporal lobe group. The findings of this study therefore differ from those of Fedio and Mirsky in that they point to the particular difficulties with immediate verbal memory as opposed to delayed recall in subjects with temporal lobe epilepsy.

The study of Loiseau et al reported in 1980, on the other hand, failed to find significant differences in the performance on immediate verbal and non-verbal subtests of the Wechsler Memory Scale and a list learning test between types of epilepsy (see previous chapter). While the group of 100 patients performed more poorly than controls, this difference was not found to relate to any of the epilepsy associated variables that were investigated.

In the study of 157 patients with different types of

epilepsy reported earlier, Brittain (1980) found that impairments in the forced-choice recognition memory task using words and faces were to an extent influenced by seizure type. Temporal lobe seizures seemed to be associated with significant impairment in the long-term recognition of words.

In the same year, Delaney et al compared subjects with unilateral temporal lobe epilepsy to subjects with epilepsy originating in the frontal lobes. Two verbal and two non-verbal memory tests were used. These were the Logical Memory and Visual Reproduction subtests of the Wechsler Memory Scale and verbal list learning (Warrington and Weiskrantz, 1970) and the Recurring Figures Test (Kimura, 1963). Thirty of the adult subjects had unilateral temporal lobe epilepsy (15 left and 15 right) and fifteen had unilateral frontal lobe foci (10 left and 5 right). The groups were carefully matched for epilepsy related and demographic variables. Results demonstrated significantly impaired performance in the temporal lobe group with evidence of lateralisation of function. Delayed recall conditions uncovered the lateralised differences. The frontal lobe group on the other hand performed as normal. The results, therefore, corroborated the findings of Fedio and Mirsky (1969) in children.

In 1980, Milberg and colleagues conducted a study which looked specifically at the information and similarities subtests of the WAIS. They examined 10 patients with EEG

evidence of temporal lobe epilepsy and 38 patients who had EEG traces suggestive of generalised seizures. On the basis of their findings they were able to speculate on the likelihood that patients with temporal lobe epilepsy have a specific deficit in some form of linguistic or memory function that differentiates them from patients with more diffuse epileptic activity. This conclusion is similar to suggestions made in relation to some of the studies reviewed in the previous chapter. Milberg et al note that the findings of impaired verbal skills could be a reflection of the larger number of subjects in the study with evidence of left temporal lobe involvement (16 left, 10 right, 14 bi-temporal).

In Loiseau et al's 1983 study, eighty-seven patients were considered to have primary generalised epilepsy; twenty-three were described as having 'undetermined' generalised epilepsy; thirteen subjects were considered to have simple partial epilepsy and seventeen had complex partial epilepsy. Impairments related to type of epilepsy were found, with the poorest memory scores demonstrated by those with primary generalised epilepsy. This rather unusual finding was considered to be a reflection of impaired attentional skills. Patients with complex partial epilepsy performed poorly on the learning task but equivalently to the control group on the other tasks. Subjects with simple partial epilepsy performed poorly on both learning and digit span.

In a further study, Loiseau et al (1984) addressed the

question of the relationship between attention and memory impairment. Eighteen subjects with epilepsy were examined, 9 with generalised epilepsy and 9 with partial epilepsy of right temporal lobe origin. The groups were reasonably matched for age, level of education, duration of epilepsy, therapy and plasma anticonvulsant levels. Seizure frequency appeared to be higher in the group with partial epilepsy however. Subjects were tested for non-verbal reasoning ability on the Ravens Progressive Matrices (Raven 1949) and also on various tests of learning, memory and attention. Memory and learning performance was considered below average in both groups with the generalised group showing most deficit. Attentional tasks also produced below average results but the two groups were seen to perform equivalently. Hence, attention, learning and memory impairments appeared in both groups, but learning and memory were considered to be more impaired in the generalised group. The authors concluded that the learning and memory difficulties experienced by these patients with generalised epilepsy can not be solely attributed to the effects of impaired attention. Patients with generalised epilepsy appear to suffer from both memory and attentional disabilities.

Finally, Gallassi et al (1988) report on six case studies who presented with severe adult-onset memory deficit. The condition was subsequently diagnosed as complex partial epilepsy. However, neuropsychological assessment revealed a dissociation between the subjective complaints and the objective performances of these patients. The

fact that only a few long-term verbal tests revealed impaired performance failed to reflect the serious nature of the complaints heard from these patients. While this kind of dissociation is interesting, it has gathered little in the way of scientific interest apart from anecdotal reports of its occurrence (e.g. Hermann et al 1988). Reports such as this imply that perhaps subjective complaints of poor memory ought to be taken more seriously.

Comments upon the Seizure Type and Epilepsy Classification Studies

A number of comments and criticisms apply to these studies which hinder the drawing of many firm conclusions. The area is confusing because of the use of numerous different materials and varying methods. Regarding such diversity of procedures, Nilson (1980) remarked that "there are almost just as many different methods as there are published studies". Small sample sizes also limit the implications of findings. Nevertheless, a few conclusions can be made on the basis of the available data but, even these should be considered cautiously as the following comments demonstrate.

Earlier studies in the field may be erroneous in their classification of epilepsy and/or seizure types. The classificatory system used today is more precise and discriminative than were those accepted during the 1950s,

1960s and 1970s.

Even given the advances in diagnostic skills that have been made in recent years, it can be argued that these studies examining the roles of type of epilepsy and seizure type may be rather simplistic. For example, to expect to find differences in performance on measures of memory functioning between groups divided into 'temporal' and 'generalised' categories, may be rather ambitious. Warrington (1981) argues for a triple dissociation of memory functions into short-term, long-term semantic and long-term event memory on the basis of neuropsychological evidence. Simply stated, her work demonstrates that what may seem to be very slight deviations in the area of damage can result in dramatic cognitive deficit differences. Hence, to place subjects into a temporal lobe group because, according to current surface EEG recordings, their epileptic foci are located somewhere in the temporal lobe(s), and to expect clear differences to emerge on a small selection of tests between such a group and a 'generalised group' is perhaps a little naive.

With regard to generalised epilepsy, the electrical disturbance is diffuse and is therefore likely to have effects upon a variety of skills which may underpin adequate mnemonic processes. Indeed, Binnie (1988) has questioned the existence of primary generalised epilepsy. He has suggested that the seizures associated with this type of epilepsy may be focal in onset but that activity spreads too quickly to be recorded by the EEG.

Alternatively, onset may occur in the deep structures of the brain which will not be detected without the use of depth electrodes.

A final point is the relative neglect of other areas of the brain where epileptic seizures may originate. Frontal, parietal and occipital seizures are clearly regarded as less important with respect to their possible influence upon memory test performance. However, some aspects of memory are disrupted by frontal lobe seizures, for example, memory for order of items (Ladavas et al 1979). Auditory verbal short-term memory has been shown to be disrupted by lesions of the inferior parietal lobe of the left hemisphere (e.g. Warrington et al 1971). Furthermore, foci within these areas can disrupt skills which may underlie performance on memory tests. Examples include organisation and planning deficits found in association with frontal lobe lesions and perceptual and imagery difficulties related to parietal and/or occipital lobe damage. These areas should perhaps be more fully considered when memory problems in epilepsy are being studied.

A Summary of Research Findings

On the basis of the studies reviewed, the following conclusions can be drawn but should be considered with the preceding comments borne in mind.

1. There remains a great deal of uncertainty surrounding

the issue of which type of epilepsy or seizures are detrimental to memory.

2. A tentative suggestion can be made that people with temporal lobe epilepsy tend to have more impaired memory than those with generalised seizures.

3. Conditions of delayed recall are those most likely to detect the memory problem.

4. People with generalised epilepsy seem to suffer greater impairment of attentional skills which may superficially present as memory deficits. Loiseau and colleagues (1984) have, however, argued that memory itself is also deficient in these patients.

CHAPTER 5: TEMPORAL LOBE EPILEPSY AND THE
LATERALISATION OF MEMORY FUNCTIONS

In a review article of 1964 Piercy concluded that damage to the left hemisphere will impair verbal ability in most right handed, left hemisphere dominant people. Damage to the right cerebral hemisphere, will give rise to difficulties of a non-verbal, perceptual nature. In the clinical sphere, Milner's work on patients with unilateral temporal lobectomies is best known for implicating the left and right temporal lobes in material - specific memory deficits (Milner 1975). Given that the focus of this thesis is upon memory complaints in patients with active epilepsy and excludes those having previous surgical intervention, research investigating the effects of surgery upon memory will not be considered within this review. However, studies examining lateralisation of function in non-surgical cases of temporal lobe epilepsy have tended to be less conclusive. It could be argued that the concurrent disruption of frequent seizures and the existence of a neurological and/or biochemical disturbance will disrupt memory functioning to a comparable or greater degree as surgery. Dam's (1980) study could be argued as supporting this assertion where a clear relationship between the number of seizures and neuron loss in the hippocampus was demonstrated.

In a study by Quadfasel and Pruyser (1955) described in the preceding chapter, the authors were able to find no

clear indication suggesting the lateralisation of functions in their 19 subjects with epileptogenic foci in the temporal lobes. More generally, Mirsky et al (1960) presented evidence showing that memory impairment was greatest for patients with bilateral temporal lobe foci compared to those with unilateral seizure origins.

Scott et al (1967) also analysed their results in these terms in their study of non-verbal learning and immediate memory. It would be expected that of their 16 temporal lobe epilepsy patients, those with right temporal lobe involvement would be most impaired on these tasks. In fact what they did find was that patients with right temporal lobe foci and recent major fits were impaired on the visual learning task compared to patients without recent major seizures.

When Fedio and Mirsky (1969) examined the verbal and non-verbal performance of children with temporal lobe and generalised epilepsy, they found clearer evidence relating to this lateralisation of memory function. In both auditory and visual modalities, the five minute delayed recall condition gave rise to greater impairment in the material related to the side of focus. Hence, the children with left temporal lobe epilepsy performed more poorly on the delayed recall of verbal material, while the right temporal lobe epilepsy group demonstrated more impairment during delayed recall of non-verbal material.

Glowinski (1973) also investigated material specific memory deficits. He found that overall performance on the Wechsler Memory Scale and performance on two individual subtests assessing new learning and immediate and delayed recall of prose did not significantly indicate hemispheric specialisation of functions. The trend in the data did, however, tend toward the expected hypotheses.

In 1978, Rausch et al examined the laterality of functions in patients prior to unilateral temporal lobectomy. Electrodes were implanted and remained in place throughout the testing session. Twelve subjects were examined on various neuropsychological tests including a modified Wechsler Memory Scale. The authors found that where spike activity was restricted to the right, delayed recall of verbal material tended to be better and the difference between verbal and non-verbal performance was greater. This more thorough study therefore established indirect evidence of the lateralisation of memory skills within the temporal lobes of these patients. The delayed verbal memory of subjects with epileptic activity confined to the right temporal lobe was better than in other subjects. Interestingly, the authors also found that the total amount of spike activity was correlated to intellectual performance, but not to memory scores.

In 1979, Ladavas and colleagues examined long-term and short-term memory along with the judgement of recency in seventy-five right handed subjects with epilepsy. Four

regions of the brain were examined. Twenty-nine subjects had right temporal lobe epilepsy; 24 had left temporal lobe foci; 12 subjects had right frontal lobe seizures and 10 had left. Findings of this study generally supported the expectations. While short-term memory did not differentiate the four groups, long-term memory proved to be impaired in the temporal lobe group with specific laterality differences in evidence. Furthermore, the authors were able to show that quite simple recency judgements proved more difficult for the individuals with frontal lobe foci and the difficulties here too suggested lateralised functions. Given that impaired recency judgement could have been mistaken for a short-term memory deficit, this result emphasises the degree of care that must be taken when interpreting experimental and clinical findings.

Further evidence supporting the lateralisation of function came from a study conducted by Berent et al (1980). Subjects, both adults and children, were tested on paired learning of verbal and visual material. The findings indicated that subjects with foci within the left temporal lobe were more impaired in their learning of verbal pairs, while individuals with right temporal lobe foci tended to find the visual pairs significantly more difficult to learn.

The Delaney et al (1980) study of 30 subjects with unilateral temporal lobe epilepsy found no lateralised differences when short term memory was assessed.

Long-term memory assessment produced results which agreed with the expected asymmetry. The authors suggest that failure to demonstrate lateralised differences in immediate memory may be due to the nature of the Wechsler Memory Scale items used which could invite the possibility of employing alternative mnemonic strategies. Therefore, in order to examine possible short-term retention deficits in unilateral temporal lobe epilepsy, Delaney et al (1982) examined the effect of the Peterson procedure on verbal and visual material. Initial encoding was investigated in three groups of 13 'matched' subjects (right temporal lobe epilepsy, left temporal lobe epilepsy, and normal controls). The authors found that no differences existed between the groups in short-term retention and rates of forgetting of visual material. However, with verbal material, the epilepsy groups were equally impaired in short-term retention compared to the control group. The experimental groups forgot significantly more after 9 and 18 seconds of distraction. Furthermore, according to qualitative analysis of the types of errors made, the temporal lobe epilepsy groups were more adversely effected by proactive interference. The finding of verbal memory difficulties in both right and left temporal lobe epilepsy patients agrees with Delaney et al (1980).

The study conducted by Mayeux and his colleagues (1980) is notable for its conclusions. They examined performance on the Wechsler Memory Scale, the Benton Visual Retention Test, the Rey Osterith Complex Figure Test and the Auditory Consonant Trigrams Test.

Naming ability was assessed using the Boston Naming Test (Kaplan, Goodglass and Weintraub 1978). Subjects included groups of patients with unilateral temporal lobe epilepsy who were matched for age, level of education, duration of illness and seizure frequency. Their medication profiles looked quite different, however, with more subjects in the left group taking phenytoin (71% in the left group compared to 43% in the right group). Furthermore, the groups were small, with 14 subjects in the left temporal lobe group and 7 in the right temporal lobe group. The results suggested no difference in memory functioning, but when naming ability was examined, the left temporal lobe group were significantly more impaired. The authors therefore suggest that the left temporal lobe group have a naming disability. They argue, that previous studies have not considered this possibility because they had failed to employ tests of language or naming ability. This linguistic deficit hypothesis has been suggested previously in relation to the findings of studies reviewed in the earlier chapters. Furthermore, these authors argue that the possibility of a naming deficit in association with temporal lobe epilepsy may go some way to explain the apparent dissociation between subjective complaints and scores obtained on objective neuropsychological memory tests. In fact, the study does provide some evidence of this. Within the left temporal lobe epilepsy group, ten out of fourteen subjects acknowledged an interictal memory disturbance (71%) and four out of seven did so in the right temporal lobe group (57%). A dissociation exists between

subjective reports and memory test performance, but the naming test performance is more in line with these subjective impressions. It is argued that people regard naming difficulties as memory problems. The authors point out that according to Benson (1979), patients with anomia rarely demonstrate memory impairment on the basis of objective tests. The parallel here is clear. With regard to naming deficits, a distinction should perhaps be drawn between a retrieval difficulty and a weakness of semantic knowledge in order to help classify the nature of the deficit.

In their 1983 study of a sample of two hundred adults with epilepsy, Loiseau et al detected no differences in verbal and non-verbal memory performance between patients with partial epilepsy of unilateral origins. The authors argued that perhaps their subjects had less severe seizure disorders than was the case with other studies examining the issue. However, the other possibility which may explain this lack of confirmation is the use of tests of immediate recall only. Long-term memory was assessed only by delayed recognition of words in the verbal list learning task. Other studies have demonstrated that delayed recall is perhaps the most powerful indicator of lateralised differences.

Masui et al (1984) argued that in order to clarify the relationship between focal lateralisation and specific memory difficulties, stimuli should be presented to each hemisphere separately using tachistoscopic presentations.

Twenty-two right handed patients with unilateral temporal lobe epilepsy (10 left and 12 right) and fifteen normal controls matched for IQ, age, education and various epilepsy and treatment variables, were presented twenty Japanese words, half to each visual field. Recognition of these words was then tested. The data indicated that, as a whole, patients with temporal lobe epilepsy recognised fewer words than the control group. The left focal group performed more poorly than the right group with right visual field presentation and were the only group who did not display the expected right visual field advantage. Performance in the left temporal lobe group being superior when stimuli was presented to the left visual field. The authors stress the desirability of performing the equivalent experiment using non-verbal material. However, a pilot study implied that such material may be too difficult to encode quickly enough for tachistoscopic methods to be employed.

Mungas et al (1985) examined verbal learning in ten right and eleven left temporal lobe epilepsy patients who were matched for age, education level and age of seizure onset. Seizure control differed between the groups, however, with five of the left temporal lobe epilepsy group enjoying good seizure control while only one of the right temporal lobe group was so fortunate. Differences between the groups were also apparent for the use of anticonvulsants. Five of the left temporal lobe group were not taking medication compared to just one person in the right lateralised group. The authors found that the

performance of the groups on the five immediate recall trials was remarkably similar. The delayed recall trial, however, did uncover deficits in the performance of the left temporal lobe group in spite of the group's more favourable profiles of seizure control and anticonvulsant use. When performance on the three delayed performance trials (free recall, phonemic cued recall and semantic cued recall) were averaged out, the left temporal lobe epilepsy group scored significantly more poorly than the right group and the normal matched control group. The poorest performance by this group was recorded on the phonemic cued recall condition, while delayed free recall showed more moderate impairment. Responses to semantic cued recall, however, were equivalent in the three groups. The results give an overall picture favouring an interpretation of lateralised memory functions. It is of note that the left group showed particular difficulties with the phonemic cued recall condition which is particularly effective for alleviating 'tip-of-the-tongue' states. The subjects with left temporal lobe epilepsy would presumably benefit less from this technique when naming difficulties arise.

Hermann et al (1987) investigated several aspects of verbal learning and memory function in patients with complex-partial seizures of temporal lobe origin. Subjects were thirty pre-surgical adults with temporal lobe epilepsy, fifteen each with left and right foci. Compared to the right temporal lobe and the matched control groups, the left focal subjects manifested poorer

verbal learning, immediate memory and increased difficulty with the retrieval of verbal material. Furthermore, compared to the other groups, the left temporal lobe group showed poorer semantic organisation in their verbal learning and recall. 'Chunking' of information was apparently more difficult for the left temporal lobe group. This may reflect an organisational deficit or one of a more general linguistic nature.

In 1988, Hermann and his colleagues reported on further findings of possible linguistic deficit associated with left temporal lobe epilepsy. Twenty-five adults with complex-partial seizures originating in the dominant temporal lobe were examined. Language dominance was determined by the sodium amytal procedure (Wada 1949; Wada and Rasmussen 1960). Two of the subjects were found to have speech represented in the right hemisphere. The subjects were assessed using the California Verbal Learning Test. Emphasis was placed on immediate and delayed retrieval difficulty as well as the effect of retroactive interference. The authors incorporated seven tests from the Multilingual Aphasia Examination (Benton and Hamsher 1983) and looked at the presence, severity and qualitative aspects of language disorder. Results corroborated the hypothesis put by Mayeux and his colleagues. The degree of language impairment was found to be the most frequent and powerful predictor of memory and learning performance in this sample. The authors question what the relationship between adequacy of visual/perceptual skills and non-verbal learning and

memory in patients with complex-partial seizures of non-dominant temporal lobe origin might be. Studies are clearly necessary in this particular area.

In 1987, Powell and colleagues examined laterality effects and disruption of memory function in 27 patients with unilateral temporal lobe foci undergoing sodium amytal tests. Memory was measured by necessarily simple and brief procedures. Although numbers were small, the authors summarised their findings by stating that results were "not entirely consistent with the classical views of clinical neuropsychology". It was found that verbal memory was liable to disruption from foci within either temporal lobe. Spatial memory was, on the other hand, relatively unaffected by temporal lobe epileptic foci. Furthermore, memory was found to be exclusively unilateral in 44% of their subjects with both verbal and non-verbal functions residing in the area without the epileptic focus.

Prevey et al (1988) conducted two studies examining rather different aspects of memory functioning in patients with temporal lobe epilepsy. Their first study examined metamemory, that is, the individuals introspective knowledge about his/her own memory functions. The two experiments involved the prediction of memory span and self-monitoring of retrieval function. The subjects included thirty patients with left temporal foci and thirty with right who were matched for age, education and sex, as well as age of onset, duration of illness and

current seizure frequency. No control for anticonvulsants was reported. Generally, the authors found that subjects with epilepsy tended to overestimate both their short-term memory and their retrieval ability. The authors found greater inaccuracy in estimates of verbal material by the left temporal lobe group and more inaccuracy for non-verbal material by the right focal group. It was argued that inflated self-perception of memory functions can negatively influence actual memory performance, by giving rise to an ineffective or insufficient use of strategies aimed at improving memory performance. The study stresses the active role the subject can play in determining his/her own memory ability and it is important because of this.

In their second study, Prevey et al investigated gist recall and adaptive memory functions in subjects with temporal lobe epilepsy. Data on twenty-two matched subjects with IQs within normal limits was analysed, eleven with left temporal lobe epilepsy and eleven with right. The Wechsler Memory Scale logical memory subtest was used. Results indicated significantly poorer scores on this test by the left temporal lobe group in immediate and delayed recall conditions. The intermediate position was held by the right temporal lobe group who performed worse than the matched controls. Gist recall differences were also evident. The left temporal lobe group were most impaired applying this kind of adaptive recall. What is particularly interesting is the evidence which is presented upon the use of observable mnemonic strategies

such as note taking, underlining and sub-vocalisations. The left focal group employed these adaptive strategies the least. The right temporal lobe group again held the intermediate position. The authors mention the linguistic deficit hypothesis of Mayeux et al (1980) and suggest that perhaps a subtle deficit in this area may be causing an inadequate use of verbal mnemonic strategies. Distortion of details in the prose piece was often noticed in the left temporal group, which persisted even after a study period. The degree of distortion varied widely within the group from gross distortions such as intrusion of inappropriate ideas to vagueness and oversimplification. The authors argue that this latter kind of distortion is indicative of an inability to organise the material into a meaningful reconstruction of the text. Results of this study are illuminating in that they clearly demonstrate the possibility that deficits in skills other than memory per se can determine adaptive performance.

Comments upon the Lateralisation Studies

These studies of the lateralisation of memory functions provide a relatively uncomplicated overall picture. However, some general comments upon the issue of lateralisation and on the nature of the work should be made.

It is of significance to note first of all that these lateralised differences emerge in spite of the fact that,

in terms of precise organic localisation, the groups of patients in these investigations are likely to be fairly heterogeneous. Again, the neuropsychological evidence which demonstrates the importance of small deviations in damaged areas should be stressed (Warrington 1981). Delaney et al (1982) mention the need to study the effects of medial versus lateral foci in the temporal lobes. The former would present a profile of hippocampal involvement, while the latter would demonstrate the role of cortical areas in memory. They go on to point out that as more patients undergo depth electrode examination, this kind of data will become more readily available.

The age at which the seizure condition first presents may be crucial to the lateralisation of memory functions. Early onset of the condition may cause a reorganisation of function away from the damaged into the intact hemisphere. This may be particularly true of those with early and severe febrile convulsions who are prone to hippocampal sclerosis. Any reorganisation of function would, of course, confuse lateralisation findings (see Powell et al 1987).

It is equally important to emphasise the ability to detect lateralised memory deficits in spite of the difficulty of finding tests which are capable of measuring visual skills in isolation of verbal abilities. Tests such as face recognition or design learning may often be encoded and understood largely by verbal means.

Some of the research in this field has widened its search to consider the notion that general skills which may underlie memory test deficits may be impaired. It is becoming accepted that it is not sufficient to report impairments in memory between groups differing in focal lateralisation without further investigating what the real underlying causes might be.

Some areas of memory skills which may be particularly relevant to daily life skills have not been studied however. The traditional test of delayed memory involves examining recall within schedules of minutes rarely hours. Assessment of very longterm memory has been neglected. Prospective memory (i.e. remembering to do something later) is a typical requirement of day to day life and can involve very longterm memory with the added distracting effects of retroactive and proactive interference. Although clinical methods could lend themselves well to an examination of prospective memory, little or no information has been gathered upon this type of memory. This criticism applies equally to the areas examining other neuroepileptic variables.

A Summary of the Research Findings

The studies presented tend, on the whole, to confirm that differences do exist in the performance of non-surgical patients with foci in the right and left temporal lobes.

1. In most of the later studies, findings suggest that

most people with epileptogenic foci in the left temporal lobe perform poorly on tests of verbal memory. Patients with right temporal lobe foci tend to be impaired on tests of visual memory. However, the study of Powell et al (1987) and to some extent the investigations of Delaney and colleagues (1980) point to the greater vulnerability of verbal skills.

2. Patients with bilateral temporal onset suffer more widespread memory deficits.

3. It seems, as was the case with the type of epilepsy/seizure studies, that tests of delayed memory are more likely to demonstrate lateralised impairment. Tests of learning are also sensitive indices.

4. A few of the later studies consider impairments which possibly give rise, or contribute to memory difficulties. This is particularly so of studies where verbal deficits were noted. Two general skill areas have been specifically referred to. First, a linguistic or naming deficit has been postulated (Mayeux et al 1980; Hermann et al 1988). Second, a deficit of organisational skills is suggested (Hermann et al 1987; Prevey et al 1988a and b).

CHAPTER 6

THE HIGH RISK TRIAD: THE ROLES OF SEIZURE FREQUENCY, AGE OF ONSET AND DURATION OF EPILEPSY

a. Seizure Frequency

Reynolds (1861) was convinced of the importance of seizure frequency as a determinant of memory functioning. Research investigating this variable has accumulated since then, but in more recent years, it has become rather a less popular variable for study.

In their review of 1988, Loiseau et al explained that seizure frequency may play both a direct and indirect role in memory impairment. Directly, the loss of consciousness, partial or complete, will disturb mental functioning during seizures and, in some cases, for days after. They stress that when a test is carried out post-ictally, the score will be lower than if it had been undertaken at a time between seizures. When seizure frequency is high, seizures are never far apart and therefore test scores are more likely to be impaired. Indirectly, they cite evidence reported by Reynolds et al (1983) which suggests that in chronic epilepsy, repeated seizures may give rise to an ongoing process of cerebral damage which is likely to cause memory impairments. The studies which follow have all examined the frequency of seizures with respect to memory test performance.

Seizure frequency per se was not found to be a variable which influenced results in either visual or auditory modalities in Scott et al's (1967) study. However, non-verbal memory deficits were found to be greater in subjects with right temporal lobe foci and recent major seizures.

Mohan and colleagues, on the other hand, did demonstrate significant negative correlations between the number of generalised seizures and the overall score obtained on the Boston Memory Scale in their 1976 study of fifty adults with epilepsy.

In the following year, Dikmen and Matthews (1977) examined the effects of seizure frequency exclusively in a study of seventy-two patients with major motor seizures. Subjects were divided into three subgroups on the basis of whether they were considered to have low (1 per 4-6 months), moderate (1 per 1-3 months) or high frequency (more than 1 per month) of major motor seizures. Subjects were tested on the WAIS and eight subtests from the Halstead-Reitan Neuropsychological Battery. Generally, they found that subjects with a high frequency of seizures performed worse than those with lower frequencies on the cognitive intellectual measures. However, the three subgroups did not differ in their performance on the memory component of the tactual performance test. It may, however, be ill-advised to use group frequency data in this way. Seizure frequency is notoriously variable, being affected by a multitude of things from compliance to lack of sleep,

menstrual cycles and stress. Furthermore group frequency data necessarily involves a loss of information.

In another study (Dikmen, Matthews and Harley 1977) the group was able to report significant impairment on the same memory measure in a category of patients which the authors referred to as a 'high risk' group. These were subjects with high frequency seizures, long duration of epilepsy and early onset of major motor seizures (see Section b for further discussion).

In the studies of Loiseau and his colleagues (1980; 1983) seizure frequency was not considered to be a factor which influenced memory performance. In the 1980 report of one hundred patients testing short-term verbal and visual recall and verbal list learning, no seizure variables were implicated in the poorer scores. In the 1983 study, two hundred adults with epilepsy were examined for their performance in the same three skills and also on verbal recognition. To examine seizure frequency, subjects were divided into four groups: those with no seizures for two or more years (n = 63); those with no more than one seizure in the past two years (n = 40); those who had one to eleven seizures in the past year (n = 48) and finally, those who had twelve or more seizures in the past year (n = 49). The last category in particular covers a very wide range of frequency. The authors concluded that seizure frequency analysed in this group format was not a factor which determined memory ability. Had correlational analysis been conducted, the findings may

have been different.

Brittain's (1980) battery included verbal and non-verbal, forced choice recognition. She found that seizure frequency per se did not influence recognition. However, when she examined the more complex index of 'ictal time' (number of seizures times reported duration of seizures over two years prior to testing), a positive relationship was found.

b. The Roles of Age on Onset and Duration of Epilepsy

In the past, the duration of epilepsy and the age of onset of the condition have often been considered together. Both variables are related to the total number of seizures experienced and this may be crucial in determining the efficiency of cognitive functions (see Brittain 1980). However, the age at which the seizures begin may in itself be critical. The occurrence of abnormal brain activity and possible CNS damage at a young age may adversely effect the development of cognitive skills. Conversely, the greater plasticity of the younger CNS may allow a successful transfer of functions from damaged to intact hemispheric regions (Strauss et al 1990). It must be remembered that neither age of onset nor duration are autonomous variables. Early age of onset and duration mean, by definition, that in adults seizures have occurred over a number of years. This typically means chronic use of anticonvulsant therapy which may in itself influence

memory functions (see Chapter 8).

In 1960, Mirsky and colleagues reported the findings of a study examining the effects of focal versus non-focal epilepsy on neuropsychological test performance. All subjects, who were of mixed seizure types, were described as being on 'some small maintenance dose of anticonvulsant medication'. A significant negative correlation was found to exist between the duration of the temporal lobe disorder and the memory quotient. This result, unfortunately, tells us little about the nature of the deficit. They concluded that the memory dysfunction associated with temporal lobe epilepsy may not present until the disorder has existed in excess of ten years, a point which Loiseau et al (1988) support.

Scott et al (1967) also reported findings on duration and age of onset in their study. Neither of these variables was found to bear any relationship to scores on the non-verbal tests used in this study.

Dikmen, Matthews and Harley (1975) considered age of onset individually. The study involved sixty-four subjects with major motor seizures as the predominant type. These were compared to fifty-six subjects with verified brain damage but without a history of epilepsy. Both groups of subjects were divided into early onset (birth to 5 years) and late onset (17-50 years) subgroups. Unfortunately, only one measure of memory was used within the battery. This was the memory component of Halstead's Tactual

Performance Test. The authors found a tendency for both groups with early onset to perform more poorly on this memory measure with early onset seizure subjects performing the worst.

The 1977 study by the same authors attempted to examine the variables of seizure frequency and duration along with onset age. Two groups of subjects with major motor seizures were selected. Group 1 consisted of twenty-two subjects with early onset between 0-5 years. Group 2 involved subjects with onset between 10-25 years. Seizure frequency was ranked according to the number of seizures per-month. The same single memory test was used (the tactual performance test). Results demonstrated significant impairment in a 'high risk' group. These were patients with a long duration of epilepsy, early age of onset and a high frequency of seizures. Within the same report, the authors mention the results of an unpublished study which implicated duration of epilepsy as an important single variable determining cognitive skills.

In a study which investigated hemispheric specialisation, Ladavas et al (1979) reported that the duration of epilepsy effected cognitive skills. The study involved seventy-five adults with differential diagnoses of epilepsy. All of the subjects had developed the disorder when they were ten years old or more. It was found that clear deficits were only noticed in subjects who had had epilepsy for more than one year. The authors state; "The lack of clear-cut hemisphere-dependent cognitive deficits

when the length of illness is one year or less may be attributed to the fact that the epileptic focus requires considerable time to spread and be manifest in measures of cognitive behaviour". Merlis (1974) and Goldensohn (1975) had argued in a similar way. Deficits recorded included long-term memory as measured by four tests (digit span + 1, Hebb 1961; 20 words test, Rey 1966; block tapping, Milner 1971; complex figure test, Rey 1967). However, differences in the length of anticonvulsant therapy cannot be ruled out as an explanation of these findings.

In Loiseau et al.'s study reported in 1980, neither age of onset nor duration were found to influence scores on immediate visual and verbal recall or verbal learning tasks. However, in the larger study of two hundred patients (1983), their findings were a little different. The duration of the condition remained an apparently unimportant variable. However, age of onset did appear to be important in relation to memory performance. The authors found that the major memory difficulties tended to present in patients whose epilepsy began during adolescence. Loiseau et al explained this rather unusual finding in terms of critical period hypothesis, suggesting that cognitive functions are probably more vulnerable during adolescence than they are at other periods of development. Given that age on onset can rarely be established with precise accuracy, it is possible that some of these subjects may have developed epilepsy at an earlier age but, it may have gone unnoticed. This may

often be the case with absences and simple partial seizures. Nevertheless, Loiseau et al's finding is intriguing.

In the study reported in 1980, Brittain found that both age of onset and duration of epilepsy were related to performance on the forced choice recognition test. Long duration of epilepsy was associated with poor recognition of faces and words. Early age of onset was implicated in the impairment of face recognition only. Again, the possible influence of chronic anticonvulsant use should be considered in relation to these findings.

Delaney et al (1980) reported findings on age of onset and duration of epilepsy in their examination on memory functioning in focal versus non-focal epilepsy. The impairments that were identified by the study were not found to relate to age of onset, but the duration of the disorder was found to be reliably correlated with memory difficulties.

Finally, in 1981, O'Leary et al reported the negative effects of early age of onset of tonic clonic seizures on neuropsychological performance of children with epilepsy. Halstead's Tactual Performance Test and a test of tonal memory were included in the battery. The forty-eight children were divided into two groups on the basis of age of onset. The early group comprised those with onset between 0-60 months and the late group had onset between 61-170 months. Statistical analysis revealed that

duration was unlikely to be playing a part in determining memory scores. Age of onset was, on the other hand, found to relate to performance on tasks which were regarded as requiring both memory and concentration. On such tasks, the children with early onset performed less well.

Comments upon Studies examining the 'high risk triad'

As was the case for earlier chapters, a number of methodological drawbacks exist in the studies reviewed here. Experimental designs using arbitrary and often large subject groupings may be insensitive to test differences as this strategy necessarily involves a loss of information. Generally, the studies which examine a broad range of cognitive intellectual functions cannot be considered to test memory at all adequately. To draw conclusions, particularly about the absence of memory deficits on the basis of results from one or two tests may be unjust. Furthermore, between study comparisons are difficult because of the use of varying techniques. Once again, no consideration is given to alternative explanations.

In the studies of Dikmen and colleagues and also Brittain (1980) the effects of individual variables were combined, and found to be significantly related to memory functions. It should be stressed that combining variables in this way leads to problems of interpretation. The so-called 'high risk' group highlighted by Dikmen et al (1977) will probably have been more disadvantaged by chronic use of

anticonvulsants. The authors do acknowledge this but claim that differences in drug use alone could not fully explain the large differences in test scores found within their data. The authors do not, however, consider the possibility that the 'high risk' group may have suffered more head injuries as a consequence of their seizures. The incidence of head injury has been isolated as being an extremely important variable determining intellectual deterioration in epilepsy (Mader et al 1990).

The accurate recording of the three variables pose further problems. It is likely that subjects' self-reports of seizure frequency and the reports of relatives will be minimal estimates. A proportion of seizures will probably be missed even given the most diligent recording. Similarly, the accurate categorisation of seizure frequency into groups can become difficult when patterns of seizures change over time. Furthermore, seizures which are not tonic-clonic convulsions or other major motor types may not be classed as seizures by patients. Simple partial seizures present the best example. Patients often regard these as 'warnings' of a seizure.

With respect to the recording of age of onset and duration of epilepsy, both patients and clinicians may be unsure when the condition first presented. It is not uncommon for some years to elapse between onset and diagnosis. This is particularly so for the partial epilepsies and childhood absences. Significant periods of remission should also be taken into account.

A final point to note which relates particularly to the frequency of seizures is that this variable may simply be a reflection of the extent and severity of underlying CNS pathology. Therefore, studies examining the variables of seizure frequency may be indirectly assessing the influence of different types and severities of brain pathology.

Summary of the Research Findings

1. There has been less extensive study of the variable of seizure frequency compared, for example, to type of epilepsy and lateralisation. This may be because seizure frequency remains a less objective and verifiable factor.

2. Most studies have failed to demonstrate the importance of seizure frequency as a factor which determines memory efficiency. However, in spite of the rather negative research findings, it is generally agreed that frequent seizures will adversely affect memory functions.

3. Some studies demonstrate the significance of seizure frequency when considered together with other variables, for example, duration of epilepsy, age of onset or total time spent in seizures over a set period.

4. Both age of onset and duration are now widely regarded as deleterious variables in respect of memory functions (Loiseau et al 1988) even though not all studies

have been successful in demonstrating their significance.

5. The positive duration findings point to a direct correlation between length of epilepsy and degree of impairment given a certain length of time with seizures. It has been suggested that after ten years of seizures memory deficits will begin to present.

6. The majority of findings relating to age of onset suggest that early onset has more deleterious effects upon memory than late onset. It is argued that the development of mnemonic skills is handicapped by early CNS disturbance. However, the findings of one study suggests that the relationship may be more complex. Loiseau et al (1983) indicated the possible importance of a specific, relatively late development period (i.e. adolescence) with regard to the disruption of memory functions. This claim deserves more careful investigation.

CHAPTER 7

THE ROLE OF SUBCLINICAL DISCHARGES AND TRANSIENT COGNITIVE IMPAIRMENT

In 1936, Gibbs and colleagues found that spike-wave activity, similar to that which occurs in overt clinical absence seizures, can in fact be identified in the EEG traces of some people when no clinical manifestations are observable. Three years later, Schwab (1939) found that cognitive functioning assessed using simple reaction time tasks, may be disrupted during these subclinical spike-wave discharges. It is now widely accepted that transient cognitive impairment (TCI) can accompany this subclinical activity in about 50% of patients whose EEGs show evidence of this generalised subclinical or 'larval' type of spike-wave activity. Binnie et al (1987) and Binnie (1988) report that forty studies have supported this conclusion.

It is clear then that the occurrence of TCI during neuropsychological testing will effect subtest scores and overall profiles. In 1976, Wilkus and Dodrill, in a study not specifically designed to detect TCI, reported that abnormal test profiles were more likely to occur where subclinical discharges were frequent. However, two important points should be considered when discussing the likelihood of detecting TCI. First, it is easier to demonstrate the presence of TCI during generalised, symmetrical regular spike-wave activity of about 3/second

(Binnie 1988). This is the pattern typically manifested during the overt absence seizure. The more the discharge differs from this pattern, the more unlikely will be the detection of TCI. Of the early studies, only one had claimed to demonstrate TCI in focal discharges and this reported on only three subjects (Kooi and Hovey 1957). Furthermore, the effects of the focal discharges were markedly weaker than the corresponding effects of generalised discharges. However, in 1984, Aarts et al reported demonstrable TCI in patients with clearly focal subclinical discharges. This study carefully selected the type of cognitive task to be used. This then is the second issue which is important in determining whether TCI will be detected. Binnie (1988) has suggested that the tests most likely to demonstrate TCI are continuous monitoring tasks requiring high rates of information processing. He argues that simple repetitive motor or mental tasks will be relatively insensitive to the subtle cognitive effects of these discharges. Clearly, tasks of an intellectually demanding nature are preferred. A problem arises however because epileptiform activity will often decrease during the performance of the type of difficult task so suited for elicitation of TCI. Aarts et al (1984) tackled this by using enjoyable computer games which comprise these continuous monitoring tasks in a palatable form. This means that patients are prepared to co-operate for long enough to allow the collection of sufficient data. The difficulty of the tasks was automatically adjusted to work at the highest level of

performance achieved by each subject. The games incorporated short-term memory tasks and spatial and verbal elements were examined separately. Close behavioural monitoring enabled the authors to exclude from study any patients who suffered overt clinical seizures during the testing session. In so doing, all patients with generalised 3/second spike-wave discharges of three seconds or longer were excluded. Even given the elimination of this sensitive group, Aarts et al were able to demonstrate TCI in 50% of their subjects. The short-term memory tasks and procedures adopted seemed sensitive to TCI even amongst patients with subclinical discharges of a focal nature and of less than three seconds in duration. Furthermore, patients with right focal discharges were found to be particularly disrupted by the spatial memory tasks while those with left focal discharges were more disrupted on verbal memory material.

A further study by Binnie et al (1987) replicated these laterality findings as did Rugland et al (1987). The latter investigators reported a study using computerised cognitive tests during clinical EEG investigations. Binnie and colleagues also confirmed the particular sensitivity of short-term/working memory to disruption from subclinical discharges. The authors used short-term verbal and non-verbal memory tasks and reported that TCI was most commonly related to discharges occurring immediately prior to, or during, stimulus presentation. Discharges during responses were not associated with errors. This finding is, the authors argue, best

interpreted as evidence of impairment of working memory by interruption of the encoding process at critical times. Hutt and Gilbert (1980) and Gallassi et al (1988) also explain their findings examining spike and wave discharges in this way.

A study by Siebelink and colleagues (1988) examined the possible everyday repercussions of TCI. They administered a shortened version of the Amsterdam Children's Intelligence Test to twenty-one children with epilepsy who were continuously monitored on video and EEG. They reported that the group as a whole showed an anomalous profile which suggested selective impairment on a subtest examining short-term verbal memory. Further analysis demonstrated that this picture was typical only of those children who had exhibited subclinical discharges during that particular subtest. Furthermore, the authors found that there was a robust positive relationship between the occurrence of discharges and the number of errors made on four out of the six subtests administered.

The implications of TCI upon everyday functioning is emphasised further by a study which examined the ongoing working memory processes involved in reading. Kastelejn-Nolste Trenite et al (1988) examined the effects of subclinical discharges upon reading in children with epilepsy using video telemetry. Discharges were found to be related not only to an increase in errors during reading but also to an increase in reading speed. It is unclear why this should be. What is clear though is that

subclinical discharges and their effect upon working memory will disrupt adaptive cognitive functioning. Fortunately however, Aarts et al (1984) report that individual patients have shown improvements not only in cognitive functioning but also in areas of social behaviour as a result of the successful suppression of subclinical discharges by anticonvulsants.

Comments upon the Subclinical Discharge Studies

The role of TCI in determining memory test performance has not been considered in the work concerned with other neuroepileptic variables. Interest in the area has developed relatively recently, and the assessment of its influence requires continuous telemetry monitoring. This makes its consideration rather impractical for most research. Future work should at least note the significance of this variable however.

It is clear that TCI must be regarded as an important determinant of adaptive memory functioning. As such, the consequences of TCI could be potentially very damaging within the context of daily life.

Summary of Research Findings

1. The evidence presented here suggests that of the

people with epilepsy who display subclinical discharges, 50% will suffer TCI.

2. Since discharges are often frequent, the implications should not be underestimated.

3. Cognitive deficits arising during subclinical discharges have been reported on a number of different tasks but, the sensitivity to TCI increases as the difficulty and continuous monitoring requirements of the task increase.

4. In particular, it seems that working memory is most sensitive to the disruptions caused by subclinical discharges during critical encoding periods.

CHAPTER 8 : THE EFFECTS OF ANTICONVULSANT DRUGS ON
MEMORY FUNCTIONS

Considerable research has been devoted to assessing the influence of anticonvulsants upon the cognitive functions of adults with epilepsy (see Trimble 1987). Of these studies, very few have adequately reported and/or assessed their effects upon memory functions. Early studies will be presented only briefly since they tended not to adopt the double-blind placebo methodology in which neither experimenter nor patient knows when the active drug is being taken. This procedure is now considered to be the only satisfactory way to investigate the effects of drug treatments upon mental functions. Methods have differed widely from large scale comparative studies to small single drug studies. The chapter will thus be divided into sections according to the manner in which the subject has been considered. The review largely concentrates upon the effects of the major first line drugs. Studies of other compounds are few and therefore conclusions difficult to draw.

I. Single Drug Studies

a. Phenobarbitone and Primidone

As one of the earliest anticonvulsants, phenobarbitone was the focus of a number of investigations, several of which

studied children and focused upon behaviour as well as cognition. However, in 1968, Hutt and colleagues gave four normal adults phenobarbitone for up to one month. A significant negative relationship was found to exist between serum phenobarbitone concentrations and verbal learning ability. Another study which examined the effects of phenobarbitone on volunteers was conducted by Salzman and Shader (1973). Elderly people were given phenobarbitone, diazepam or methylphenibate for one week in a double-blind placebo design. Using the memory measures incorporated in the Wechsler Memory Scale, the authors found that phenobarbitone at a dose of 15mg t.i.d. had no significant memory effects in these elderly subjects.

In 1978, Macloed et al investigated the effects of phenobarbitone upon short and long-term memory in a group of patients with epilepsy. Tests included letter scanning and matching with various doses of phenobarbitone and primidone given. The pattern of impairments suggested that increasing concentrations of phenobarbitone were associated with greater short-term memory difficulties. Oxley and colleagues (1979) also noted improvements on the Wechsler Memory Scale subtests following reductions of phenobarbitone and primidone doses in people with epilepsy. However, no significant correlations were found between changes in serum levels and scores on the Wechsler Memory Scale tests. It is of note that the improvements in memory found by these authors occurred in spite of increases in seizure

frequency.

From these single drug studies, it does seem that phenobarbitone and primidone have adverse effects upon memory functions in people with epilepsy and probably for volunteers as well. It must be stressed, however, that the 'epileptic brain' may be more or less prone to adverse effects of chemicals than is the 'normally functioning' brain. This is a major criticism against using volunteer subjects in these studies which otherwise has many advantages by avoiding the confounding effects of neuroepileptic variables.

b. Phenytoin

Volunteer subjects were also used by Gordon et al (1968) who investigated the effects of phenytoin upon paired associate learning and digit span. Subjects were given phenytoin or placebo at 200mg per day for a period of one week. Serum levels were not measured. No effects upon learning or short-term memory were detected after the use of phenytoin.

In 1975, Dodrill examined neuropsychological test performance in seventy adult patients with epilepsy who had been stabilised on phenytoin. Patients had either high or low serum levels of the drug and twenty-four were considered toxic. The patients were matched for age, education, onset, duration and number of recent major motor seizures. Dodrill included two memory measures in

his battery, the Seashore Rhythm Test and the memory component of the Tactual Performance Test. The higher drug level groups performed consistently more poorly than the subjects on lower levels of the drug, but, no differences in mental functions reached statistical significance.

Most studies examining the effects of phenytoin have been comparative but even from the single drug studies using very few memory measures, evidence exists regarding some adverse effects of phenytoin upon memory functions. It is significant that early studies often found no adverse effects of drugs when examined in these terms. This has led to claims of psychotropic effects of some anticonvulsants which may be put down to the action of the drug itself, its success in reducing seizures and/or the replacement of sedative drugs. However, the real test of any drug requires comparison to other compounds within strict experimental conditions (see Section II).

c. Carbamazepine

Carbamazepine is all the more successful as an anticonvulsant agent because of its apparently minimal effects upon cognitive functions. In an early study of the effects of this particular drug, Leder et al (1968) examined performance on paired associate learning and digit span in a group of adults with epilepsy, before and after carbamazepine was added to existing drug regimes. While the authors detected improvements in the moods of

the patients, no learning or short-term memory deficits were detected. Later in 1979, Siirtola and Siirtola investigated carbamazepine as monotherapy. Paired associate learning, digit span and immediate recall of geometric designs were examined with patients tested before and after three months treatment with carbamazepine. No effects were detected in areas of verbal and non-verbal learning and short-term memory.

More recently, Gillham et al (1988) examined cognitive and psychomotor functions in fifty-nine outpatients who were taking carbamazepine either monotherapeutically or with one other drug. Results were compared to twenty-six untreated patients who were either under investigation for a seizure disorder or were six months into a trial of drug withdrawal. Clearly, the treated and untreated groups were not matched for seizure frequency nor duration of epilepsy. The memory measures consisted of digit span, paired associate learning and visual span. The authors found no differences in memory test performance between the untreated and carbamazepine monotherapy group. When carbamazepine monotherapy was compared to the polytherapy group, it was found that the former scored significantly higher on digit span. Gillham and colleagues suggest that carbamazepine epoxide may contribute substantially to the cognitive effects of carbamazepine polypharmacy. In terms of serum concentration, the authors found that paired associate learning deteriorated with increasing carbamazepine concentrations, while digit span backwards and visual span deteriorated with increasing carbamazepine

epoxide concentrations.

It is difficult to draw firm conclusions on the basis of results gathered during clinical practice since randomisation and matching procedures cannot be adopted and therefore 'hidden' differences between groups could explain findings. However, from the above it would seem that carbamazepine does not have dramatic adverse effects upon higher mental functions, particularly when used as a single treatment.

d. Sodium Valproate

Sodium valproate is another anticonvulsant which has been more heavily studied using multi-drug methodology. However, some single drug studies examining mental functions have been conducted and results would suggest minimal effects of sodium valproate on cognitive functions when used in a therapeutic fashion. Sommerbeck et al (1977), for example, examined the effects of sodium valproate as an add-on therapy in a group of 20 patients ranging in age from 13-63 years. A double-blind cross-over placebo design was run over twelve weeks. Measures included digit span, paired associate learning and a design learning task. No significant effects upon learning and memory were noted but there was a non-significant trend towards improved associate learning.

A second study demonstrating the minimal effects of sodium valproate is that of Gillham et al (1990). Method and

procedure were similar to Gillham et al's carbamazepine study. Forty-eight patients were treated with sodium valproate monotherapeutically, twenty-eight were taking sodium valproate and one other drug and twenty-six were untreated. The authors found no significant differences in memory performance of the monotherapy and untreated groups. The group treated with two drugs, however, performed worse on the visual span task than the other two groups. However, since the polytherapy group had higher seizure frequency, the above result should be viewed cautiously. Again this shows the difficulty of conducting drug studies in uncontrolled clinical settings.

e. Vigabatrin

Vigabatrin, one of the most recently introduced anticonvulsants is, according to experimentally induced animal models of epilepsy, efficacious in terms of memory function. Yliven et al (1990) suggest that the enhanced GABA-ergic inhibition associated with vigabatrin prevents seizure induced memory impairment by protecting the structure and function of the hippocampus. Only a few studies examining memory functions in adults with epilepsy have been conducted but, those that have, generally present an optimistic picture. For example, Kalviainen et al (1990) examined the cognitive effects of vigabatrin as initial monotherapy in sixteen adults with epilepsy. Immediate and delayed recall of a list and attention on a visual cancellation task were amongst the cognitive functions tested. The battery was repeated after three

months and all patients were satisfactorily controlled on the drug during that period. Significant improvement was noted on immediate and delayed recall as well as on the attention task.

This favourable impression is reinforced by Mumford et al (1990) who presented a meta-analysis based upon nine studies incorporating tests results of eighty-two adults with epilepsy. There was no evidence of impaired cognitive functions and indeed one study found a significant improvement in short-term memory.

These initial examinations certainly seem to be promising but, it is worth noting again the frequency with which novel anticonvulsants are met with very positive reports in these terms.

II. Comparative Studies

Since the acceptance of carbamazepine and sodium valproate as highly effective first line drugs, comparable to phenytoin in terms of seizure control, more emphasis has been placed upon the possible adverse cognitive effects of these drugs. Clearly, the multi-drug double-blind cross-over study with adequate 'wash-out' phase is the methodology of choice for comparing drugs in these terms.

Two studies conducted in 1975 examined doses and serum levels of various different anticonvulsants. Mathews and Harley found significant differences in short-term

non-verbal memory in two groups of patients. Those on toxic levels of various anticonvulsants performed consistently more poorly than those who were not toxic. Dekaban and Lehman found a non-significant weakening of digit span and short-term verbal recall in patients on high doses of various anticonvulsants.

One year later, Kalska (1976) conducted a study comparing the differential effects of three different drugs upon memory. One hundred patients with epilepsy were given phenytoin, phenobarbitone or carbamazepine and were tested on the Wechsler Memory Scale and the Benton Visual Retention Test. It was found that high serum levels of phenobarbitone were associated with poorer performance on the memory measures. However, many of the subjects in this study were on polytherapy and so individual drug effects could not be isolated.

During the early 1980s, Thompson and Trimble conducted a series of studies on patients with epilepsy and healthy volunteers in which double-blind cross-over designs were used. Of particular importance was the fact that individual tests were specifically devised to be sensitive to the effects of anticonvulsants (Thompson and Huppert 1980). Tests of visual and verbal memory were developed in parallel versions and practice trials were built into the procedures. The battery also included tests of concentration, mental and motor speed.

The comparative effects of phenytoin, carbamazepine and

sodium valproate upon twenty-six age-matched male volunteers was reported in 1983. Eight patients took 300mg of phenytoin for two weeks, eight took 600mg of carbamazepine for two weeks and the remaining ten patients took sodium valproate for two weeks with dose gradually increasing to 1000mg. The cross-over was balanced between active drug and placebo. Cognitive testing took place pre-treatment and at the end of both treatment phases and serum levels were assessed at the end of the testing sessions. Results indicated that at mean serum levels of phenytoin just below the 'therapeutic range', delayed visual recall was significantly poorer. Phenytoin also affected the immediate recall of words compared to placebo. Carbamazepine at mean serum levels within the therapeutic range tended to result in slightly worse performance on memory measures but none of these differences reached significance. For sodium valproate at a mean serum level within the therapeutic range, no trend toward impairment was noted. Clobazam was similarly assessed and found to have no significant effects upon the memory tasks (Thompson and Trimble 1982a).

The comparative effects of phenytoin, carbamazepine and sodium valproate at high and low serum levels were examined in twenty-five patients with epilepsy (Thompson and Trimble 1982b) over a six month period. Nine took phenytoin, eight were given carbamazepine and eight took sodium valproate. Groups were matched for age, education, full scale IQ, age of onset and duration of

epilepsy. Cross-over from high to low levels was balanced and blood was taken on completion of test sessions two and three. Results showed that the impairments associated with high serum levels of sodium valproate and phenytoin were remarkably similar. High levels of both drugs impaired the immediate recall of pictures, even though the mean high levels of both drugs were within the 'therapeutic ranges'. In contrast, high levels of carbamazepine did not effect performance on any of the memory measures when compared to the performance at low serum levels. No differences in seizure frequency were recorded when serum levels were altered.

In 1984, Andrewes et al supplied some useful information upon the memory functions of 16 new referrals treated either with phenytoin or carbamazepine. Although the patients had only recently started on anticonvulsants, data on pre-treatment functioning was not reported. Groups were matched for age, IQ, seizure classification, frequency, duration of epilepsy and treatment. Seizures were well controlled by the drugs. Four memory tests were used, short-term scanning, verbal list learning, prose recall and recognition of pictures. Memory questionnaire data was also collected. Results obtained on memory testing indicated that the carbamazepine group performed consistently better than the group on phenytoin. However, only differences on the short-term scanning task reached significance. Subjective measures revealed no significant differences between the two groups. In discussion, the authors refer to Thompson's (1981) claim

that phenytoin slows cognitive performance and that this slowing may underlie poor memory test performance. The scanning task used in this study involved the rapid serial presentation of items. Differences between the two groups became most marked when presentation rate was increased. Andrewes et al argue further that phenytoin effects performance on tasks which require high degrees of sustained concentration. It is of note that studies had begun to propose ideas about how certain drugs effect memory instead of merely reporting that they do.

Examination of previously untreated patients continued when in 1984(a), Butlin and colleagues examined the cognitive performance of fifty-six previously untreated patients who were split into three groups and matched for age, IQ and lateralising EEG signs. Memory performance was assessed using an auditory verbal learning task, digit span and facial recognition. A group of non-epileptic controls was tested along with the phenytoin, carbamazepine and sodium valproate patients before and after three months of treatment. It was found that phenytoin was associated with a significant decline in face recognition, whereas untreated controls and patients treated with carbamazepine and sodium valproate showed relatively little change.

In the same year (Butlin et al 1984b), the authors attempted to determine the importance of red cell folate levels in determining memory performance in treated patients with epilepsy. They concluded, on the basis of

results of partial correlations, that low levels of red cell folate may be more important in determining memory difficulties than are high serum levels. The notion of folate deficiency being an important determinant of mental state in patients treated with anticonvulsants was first emphasised by Reynolds (1972) and has since gathered a good deal of support (e.g. Trimble et al 1980) and may explain the particular association between phenytoin and memory difficulties (Chanarin 1979).

A further study of newly diagnosed patients on a larger scale was conducted by Mattson and colleagues (1985). The study was longitudinal and examined the efficacy and toxicity of carbamazepine, phenytoin, phenobarbitone and primidone. Six hundred and twenty-two patients were collected for study. All were either newly diagnosed or under-treated patients. The dose of each drug was increased until mid-high therapeutic range had been reached. The neuropsychological battery included tests of digit span and a word finding task. Smith (1988) reports that the measures used had been shown to be sensitive to the subtle cognitive changes which may be associated with anticonvulsants. Testing took place pre-treatment whenever possible and then at one month, three months and every six months thereafter for the five year duration of the study. Results showed that those on carbamazepine scored significantly better than at least two other groups on digit span at six and twelve month follow-up. In contrast, the patients taking phenobarbitone or primidone performed most poorly on digit

span at twelve months. No differences were found between low and high serum levels of the drugs on any of the cognitive tasks. Mattson et al also reported an interesting finding which has implications for long-term memory in epilepsy. Practice effects from session one to two were recorded in the control group for a number of the cognitive tests including digit span. This was not the case in the epilepsy group however. Whether this is a drug effect or one associated with the condition itself is unclear. This is an interesting finding and should be pursued by examining the incidental learning and very long-term memory capabilities of people with epilepsy.

In 1987, Brodie et al used a battery of simple psychomotor tests to assess mental functions in a group of fourteen untreated patients with epilepsy, sixty-six patients with established drug regimes of whom fifty-four were treated monotherapeutically, and a group of eleven healthy controls. A 'simple simon' sequential recall task was used to assess short-term memory within a cross-sectional design. The authors reported that the untreated group performed more poorly on this task compared to the controls but that the chronically treated patients performed more poorly still. When the type of drug being taken was examined, no significant differences were found between patients on phenytoin, carbamazepine or sodium valproate monotherapy or polypharmacy. The results suggest that verbal short-term memory is effected first by the condition of epilepsy itself and may be further

impaired by the chronic use of anticonvulsants.

The final study to be discussed in this section was conducted recently by Meador and colleagues (1990) who investigated the cognitive effects of carbamazepine, phenobarbitone and phenytoin in fifteen patients with complex partial seizures. All patients were treated with each drug for three months in a double-blind cross-over design. At the beginning of each phase old medication was carefully withdrawn and patients begun on gradually increasing doses of the appropriate drug. Two memory measures were used, digit span and verbal selective reminding. The authors found no significant differences between the drugs for performance on the memory measures. It is possible, however, that the length of cross-over was insufficient to detect the delayed effects of medication changes in this study.

III. Single Drug Substitution Studies

Another method which is becoming increasingly popular involves the monitoring of cognitive changes during a treatment change, usually to a single drug. Butlin et al (1984a) report on changes arising from switching from phenytoin to carbamazepine and from carbamazepine to sodium valproate. Twenty-four well-controlled patients who had been on phenytoin for an average of four years, mostly monotherapeutically, were divided into two groups. Group one changed to carbamazepine and group two remained on phenytoin. Patients were pre-tested on phenytoin and

then three months after the switch to carbamazepine. Memory was assessed as described previously. Of the patients who remained on phenytoin only those whose serum levels did not vary over the three months were included in the analysis. The authors found that the performance of the patients who switched to carbamazepine improved significantly on all memory measures after three months treatment compared to those who remained on phenytoin.

Identical procedures were adopted for a group of eighteen patients who had been treated with carbamazepine, mostly as monotherapy, for an average of six months prior to testing. No differences were found on the three memory tests within or between the patients who changed to sodium valproate and those who remained on carbamazepine.

In a more recent study of eight patients with uncontrolled generalised idiopathic epilepsy on multiple different anticonvulsants, Prevey et al (1989) examined the cognitive effects of converting these patients to sodium valproate monotherapy. The Rey Osterreith Complex Figure Test and the Rey Auditory Verbal Learning Test were presented prior to change and after an average of forty-five days treatment on ^{valproate} monotherapy. While the composite neuropsychological scores improved significantly, the individual memory test scores did not. Attention and concentration also improved significantly with the drug change. Results of this study are difficult to interpret since blind procedures were not adopted and significant improvements in seizure control

accompanied the drug change.

IV. Polytherapy Reduction and Drug Withdrawal Studies

Reduction of polytherapy had been shown to have generally beneficial effects upon seizure frequency by Shorvon and colleagues who had been advocating the adoption of monotherapy for control of epilepsy for some time (e.g. Shorvon and Reynolds 1977, 1979; Shorvon et al 1978). Reduction of polytherapy and the monitoring of systematic drug withdrawal is a useful technique for assessing the effects of antiepileptic drugs on cognitive functions.

In 1981, Thompson and Trimble reported the results of a study in which either polytherapy was reduced or carbamazepine replaced an existing drug. Since the drug changes were made clinically, groups of patients were not matched so a number of difficulties arise when interpreting the findings of the study. Over six months the patients were tested three times, pre-treatment, three months and six months post drug changes. Blood levels were taken immediately after testing. Three groups of patients were collected. Group one involved fifteen patients who had their original medication reduced or withdrawn and were subsequently prescribed carbamazepine, seven of those were consequently taking carbamazepine monotherapy. Group two comprised twenty patients whose drugs were reduced but no alternative medication was prescribed. Group three consisted of ten subjects who

had not had their drug regimes changed and had no marked changes in serum levels from sessions one to three. Results showed that the group who had changed to carbamazepine improved significantly at three months on recall of pictures and immediate and delayed verbal recall. These improvements were maintained at six months and furthermore, the recognition of pictures had also improved. However, the drug reduction group fared less well. Significant improvement only occurred at six months for the delayed recall of pictures. Unfortunately, results were confounded by the fact that the number of tonic-clonic seizures in group one significantly reduced from sessions one to three while seizure frequency in groups two and three did not change. However, the authors point out that while most of the memory improvement occurred over three months, the seizure frequency only improved over the six month period. A further factor which made interpretation of results difficult was that serum phenytoin levels fell significantly more after drug changes in group one compared to group two. The effects of high serum levels of phenytoin in patients and volunteers have been reported earlier. This latter difference between groups meant that the authors could not argue that carbamazepine has beneficial effects upon memory. A final point concerns the fact that seven out of fifteen in the carbamazepine group were reduced to monotherapy. It would have been interesting to know what proportion of the benefits were attributable to those patients.

In 1985, Ludgate et al analysed the results of twelve patients who had their drugs reduced to monotherapy. Each patient was assessed on the Benton Visual Retention Test (BVRT) and digit span while on polypharmacy, after reduction, and at one year follow-up. The tester was blind to the outcome of the polytherapy reduction. The authors found that while the error score on the BVRT improved significantly on drug withdrawal, the actual number of correctly recalled figures did not improve. Again however, results are confounded by a fall in seizure frequency following the drug reduction.

Preliminary data on withdrawal of phenobarbitone in nine adults with epilepsy is presented by Gallassi et al (1987). Patients were assessed at systematic times; prior to withdrawal (T1), at half phenobarbitone dose (T2), three months post withdrawal (T3) and at one year follow-up (T4). Verbal and spatial short-term memory and learning were assessed and the authors found that spatial span improved significantly from T1 to T4 but there was no significant correlation between drug level and test performance at T1 or T2.

The same authors (Gallassi et al 1988) report the results of withdrawing phenytoin and carbamazepine in twelve and thirteen patients respectively who had been seizure free for at least two years and had been taking prolonged monotherapy. A group of twenty-six matched normal controls were also assessed. Withdrawal and testing procedures were as described for the phenobarbitone study.

At T1 the phenytoin group were impaired on an attention task compared to controls and those on carbamazepine. Digit span was impaired at T2 and verbal learning at T3 . However, at T4 , the phenytoin patients were performing equivalently to the carbamazepine and control patients. The authors, therefore, concluded that phenytoin does have more adverse effects upon cognition than carbamazepine but that the negative effects are entirely reversible by complete withdrawal.

Finally, Duncan et al (1990) report the cognitive test results of fifty-eight patients who had either phenytoin, carbamazepine or sodium valproate removed from their drug regimes of two or more anticonvulsants. Twenty-one patients had phenytoin withdrawn, fifteen carbamazepine and twenty-two sodium valproate. Digit span was the only memory measure incorporated into the neuropsychological battery which also assessed concentration using a letter cancellation task. Once more, since clinical concerns dictated therapy changes, randomisation and group matching was not possible. This meant that the control group of twenty-five who remained on their existing therapy had significantly longer duration of epilepsy than the withdrawing groups. Furthermore the number of drugs taken by the control group was significantly less than in the phenytoin group. The study was a placebo controlled prospective double-blind project with cognitive data collected before, at the end of withdrawal, and at four weeks follow-up. No differences in digit span were detected with removal of the three drugs. However,

concentration improved on discontinuation of phenytoin but did not alter with removal of carbamazepine or sodium valproate.

Comments upon the Anticonvulsant Drug Studies

Again, a serious limitation of these studies is the use of only a few memory measures. Furthermore, investigations have tended to concentrate upon short-term recall and learning. Other areas of memory such as delayed recall have been relatively neglected. Of course, a thorough investigation of memory functions would not be possible but, a wide selection of tests needs to be used before it can be concluded that a drug does not effect memory functions.

A number of methodological inadequacies of these drug studies should be considered. First, some of the earlier studies failed to monitor blood serum levels and emphasised dose instead. Dodrill (1975) noted that marked individual differences in drug metabolism and bioavailability do occur, and that clinicians should be aware of limitations of considering dosage or even dose-to-weight ratio as indicators of the amount of drug being metabolized.

A second point to emphasise concerns the appropriateness of using standard neuropsychological memory tests in this area of research. These tests were devised to detect gross brain lesions and may, therefore, be insensitive to

subtle drug effects. Some studies selected tests which were known to be sensitive to drug effects (e.g. Thompson and Trimble 1981, 1983 and Mattson et al 1985) but most did not.

As a whole, there is an insufficient number of studies concentrating upon anticonvulsant effects in previously untreated patients. Only two studies have presented this sort of information (Andrewes et al 1984; Mattson et al 1985). Data on previously untreated patients is invaluable for clarifying individual drug effects. Studies which investigate effects of add-on therapy are examining polypharmacy. Since monotherapy is the standard practice for treating uncomplicated epilepsy, it is crucial to collect more information upon initial single drug prescription.

Finally, the use of volunteers, small numbers and highly selected groups of patients limits the extent to which the results can be extrapolated to the population of people with epilepsy as a whole.

Summary of Research Findings

1. The most outstanding impression gained from the review is the amount of evidence pointing to the relative adverse effects of phenytoin compared to the other two most common first line drugs.

2. At low serum levels, carbamazepine and sodium

valproate appear to have little effect upon memory test performance.

3. At high serum levels, sodium valproate may be comparable in its effects with phenytoin which interferes with performance on some memory tests even at doses below the so-called therapeutic range.

4. Research into the effects of phenobarbitone and primidone in adults has tended to decrease in recent years. The conclusion that these drugs are detrimental is based largely upon the single drug studies. However, the digit span findings of Mattson et al and the withdrawal data provided by Butlin and colleagues supports this conclusion.

5. There is evidence to suggest the role of reduced levels of red cell folate in determining cognitive differences in patients on anticonvulsants, phenytoin in particular (e.g. Chanarin 1979).

6. A fairly confident conclusion can be drawn about the comparative benefits of monotherapy over polypharmacy for memory functions.

CHAPTER 9 : THE STUDY OF EVERYDAY MEMORY IN COGNITIVE AND
NEUROPSYCHOLOGY

i. The Shift in Emphasis

Over the past century it has become traditional to study memory within the confines of the psychological laboratory. Without doubt, useful and relevant theories have been developed through this kind of work (e.g. Craik and Lockhart 1972; Baddeley and Hitch 1974; Atkinson and Shiffrin 1979). Nevertheless, over the past decade or so, some psychologists have questioned the relevance of these methods to real life memory requirements and difficulties. Neisser, one of the most vociferous contemporary advocates of the study of everyday memory, says of those traditional researchers:

"..so much harder (sic. the realistic study of memory) that one can easily forgive those who have been reluctant to undertake it. After all, we bear no malice toward that legendary drunk who kept looking for his money under the street lamp although he had dropped it ten yards away in the dark. As he correctly pointed out, the light was better where he was looking".

(from Neisser 1978)

In other words, the realistic study of memory necessarily involves the loss of experimental control so crucial for

the orderly study of cognitive processes. Neisser's comparison of the traditional researcher to the drunk, stresses the futility of the search for relevant findings from work which confines itself to packaged 'topics' which bear little relation to memory as most non-psychologists know it. Neisser's views against these traditional methods are stronger than most. It is nevertheless, largely due to him that interest in the 'ecologically valid' study of memory (Gibbs 1979) has developed and thrived in the past twelve years. This does not mean, however, that interest in everyday memory is a new phenomenon. In 1890, William James professed some interest in subjective memory and, of course, Freud (1901) published his theories about the causes of everyday memory failures. It was however, Bartlett (1932) who was the real pioneer. In his book 'Remembering', he criticised his contemporaries for misunderstanding the purpose and nature of memory. In doing so, he argued against the traditional laboratory techniques. Bartlett's comments provoked very little interest at the time.

ii. What to Study?

The same questions which were asked in the traditional sphere are important in the study of 'subjective' memory. Studies of individual differences in the use of memory; the variables which influence its proficiency; how many different forms it has; which factors it is dependent upon, would all be of interest. It is also of course important to establish just how closely it is associated

to the traditional performance measures which have dominated cognitive and neuropsychology in the past. Furthermore, our own day to day experiences should provide a wealth of ideas for study. How do we remember to do things? When do we mislay things? What processes underlie our ability to put names to faces? What factors influence the tip-of-the-tongue state and its resolution? Why are we sometimes uncertain about whether we have done something? Some of these topics have already been studied and particularly sound 'naturalistic' studies have been undertaken on prospective memory and 'tip-of-the-tongue' states. Some of these are reviewed next.

Prospective Memory

Baddeley (1981) argues that prospective memory may represent the major problem of daily life recall because remembering to do things at particular times cannot be guaranteed by the use of simple aids. In his 1981 paper, Baddeley describes an early attempt to investigate prospective memory. Female volunteers were asked to return a card on a set date. Baddeley and Wilkins expected to find that the longer the interval between the instruction and the return date, the higher would be the frequency of failures to return. Unfortunately, their subjects were too highly motivated and very few failures occurred at all! The experiment had probably failed to find the right balance between experimental control and realism. However, Levy and Claverall (1977) conducted a

similar experiment in which patients attending a medical clinic were expected to return appointment cards as a matter of course. These authors did in fact find what Baddeley and Wilkins had predicted. It was clear that the longer the inter-appointment interval, the less likely it was that the card would be returned on time.

In 1978 Baddeley and Wilkins performed a natural experiment which simulated pill taking. A device recording the time of a button press, was constructed. Subjects, mainly housewives, had to press the button at 8.30 a.m., 1.00 p.m., 5.30 p.m. and 10.00 p.m. for a period of 7 days. - The subjects were told that if they forgot to respond at the set time, they were to do so as soon as they remembered. If a response was forgotten until the next one was due, this was to be recorded on a label attached to the device. Results indicated reasonable accuracy. Responses peaked at or just before the target time. There was, though, a very long tail of late responses. Complete omissions averaged at 1 per subject during the 7 days.

The authors wanted to discover if performance on this task was related to performance on more traditional objective tests. To do this, two groups of subjects were formed. Sixteen performed very well on a task of free recall of words and fifteen had performed poorly. The authors found that those with good free recall were significantly less accurate in the pill taking experiment than those with poor free recall scores! It seems from these

results that the ability to remember to do something is quite different from the ability to remember a list of words. Baddeley et al (1987) refer to this as the 'absent-minded professor effect'. However, it is possible, since the authors collected no data on how subjects went about remembering, that the poor free recall subjects, aware that they may be more liable to forget, used more effective strategies to remember the 'pill taking task'.

Memory Blocks

Reason and Lucas (1984) report upon the use of cognitive diaries to record the incidence of 'tip-of-the-tongue' states (TOTs) and memory blocks characterised by 'strong habit intrusion', (i.e. where recall of the target word is blocked by a, usually phonetically, similar non-target word which is more frequently used). Thirty-two subjects kept diaries for a period of one week. Seventy-five resolved TOTs were recorded, an average of 2.5 per person. 53.3% of 'blocked' TOTs were typically only resolved by external means (e.g. looking it up or asking someone), whereas the non-blocked TOTs were resolved using internal strategies such as alphabetical search. The blocked TOTs required more 'searches' of the memory store than the non-blocked ones, but paradoxically, more features were known of the blocked target than were known about the non-blocked words. A further study with sixteen subjects provided evidence supporting the idea of the memory blocks being 'strong habit intrusions'. The non-target blockers

tended to be words used more frequently or more recently.

The major difficulty with naturalistic work lies in achieving the correct balance between control and authenticity. There is little to be achieved from naturalistic investigations if the results tell us nothing about everyday behaviour because the experimental situation was too artificial. On the other hand, there is little point in providing results which are uninterpretable because of too many uncontrolled influential factors. However, it does seem that the so-called 'naturalistic' experiments will necessarily lose validity since recording and experimentation will always interfere with 'natural' behaviour. A further problem is particularly relevant to the cognitive diary studies and that is the nature of volunteer subjects. Reason (1981) himself reports that subjects who volunteer to supply information tend to be those who believe that they have problems in the area of investigation. The recorded frequency of the problem is therefore likely to be an overestimate of the population incidence.

For all these reasons and more, experiments on human behaviour no matter how carefully designed can never be truly representative, and will therefore never accurately reflect everyday behaviour.

iii. Questionnaires: An alternative to ecological experiments

Hermann (1982) argues that questionnaires avoid most of the difficulties associated with naturalistic experiments in memory. They do of course have difficulties of their own which are described in a later section. The advantage which these measures have is that they provide efficient means by which to gather a large sample of representative information.

Hermann distinguishes two types of questionnaire, the memory questionnaire and the metamemory questionnaire. The former asks people to recall knowledge or events, i.e. it assesses the person's retrograde performance. The latter asks people how well they remember things, i.e. it assesses a person's belief about his/her memory performance. (It is the metamemory questionnaire which is the focus of this thesis and, within the remainder of the text, it will be referred to as the memory questionnaire (MQ)). Table 2 shows the characteristics of the self-report metamemory questionnaires available. Two of these questionnaires have parallel versions to be completed by relatives (the HIPQ and the MOQ). The exact memory inquiry differs from measure to measure. Frequency of forgetting, clarity of recall, memory change, learning, the use of strategies and feelings about memory performance have all been examined. The test-retest reliability of these measures is considered to be good ($r = 0.8$, see Hermann 1981). However, the validity of the measures has provoked a good deal of debate. Generally, reports by the authors of the questionnaires themselves suggest that the validity of the questionnaires is poor

TABLE TWO: THE METAMEMORY QUESTIONNAIRES

Adapted from Hermann (1982)

Questionnaire	Authors	No. of items	Nature of Inquiry
Cognitive Failures Questionnaire	Broadbent et al (1982)	25	Forgetting
Head Injury Postal Questionnaire (HIPQ)	Sunderland et al (1983)	28	Forgetting
Everyday Memory Questionnaire (EMQ)	Sunderland et al (1984)	28	Forgetting
How Good is Your Memory Questionnaire Part I	Wright (1975)	25	Forgetting/remembering
Inventory of Learning Processes	Schmeck et al (1977)	62	Learning
Inventory of Memory Experiences	Hermann & Neisser (1978)	72	Forgetting/remembering
Short Inventory of Memory Experiences	Hermann (1979)	32	Forgetting/remembering
Memory Change Questionnaire	Cronholm and Ottoson (1961)	5	Forgetting
Memory Questionnaire	Ash (1977)	10	Quality of remembering
Memory Questionnaire	Perlmutter (1978)	60	Forgetting/quality of remembering
Metamemory Questionnaire	Zelinski et al (1980)	92	Forgetting/remembering/quality of remembering
Memory Scale	Schulster (1981)	60	Forgetting/remembering/quality of remembering
Slips of Action Inventory	Reason (1977)	50	Forgetting
Error Proneness Questionnaire	Reason (1981)	30	Forgetting
Subjective Memory Questionnaire	Bennett-Levy & Powell (1980)	43	Forgetting/quality of remembering
Memory Observation Questionnaire Part A (MOQ)	Wands & McGlone (1989)	50	Forgetting
Memory Observation Questionnaire Part B	Wands & McGlone (1989)	50	Change in quality of remembering

when the criteria of validity are laboratory test measures of performance ($r < 0.5$, see Hermann 1984). Responses to the questionnaires do not predict performance on most objective memory tests. This is perhaps not surprising, particularly when one considers the negative relationship which was found to exist between the remembering of the prospective task and the free recall of words in the experiment described earlier (Baddeley and Wilkins 1978). What is more, the questionnaire measures opinions about performance and not actual everyday memory functioning. However, these findings have lead many to argue that the study of self-reported memory abilities is of limited value. However, the authors of the measures argue that traditional objective memory tests are unsuitable criteria to adopt in order to test the validity of questionnaires. It is proposed that more, and different, skills are required by everyday memory than are tested by the objective tests. It is argued that validity coefficients would be higher when different criteria were adopted. There is some support for this assertion. For example, expected differences in memory performance are reflected by these memory measures. Neurological patients report their memories as being poorer than neurologically normal subjects (Sunderland et al 1983; Bennett-Levy, Polkey and Powell 1980; Wands and McGlone 1989; McGlone and Wands 1991). Expected differences also arise with psychiatric patients (Ash 1977). Furthermore, it has been shown by some authors that when compared to objective tests which are more relevant to daily life activity, that is, meet the criterion for isomorphic question-to-task agreement

(Herrmann 1982), correlations are more acceptable. Baddeley et al (1987) report significant correlations between the responses to the HIPQ (patients and relatives versions) and the immediate and delayed recall of prose. Furthermore, behavioural measures of memory have been found to correlate significantly with the total HIPQ score of patients with post-traumatic amnesia (Wilson et al 1984). In another study, Lincoln and Tinson (1989) found that questionnaire responses (EMQ - Sunderland et al 1984) were more highly correlated with test scores on the Rivermead Behavioural Memory Test (RBMT; Wilson, Cockburn and Baddeley 1985) than scores on conventional objective tests in patients post-stroke (see also Larrabee et al 1991). However, the development of the memory questionnaire reflected the interest in understanding the relationship between self-knowledge and performance. It is this interest which has meant that the memory questionnaire is used enthusiastically by researchers and clinicians alike. It is used in conjunction with the traditional objective performance measures to give a more thorough profile of memory functioning. They tend not to be used as substitutes for the objective tests for two reasons. First, as argued, they may be concerned with different skills. Second, the self-report questionnaire may not be an accurate reflection of everyday memory anyway. It measures opinions about performance and not actual performance. The measure of choice for recording everyday memory failures would be a memory diary or checklist. The daily monitoring required by a prospective checklist/diary would provide more accurate

data than that supplied on the basis of heuristics (Morris 1981). However, even the checklist measure apparently does not predict performance on most memory tests in some neurological patients (Baddeley et al 1987).

iv. The Adoption of the Memory Questionnaire in Epilepsy

In the past, just seven reports have used questionnaires to examine beliefs about memory performance in people with epilepsy. Of these, one looked at the effects of certain anticonvulsants upon memory functions in new referrals and was discussed earlier (Andrewes et al 1984); three examined patients following unilateral temporal lobectomies (Bennett-Levy, Polkey and Powell 1980; Wands and McGlone 1989; McGlone and Wands 1991). The remaining three examined everyday memory in non-surgical cases (Guerrant et al 1962, Broughton et al 1984, Easterbrook and Cull unpublished). Bennett-Levy et al examined the responses of 58 patients following their operations and compared them to the responses of 94 healthy controls matched for age. The interval between surgery and investigation ranged from six months to six years. The questionnaire used in this study was Bennett-Levy and Powell's Subjective Memory Questionnaire (SMQ). Results indicated that the patients rated their memories as being significantly worse than the controls. Of the forty-three items on the SMQ, the patients rated their performance as being worse than the controls on seventeen and as better on none. The responses of those with left

and right lobectomies were essentially similar with only three items discriminating the groups. There was a significant interaction between sex and side of resection with males complaining most after right temporal lobectomy.

It will be recalled that the Andrewes et al (1984) study using the SMQ and the relative's HIPQ discussed no subjective memory findings. Had they obtained self-report data from the subjects before starting treatment, they may have found changes worthy of consideration.

These two studies looked only at rather atypical populations of people with epilepsy. It could be argued that new referrals, who have had epilepsy for a short time only, would not suffer from memory problems anyway (see studies upon the role of duration). Furthermore, it is by no means certain that the subtle effects of AEDs (Thompson and Huppert 1980) will be picked up by a self-report questionnaire. The other study examined people with epilepsy post-surgery. Memory deficits are expected in these patients and the study was performed to test the validity of the SMQ.

Two recent reports by Wands and McGlone (1989, 1991) aimed to replicate and expand Bennett-Levy et al's findings. The authors used their own Memory Observation Questionnaire (MOQ) to investigate the memory complaints of people post-temporal lobectomy. They included

comparative data on a group of patients with unilateral temporal lobe epilepsy^(TLE) and it is this data which is of particular interest. The MOQ incorporates two parts. Part A examines 'current status' using a true/false dichotomy and Part B examines 'change' by a five point subjective rating scale. Each part has fifty questions and relative's versions are also available. Subjects included thirty-one pre-operative adults with unilateral TLE and IQ scores of > 80 and seventy-two patients who had undergone unilateral temporal lobectomy. Time since surgery varied from six months to ten years. Data on a group of sixty-three healthy controls was also used. Sex, age and level of education were equivalent and no lateralised differences were evident between the two experimental groups. Analysis revealed that controls had significantly fewer memory complaints than both of the epilepsy groups who did not differ in terms of current status. Relative's reports agreed with this. When change scores were investigated however, the post-operative group differed from the other two groups. They believed that their memories had improved since surgery whereas the control and TLE groups reported no change in memory 'over the past several months'. Again, relative's data agreed. This difference may have been expected since patients post-surgery are likely to become more aware of their cognitive functions. Furthermore, it would have been useful to know how successful these operations were in controlling seizures. Better seizure control will have beneficial effects upon memory, and will probably make subjective reports more optimistic into the

bargain. The accurate report of memory change over the past several months with no significant intervening factor probably required greater introspective efforts on the part of the TLE subjects.

Other findings of interest included the same sex by side of resection interaction as Bennett-Levy et al had found. Males complained significantly more after right sided resection than females. No other laterality effects were significant.

This work does expand upon Bennett-Levy et al's findings by examining questionnaire data of patients with TLE. However, most of the data refers to post-operative patients and as such is not indicative of the population of people with epilepsy as a whole. Indeed, the MOQ may itself be a rather cumbersome measure for use in large scale research or clinical practice. With 100 questions requiring in-depth powers of introspection, response rates and perhaps the reliability of the responses may prove problematic.

The three other studies referred to earlier considered non-surgical patients. Of these, one involved only a very cursory inquiry into everyday memory beliefs and will not be referred to further, (Broughton et al 1984) apart from mentioning that the sixty subjects with primary generalised or temporal lobe epilepsy attributed worsening memory to their condition.

Guerrant and colleagues (1962) report the results of a brief questionnaire study involving thirty-two subjects with temporal lobe and twenty-six with idiopathic epilepsy. These were compared to twenty-six 'control' patients who had other forms of chronic illness. Rather surprisingly, but supporting the later findings of Prevey et al (1988a), these authors found that patients with focal seizures rated themselves as having superior memory compared to either the idiopathic group or the control group. The insight of these patients might be questioned on the basis of these findings.

Finally an unpublished study conducted at a special centre reported on the nature of self-reported memory and its relationship to neuropsychological tests in people with epilepsy (Easterbrook and Cull). These authors used the SMQ on twenty-one patients with temporal lobe epilepsy and twelve patients with generalised epilepsy. Unfortunately, statistical procedures adopted were inappropriate for analysis of questionnaire data. However, a number of conclusions could be drawn on the basis of the raw data. First, self-report and neuropsychological measures of memory tended not to correspond. Only immediate story recall was related to total score on the SMQ. Second, no difference in total SMQ score was detected between the temporal lobe subjects and those with generalised epilepsy. Third, using the 'control' data of Bennett-Levy et al. (1980), the authors found no difference in the total SMQ score for the 'control' and epilepsy group although some differences on

individual items were significant. The epilepsy group reported more problems on nine items including naming problems, forgetting where something was put and appointments. The authors also considered the role of depression in determining self-report of memory difficulties. Total score on the BDI was not related to SMQ scores.

These studies demonstrate that more consideration should be given to the memory complaints of people with epilepsy using questionnaire survey techniques. In view of Nilsson's (1980) comment upon the multiple methods used to study 'objective' memory, it would be useful to establish, at this early stage, a questionnaire of choice in epilepsy.

v. General Problems of Self-Report Data

There is one fundamental problem with self-report data that underlies all of the subsidiary disadvantages and that is simply their sole reliance upon the participant for the answers. Several biases can creep in to responses given about 'self' on questionnaires and these are apart from the problem of purposeful misrepresentation.

Poulton (1975) discusses range effects in terms of the role these play in determining experimental findings in people. Range effects equally apply to subjective rating scales. Central-tendency range effects suggest that

people will choose responses lying in the middle of a scale as opposed to those lying at the extremes.

There are, of course, range effects which favour points at the poles because responses in the central range become confused as they are regarded as being too similar. Again, making the scale more objective should decrease this effect. Apart from range effects, there is the 'experimenter effect', where subjects will be inclined to respond in terms of how they believe the experimenter wants them to. The best way to combat this problem is to insure complete impartiality on the part of the experimenter. This difficulty can be exaggerated in survey methodology by the nature of the requests for subjects. Appeals may be entitled in ways that imply what is expected from the survey.

vi. Problems Associated with Memory Questionnaires

Range effects and expectations clearly apply to these questionnaires, with the rating of what may be relatively infrequent events. Setting a time reference guide, such as rating over the last three months, is advantageous to the extent that it can reduce the range effect of central tendency. It will make responses of 'not at all' and 'more than once a day' much more acceptable.

However, with a sample where complaints of poor memory

seem to be frequent, the bias may be towards the far end of the scale. If a subject believes his/her memory to be bad, he/she may feel this should be confirmed and hence may concentrate his/her responses over the 'frequent' end of the scale. Affirmation bias is therefore a problem to consider with these types of questionnaire. Broadbent et al (1982) attempted to tackle response bias, particularly the effects of social desirability, in their Cognitive Failures Questionnaire (C.F.Q.) by incorporating the Lie Scale questions from the Eysenck Personality Questionnaire (Eysenck and Eysenck 1975) into it. However, the Lie Scale questions from the E.P.Q. are somewhat transparent and Broadbent et al omitted them from later versions of the C.F.Q. because respondents found them objectionable. Wands and McGlone (1989) report using what they refer to as a 'superlative subscale' in their Memory Observation Questionnaire which includes examples such as; 'When I read a newspaper, I remember every news item for several days'. In some preliminary studies of subjects with unilateral temporal lobectomies and temporal lobe epilepsy, this subscale did seem to be a successful measure of response bias. It may have been useful for this particular study group to incorporate a scale reflecting very severe amnesic difficulties so that affirmation bias could be detected.

An independent observer's version would seem to be a reasonable way of indicating the reliability and validity of subjects own responses. A respectable correlation between this and the self-report measure would, it can be

argued, validate the responses given by the subject. This, of course, would be the case only if the observer had not been unduly influenced by the subject's beliefs beforehand, or indeed, vice versa.

Turning to possible areas of subject error in more individual terms, Morris (1984) suggests that there are five stages involved in the process of self-assessment of the frequency of memory failures. He argues that at each of these stages, the accuracy of responses can be frustrated.

Individual examination of these stages will clarify the problems that can arise in the process of the self-assessment of memory failures. These errors and problems apply not only to questionnaire responding but also the recording of failures in a diary/checklist format.

Having an appropriate memory failure

Items on memory questionnaires tend to be of the form 'how often do you/have you ...?' Here the variable of lifestyle and relevance of the item to each subject appears. Morris uses the following example: 'When you are in a restaurant and want to speak to your waiter/waitress, how often do you forget what he/she looks like?' For someone who rarely eats out or who uses self-service, the relevance of the question is severely limited. The pool of instances from which the subject

can draw will be small and so the accuracy of the response is diminished. This problem is likely to be even more apparent when the subject is answering a questionnaire which incorporates an objective time-measured response scale and more still if a suggested time limit is set into the questionnaire.

Accuracy is not definitively lessened in these cases of reduced relevance if the subject is allowed to respond in a relative, as opposed to an absolute manner. It could be, for example, that because the subject rarely eats out, the events of the outing will stay in memory and this should have the effect of increasing rather than diminishing accuracy.

Most memory questionnaires are made up of items which relate to very specific situations, correspondingly, the response pool which the specific items elicit will be small. The obvious alternative is to use more general questions in order to elicit a greater response pool. An example would be; 'how often do you misplace things?' The pool of reference is certainly large, but the question is so vague that it may not act as a cue to memory and so the recalled pool upon which the judgement is made may well, again, be small. According to Harris (1979), specific memory cues are better than general ones for activating recall.

Classifying the incident as a failure

It is important to realise that subjects will, of necessity, base their judgements upon what they have come to expect themselves to be able to remember. Their expectations are moulded by the beliefs of their memory efficiency. As an example, take the case of people who make extensive use of memory aids because they believe their memories to be unreliable. One person may regard consulting a diary to find out what time a meeting is scheduled, for example, as a memory failure. Another individual may not regard this in the least unfavourably and may in fact view it in a very positive light. That person may be pleased with him/herself for remembering to consult his/her diary and for making an appropriate entry in the first place. Negative expectations of performance may particularly characterise responses of people suffering from high levels of negative mood (see Chapter 10).

Remembering the memory failure at the time of recording

Hermann (1979) introduced the term 'memory introspection paradox'. This refers to the fact that those people most likely to make memory errors, are also those who are most likely to forget that those errors occurred!

On the whole, people do not carefully monitor their memories. In answering questionnaires they will make probability judgements based upon what they can recall of their memory failures. The frequency of memory failures will probably be judged by examining how easy examples are

to elicit and how many we recall. A good example here would be the case of word finding difficulties. The tip-of-the-tongue state is a memorable one because it often has repercussions. Stress can arise because of the inability to remember the name or word. In a 'blocked TOT' state, other phonetically similar words persistently intrude into one's thoughts, which adds to frustration. Stress or frustration as negative states are memorable experiences. TOT experiences may be rare, but because they are distinctive, they will be remembered and perhaps over-emphasised on the rating scale.

Judging the failure to be reportable

This relies entirely upon the discretion of the individual concerned. One person might deem the misplacement of something fairly inconsequential, or the loss of something for a short time only, as reportable whereas another may not.

Classifying or describing the failure

Accurate assessment of memory failures is not easy unless people become practised in recording failures. Shlechter and Hermann (1981) compared the frequency of subjects' diary entries for various types of memory failures with their ratings given on the Short Inventory of Memory Experiences (S.I.M.E.) made before diaries were begun. No correlation exceeded 0.15 (Pearson's r). Only the total S.I.M.E. score correlated significantly with the total

frequency of errors reported and even then that correlation was only 0.32. When diary reports were compared to S.I.M.E. ratings made after the diary study, correlations improved dramatically and two of the correlations exceeded 0.70. It seems then that accurate judgements of memory performance may require a good deal of practice.

It is the problems elaborated above, along with some of the apparently paradoxical findings surrounding memory questionnaires, and their relationship to test performance, that has caused a certain amount of scepticism to surround their use.

CHAPTER 10 : EPILEPSY, MOOD AND MEMORY: A NEGLECTED
RELATIONSHIP?

i. Epilepsy, Depression and Anxiety

Studies of the prevalence of, and vulnerability to psychopathology in epilepsy abound (e.g. Meier and French 1965, Flor-Henry 1969, Standage and Fenton 1975, Rodin et al 1976, Shukla and Katiyer 1980, Hermann et al 1982, Korgeogos et al 1982, Hermann and Whitman 1984). The majority of these studies have found elevated levels of depression and anxiety in people with epilepsy compared to healthy controls. However, when the comparison is against other chronic disabilities, the picture is less clear (e.g. Betts 1981, Hermann and Whitman 1984, Robertson 1988, Sorensen et al 1989).

The nature of the relationship which exists between mood and epilepsy is complex since both depression and anxiety can be directly or indirectly associated with the ictus and the underlying epileptogenic dysfunction (Betts 1981, 1988). It is, however, the reactive forms of these two moods which concern us since these are amenable to psychological treatment.

The prevalence of the two moods within the population of people with epilepsy is probably equivalent but, since both can occur together (Downing and Rickels 1974, Clancy et al 1978) and because anxiety is regarded as a symptom of neurotic depression anyway (Kendell 1976) comparison of

exact prevalence is probably inappropriate. What is clear is that both conditions can be extremely debilitating and can influence all aspects of functioning. Indeed, the moods may surpass the seizures themselves as the most disabling symptom of epilepsy (Commission for the Control of Epilepsy 1978). However, treatment options are typically limited to psychological interventions since chemotherapy is usually inappropriate for people with epilepsy (Robertson 1988). Few controlled outcome studies of the efficacy of psychological interventions to control negative moods have been undertaken and the results of those which have been conducted have been largely unconvincing (e.g. Davis et al 1984, Tan and Bruni 1986). Although there is some evidence that certain anticonvulsants and polytherapy are associated with negative moods while others appear relatively beneficial (e.g. Dodrill and Troupin 1977, Shorvon and Reynolds 1979, Ballenger and Post 1980, Okuma et al 1981, Folks et al 1982, Thompson and Trimble 1982, Thompson and Trimble 1983, Post 1986, Robertson, Trimble and Townsend 1987), it seems that behavioural and cognitive treatment options deserve more investigation and further refinement.

ii. Depression and Memory

The existence of some kind of memory deficit in patients with depression is well substantiated (e.g. Cronholm and Ottosson 1961; Sternberg and Jarvik 1976; Breslow et al 1980; Davis and Unruh 1980; Lang and Frith 1981; Cohen et al 1982; Koh and Wolpert 1983; Frith et al 1983;

Calev and Erwin 1985; Watts et al 1990). The nature of the impairment is however far from understood and the literature highlights four main questions with regard to this. First, there is debate about whether the deficit is functional or organic in nature (e.g. Sternberg and Jarvik 1976, Cohen et al 1982, Rattenburg et al 1983, Shima et al 1984, Calev et al 1986). The second question is whether the memory deficit associated with depression is specific in nature. Some authors have argued that verbal recall and learning are particularly impaired (Kahn et al 1975; Miller and Lewis 1977; Breslow et al 1980). Others have found greater impairment of non-verbal functions (Depulta and Yozawitz 1984). However, the debate remains open since the studies which have found differential impairments had failed to use matched tasks. When matched tasks are used specific deficits may not be found (Calev et al 1986). Still other research has found particular deficits of short term memory suggesting impaired registration in association with depression (e.g. Walton 1958; Friedman 1964; Sternberg and Jarvik 1976). On the other hand, some researchers have found either more widespread memory difficulties (e.g. Calev et al 1986; O'Connor et al 1990), or impairments which are best explained by deficits in performance/motivation as opposed to learning or recall per se (Davis and Unruh 1980). Deficits in sustained attention and/or concentration have also been considered as explaining apparent memory problems (Breslow et al 1980, Cohen et al 1982, Roy-Bourne et al 1986). Breslow et al specifically refer to a deficient alerting mechanism in depression.

The third area of debate is whether the memory problem is simply a cognitive symptom of the emotional state. Depression is characterised by lethargy, slowing, loss of motivation and lowered self-esteem. All of these symptoms may conceivably give rise to deficits in cognitive performance, as Davis and Unruh argue, which would increase with the demands of the task (Cohen et al 1982).

The final issue is one which is of particular relevance to this work. It has been suggested that since only weak correlations have been found to exist between memory complaints and impairments in depression, that the depression is causing the patient to exaggerate the memory difficulty. This relationship and resulting argument is familiar. It agrees with Sunderland et al's work with the head injured and with clinical findings in people with epilepsy. Hence, while it is possible that depression does cause an exaggeration of difficulties (depression is common post-head injury and in epilepsy), it is equally likely that everyday and traditional objectively assessed memory requirements are not the same.

The work examining complaints and test performance has concentrated upon elderly populations where complaints of memory failure and depression are both frequent (Zarit et al 1981; West et al 1984; Scogin et al 1985). Four typical papers are described next.

Kahn et al (1975) examined 153 subjects of 50 years or older, with varying degrees of depression and/or 'altered

brain functions'. Complaints about memory and test performance were compared. Level of depression was assessed using the Hamilton Depression Rating Scale (Hamilton 1967) and an adjective checklist. Dementia was diagnosed using two brief measures. The memory performance measures assessed immediate and delayed verbal recall and learning. The authors also devised scales to assess recent and remote autobiographical and semantic memory. Information on the level of memory complaint was derived from spontaneous comments offered at clinical interview. The authors found that while performance changed with altered brain function, complaints were related to depression regardless of performance. In fact, those in the organic group who were also depressed, complained more but actually performed better on the tests than their non-depressed counterparts. On the other hand, in the non-organic group, those who were depressed complained more, but their performance did not differ from those who were not depressed. The only test to correlate with complaint was prose recall (see Sunderland et al 1983). Kahn et al explain their findings by arguing that depressed patients are unduly pessimistic about their cognitive performance. They cite Beck's (1971) finding that depressed patients tend to underestimate the quality of their performance on a card sorting task compared to controls. It is interesting to note how this work ties in with the other popular area of research into depression and memory which has produced generally robust findings indicating that depressed people remember a significantly greater number of unpleasant rather than pleasant memories

(e.g. Bower 1981; Fogarty and Hemsley 1983). This apparent cognitive bias would support Kahn et al's theory that depression is causing an over statement of difficulties.

A smaller scale study was conducted by Popkin et al (1982). They compared 18 depressed elderly subjects with a group of normal elderly subjects matched for age and level of education. A battery of memory tests and a self-report questionnaire were used. Results were similar to Kahn et al's. Memory test performance did not differ between the groups. However, the depressed subjects complained of significantly more memory difficulties. Furthermore, memory complaints were significantly reduced for those subjects who benefited from psychotherapy sessions. It seems that psychological treatment for depression can have a measurable impact upon memory complaints. The picture in this respect is not a thoroughly optimistic one though. In a follow-up to Kahn et al's study, Niederehe (1976) found that self-reports of memory were inclined to remain stable over time even with positive changes in clinical status. Zarit et al (1981) on the other hand noted positive changes in depression as a result of memory training endeavours. The causal nature of the relationship between depression and memory complaints is unclear.

In 1989, Niederehe and Yoder conducted a thorough investigation into age-related metamemory. Forty-four younger (mean age 30.66 years) and 56 older women (mean

age 68.86 years) made up the subject group. Twenty-one of the younger women and 24 of the older women were depressed. Hence there were four groups of women matched for level of education. The authors found that compared to controls, the depressed subjects, older and younger, tended to report generalised and extensive memory problems on a 135 item metamemory questionnaire (adapted from Perlmutter 1978). The depressed subjects particularly complained of recent memory difficulties. There was no age by depression interaction in this relationship. The cumulative correlations between performance on objective measures and self-reports were reasonable, standing at 0.6 approximately. Again, the relationship did not vary as a function of age. This investigation dispels one criticism of the studies using elderly samples, that the effects of depression upon memory complaints may increase with age. The absence of interactions between age and depression in this study would argue against this.

The final study to be examined is that of O'Connor et al (1990). The authors identified normal, depressed and demented elderly persons using CAMDEX (Cambridge Mental Disorders of the Elderly Examination) in six G.P. practices. The method involves a diagnostic interview, taking medical and psychiatric histories, performing cognitive tests and collecting observer's reports of deterioration. The cognitive tests include a number of immediate and delayed memory tests and also tests of remote and recent semantic memory. Level of memory

complaint was derived from a series of seven questions and resulted in a seven point index. The authors describe their findings as being entirely consistent with Kahn et al's despite the very different subject samples. The depressed elderly subjects in this study reported memory problems more often than 'normal' subjects. Furthermore, the highest depression scores within the normal and demented groups were obtained from those subjects who reported memory problems. Regarding the relationship between memory complaints and test performance, correlations were poor for both the depressed and the normal groups. Performance itself was described as being erratic in the depressed subjects in the way Friedman (1964) had found. It was this irregular test performance that made interpretation of the deficit troublesome.

This set of studies is provocative, particularly the latter one, because correlations between complaints and performance were found to be poor, not only in depression, but also in normal elderly subjects. This evidence casts doubt upon the explanation of the relationship between depression and memory offered by Kahn et al (1975). What is clear, however, is that depression is strongly associated with memory complaints which are not paralleled by performance deficits in the elderly. It is manifestly necessary to examine the role of depression in relation to memory complaints in people with epilepsy.

iii. Anxiety and Memory

The effects of both state and trait anxiety upon short term memory have been extensively studied almost exclusively using the digit span test. Subjects high and low in state and trait anxiety are compared and results tend to be variable (see Eysenck 1979 for review). It is generally accepted, however, that trait anxiety has little or no effect upon digit span while state or test anxiety is related to negative performance (Wright 1954; Griffiths 1958; Capretta and Berkun 1962; Pyke and Agnew 1963; Dunn 1968; Hodges and Spielberger 1969; Finch et al 1976; Eysenck 1977; Mueller 1976, 1978; Haynes and Gormley 1977). However, relationships between cognitive performance and dependent variables are seldom so straightforward and, some studies have found interactions between anxiety, intelligence and performance (Calvin et al 1955; Hodges and Durham 1972; Knox and Grippaldi 1970). Furthermore, Verma and Nijhawan (1984) found interactions between intelligence, anxiety, and type of reinforcement. The relationship which is found between anxiety and task difficulty is as would be predicted by the Yerkes-Dobson Law (Yerkes and Dobson 1908) which proposes a curvilinear relationship between arousal and performance and that the optimal level of arousal varies inversely with task difficulty.

The findings outlined above are of only theoretical value for this particular research. Digit span can be argued to measure concentration as much as short term memory (e.g. Finch et al 1976), thus state anxiety may have its effects upon concentration rather than memory per se. Of

more bearing is the fact that the effects of anxiety on performance of simple objective tests may share little with its effects upon everyday functions. Perhaps a more suitable paradigm for the purpose of paralleling the more complex requirements of everyday memory would be the effects of anxiety upon incidental recall and/or learning. Studies using intentional and incidental dual task procedures have, on the whole, tended to demonstrate the negative effects of anxiety upon incidental learning performance and its lack of effect upon intentional learning (e.g. Silverman and Blitz 1956; Miller and Dost 1964; Markowitz 1969; Hamilton 1975).

Only a very few studies have probed the effects of anxiety upon everyday memory. Broadbent et al (1982) report that the total score on their CFQ correlates significantly with the neuroticism subscale of the EPQ and also with Spielberger's Trait Anxiety Scale. The same authors report significant modest but consistent correlations between depression and anxiety as measured by the Mental Health Questionnaire and CFQ scores for various different subject groups. On the basis of these findings, they argue that both depression and anxiety determine approximately 30% of the variance of the CFQ. The authors argue that a high CFQ score predisposes an individual to the negative effects of stress. Their data (i.e. the fact the CFQ is stable over time) is not consistent with the more intuitively pleasing view that cognitive failures become more frequent at times of high stress/anxiety.

A rather different report is given by Watts and Sharrock (1985). Recognising the concurrence of depression and anxiety, they considered the effects of state anxiety upon concentration problems of an everyday nature in a group of depressed patients. The authors state that "It is generally assumed that concentration problems in anxiety states take the form of mind wandering". Their patients complained mostly of problems with reading and watching television, and the authors used on-line self-report of concentration lapses while reading. They found from this analysis and from the results of other 'objective' tests, that the concentration difficulty reported by these depressed patients was indeed due to 'mind wandering'. Furthermore, the correlations between concentration problems and the severity and endogeneity of depression and state anxiety were generally very similar. However, statistical methods failed to unravel which emotional state was causing the problem.

In 1982 Yesavage and colleagues went a step further by applying therapeutic techniques to effect memory performance. They were interested in examining the effects of relaxation training upon performance of a memory and concentration task. They trained a group of elderly subjects, with differing original levels of anxiety, in typical relaxation techniques. Results were very favourable. The authors found that those subjects with high original levels of state anxiety performed significantly better on the memory and concentration task after successful relaxation training.

As with depression then, it seems that there is strong evidence to suggest the negative effects of anxiety upon concentration and/or memory. The work in this area is largely experimental, but the final study suggests possible applied therapeutic routes using the relationship between mood and memory function.

iv. Psychopathology and Neuropsychology in Epilepsy

Mood as a determinant of memory problems in epilepsy has been neglected. Some research has, however, been undertaken into the relationship between neuropsychological impairments and psychopathology in people with epilepsy and this requires discussion.

In 1969, Ferguson et al proposed that 'temporal lobe psychosis' is organic in nature and that this claim could be substantiated through three sources. First, by demonstrating the existence of deficits in higher cerebral functions related to the temporal lobe using neuropsychological tests. Second, by discovering areas of damage by neurosurgical investigation. Third, by examining mental content and higher cerebral functions during psychotic reactions and other altered states. The same authors further suggest that this kind of model may also explain the 'everyday psychopathology of patients with temporal lobe epilepsy'.

This original article provoked only a few follow-up papers which examined performance on batteries of

neuropsychological tests of patients with temporal lobe epilepsy (Stevens et al 1972) and of patients with generalised motor and temporal lobe epilepsy (Mathews and Klove 1968). Both of these studies made use of the MMPI and analysed results in terms of single scales. Neither study found any relationships between neuropsychological impairment and psychopathology. However in 1977, Mathews et al provided some evidence supporting a relationship when they noted elevated MMPI hypomania scores in 25 patients with low full scale IQs compared to 25 patients with significantly higher full scale IQs.

Interest in the area was revived by Hermann (1981) when he argued in favour of Ferguson et al's hypothesis. He proposed that research which had failed to demonstrate relationships between the two areas of functioning had used insensitive statistical techniques. Using a technique devised by Goldberg (1965), Hermann was able to demonstrate relationships between impaired neuropsychological performance and psychoticism in the data of two studies which were aimed originally at identifying correlates of unemployment in people with epilepsy (Batzel et al 1980; Dikmen and Morgan 1980). Furthermore, Hermann argues that this kind of relationship is not peculiar to those with temporal lobe epilepsy or particular seizure types.

Hermann's paper provoked an investigation which applied Goldberg's rules to the MMPI profiles of 34 patients with temporal lobe epilepsy grouped according to

neuropsychological performance. Moehle et al (1984) in fact collected data specifically on memory using the WMS but, failed to employ it to the full by grouping subjects according to an impairment index derived from the Halstead Reitan Neuropsychological Battery. Results did not support Hermann's hypothesis. In fact, by applying Goldberg's rules to the profiles of these temporal lobe epilepsy subjects, all were classified as psychotic.

A more recent study investigating psychopathology in limbic epilepsy considered possible relations between cognitive impairment and psychopathology. Czernansky et al (1990) assessed psychopathology using selected scales from the Brief Psychiatric Rating Scale (Overall and Gorham 1962), the Bear-Fedio Inventory (Bear and Fedio 1977), and the MMPI. A global performance score from the Luria Nebraska Neuropsychological Battery was used to identify cognitive impairment. The authors found that several measures of psychopathology, and of particular relevance here, including those measuring mood disturbance and anxiety were correlated with the degree of neuropsychological impairment in their sample of 21 mainly male patients with limbic epilepsy.

The results of research in this area is then extremely mixed and too few studies have been undertaken to allow guided interpretation. However, the manner in which the research has been channelled limits its practical utility. Since neuropsychological batteries have tended to be used to give a gross index of impairment, no conclusions can be

drawn regarding which cognitive skills are implicated. In some instances, data is available but unused. Perhaps more restrictive is the absence of debate regarding the nature of the relationship(s) between the cognitive and emotional areas. Ferguson's original premise that a shared organic base would explain any correlation is apparently unquestioned. This is, of course, a perfectly reasonable explanation but it does not rule out the possibility of other interactions between these cognitive and emotional variables. Such interactions should be contemplated. It is quite clear from research in other clinical populations and in experimental fields that both depression and anxiety can have detrimental effects upon memory complaints and/or performance. Since this type of relationship is of great value in terms of intervention, it requires proper exploration in people with epilepsy.

CHAPTER 11 : THE USE OF MEMORY AIDS AND MNEMONICS:
EXAMINING AND ALTERING MEMORY BEHAVIOUR

i. The Argument

While the advice given and the mnemonic strategies advocated by 'memory experts' are familiar to many, the nature of our everyday reliance upon more flexible, less task-specific aids to memory is relatively unfamiliar to psychologists. The increased interest in everyday cognitive psychology has, however, promoted some interest in the area of day to day 'memory behaviour'.

The use of memory aids and recall strategies is of interest because it can influence both memory performance and memory beliefs. The adoption of efficient and appropriate aids to memory can improve recall, but the less recognised relationship between the use of strategies and memory beliefs is also important. The amount of confidence one has in one's memory abilities regulates the use, and choice, of memory aids. Confidence levels, may, however, be unrealistic. Prevey et al (1988a) had found that their samples of people with temporal lobe epilepsy were inaccurate when it came to judging their learning and recall abilities. This inaccuracy of 'metamemory' would have effects upon their memory performance, they argued. It seems then that Prevey et al's subjects were displaying a trait typically associated with impairment of the frontal lobes (see also Guerrant et al 1962). The lack of insight into areas of weakness could contribute to

memory problems in people with epilepsy because they fail to adopt appropriate compensatory strategies.

The efficient adoption of memory aids and strategies in fact requires another set of skills widely regarded as governed by the frontal lobes i.e. organisation and/or planning. Mayes (1987) refers to five major groups of organic memory disorders, one of which comprises memory failures that are secondary to impairments of planning ability. It is argued that memory deficits arising from frontal lobe lesions will selectively effect certain memory tasks (i.e. recall of recently presented information) because of disability in the planning of complex encoding and retrieval strategies (Luria 1973; Shallice 1982). Evidence has accumulated which suggests that patients with frontal lobe damage tend not to apply encoding and retrieval strategies in verbal learning situations without guidance (Signoret and Lhermitte 1976; Hirst 1985; Hirst and Volpe 1988). Furthermore, Hirst (1985) found that his subjects with frontal lobe lesions tended not to be aware of how they could achieve more successful learning. This deficit in metamemory is remarkably similar to that reported by Prevey et al in their patients with temporal lobe epilepsy (1988b).

This converging evidence suggests that some people with epilepsy may display memory difficulties which are secondary to deficits in skills associated with the frontal lobes. Considering the frequency of reports of memory problems in epilepsy, this might appear to be

rather an untenable suggestion but, when one considers the often frequent and diffuse abnormal electrical activity involved in a generalised seizure, the susceptibility to disruption of these skills may not be so surprising. The memory problems in epilepsy are already regarded as multifactorial in origin and it is unlikely that an explanation along these lines could explain the entire situation. Should these deficits exist, though, it may be possible to detect them using appropriate psychometric measures sensitive to frontal lobe dysfunction. If deficits are found which are believed to be contributing to memory difficulties in some people with epilepsy and/or if there is insufficient reliance upon memory aids and strategies, then guidance in the appropriate and efficient application of strategies may be of some practical help.

ii. The Means to Change Memory Difficulties

Attempts at intervention to lessen memory difficulties within clinical populations are not new (see Yates 1966). However, during the past decade or so there has been an upsurge of interest in the area. Rehabilitation/retraining endeavours have been aimed almost exclusively at patients with severe head injuries, stroke or people with Korsakoff syndrome (e.g. Cermak 1976; Lewinsohn et al 1977; Grafman and Mathews 1978). The aim of the procedures has mainly become the amelioration of difficulties rather than the restoration of function. The latter is now widely regarded as an optimistic aim (Moffat 1984). Time is now considered to

be the greatest healer of memory functions after trauma. However, some still rely upon techniques which stress memory practice. These have been termed 'repeated practice procedures; (Bennett-Levy 1984) and they are aimed at retraining cognitive functions along the lines of 'practice makes perfect'. A typical example would be the memory span training conducted by Gianutsos (1981).

Procedures aimed at ameliorating memory problems concentrate efforts upon finding ways around the difficulties. Bennett-Levy has referred to this as 'specific strategy training'. It is these techniques which now enjoy the wider use. Generally they involve training in the use of mnemonic strategies which allow alternative ways of encoding, storing and retrieving information to be remembered.

There are a number of strategies and techniques which may be suitable for the various kinds of memory deficit. However, they all share one aim and that is that the learned benefits should generalise to the real world. Generalisation has to be the single most important aim of cognitive retraining. There is, after all, little point in teaching someone to use visual imagery to remember faces and names in magazines if they do not find the technique useful in their daily life. How does specific strategy training fare in terms of generalisation to everyday memory? Bennett-Levy (1984) has suggested that generalised benefits can arise from these procedures provided that the need for generalisation is stressed

within the teaching programme. Grafman (1983) found that the benefits of his memory programme spread to improvements at home, work or school for 40% of his patients. The programme continually stressed the need to use the strategies twenty-four hours a day, every day. The clients were constantly asked to explain to others the strategies they had been taught. Others are less optimistic about the applicability of mnemonic techniques to everyday life (e.g. O'Connor and Cermak 1987). It does seem though that generalised benefits can occur for some patients providing these aims are stressed during teaching. It would be reasonable to assume that the more problem-centred the approach is, the greater will be the generalisation. If the teaching is firmly based upon amelioration of memory difficulties of an everyday kind, then generalisation should be a more natural process. Hence, an everyday memory assessment to determine where problems lie would be the logical starting point of a retraining programme.

Many other problems accompany the efficient adoption of memory retraining techniques. The rather unpromising feel which comes from the literature is no doubt a reflection of these problems. The severe deficits of the client groups is an obvious example. Amnesics will be very prone to losing external memory aids such as memo pads as well as being unable to remember how and when to apply internal mnemonics. The magnitude of the task becomes even clearer when one considers the several individual neurological variables which have to be taken

into account. Wilson and Moffat (1984) state that an all-encompassing style of intervention will be of little value to a densely amnesic client group. Each individual has to be examined separately, giving consideration to his/her own difficulties, as well as the nature of his/her injury or damage. It would be quite inappropriate to suggest the use of visual imagery strategies as an aid to memory for someone with clear right hemisphere damage for example (Jones 1974, Jones-Gotman and Milner 1978). From this overview of the difficulties, it is clear that rehabilitative intervention with densely amnesic clients will be very time consuming and labour intensive. People with epilepsy and memory difficulties may prove to be an easier group. Their memory problems may be less severe and the patients may be more insightful of their difficulties. The task of retraining would, at first glance, appear to be a more manageable one. Motivation to participate in intervention procedures should be high, since people with epilepsy frequently complain of everyday memory difficulties. What is more, the training perhaps need not be so intensive for the majority of people with epilepsy, since the techniques are less likely to be forgotten between teaching and actual use.

PART B : THE STUDIES

STUDY A : The Questionnaire Survey

The Rationale

The survey is a large scale cross-sectional questionnaire study, aimed at answering the following questions:-

- What opinions do people with epilepsy hold about the nature and efficiency of their memory?
- How do these beliefs differ from those of people who do not have epilepsy?
- What factors may influence these beliefs?

The survey concentrates solely upon beliefs about memory and does not address how accurate these are.

The Hypotheses

The following hypotheses detail the expected findings:-

1. People with epilepsy would report having greater difficulties with their memories than people without epilepsy.

2. Observers would also report greater problems for people with epilepsy compared to those without but, would report fewer problems on the whole than target subjects themselves.

3. Naming difficulties are often reported clinically and hence it was expected that the 'tip-of-the-tongue' difficulty would produce the most problems for people with epilepsy. It was further anticipated that problems with a heavy prospective memory element, involving planning and organisational skills, would be more frequent in the epilepsy group.

4. It was expected that relationships would exist between neuroepileptic and treatment variables and complaints of poor memory. These relationships would be as predicted by previous literature examining traditional performance measures.

5. A comparison of the use of memory aids and mnemonics would reveal that subjects with epilepsy report using the devices and techniques less than subjects without epilepsy.

6. The difference in levels of memory complaint made by subjects with and without epilepsy will be related to the

sufficiency or adequacy of use of these memory techniques and devices.

7. The use of memory aids and mnemonics in subjects with those neuroepileptic and treatment characteristics which had been found to be associated with memory complaints may be lower or less efficient than in other epilepsy subjects.

8. The moods of anxiety and depression were expected to be elevated in people with epilepsy compared to those without. Furthermore, it was expected that a significant proportion of people with epilepsy would be both anxious and depressed.

9. Significant positive relationships were expected to exist between the level of perceived memory complaint and the degree of both anxiety and depression.

10. Subjects reporting both anxiety and depression were expected to report more memory failures than subjects indicating symptoms of just one emotional state.

11. Elevated levels of depression and anxiety were expected to be related to the neuroepileptic and treatment variables found to be significant in terms of memory complaint.

Method

Seven questionnaires were to be completed. The reasons governing the choice of these and a description of each is given next.

1. The Memory Questionnaire

A good many factors should influence which questionnaire to choose in studies of everyday memory. The most important of these are the population of study, the nature of the inquiry, and the requirements and purpose of the data collection. Since the intention here is to collect large amounts of data, the measure should be brief and reasonably easy to complete to insure maximum response rates. The focus of the inquiry is to be the memory complaints of people with epilepsy and so a questionnaire which examines the frequency of everyday memory failures would be most appropriate. Furthermore, a measure which was devised for use in a neurological sample would presumably be suitable since the most likely kinds of memory complaints will have been incorporated into the measure. To insure a large and geographically dispersed sample, a measure designed for postal administration would be the best. One other factor influences the choice for this research, and that is, the need for some kind of validity check on the subject's reports. A measure which could be easily adapted into an observer's version and,

which could be used in a prospective fashion to contrast with the metamemory results would be ideal.

Of the measures available, one stands out as satisfying the above requirements. The Head Injury Postal Questionnaire has the features which make it suitable for this and future investigations in the area. The measure was adapted and used to assess the subjects' beliefs regarding their everyday memory performance (MQ = memory questionnaire. See Appendix II). Two modifications have been made, both suggested by the original authors in order to decrease the complexity of the questionnaire and increase response-rates. First of all, the number of items was reduced to eighteen. Sixteen items refer to problems which were reported as occurring within the head injured group and, seemed appropriate for people with epilepsy according to findings of a pilot study. The remaining two items (10 and 18) referred to difficulties reported very seldom by the head injured sample. These are included as an indication of response bias where subjects may be reporting a high frequency of errors irrespective of the content of the inquiry. The second adaptation involved the simplification of the response key from a nine point scale to a six point time-specific scale. The end points are defined by responses of 'not at all' and 'more than once a day'. In completing the questionnaire, the subjects were asked to refer to their memory performance specifically over the last three

months. It should be stressed that within this modified version, and the original, there are items which may not usually be considered to represent memory failures but for which a memory failure may reasonably be expected to lie at the root of the difficulty (e.g. items 6, 12, 14 and 17. Sunderland et al 1983). Five categories of memory failure are included in the original and modified measure. These are 'speech', 'reading and writing', 'faces and places', 'learning new things' and 'actions' (Sunderland et al 1983).

In addition to the eighteen questionnaire items, an open ended inquiry asked subjects to specify any other memory or concentration difficulties. Also, to take account of the different degree of importance that memory failures may have for different individuals depending, for example, upon their lifestyle and personality, respondents were asked to rate the degree of nuisance their memory and concentration difficulties represented to them. Subjects chose from four alternatives: no nuisance; a slight nuisance; a moderate nuisance; a serious nuisance. Subjects were requested to complete this questionnaire first to prevent possible induced negative states arising from the mood scales from influencing responses. The MQ total score is derived by adding the individual responses which were all found to be positively correlated with the total in Sunderland et al's (1983) work. It has a range between 18 and 108 and high scores

represent greater reported difficulties.

2. The Memory Questionnaire - Observer

This questionnaire is equivalent in content and format to the Memory Questionnaire (MQ) but adapted for completion by someone in daily contact with the subject (RMQ. See Appendix III). The observer is asked for his/her opinions about how the subject fares on the eighteen items, the open ended question and the subjective rating scale. They were asked to complete this independently of the subject.

3. The Memory Aids Checklists

In order to establish whether people with epilepsy are using memory aids and strategies in efficient and appropriate ways, it would be helpful to have some idea of which are the most widely used generally. In two interview studies, Harris (1980) attempted to answer just this question. The combined data provides reasonable information on the most frequently used memory aids and mnemonics.

External Memory Aids

External memory aids are those which transfer the burden of recall on to someone or something else. The eight

most frequently used are shown in Table Three.

Table Three: The eight most frequently used external memory aids.

Keeping things in special places.

Personal memos.

Diaries.

Shopping lists.

Asking someone to remind you.

Alarms (for cooking and other tasks).

Year planner/calendar.

-Writing on your hand.

From Harris (1980)

Examination of the efficiency and adequacy of use of these aids would require quite in-depth investigation. To find out which are ever used by people with epilepsy would involve the compilation of a simple checklist.

Internal Mnemonic Strategies

Internal memory strategies are those which aid encoding, storage and/or retrieval within the mind itself. The burden of remembering remains entirely with the subject, but information is encoded in a more efficient manner. Table Four shows the eight most commonly used internal strategies according to Harris (1980).

Table Four: The eight most frequently used internal mnemonic strategies.

Mental retracing of events (retrieval only).

Alphabetical searching (retrieval only).

First letter mnemonics (e.g. Richard Of York Gave Battle In Vain).

Rhymes (e.g. in 1492 Columbus sailed the ocean blue).

Method of loci.

Story method.

Face-name association.

The Peg method.

As with external aids, the use of these strategies by people with epilepsy can be judged using a simple checklist. However, because the names of these techniques are less well known, some explanation of each technique would be necessary.

(MACLS)

Two very simple checklists_A were therefore constructed to assess the use of various memory aids and strategies. The eight most common external aids and internal strategies were incorporated in a yes/no format (see Appendices IV and V). An open ended enquiry was added to the external aids checklist to reflect the use of the many other forms of external strategy. Details of exact frequency of use was not requested on either checklist with the exception of diary use where subjects were asked .

to indicate if they used it daily, weekly or less than weekly.

iv. The Mood Inventories

The only feasible way to collect mood data upon large numbers of subjects using remote survey techniques is to rely upon self-report inventories. A number of these are widely available but they tend to suffer the general difficulties associated with all self-report measures. The scales are nevertheless widely accepted as providing valid and reliable indications of a person's emotional state (e.g. Beck et al 1961, Snaith and Taylor 1985).

However, Carroll et al (1973) have pointed out, of depression measures, that the choice of scale is often an unguided one. There seems to be little to distinguish one scale from another. In a survey containing other questionnaires, brevity of measures must be considered to maximise response rates.

In addition to brevity, a few considerations arise with regard to the sample being investigated. First, while past research has indicated the high incidence of depression and anxiety in epilepsy (Betts et al 1981), the subjects must not be considered psychiatric. Therefore, the measure(s) of choice should be tactful, and in no way imply 'madness'. Measures should cover a whole range of

severities since levels can vary considerably within the experimental population. Furthermore, guidelines should be available on cut-offs for different severities of the moods since these are useful, both clinically, and in statistical analysis of findings. The individual items incorporated in the mood scale should be examined. Many symptoms of both depression and anxiety can be similar to pre-ictal, ictal and post-ictal signs. Typical examples would be 'butterflies in the stomach' and sleep disturbance. Other symptoms of negative emotional states are similar to the side effects of antiepileptic drugs, e.g. psychomotor slowing. Others still have been associated with the condition of epilepsy itself, for instance, irritability, hyposexuality and somatic preoccupation (Bear and Fedio 1977). Physical and somatic symptoms, and others which are likely to be shared by the seizure condition, should where possible, be excluded to prevent the occurrence of elevated mood profiles arising from reference to epilepsy-related symptoms.

Another difficulty to consider is the concurrence of both moods within one condition. A person diagnosed with primary depression for example will very often have elevated levels of anxiety as well (Mendels et al 1972, Eatton and Ritter 1988). The two conditions have much in common in terms of symptomatology. Within an investigation where the roles of both states upon an

independent variable are being considered separately, it would be useful to be able to reliably discriminate one from the other so that possible differential effects may be explored. Two scales were chosen which reflect these concerns.

a. The Hospital Anxiety and Depression (HAD) Scale
(Zigmond and Snaith 1983).

The HAD scale is a self-assessment measure for the detection of the moods of depression and anxiety in a non-psychiatric population attending outpatient departments or general practice clinics (see Appendix VI). In examining depression, it concentrates upon anhedonia, regarded by Snaith (1983) as being the feature most indicative of biogenic depression. The measure comprises two subscales with seven items each. Each item is scored on a four-point severity scale from nought to three, so making the maximum score for both subscales twenty-one. A cut-off indicating a mild degree of disorder is suggested at eight or nine depending upon whether the particular population is associated with elevated levels of either mood. A cut-off score of nine is therefore used here. The authors argue that anxiety and depression are clearly differentiated by avoiding the inclusion of symptoms common to both and indeed, those which may be shared with physical illnesses, for example, insomnia.

b. The Beck Depression Inventory (BDI) (Beck et al 1961).

The BDI, twenty-one item version (see Appendix VII), is used in this study as a more thorough screen for symptoms of depression. Some of its items may be considered to be typical symptoms of anxiety and physical illness as well. Nevertheless, it is widely used in this country both clinically and as a research tool and reports of its reliability and validity are well known. The BDI is scored on a four-point severity scale where subjects choose from responses ranked nought to three. The maximum score is sixty-three and the cut-off for mild depression adopted in this study is thirteen. Although somewhat arbitrary, the score of thirteen was adopted because it represented a compromise between cut-off scores suggested by other authors. In their 1984 study of patients with complex partial seizures, Pereni and Mendius adopted a cut-off of ten which they stress was suggested by Beck (1972). However, according to Beck et al (1961) the cut-off for mild depression in patients with various psychiatric diagnoses is somewhat higher (18-19). Metcalfe and Goldman (1965) suggest a figure of 14.27 as indicating mild depression in their sample of British subjects with depressive illness. It was therefore decided to adopt a figure which lay between those suggested by Pereni and Mendius (which may be considered rather low given the high prevalence of 'depressive' symptoms in people with the epileptic condition) and

Metcalfe and Goldman whose data pertains to patients with confirmed depressive illness.

v. The Personal Details Form (see Appendix VIII)

Details upon age, sex, occupation and education were requested from subjects with and without epilepsy. Subjects with epilepsy were additionally asked to supply information on: age of onset, duration of epilepsy, and seizure type. Information on approximate seizure frequency was requested with choices made between daily, weekly, monthly, less than monthly and yearly or less. Regarding the focus of epileptic discharge, subjects choose from nine alternatives including responses of 'don't know' and 'no focus'. The form also requested information on the type of anticonvulsant medication taken and the level of medical supervision received.

SUBJECTS

Subjects were collected in a variety of ways. Some responses were gathered personally during outpatient clinics, other outpatients were contacted by post. British Epilepsy Association (BEA) self-help groups were contacted and told of the study. An announcement calling for subjects was placed in one issue of the BEA's monthly newsletter. As a result of various individuals and organisations placing announcements of the study in

several publications, the vast majority of subjects (83.6%) were collected postally.

The resulting sample is likely to be fairly representative of the population as a whole in terms of the nature and severity of the condition. However, the voluntary nature of the study will probably have produced biases favouring those reporting memory difficulties.

The following selection criteria directed entry into the study. Subjects were to be sixteen to eighty years of age and must have verified epilepsy. Endeavours were made to exclude any subject with a history of excessive alcohol intake or drug abuse. Similarly, no subjects were included who had undergone surgical techniques for the relief of their epilepsy. Patients suffering from pseudoseizures only, or other seizures which were not epileptic in origin, were also to be excluded. However, because of the remote data collection, it was not possible to apply selection criteria rigidly at all times. It is therefore possible that some subjects are included who would have been excluded had case histories been available for them.

A smaller number of subjects without epilepsy were gathered through similar channels (n = 146). The majority were either relatives of people with epilepsy or people working in the 'caring' professions. As far as

could be ascertained, the group comprised healthy individuals and certainly none had any known neurological condition. Subject numbers, categories and demographic details are shown in Table A1.

Statistical Treatment of the Data

Data analysis was conducted using the Statistical Package for the Social Sciences P.C. version. Non-parametric significance tests were used for measures which did not satisfy the assumptions necessary for adoption of parametric procedures. That is, those where the underlying scoring scale was not continuous or those in which the distribution of scores was skewed from the normal. Thus, the memory questionnaire data using the discrete 6-point rating scale was analysed using non-parametric statistical tests in the first instance. However, given that opinions seem to differ regarding the use of parametric procedures with questionnaire data such as this, it was decided to perform limited multivariate analysis in order to clarify which independent variables are related to self-report memory to the greatest extent.

A significance level of 0.01 was adopted where large group comparisons were made, for example, where the survey data for the epilepsy group as a whole was compared to the non-epilepsy group. Where smaller group comparisons were

carried out, such as those between neuroepileptic subcategories, a significance level of 0.05 was considered adequate for demonstrating differences.

Table A1: Demographic Details and Epilepsy Patient Categories of the Samples. (Frequencies and Approximate Percentages).

	Epilepsy Group	Non-epilepsy Group
NUMBER	760	146
AGE		
\bar{x} (sd)	37.5 yrs (13.8)	43.5 yrs (13.6)
Range	16-79	16-78
SEX		
Male	355 (47%)	38 (26%)
Female	405 (53%)	108 (74%)
EDUCATION	Missing details = 137	Missing details = 11
Degree	101 (16%)	37 (27%)
Prof. Qualification	49 (8%)	13 (10%)
'A' Levels	105 (17%)	34 (25%)
'O' Levels	143 (23%)	28 (21%)
CSEs	57 (9%)	4 (3%)
None	168 (27%)	19 (14%)
OCCUPATION	Missing details = 37	Missing details = 6
Professional	59 (8%)	15 (11%)
Intermediate	87 (12%)	25 (18%)
Skilled	66 (9%)	21 (15%)
Semi-skilled	88 (12%)	21 (15%)
Unskilled	91 (12.5%)	13 (9%)
Student	42 (6%)	4 (3%)
Unemployed/housewife/ retired	290 (40%)	41 (29%)
PATIENT CATEGORIES		
Outpatient	519	
Inpatient	60	
General Practice	181	

RESULTS

The Nature and Extent of Perceived Memory Difficulties in People with Epilepsy

The Epilepsy Patient Categories

Three level of care categories were applied to the epilepsy subjects. Some patients with epilepsy are supervised entirely at the primary care level by their GPs. Others, by nature of their cases, are referred to non-specialist or specialist neurologists. That is to say they are treated at secondary or tertiary care levels. Finally, a minority of patients require a period of inpatient care at special centres for purposes of closer assessment, drug therapy rationalisation or investigative assessment procedures prior to possible surgical treatment. These levels of care define, to an extent, the severity and nature of the patient's condition. The sample collected in this study were mostly outpatients, secondary or tertiary (N = 519). Patients from the primary care level were fewer (N = 181) and only a small number were inpatients at the time of the study (N = 60).

Demography

It is clear from Table A1 that the groups are not well matched for demographic characteristics. The six year

difference in the mean age of the groups is highly significant ($t = -4.76$, 895df, $p < 0.0001$, 2 tailed). The non-epilepsy group is significantly older.

Chi square analysis revealed a significantly higher proportion of females in the non-epilepsy group where the female/male ratio is approximately 3:1 ($\chi^2 = 21.33$, 1df, $p < 0.0001$).

The distribution of educational achievement is also different between the groups ($\chi^2 = 25.495$, 6df, $p < 0.0005$). A higher proportion of the non-epilepsy group have graduated ($\chi^2 = 8.57$, 1df, $p < 0.0005$) and a significantly higher proportion of the epilepsy group have no qualifications ($\chi^2 = 9.26$, 1df, $p < 0.005$).

Differences in occupational status are less obvious, although the distribution within the groups is different ($\chi^2 = 15.27$, 7df, $p < 0.005$). The difference lies in the proportion of the groups who fall into the unemployed/housewives/retired category and the proportion who are full-time students, but these differences do not reach significance at the 0.01 level ($\chi^2 = 5.37$, 1df, $p < 0.05$; $\chi^2 = 4.98$, 1df, $p < 0.05$, respectively).

The MQ, RMQ and Nuisance Ratings

In order to check the appropriateness of taking the total

score to be an approximate measure of general impairment, responses to each individual item were correlated with the summed score for epilepsy and non-epilepsy subjects separately and for both MQ and RMQ measures. For those with and without epilepsy all correlations (Kendall's Tau) were positive. For the epilepsy group the range of correlations lay between +0.35 and +0.62 for self-report and observer's measures except those for items 10 and 18 which fell below 0.31. For the non-epilepsy sample MQ correlations fell between +0.2 and +0.53 except for items 10 and 18 which fell below +0.2. RMQ correlations for this group ranged between +0.28 and +0.575 with the exception of the same two 'affirmation bias' items where correlations fell below +0.27. It was therefore deemed acceptable to use the summed scores as measures of general impairment.

Table A2 shows the summary statistics of the total MQ score (MQtot), the total RMQ score (RMQtot) and the nuisance ratings given by subjects and observers (MQrat and RMQrat) for both groups.

Table A2: Summary Statistics of MQ total, RMQ total and Frequency of Nuisance Ratings for Epilepsy and Non-Epilepsy Groups.

	Epilepsy	Non-epilepsy
Median MQ total	49	39
Range MQ total	18-107	20-77
Median RMQ total	41 (n = 680)	32 (n = 129)
Range RMQ total	18-100	18-82
MQ Rating	Missing details = 6	Missing details = 2
No nuisance	87 (11.5%)	51 (35.5%)
Slight nuisance	259 (34%)	60 (42%)
Moderate nuisance	266 (35%)	30 (21%)
Serious nuisance	142 (19%)	3 (2%)
RMQ Rating	Missing details = 100	Missing details = 21
No nuisance	156 (24%)	71 (57%)
Slight nuisance	247 (37%)	42 (34%)
Moderate nuisance	178 (27%)	10 (8%)
Serious nuisance	79 (12%)	2 (1.5%)

Differences in terms of memory complaints are clear. Not only do the subjects with epilepsy report a higher level of difficulty on the MQtot using a large sample Mann Whitney 'U' test ($z = -7.78$, 1 tail, $p < 0.0001$) but, their relatives confirm this belief ($z = -5.54$, 1 tail, $p < 0.0001$).

Examining the subjective nuisance ratings, the difference between the groups remains for self-report and observer's reports ($\chi^2 = 75.34$, 3df, $p < 0.0001$, and $\chi^2 = 67.13$, 3df, $p < 0.0001$ respectively).

Kendall's Tau correlations reveal significant moderate relationships between self and observer's reports, subjective nuisance ratings and total questionnaire scores for the two groups. Correlations can be seen in Table A3.

Table A3: Kendall's Tau Correlations between Self and Observer Scores and Subjective Nuisance Ratings for Epilepsy and Non-epilepsy Groups.

	<u>Epilepsy</u>	<u>Non-epilepsy</u>
MQ total x RMQ total	0.458 (n = 681)	0.408 (n = 129)
MQ total x MQ rating	0.497 (n = 753)	0.477 (n = 143)
RMQtotal x RMQ rating	0.517 (n = 659)	0.349 (n = 124)

Given the demographic differences between the groups it is crucial to establish the influence of demography upon the MQ responses in both groups.

The correlations found between the total score on the MQ and age in the two groups were weak (Epilepsy group Tau = 0.1183, $p < 0.0001$; Non-epilepsy group Tau = -0.07661, ns). There is therefore little evidence to argue for a

strong relationship between age and MQtot in the groups, particularly considering the opposite directions of the group correlations. There is perhaps however a tendency for the older epilepsy subjects to report higher levels of difficulty.

Sex does not appear to be a variable which directly influences MQtot either. A Mann-Whitney 'U' Test revealed that scores on the MQ are not influenced by sex in either group (Epilepsy group $z = -0.3128$, 2 tailed, ns; Non-epilepsy group $z = -0.5197$, 2 tailed, ns).

The Kruskal-Wallis Nonparametric One-Way Analysis of Variance Test was used to assess the influence of both education and occupation upon MQtot. Educational grouping did not influence scores on the MQ in either group (Epilepsy $x^2 = 12.2$, ns; Non-epilepsy $x^2 = 5.96$, ns). Occupational status also lacked influence upon MQtot for both groups (Epilepsy $x^2 = 7.8$, ns; Non-epilepsy $x^2 = 6.68$, ns).

As an extra precaution against hidden effects of the unmatched variables, the two groups were separated into educational grouping thereby sampling out an area of large cross-group difference. Thus, six subgroups matched for educational achievement were examined in terms of scores obtained on the MQ and RMQ. Data from the two groups were split into three educational subgroups, those with

degrees and professional qualifications (group A); those with 'A' and 'O' levels (group B) and those who obtained CSEs or no qualifications (group C). Demographic details of the epilepsy and non-epilepsy group as arranged by education can be seen in Table 4.

Table A4: Demographic Details of Epilepsy (E) and Non-epilepsy (N-E) Educational Attainment Subgroups

	GROUP A		GROUP B		GROUP C	
	E	N-E	E	N-E	E	N-E
NUMBER	151	50	248	62	225	23
AGE \bar{x} (sd)	39.7 (11.975)	40.3 (12.932)	35.4 (13.138)	*45.05 (13.89)	38.7 (14.977)	42.7 (12.34)
PROFESSIONAL	53 (35%)	13 (26%)	1 (0.5%)	1 (1.5%)	-	-
INTERMEDIATE	45 (30%)	20 (40%)	31 (12.5%)	5 (8%)	2 (1%)	-
SKILLED	5 (3%)	5 (10%)	37 (15%)	15 (25%)	11 (5%)	1 (4%)
SEMI-SKILLED	4 (2.5%)	1 (2%)	42 (17%)	13 (21%)	22 (10%)	*7 (30%)
UNSKILLED	2 (1%)	-	23 (9.5%)	4 (7%)	47 (21%)	8 (35%)
STUDENT	8 (5%)	-	26 (11%)	3 (5%)	4 (2%)	1 (4%)
UNEMPLOYED/ HOUSEWIFE/ RETIRED	33 (22%)	11 (22%)	83 (34%)	20 (33%)	134 (61%)	*6 (26%)
% MALE	53% *	30%	39% *	18%	49%	35%
% FEMALE	47%	70%	61%	32%	51%	65%
MEDIAN MQ _{tot} (range)	48 @ 18-87	40 26-60	50 @ 18-92	36.5 20-61	51 @ 18-107	37 22-75

* p < 0.01 @ p < 0.001

Some demographic differences between the epilepsy and non-epilepsy education subgroups are still evident, but less marked. The differences in MQtot between the epilepsy and non-epilepsy groups still exist (group A, $p < 0.001$; group B, $p < 0.001$; group C, $p < 0.001$). In each case the epilepsy group scored significantly higher. However, none of the demographic differences which still existed within the matched education subcategories were found to effect MQtot or RMQtot.

It seems reasonable to conclude, therefore, that while the two groups are not well matched for demographic characteristics, these differences are not exerting any direct, observable influence upon the level of reported memory failures.

Qualitative Differences

It would be useful to examine responses to the MQ qualitatively, so that any differences in profile of difficulties may be distinguished. The top five memory failures for both groups were found by examining the frequency of daily reports of failures (frequency of responses of E and F on MQ). These top five difficulties can be seen in Table A5. The major failures, as reported by subjects themselves and their observers, are very similar in the two groups.

Table A5: The Top Five Problems of Epilepsy and Non-epilepsy Groups as reported by self and observers.

Epilepsy		Non-epilepsy	
Self	Observer	Self	Observer
I Tip-of-the-tongue (43%)	Forget told something (26%)	I Go back to check (20.5%)	Losing things (15.5%)
II Go back to check (39%)	Go back to check (25%)	II Losing things (18.5%)	Rambling on (12%)
III Losing things (33%)	Tip-of-the-tongue (24%)	III Forgetting names (14%)	Go back to check (11%)
IV Forgetting names (31%)	Losing things (22%)	IV Tip-of-the-tongue (14%)	Forget told something (8%)
V Forget told something (30%)	Rambling on (19%)	V Rambling on (11%)	Tip-of-the-tongue (6%)

Further qualitative analysis using the Chi square test showed that thirteen out of eighteen items on the MQ were reported as occurring daily, significantly more often by the epilepsy group compared to the non-epilepsy group. The five items which were not significant at the 0.01 level included the two items which were incorporated into the measure to indicate response bias (ten and eighteen). The remaining three items (two, seven and fifteen) all tended towards presenting greater problems for the epilepsy group. Analysing the RMQ in the same manner produced fewer significant results. Ten out eighteen items could not be statistically analysed because too few non-epilepsy subjects reported the problems occurring daily. Of the remaining eight, six were reported as occurring significantly more often daily by the epilepsy group (four, five, eight, eleven, fourteen and fifteen). Again, none of the items produced a reverse trend.

The Relationship Between Memory Complaints and the Epilepsy-related Variables

The influence of six seizure related and two treatment variables upon MQtot and MQrat were considered. These were:-

- Age of onset of epilepsy.
- Duration of epilepsy.
- Type of seizures.
- Frequency of seizures.
- Number of different seizure types.
- Focal-onset.
- Type of monotherapy taken.
- Total number of anticonvulsants taken.

Descriptive statistics, frequencies and percentages of these variables within patient categories and for all epilepsy subjects taken together can be seen in Table A6. It should be borne in mind that for the majority of subjects (83.6%) these details were self-reported. Therefore data relating to seizure type and focal onset in particular may be rather unreliable.

Table A6: The Neuroepileptic and treatment characteristics of the epilepsy subgroups and whole sample

	Ops n = 519	IPS n = 60	GPS n = 181	All n = 760
MQtot median	49 (18-107)	46 (18-84)	51 (18-98)	49 (18-107)
RMQtot median	41 (18-100)	39 (18-71)	41 (18-97)	41 (18-100)
@% complainers on MQrat	56%	30%	57.5%	54%
Xage (s.d) yrs	36.7 (13.6)	28.4 (9.35)	42.65 (13.6)	37.5 (13.8)
Sex % Female	54.3%	48.3%	51.9%	53.3%
Xage onset (s.d) yrs	19.1 (14.39)	11.72 (6.46)	22.2 (15.9)	19.25 (14.5)
X duration (s.d) yrs	17.59 (12.6)	16.2 (8.75)	20.6 (14.37)	18.2 (12.9)

SEIZURE TYPES				

FREQUENCIES AND (PERCENTAGES)				

Primary Gen.Ton.Clonic	76 (14.64%)	10 (16.67%)	23 (12.71%)	109 (14.3%)
Secondarily Generalised	154 (29.67%)	31 (51.67%)	52 (28.73%)	237 (31.2%)
Partial (complex and/or simple)	181 (34.9%)	43 (71.67%)	63 (34.8%)	287 (37.76%)
Other (e.g. absences, myoclonus)	50 (9.63%)	18 (30%)	19 (10.5%)	87 (11.45%)
Unknown/unclear	58 (11.2%)	-	24 (13.26%)	82 (10.79%)

SEIZURE FREQUENCIES *				

Primary Gen.Ton.Clonic	1 (3%)	-	-	1 (0.92%)
2	6 (7.9%)	4 (40%)	-	10 (9.2%)
3	16 (21.05%)	5 (50%)	4 (17.4%)	25 (22.9%)
4	30 (39.5%)	-	6 (26.1%)	36 (33.03%)
5	23 (30.25%)	1 10%	13 (56.5%)	37 (33.9%)

@complainers = those reporting moderate or serious memory nuisance.

Table A6 (cont)

Secondary Generalised	1	6 (3.9%)	4 (12.9%)	1 (1.9%)	11 (4.64%)
	2	21 (13.64%)	9 (29%)	3 (5.8%)	33 (13.9%)
	3	36 (23.4%)	8 (25.8%)	7 (13.5%)	51 (21.5%)
	4	47 (30.5%)	7 (22.6%)	11 (21.15%)	65 (27.4%)
	5	44 (28.6%)	3 (9.7%)	30 (57.7%)	77 (32.5%)
Partial (Complex and/or Simple with/without secondary generalisation)	1	31 (17.1%)	19 (44.2%)	4 (6.35%)	54 (18.8%)
	2	52 (28.7%)	18 (41.9%)	15 (23.8%)	85 (29.6%)
	3	44 (24.3%)	3 (6.98%)	15 (23.8%)	62 (21.6%)
	4	32 (17.7%)	3 (6.98%)	12 (19.1%)	47 (16.4%)
	5	22 (12.2%)	-	17 (26.98%)	39 (13.6%)
Other (absence, myoclonus, etc.)	1	19 (38%)	9 (50%)	2 (10.5%)	30 (34.5%)
	2	6 (12%)	5 (27.8%)	2 (10.5%)	13 (14.9%)
	3	3 (6%)	2 (11.1%)	3 (15.8%)	8 (9.2%)
	4	15 (30%)	1 (5.56%)	5 (26.3%)	21 (24.1%)
	5	7 (14%)	1 (5.56%)	7 (36.8%)	15 (17.2%)
Number of seizure types	n = 319	n = 57	n = 122	n = 498	
	1	191 (59.9%)	19 (33.33%)	88 (72.1%)	298 (59.8%)
	2	118 (37%)	31 (54.4%)	32 (26.2%)	181 (36.3%)
	3	9 (2.8%)	7 (12.3%)	2 (1.6%)	18 (3.6%)
	4	-	-	-	0
	5	1 (0.31%)	-	-	1 (0.2%)

*1 = daily 2 = weekly 3 = monthly 4 = less than monthly 5 = yearly or less

Table A6 (cont)

Focal Details

Given/Known	174 (33.5%) **	40 (67%) **	33 (18.2%) **	249 (32.8%) **
Right Temporal	44 (25.3%) (8.5%)	17 (42.5%) (28.3%)	9 (27.3%) (5%)	70 (28.1%) (9.2%)
Left Temporal	78 (44.8%) (15%)	7 (17.5%) (11.7%)	15 (45.5%) (8.3%)	100 (40.2%) (13.15)
Bilateral Temporal	26 (14.9%) (5%)	5 (12.5%) (8.3%)	3 (9.1%) (1.7%)	34 (13.65%) (4.5%)
Right Frontal	13 (7.5%) (2.5%)	6 (15%) (10%)	1 (3%) (0.6%)	22 (8.8%) (2.9%)
Left Frontal	9 (5.2%) (1.7%)	3 (7.5%) (5%)	4 (12.1%) (2.2%)	16 (6.4%) (2.1%)
Bilateral Frontal	2 (1.19%) (0.4%)	2 (5%) (3.3%)	-	4 (1.6%) (0.5%)
Right Other	2 (1.1%) (0.4%)	-	-	2 (0.8%) (0.25%)
Left Other	-	-	1 (3%) (0.6%)	1 (0.4%) (0.13%)

Anticonvulsants

	n = 493	n = 60	n = 175	n = 728
Phenytoin	212 43%	27 45%	74 42.3%	313 43%
Carbamazepine	272 55.2%	41 68.3%	72 41.1%	385 52.9%
Sodium Valproate	138 28%	22 36.7%	44 25.1%	204 28%
Phenobarbitone	45 9.1%	8 13.3%	27 15.4%	80 11%
Primidone	36 7.3%	7 11.7%	11 6.3%	54 7.4%
Clobazam	57 11.6%	10 16.7%	4 2.3%	71 9.75%
Diazepam	18 3.7%	1 1.7%	3 1.7%	22 3%
Lamotrigine	4 0.8%	2 3.3%	0 0%	6 0.8%
Vigabatrin	6 1.2%	3 5%	1 0.6%	10 1.4%
Other drug	66 13.4%	13 21.7%	26 14.9%	105 14.4%

Number of Drugs

0	11 2.2%	3 5%	5 2.9%	19 2.6%
1	190 38.5%	10 16.7%	96 54.9%	296 40.7%
2	215 43.6%	21 35%	57 32.6%	293 40.25%
3	72 14.6%	23 38.3%	16 9.1%	111 15.25%
4	5 1%	3 5%	1 0.67%	9 1.2%

**% of focal sample.

***% of whole sample

Age of Onset

The relationship between MQtot and age of onset of epilepsy was examined using the Kendall's Tau correlation. A weak but statistically significant positive correlation was found to exist between these variables (Tau = 0.07455, p = 0.0016). Given this weak positive result, the data was analysed through group comparison. A large sample Mann-Whitney 'U' Test compared subjects who reported onset below the group mean to those with onset above the average. The median MQtots and ranges of these two groups can be seen in Table A7. Analysis showed that subjects with onset of epilepsy after the group mean scored significantly higher on the MQ than those with onset of epilepsy earlier than the sample average (z = -3.728, p < 0.002, 2 tailed).

Table A7: Median MQtots and Nuisance Ratings of the two Age of Onset Groups.

	Group One (Onset 0-19)	Group Two (Onset 20-Hi)
Number	463	270
Median MQtot	47	51 *
Range	18-107	18-99
No nuisance	65 14.2%	17 6.3%
Slight nuisance	180 39.2%	74 27.4%
Moderate nuisance	137 29.8% **	117 43.3%
Serious nuisance	77 16.8%	62 23%

*p < 0.002 **p < 0.001

The above finding was reinforced when MQrat was examined

(see Table A7). Chi square analysis revealed a significant tendency for subjects with older onset (i.e. above group mean) to report more serious nuisance from their memories than those with earlier onset ($\chi^2 = 28.44$, 3df, $p < 0.001$).

Duration of Epilepsy

The Kendall's Tau correlation found between MQtot and duration of epilepsy was not significant (Tau = 0.012, ns). Furthermore there was no relationship between the duration of the condition and the memory nuisance ratings when the group was split according to the sample mean duration (see Table A8. $\chi^2 = 1.46$, 3df, ns).

Table A8: Median MQtot and Nuisance Ratings of the Two Duration Groups.

	Group One (duration 0-18)	Group Two (duration 19-Hi)
Number	425	308
Median MQtot	49	49
Range	18-107	18-93
No nuisance	51 12%	31 10.2%
Slight nuisance	146 34.4%	108 35.4%
Moderate nuisance	151 35.6%	103 33.8%
Serious nuisance	76 17.9%	63 20.7%

Seizure Types

To examine the roles of particular seizure types upon memory beliefs, Mann-Whitney 'U' Tests compared MQtot scores of those reporting and those not reporting specific seizure types. No differences were found between those

with and without primary generalised tonic-clonic seizures, absences, other generalised seizure types, complex or simple partial seizures (see Table A9 for details). However, those who reported having secondarily generalised seizures scored significantly higher on MQtot than those who did not report this seizure type ($z = -2.61$, $p < 0.01$, 2 tailed). Since it is entirely possible that result is due to experiencing a number of different seizure types, the group with secondary generalised seizures was bisected according to whether or not subjects reported experiencing complex partial seizures as well. Analysis revealed no significant difference in MQtot between those with and without complex partial seizures in this secondarily generalised group ($z = 1.05$, ns). However, the trend in the data does suggest that those with complex partial seizures are contributing most to the observed difference in MQtot between those with and without secondarily generalised seizures .

Table A9: Median and Ranges of MQtot according to presence/absence of the six seizure types.

	With	Without
Primary generalised		
Number	109	468
Median MQtot (range)	51 (21-99)	49 (18-98)
Secondary generalised		
Number	237	327
Median MQtot (range)	52 (18-93)	46 (18-99)
Absence		
Number	50	549
Median MQtot (range)	51 (18-84)	48 (18-99)
Generalised Other		
Number	37	571
Median MQtot (range)	47 (21-98)	49 (18-99)
Complex Partial		
Number	256	286
Median MQtot (range)	49 (18-93)	48 (18-99)
Simple Partial		
Number	31	519
Median MQtot (range)	43 (18-88)	49 (18-99)
Secondary Generalised without CP		
Number	106	-
Median MQtot (range)	50 (18-84)	-
Secondary Generalised with CP		
Number	131	-
Median MQtot (range)	53.5 (18-93)	-

Nuisance ratings within seizure types were also explored (see Table A10). However, the small numbers of subjects reporting simple partial seizures, absences and forms of generalised attack other than tonic-clonic convulsions in isolation of the other major seizure types prohibited analysis of these. The presence or absence of the other three seizure categories (primary and secondarily generalised tonic-clonic and complex partial seizures), was not found to influence responses to the four-point nuisance rating scale.

Table A10: Nuisance Ratings of Subjects With and Without Primary Generalised Secondarily Generalised and Complex Partial Seizures.

	Nuisance Ratings			
	None	Slight	Moderate	Serious
Primary Generalised				
With	12 (11.2%)	45 (42.1%)	34 (31.8%)	16 (15%)
Without	58 (12.4%)	163 (35%)	154 (33%)	91 (19.5%)
Secondarily Generalised				
With	27 (11.4%)	76 (32.2%)	78 (33.1%)	55 (23.3%)
Without	41 (12.7%)	129 (39.8%)	101 (31.2%)	53 (16.4%)
Complex Partial				
With	35 (13.7%)	83 (32.5%)	90 (35.3%)	47 (18.4%)
Without	33 (11.7%)	104 (36.7%)	89 (31.4%)	57 (10.1%)

Frequency of Seizures

The Kruskal-Wallis procedure was used to examine the role of seizure frequency. Frequency was analysed using five

groups: daily, weekly or monthly seizures, those with seizures less than monthly and finally, subjects with seizures occurring yearly or less often. The relevant median MQtot and ranges can be seen in Table All. Of the six seizure types, only the reported frequency of complex partial seizures was found to influence MQtot ($\chi^2 = 9.8379$, $p < 0.05$). Numbers of subjects reporting the frequency of absences, other generalised non-convulsive attacks and simple partial seizures were small however. Multiple comparisons between conditions (see Siegel and Castellan Jr, 1988) revealed that subjects with complex partial seizures occurring weekly, monthly or less than monthly scored equivalently on MQtot and this was significantly higher than those who reported daily complex partial seizures. However, those with the lowest MQtot scores within this seizure type reported seizures occurring yearly or less often.

Table All: Median and Range MQtot According to Seizure Frequency within Seizure Types

	Primary Generalised	Secondary Generalised	Absence	Generalised Other	Complex* Partial	Simple Partial
Daily	(n = 1) 28	59 (18-77)	42 (21-70)	32 (21-75)	47 (18-82)	39 (18-74)
Weekly	54.5 (31-84)	55 (18-85)	50 (35-84)	52.5 (29-81)	53 (18-85)	47 (27-63)
Monthly	52 (23-85)	56 (23-93)	25 (18-55)	40 (25-53)	50 (18-93)	41 (33-57)
< Monthly	48.5 (21-99)	50 (23-88)	58 (31-80)	52.5 (35-85)	52.5 (20-88)	50 (34-88)
< Yearly	51 (21-82)	49 (19-86)	51 (44-69)	55.5 (38-98)	42.5 (21-70)	47 (26-63)

*{weekly/monthly/<monthly>>daily>yearly p <0.05

Nuisance ratings were also examined. However, Chi square analyses could be conducted only upon groups with secondarily generalised and complex partial seizures. Small numbers within the frequency categories prevented analysis for the other four seizure types. Nevertheless, no trends were evident in these data and the frequencies of neither secondarily generalised nor complex partial seizures were found to relate to nuisance ratings (see Figure A1).

Number of Seizure Types

Valid details of the number of different seizure types was available on only 497 subjects. Missing details on seizure type and frequency of seizures reduced the overall numbers here. However, Kruskal-Wallis analysis of MQtot by the number of different seizure types revealed significant differences between those with one, two and three seizure types ($\chi^2 = 6.56$, $p < 0.05$. See Table A12 for MQtot details). Multiple comparisons between conditions showed that those with three seizure types ($n = 18$) scored significantly lower on MQtot than those with only one seizure type ($n = 298$) who, in turn, scored significantly lower than those reporting two seizure types ($n = 181$).

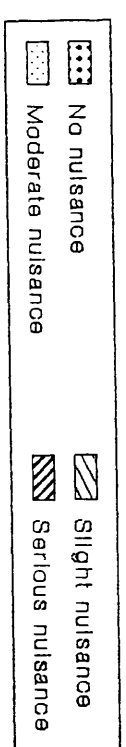
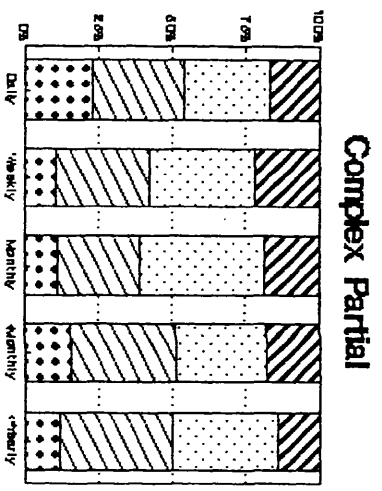
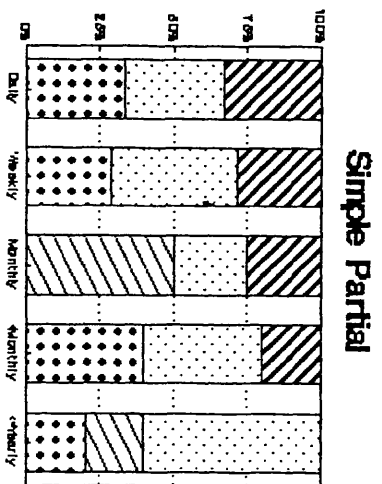
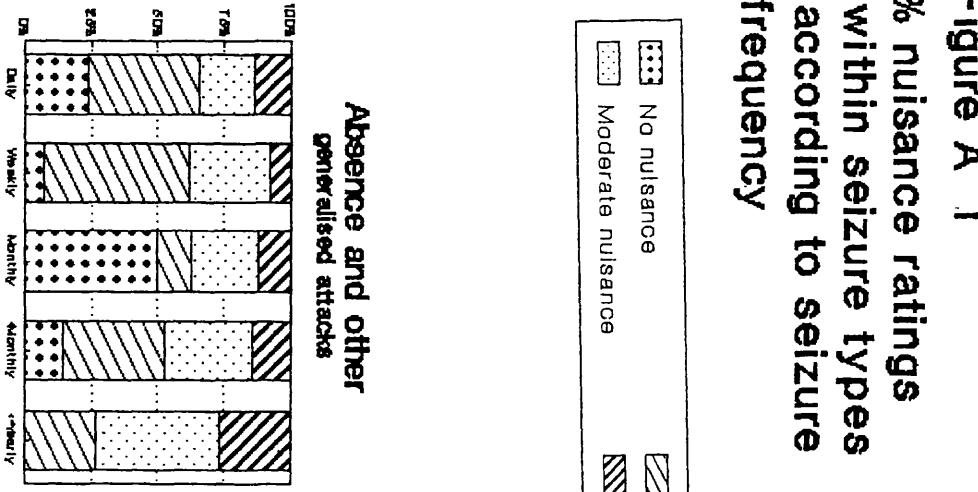
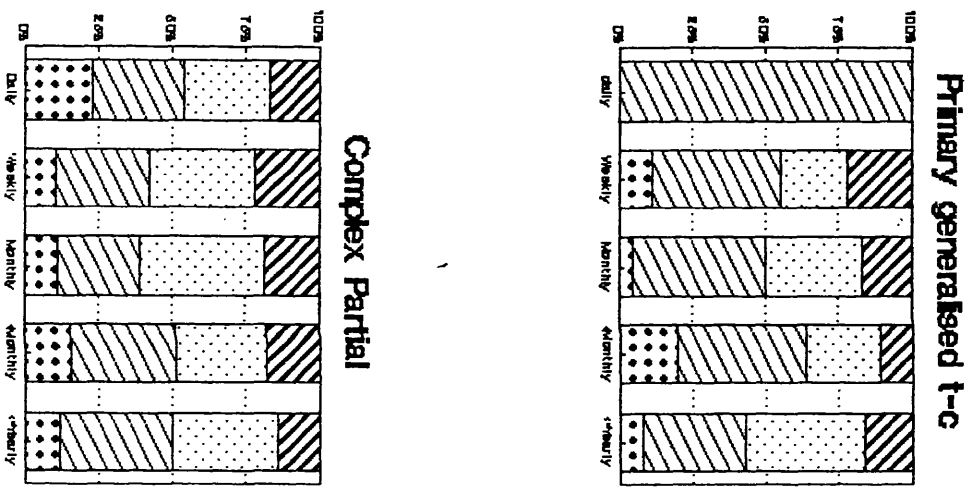
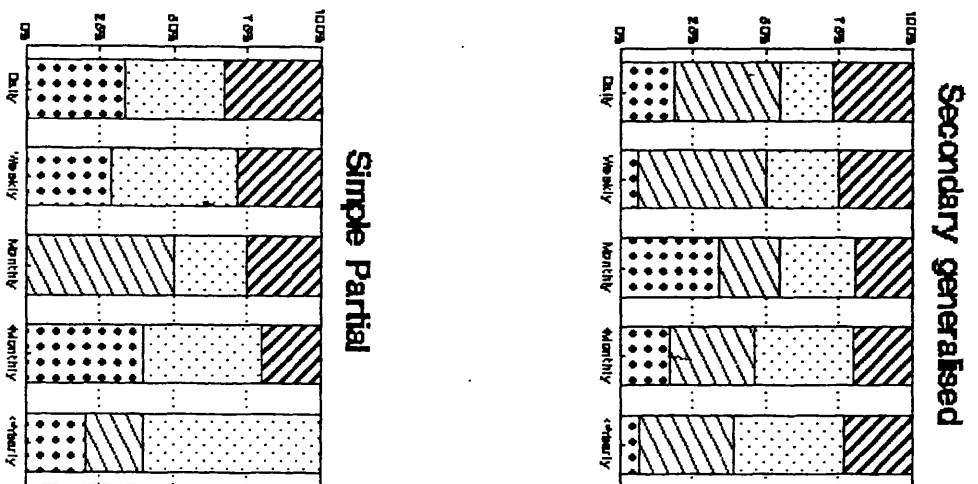


Figure A 1
 % nuisance ratings within seizure types according to seizure frequency

Table Al2: Median and Range MQtot and Nuisance Ratings for Subjects with One, Two or Three Seizure Types.

	Number of Seizure Types		
	1 (n = 298)	2 (n = 181)	3 (n = 18)
Median MQtot	47	54	47 *
Range	18-99	18-93	21-88
No nuisance	35 (11.9%)	21 (11.6%)	5 (27.8%)
Slight nuisance	106 (35.6%)	63 (34.8%)	3 (16.7%)
Moderate nuisance	97 (33.1%)	60 (33.1%)	7 (38.9%)
Serious nuisance	55 (18.8%)	37 (20.4%)	3 (16.7%)

* $3 < 1 < 2$ $p < 0.05$

Frequency analysis of the memory nuisance ratings was also conducted (see Table Al2). This showed no differences in the nuisance ratings given by subjects with one, two or three seizure types ($\chi^2 = 5.8$, ns).

Focal Onset

The first piece of analysis compared the effects of site of focal onset by examining the MQtots of subjects with primary generalised epilepsy and therefore no focal onset, those with a temporal lobe focus, subjects with frontal lobe involvement and those with an epileptic focus elsewhere (i.e. the parietal or occipital lobes). The MQ details of these four groups can be seen in Table Al3. The Kruskal-Wallis procedure demonstrated no significant differences between these four groups of subjects ($\chi^2 =$

0.96, ns). Frequency analysis upon MQrat revealed no differences in responses given to the nuisance ratings by those subjects reporting no focus, a temporal or a frontal focus ($\chi^2 = 2.12$, ns). Analysis upon those with parietal or occipital focal sites could not be conducted because of small numbers ($n = 3$).

Table A13: Median and Range MQtot and Nuisance Ratings of Subjects with no focus, temporal, frontal or focal onset elsewhere.

	No Focus n = 109	Temporal n = 204	Frontal n = 42	Other Focus n = 3
Median MQtot	48.5	48	48	40
Range	18-99	18-93	18-79	39-41
No nuisance	18	22	5	0
Slight nuisance	54	72	9	0
Moderate nuisance	39	61	9	2
Serious nuisance	19	34	5	0

Given the professed importance of temporal lobe epilepsy in determining memory performance difficulties and the proposed lateralisation implications, MQtot was compared between groups of subjects with temporal lobe epilepsy of left, right or bilateral onset (see Table A14). The Kruskal-Wallis test detected no significant differences between these groups ($\chi^2 = 4.84$, ns).

The frequency of the nuisance rating responses was also no different between groups of subjects reporting left, right or bilateral temporal onset of seizures ($\chi^2 = 6.49$, ns).

Table A14: Median and Range MQtot and Nuisance Ratings of Subjects with left, right or bilateral temporal lobe epilepsy.

	Left	Right	Bilateral
	n = 100	n = 70	n = 34
Median MQtot	52	45	46.5
Range	18-92	18-93	18-84
No nuisance	8	11	5
Slight nuisance	34	30	13
Moderate nuisance	34	19	11
Serious nuisance	23	10	4

Type of Monotherapy

The MQ details of subjects taking phenytoin, carbamazepine and sodium valproate monotherapy can be seen in Table A15. A significant difference was detected using the Kruskal-Wallis procedure ($\chi^2 = 8.062$, $p = 0.018$). Multiple comparisons between treatments showed that subjects taking carbamazepine score significantly higher on MQtot than those taking sodium valproate. There were no other significant comparisons.

The memory nuisance ratings given by the subjects on the three types of monotherapy did not differ significantly ($\chi^2 = 4.03$, ns).

Table A15: Median and Range MQtot and nuisance ratings of subjects taking phenytoin, carbamazepine or sodium valproate monotherapy.

	Type of Monotherapy		
	Phenytoin n = 89	Carbamazepine n = 126	Sodium Valproate n = 53
Median MQtot	48	53.5	45 *
Range	19-92	18-107	21-99
No nuisance	11 (12.4%)	18 (14.4%)	9 (17.3%)
Slight nuisance	32 (36%)	32 (25.6%)	18 (34.6%)
Moderate nuisance	31(34.8%)	48 (38.4%)	16 (30.8%)
Serious nuisance	15 (16.9%)	27 (21.6%)	9 (17.3%)

*p < 0.02 (carbamazepine > sodium valproate)

The Number of Anticonvulsants Taken

The MQ details of subjects taking from 0-4 anticonvulsants can be seen in Table A16. Kruskal-Wallis analysis of MQtot revealed no relationship between it and the number of drugs taken ($\chi^2 = 4.16$, ns).

The small numbers of subjects taking nought and four drugs made it necessary to collapse the therapy data to analyse nuisance ratings. Subjects were split according to whether they took nought or one drug, two drugs, or greater than/equal to three drugs. The nuisance ratings were therefore examined in a three by four contingency table. There was a significant tendency for those taking no or one drug to report no nuisance from their memories while, those on greater than or equal to three drugs were more likely to report greater nuisance from their memories ($\chi^2 = 21.73, 6df, p < 0.005$).

Table A16: Median and range MQtot and Nuisance Ratings of Subjects taking 0-4 Anticonvulsant Drugs

	Number of Drugs				
	0 n = 19	1 n = 296	2 n = 293	3 n = 111	4 n = 9
Median MQtot	51	50	48	54	52
Range	28-89	18-107	18-93	18-85	28-64
No Nuisance	1 (5.26%)	43 (14.6%)	31 (10.6%)	11 (10%)	0
Slight Nuisance	6 (31.58%)	92 (31.3%)	107 (36.6%)	36 (32.7%)	5 (55.6%)
Moderate Nuisance	7 (36.84%)	104 (35.4%)*	99 (33.9%)	41 (37.3%)	4 (44.4%)
Serious Nuisance	5 (26.31%)	55 (18.7%)	55 (18.8%)	22 (20%)	0

*p < 0.005 (0 & 1 < 3 & 4)

The Relationships Between Memory Complaints and Manageable Psychosocial Variables

Frequency of Use of Memory Aids in Epilepsy and Non-Epilepsy Groups.

Table A17 shows the percentage use of the eight external and eight internal memory devices in the epilepsy and non-epilepsy groups. Differences were analysed using the Chi square test. This revealed significant tendencies for the non-epilepsy group to report using diaries more than the epilepsy group ($x^2 = 14.07$, 1df, $p < 0.0005$) as well as the mental retracing of events and rhymes techniques ($x^2 = 12.83$, 1df, $p < 0.0005$ and $x^2 = 16.71$, 1df, $p < 0.0001$ respectively).

Since the frequency of diary use was expected to be high and the efficiency of its use most easily determined, the pattern of dairy use was investigated. The percentage of subjects using diaries daily, weekly and less than weekly can be seen in Table A18. Of the 606 people with epilepsy who reported using a dairy, 65 failed to give details of use and 15 out of 135 people without epilepsy failed to provide details here. Nevertheless, results show that the pattern of diary use is similar in the two groups and Chi square analysis showed no significant differences between the groups ($x^2 = 3.71$, ns).

Table A17: Percentage use of external and internal memory aids by both groups.

Memory Aid/ Technique	Epilepsy Group	Non-Epilepsy Group
<u>External</u>		
Diary	81%	95% *
Lists	67%	77%
Memos	60%	63%
Ask someone to remind you	59%	54%
Keeping things in special places	57%	59%
Alarms	20%	13%
Writing on hand	15%	14%
Other external memory aid	16%	12%
<u>Internal</u>		
Mental retracing	71%	86% *
Alphabet searching	45%	40.5%
First letter mnemonics	25%	34%
Method of loci	24%	18%
Rhymes	17.5%	33% **
Face-name association	10%	12%
Story method	5%	4%
Rhyming peg method	3%	3%

*p < 0.0005 **p < 0.0001

Table A18: Pattern of Diary Use in Epilepsy and Non-epilepsy Groups.

	Epilepsy Group	Non-epilepsy Group
Daily use	59.7%	60%
Weekly use	21.6%	27.5%
Less than above	18.7%	12.5%

Independent 't' tests were used to compare the use of external, internal and grand total aids (external + internal) in the epilepsy and non-epilepsy groups. The means and standard deviations of the three variables can be seen in Table A19. No significant differences were found to exist between the groups in any of the three comparisons (external $t = -0.84$, ns; internal $t = -2.32$, ns; total $t = -1.24$, ns, 1 tailed tests).

Table A19: Means and s.ds of external, internal and grand total aid use in both groups.

	Epilepsy Group	Non-Epilepsy Group
External \bar{x} (sd)	3.75 (1.72)	3.86 (1.43)
Internal \bar{x} (sd)	2.0 (1.35)	2.3 (1.36)
Total aids \bar{x} (sd)	5.92 (2.46)	6.2 (2.27)

The Relationship Between the Use of Memory Aids and Reported Memory Problems

Table A20 shows the Kendall's Tau correlations between degree of memory problems and the use of external, internal and total memory aids in people with and without epilepsy. The strongest relationship for both epilepsy and non-epilepsy groups were found between MQtot and the number of external aids used. However although most were statistically significant, correlations were modest and, contrary to expectations, positive. This implies greater, rather than lesser, use of the techniques by those subjects reporting the most frequent memory failures.

Table A20: Kendall's Tau correlations between use of memory aids and MQtot in the two groups.

Correlations	Epilepsy Group	Non-Epilepsy Group
MQtot x external aids	0.2365 (n = 745) (p < 0.0001)	0.205 (n = 142) (p < 0.0005)
MQtot x Internal aids	0.1415 (n = 590) (p < 0.0001)	0.085 (n = 140) (ns)
MQtot x total aids	0.227 (n = 588) (p < 0.0001)	0.185 (n = 139) (p < 0.005)

To examine the data using group analysis, the epilepsy and non-epilepsy groups were divided according to the group median MQtot score. Thus, for the epilepsy group, two groups were formed, those scoring at or below the median MQtot and those scoring above that median (median = 49). The non-epilepsy group was divided in the corresponding fashion for the median of 39. Independent 't' tests revealed significant differences in both groups with subjects scoring above the group medians using more external aids, internal aids (epilepsy group only significant) and aids in total (external: epilepsy group $t = -7.24$, $p < 0.0001$, 1 tail; non-epilepsy group $t = -2.51$, $p < 0.01$, 1 tail. Internal: epilepsy group $t = -3.79$, $p < 0.0001$, 1 tail; non-epilepsy group $t = -1.17$, ns. Grand total: epilepsy group $t = -6.03$, $p < 0.0001$, 1 tail; non-epilepsy group $t = -2.46$, $p < 0.01$, 1 tail).

One way analysis of variance using Tukey's Range test revealed that the use of aids within nuisance rating subgroups in the epilepsy group upheld the differences found when MQtot was analysed. Subjects with epilepsy who report no nuisance from their memories use fewer external, internal and total aids than any of the other three MQrat subgroups. Furthermore, for external and total aid use, subjects reporting a slight nuisance from their memories were using fewer aids than those reporting moderate/serious nuisances who did not differ on these variables. No differences between the use of aids within

the four nuisance categories was detected in the non-epilepsy group.

Examination was next undertaken of the three memory aids found to be used more frequently by the non-epilepsy group compared to the epilepsy group. The relationships between use of these and the degree of memory difficulties could be determined in the two groups by again dividing each at the median MQtot scores. This allows Chi square analyses to be conducted. It was found that subjects with epilepsy scoring above the group median were significantly more likely to report using diaries and the mental retracing of events than those scoring at or below the median ($\chi^2 = 5.73$, 1df, $p < 0.025$ and $\chi^2 = 11.97$, 1df, $p < 0.001$ respectively). No difference in the use of rhymes as a memory encoding device between those scoring above or below/at the median MQtot score was found in either epilepsy or non-epilepsy groups. Furthermore, the use of diaries and the mental retracing of events did not differ between the non-epilepsy subgroups divided accordingly.

Chi square analyses of the four MQrat categories by the use of these three aids tended to support the above findings. No differences in the use of these devices in the non-epilepsy group divided according to nuisance rating categories could be found. In the epilepsy group, both diary use and the use of mental retracing differed

between nuisance rating categories ($x^2 = 11.62$, 3df, $p < 0.009$ and $x^2 = 26.96$, 3df, $p < 0.0001$ respectively). By using the technique of partitioning the degrees of freedom in the contingency table (see Siegel and Castellan 1988) it was found that in each case, subjects reporting no or slight memory nuisance used the techniques less than those subjects reporting moderate or serious nuisances between whom there was no difference (diary partitioned $x^2 = 6.7$, 1df, $p < 0.01$; mental retracing partitioned $x^2 = 9.08$, 1df, $p < 0.01$). Table A21 shows the percentage use of the three specific devices in the epilepsy and non-epilepsy groups divided according to MQrat.

Table A21: Percentage use of diaries, mental retracing of events and rhymes in epilepsy and non-epilepsy groups divided according to nuisance ratings.

	Epilepsy Group			Non-Epilepsy Group		
	Diary	Mental Ret.	Rhymes	Diary	Ment.Ret.	Rhymes
No Nuisance	70.9%	42.1%	10.5%	98%	76%	32%
Slight Nuisance	79.7%	71.6%	18.95%	89.8%	94.8%	36.2%
Moderate Nuisance	86.6%	72.4%	19.9%	96.55%	92.9%	32.1%
Serious Nuisance	82.3%	76.2%	13.3%	100%	33%	0%

* $p < 0.01$

The Use of Memory Aids Within Neuroepileptic and Treatment Subtypes

The following set of investigations concerns the use of memory aids by subjects with epilepsy whose condition is characterised by the neuroepileptic and treatment variables which had been found to be related to memory complaints (either MQtot or MQrat). These were, the presence of secondarily generalised seizures; the frequency of complex partial seizures; onset of epilepsy in later years; the existence of more than one seizure type; taking carbamazepine as opposed to sodium valproate monotherapy and, polytherapy. For each of these characteristics, the external, internal and total use of aids was investigated as well as the three specific strategies whose use differed between the epilepsy and non-epilepsy groups.

Comparison of the use of aids between subjects with or without secondarily generalised seizures produced no significant results. When age of onset was examined, it was found that those subjects whose epilepsy began after age nineteen (group \bar{x} onset age = 19.25) used significantly more external memory aids and total combined memory aids than subjects whose onset of epilepsy was less than or equal to age nineteen ($t = -1.76$, $p < 0.05$, 1 tail and $t = -1.78$, $p < 0.05$, 1 tail respectively). Use of internal memory aids did not differ between the onset

groups. The older onset group were also found to use diaries and the mental retracing of events more often than those with younger onset ($x^2 = 4.69$, 1df, $p < 0.05$ and $x^2 = 5.14$, 1df, $p < 0.05$ respectively).

It had previously been found that the frequency of complex partial seizures is related to memory difficulties in an unexpected and rather odd manner. Subjects reporting complex partial seizures occurring yearly or less often scored lower on MQtot than those with complex partial seizures daily who, in turn, scored lower on the memory questionnaire than those with complex partial seizures weekly, monthly or less than monthly. Correspondingly, three groups of complex partial seizure frequency were created. A one-way analysis of variance employing Tukey's Range test revealed a significant difference in the number of external memory aids used between subjects with complex partial seizures daily and those with complex partial seizures weekly, monthly or less than monthly with the latter group using more aids (F ratio = 3.51, $p < 0.05$). Furthermore, the frequency of reported diary use differed between the three complex partial frequency groups with the greatest use of diaries by the group reporting most difficulties on the memory questionnaire ($x^2 = 17.53$, 2df, $p < 0.001$).

Neither the number of different seizure types nor the type of monotherapy taken was found to relate in any way to the

use of memory aids. Comparisons of monotherapy (0 or 1 drug taken) and polytherapy did, however, produce significant findings. In the use of external aids, subjects on monotherapy reported the greatest use of devices ($t = 2.4, p < 0.0001, 1 \text{ tail}$).

Prevalence of Negative Moods

As expected, subjects with epilepsy were found to be more depressed and anxious according to scores obtained on the two mood inventories (BDI: $z = -5.27, p < 0.0001, 1 \text{ tail}$; HAD-D $z = -4.895, p < 0.0001, 1 \text{ tail}$; HAD-A $z = 3.06, p < 0.005, 1 \text{ tail}$). Chi square analysis further revealed higher proportions of the epilepsy group scoring at or above the cut-offs on the mood inventories (see Table A22). (BDI $\chi^2 = 20.87, p < 0.001$; HAD-D $\chi^2 = 13.5, p < 0.001$; HAD-A $\chi^2 = 6.44, p < 0.025$). It is of added importance to note that the significantly higher proportion of females in the non-epilepsy group in whom negative moods usually prevail.

Table A22: Median mood scores and percentages of subjects scoring at or above the cut-offs for the scales.

	Epilepsy Group			Non-Epilepsy Group	
Median BDI tot	9	(0-55)	**	5	(0-29)
Median HAD-D	4	(0-20)	**	3	(0-13)
Median HAD-A	8	(0-20)	*	6	(0-18)
N ≥ 13 BDI	34.7%	@		14.5%	
N ≥ 9 HAD-D	18%	@		5%	
N ≥ 9 HAD-A	46%	b		33.3%	

**p < 0.0001 *p < 0.005 @p < 0.001 b p < 0.025

To analyse the proportion of the two groups who reported being both depressed and anxious, scores from the HAD scale alone were used. This was considered acceptable given that correlations between the BDI total score and the HAD-D score were reasonable and highly significant for both the epilepsy and non-epilepsy groups (Kendall's Tau epilepsy group = 0.57, p < 0.0001; Tau non-epilepsy group = 0.52, p < 0.0001).

Analysis revealed that subjects with epilepsy were significantly more likely to score as both anxious and depressed on the HAD scale than non-epilepsy group subjects ($\chi^2 = 7.8$, 1df, p < 0.01). Details of the number of subjects within each group who were either only depressed or only anxious, neither depressed nor anxious

or both depressed and anxious can be seen in Table A23.

Table A23: Subjects classified according to mood on the HAD scale.

	Epilepsy Group		Non-epilepsy Group	
Neither A nor D	349	(50.65%)	93	(66.9%)
A not D	216	(31.35%)	39	(28.06%)
D not A	27	(3.92%)	0	
Both	97	(14.8%)	* 7	(5.04%)

*p < 0.01, ldf

The Relationship between Memory Complaints and Mood

Kendall's Tau correlations between the mood scales and the memory questionnaire were computed. Convincing relationships were found to exist between the mood and memory measures in the epilepsy group but, the corresponding associations in the non-epilepsy group were rather weaker. As expected all correlations were positive, demonstrating the presence of negative moods in association with greater reported memory difficulties (see Table A24).

Table A24: Kendall's Tau correlations between MQtot and mood scale scores.

	Epilepsy Group		Non-epilepsy Group	
	MQtot		MQtot	
BDI tot	0.345	(p < 0.0001)	0.13	(p < 0.05)
HAD-D tot	0.34	(p < 0.0001)	0.15	(p < 0.01)
HAD-A tot	0.295	(p < 0.0001)	0.24	(p < 0.0001)

Group analyses, using the cut-off scores for the mood scales, were conducted. Large sample Mann-Whitney 'U' tests revealed that subjects with epilepsy scoring at or above the cut-offs on all scales scored significantly higher on the memory questionnaire than subjects who did not score as depressed or anxious. (BDI: $z = -10.415$, $p < 0.0001$, 1 tail; HAD-D: $z = -9.135$, $p < 0.0001$, 1 tail; HAD-A: $z = -8.26$, $p < 0.0001$, 1 tail). The same analyses conducted with the non-epilepsy group data revealed two significant tendencies. Those considered anxious scored significantly higher on the memory questionnaire than those who were not anxious ($z = -2.84$, $p < 0.0025$, 1 tail). Depression on the BDI was also associated with higher memory questionnaire scores in subjects without epilepsy ($z = -1.84$, $p < 0.05$, 1 tail). No relationship between the HAD depression subscale and MQtot scores was detected in the non-epilepsy group but, only seven subjects were considered depressed on this subscale. Median and range MQtot scores for the groups divided according to the presence or absence of negative

moods can be seen in Table A25.

Table A25: Median and range MQtot for the groups divided according to presence or absence of negative moods.

	Epilepsy Group		Non-epilepsy Group	
Depressed BDI	59	(18-107)	42	(27-77)
	**		@	
Not depressed BDI	45	(18-53)	38	(22-61)
Depressed HAD	66.5	(18-107)	41	(27-77)
	**			
Not depressed HAD	47	(18-93)	39	(22-75)
Anxious HAD	56	(18-107)	42	(26-77)
	**		*	
Not anxious HAD	46	(18-98)	37	(22-75)

**p < 0.0001 *p < 0.0025 @ p < 0.05

Similarly, significant findings were associated with the four memory nuisance ratings. Subjects with epilepsy reporting a serious nuisance from their memories were more depressed on BDI and HAD than those reporting a moderate nuisance who, in turn, were more depressed than those indicating a slight nuisance. The least depressed subjects were those reporting no nuisance from their memories. (BDI: K-W $\chi^2 = 120.09$, $p < 0.0001$, multiple

comparisons all $p < 0.05$; HAD-D: K-W $x^2 = 122.54$, $p < 0.0001$, multiple comparisons all $p < 0.05$). Anxiety levels also differed between nuisance ratings for subjects with epilepsy ($x^2 = 89.66$, $p < 0.0001$). Multiple comparisons revealed that the least anxious were those reporting no nuisance while those most anxious were those indicating a serious nuisance. Subjects reporting slight or moderate nuisances from their memories did not differ in terms of anxiety scores.

Analysis of data in the non-epilepsy group revealed a tendency for depression on the BDI to be associated with moderate and serious memory nuisance ($x^2 = 11.13$, $p < 0.01$). However, since only three subjects reported a serious nuisance from their memories, multiple comparisons were not carried out. Anxiety also appeared to be associated with the more serious memory nuisance ratings in the non-epilepsy subjects ($x^2 = 14.8$, $p < 0.005$). Table A26 shows median BDI and HAD scale scores for subjects divided according to memory questionnaire rating.

Table A26: Median and range BDI and HAD scale scores for subjects divided according to memory nuisance rating.

Epilepsy	No Nuisance	Slight	Moderate	Serious	
BDI	3 (0-22)	7 (0-41)	10 (0-44)	15 (0-55)	**
HAD-D	2 (0-10)	3 (0-13)	5 (0-19)	7 (0-20)	**
HAD-A	5 (0-16)	7 (0-19)	8 (0-19)	11 (0-20)	**

Table A26 (cont)

Non-

Epilepsy	No Nuisance	Slight	Moderate	Serious
BDI	5 (0-16)	5 (0-29)	8.5 (0-19)	19 (13-22) *
HAD-D	2 (0-9)	3 (0-13)	3.5 (0-9)	11 (3-12)
HAD-A	6 (0-15)	6 (0-15)	9 (1-18)	15 (7-17) @

**p < 0.0001 *p < 0.01 @ p < 0.005

Memory complaints in cases of mixed anxiety and depression

Previous analysis had shown that people with epilepsy were more likely to report being both anxious and depressed on the HAD scale than those without epilepsy. Since both moods are related to complaints of poor memory in people with epilepsy, a cumulative effect of the moods upon memory questionnaire responses was expected such that subjects who present with both moods would score higher on the memory questionnaire than those in whom only one mood is indicated. Kruskal-Wallis analysis with multiple comparisons suggests that depression is more indicated in relation to reports of memory difficulties in people with epilepsy than anxiety ($x^2 = 116.78$, $p < 0.0001$). No difference was detected between subjects who were only anxious and those who were only depressed. Furthermore, no significant difference was found to exist between those who were depressed only and those in whom symptoms of both moods presented. However, the comparison between anxious

only subjects and subjects with both moods was significant at the 5% level. All three mood categories scored higher on MQtot than subjects who suffered from neither mood. Median and range MQtot scores for epilepsy subjects classified according to mood can be seen in Table A27. Analysis of mood by nuisance ratings produced strong supporting evidence for the above findings ($\chi^2 = 81.84$, 9df, $p < 0.0001$).

Table A27: Median and range MQtot for subjects with epilepsy classified by mood on the HAD scale.

	1.	2.	3.	4.
	Neither mood	Depressed	Anxious	Both moods
	(n = 349)	only (n =27)	only (n = 216)	(n = 97)
Median	44	59	53	68
MQtot				
range	18-89	34-98	18-93	18-107

$p < 0.0001$ 1 < 2 = 3; 2 = 4; 3 < 4

Non-epilepsy group data analysed in a comparable fashion emphasised the relationship between anxiety and high MQtot scores. Those who were anxious scored higher on MQtot than those who were neither depressed nor anxious but, no difference existed when anxious only subjects were compared to subjects with symptoms of both moods ($\chi^2 = 9.28$, $p < 0.02$). The influence of depression alone could not be assessed in the non-epilepsy group because no

subjects fell into this category.

The Prevalence of Negative Moods Within Subjects
Characterised by the Neuroepileptic and Treatment
Variables Associated with Memory Complaints.

Given the possible influential role of mood in determining memory complaints, it is essential to determine whether negative moods are found in association with the neuroepileptic and treatment variables which were found to be related to memory complaints.

Comparisons of subjects with and without secondarily generalised seizures demonstrated higher levels of depression, according to the HAD scale, in subjects with this seizure type. (Mann-Whitney 'U' test; $z = -2.36$, $p < 0.01$, 1 tail). The equivalent comparisons for BDI total scores and anxiety detected no differences between those with and without secondarily generalised seizures.

Differences in all mood scale scores were found to exist between subjects with below average age of onset and those with onset of epilepsy above the group mean. All comparisons indicated higher levels of negative moods within the older onset group (Mann-Whitney tests: BDI: $z = -5.48$, $p < 0.0001$, 1 tail; HAD-D: $z = -5.18$, $p < 0.0001$, 1 tail; HAD-A: $z = -2.85$, $p < 0.005$, 1 tail).

When the frequency of complex partial seizures, the number of different seizure types, the type of monotherapy taken and the comparison of monotherapy and polytherapy were considered, no differences in the levels of negative moods were found.

Multivariate Analysis

In order to clarify which of the independent variables was related to the self-reported memory difficulties of people with epilepsy to the greatest extent, a step-wise multiple regression equation was computed. Where necessary, square root transformations were carried out to normalise scores. The equation included the mood and epilepsy-related variables indicated by the preceding non-parametric analyses. Results of this procedure showed that depression (assessed on the HAD scale) was playing the greatest role in relation to the MQ findings, accounting for 20% of the variance within the measure. Anxiety accounted for a further 3.2% of the variance. The only other variable considered of significance was the age of onset of the condition which accounted for only 0.5% of the variance of MQ_{tot}.

Summary of the Questionnaire Survey Findings

The data presented here suggests that people with epilepsy

do indeed see themselves as having more memory difficulties than people without. Furthermore, these beliefs are confirmed by relatives' reports. Unfortunately certain demographic differences existed between the epilepsy and non-epilepsy groups, notably, the non-epilepsy group were older, better educated, more likely to be employed and consisted of a higher proportion of females. Statistical procedures and further subdivision of the two groups into equivalent educational categories demonstrated that the demographic make-up of the groups was not influencing scores on the memory questionnaire.

It is of note that the qualitative properties of the memory failures reported by the epilepsy and non-epilepsy groups were very similar. The groups shared four out of five top memory difficulties and observers' beliefs also concurred. The difference between the groups therefore lay almost entirely in the frequency of perceived problems. There was, indeed, a consistent trend within both the MQ and RMQ data for the epilepsy group to report more frequent occurrence of all failures referred to, including those with a strong prospective component. The most troublesome difficulty for people with epilepsy was the 'tip-of-the-tongue' failure. This was rated as number four by the non-epilepsy group. It had been hypothesised that neuroepileptic and treatment

variables which had been highlighted as being important in determining memory performance in previous research, would be found to play a role in determining beliefs about poor memory. In fact, the most convincing role was demonstrated for the age of onset of the disorder. It seems that later onset of the condition may predispose towards memory complaints. The relationship between age of onset and perceived memory difficulties was demonstrated for both the total memory questionnaire scores and also the memory nuisance ratings. Indeed, it was the only neuroepileptic or treatment variable which was indicated as being of significance when multiple regression analysis was conducted. The rather late average onset age of the whole sample should be noted.

On the whole, the results referring to the neuroepileptic and treatment variables implicate partial epilepsy in memory complaints. Results indicating a role for secondarily generalised seizures and the use of carbamazepine are particularly suggestive. The rather inconclusive focal onset data would argue against this deduction but, this type of self-reported information is probably rather unreliable.

A major focus of this research was to examine the role of more controllable independent variables which may influence the frequency of memory complaints. Some interesting and useful findings have arisen from the

survey study.

Dealing first with the use of memory aids and mnemonic strategies, no difference in the number of aids used by the epilepsy and non-epilepsy groups was found. However, the non-epilepsy group were more inclined to use diaries, the mental retracing of events and the rhymes technique as means of alleviating the burden upon their memories. It is significant that diaries and the mental retracing of events are the most popular techniques in both groups. It may therefore be safe to assume that they are the most effective techniques. Their less frequent use may therefore have some bearing on the memory complaints of people with epilepsy.

Quite contrary to the original expectation, the use of memory aids was positively related to the level of reported memory difficulties and also to the memory nuisance ratings. This was so for the total aids used and also the use of specific types of memory aids and strategies. The Kendall's Tau correlations found here were modest and statistically significant. The subjects with epilepsy reporting the most everyday memory difficulties were those who were making the most use of memory aids and strategies in their daily lives. The pattern, however, was no so convincing in people without epilepsy. This result may suggest a less efficient use of these techniques by people with epilepsy. The similar

pattern of diary use between the groups may however argue against this view but, no adequate means to test this 'efficiency' interpretation is available.

It had been predicted that some of the significance of the neuroepileptic and treatment characteristics which had been highlighted as being important in relation to memory complaints, may be explained by the less efficient use of strategies by these particular groups of people. However, few differences in the use of aids between those with and without the neuroepileptic and treatment variables found to be salient were in fact discovered. Those which did exist supported the greater use of aids by the groups with the greater reported difficulties. One exception which may be used in support of the original hypothesis arose when the number of drugs being taken was analysed. The number of external memory aids and the total number of memory aids used was found to be higher in the monotherapy group compared to the polytherapy group. It may, however, be wise to view this result with caution given the excess of results to the contrary.

The second manageable psychosocial variable which was considered was the presence of negative emotional states. A number of predictions had been made with regard to this. The findings of this survey were largely in accord with these hypotheses. First, it was found that people with

epilepsy were more likely to present with symptoms of anxiety and depression. Furthermore, they were more likely to be both anxious and depressed.

Convincing relationships were found between the presence of negative mood and beliefs of poor memory. Correlations between mood and memory scores were reasonable, positive and highly significant for the epilepsy group. Corresponding relationships between depression and MQ scores in the non-epilepsy group were rather weaker and not significant but, the anxiety correlation was comparable to the epilepsy statistic. The weaker depression correlation in the non-epilepsy group may reflect the smaller numbers and the lower representation of ^{the} mood within this group.

As predicted, the combination of both moods, bore a stronger relationship to memory complaints than anxiety alone but not depression alone. This pattern of results, implies a stronger role for depression in determining memory complaints. Results from the multiple regression analysis confirm this view with depression scores being most implicated in relation to memory difficulties.

Again, it was predicted that some of the saliency of the neuroepileptic and treatment variables in determining memory complaints could be explained by elevated levels of negative moods within these subjects. It was found, that

subjects with secondarily generalised seizures, were more likely to be anhedonic (HAD-D scale) than those without this seizure type. Perhaps more important was the significance of the age of onset result in this respect. Those with older age of onset were found to be more anxious and depressed on both mood inventories used. Thus, the significance of age of onset in determining memory complaints, may be largely due to the higher representation of negative moods within those people who develop epilepsy later in life.

Considerations of Design, Methodology and Analysis of the Questionnaire Survey

i. The Sample

The aim of the survey was to sample a broad and representative spectrum of people with epilepsy. Clinical impressions of the frequency of complaints and research which indicates memory deficits in people with epilepsy are based on highly unrepresentative samples of patients, often from tertiary referral centres (see Sander et al 1990; Mirsky et al 1960; Scott et al 1967; Glowinski 1973; Ladavas 1979; Delaney et al 1980, 1982; Hermann et al 1987, 1988). Given this bias, it was entirely possible that the majority of people with perhaps less severe epilepsy do not complain of memory difficulties. One of the aims of the survey was to examine this possibility. In order to do so, it was necessary to use

postal survey methodology and to rely upon the responses of volunteers. The technique has obvious drawbacks, including the possibility of collecting a sample who tend to affirm the existence of the difficulties referred to in the initial appeal for subjects. The extent of reported memory difficulties found here should therefore be regarded as, if anything, an overestimation of its prevalence within the population as a whole, even though the sample is more representative, in terms of seizure severity, than those collected by previous studies in the area.

Another disadvantage related to remote data collection procedures is the inability to consult medical records. These were examined in cases where access was possible but for the vast majority of the subjects in the survey medical details were supplied by the subjects themselves. Given the often poor knowledge that people with epilepsy have of their condition which is, in part, attributed to the poor recall of information supplied during consultation (Thompson and Duncan 1987), it may be best to treat with caution those results relating to the role of neuroepileptic variables. However, there is often only limited clinical and electrophysiological investigation of patients who do not require tertiary level care. For these patients therefore it may be argued that access to medical records would have provided little extra knowledge upon which to base diagnosis of seizure type and

localisation of the epileptogenic area. Furthermore, seizure frequency, age of onset and the duration of the condition constitutes information which can usually be found in medical records but which is supplied by the patients themselves in the first instance. The type of medication being taken can of course easily be reported by the patient. Thus, the minimal consultation of medical records while at first glance appearing to be a major hindrance, may in fact have only a minor impact on the findings of the survey.

Finally, the healthy non-epilepsy sample collected for this research may not be the most appropriate group against which to compare the epilepsy group results. The disadvantages associated with such a comparison have been stressed earlier. It may have been more worthwhile to have compared the responses of people with epilepsy to those given by patients with another chronic disability and those with a different neurological condition. By doing so, it may have been possible to decipher the proportion of the perceived difficulties which are directly related to the condition itself, how much can be attributed to suffering from a chronic disability and what extent is due to the influence of central nervous system disturbance. It may also be useful to perform the same comparison using the mood inventories. Comparisons such as these are, of course, fraught with difficulties since a great number of important variables must be 'controlled'

for, e.g. the severity, longevity, treatment and social, professional and financial consequences of the condition. Furthermore, to have concentrated efforts on collection of such 'control' data would have meant straying somewhat from the original purpose of the investigation. One of the aims of the study was to investigate within the epilepsy group itself in order to discover which factors distinguish those who complain of memory difficulties from those who do not with the ultimate view of intervening to reduce the significance of these influential variables. In this sense, the subjects with epilepsy who do not complain represent the best 'controls' for those who do.

ii. The Instruments

The MQ certainly seemed to be sensitive to the memory difficulties of people with epilepsy and was therefore suited to the purposes of this study. However, it may have been worthwhile to have conducted more extensive tests of reliability and validity of the measure in this particular sample. Sunderland et al (1983) refer to tests of validity of the original HIPQ including item to total score correlations, multiple dimensional scaling and cluster analysis. They do not report tests of reliability such as split half or test-retest reliability. In this sample, the use of the total score as an approximate index of impairment was checked by correlating individual items to the sum score for epilepsy and

non-epilepsy subjects separately and for both MQ and RMQ measures. Given the lack of reliability data relating to the original HIPQ, it may have been worthwhile to perform tests to check the reliability of this modified measure over time. However, the strong correlations which existed between nuisance rating and the total score on the MQ and RMQ confirmed to an extent the reliability and validity of the measure in reflecting consistent beliefs about memory functioning. It should be further noted that Broadbent et al (1982) had found their CFQ to be a measure of trait rather than state and while it cannot simply be assumed that this questionnaire is similar in this respect, it seems likely. However, some would question the use of a self-report technique to assess memory since high level powers of introspection are required from respondents who are then asked to respond according to a difficult, time specified rating scale (e.g. Banaji and Crowder 1989). Given that judgements can be based only on 'rules of thumb' in a relative rather than an absolute manner, it may have been appropriate to use a more 'subjective' rating scale incorporating terms such as 'average', 'more often than most people' and 'less often than most people'. Of course, whichever rating scale is chosen on questionnaires about memory, the memory introspection paradox and differences in lifestyle such as increased levels of dependence upon others will always play a part in determining the accuracy of responses. Indeed, the choice of rating scales may be just as

important for the relatives answering with regard to the target subject. In all cases, but especially with respect to the less observable memory failures, for example, losing track of a story, it is difficult for an observer to answer in absolute terms about the memory failures of another person. It would be more reasonable to expect them to judge another's ability using their own functioning as reference and therefore to answer in relative terms.

The other scales used within this survey also have difficulties which will impede the accuracy of the responses gathered and the interpretation of results. The MACLs cannot assess the efficiency and exact frequency of use of memory aids. Subjects may respond by saying that they use their diaries daily because they write in them on average on a daily basis. This does not mean that they refer to them daily in order to remind them of things they must do. Similarly, the efficiency or appropriate use of internal strategies cannot be guaranteed simply because a subject responds that he/she does use a particular strategy perhaps only on occasion.

Finally, affirmation bias is always a difficulty to consider when survey methodology is used. If the subject is complaining of a problem to which the main inquiry refers, there is always the chance that the subjects will answer subsidiary inquiries in a similar manner in order

to lend credence to his/her original reports of difficulty. Some of the agreements between the MQ, the MACLs and the Mood Inventories could be accounted for in this way, although results, particularly with respect to mood are probably too pronounced to be accounted for totally in these terms. A similar difficulty is the method variance problem (Campbell and Fiske 1959) where questionnaire responses will share a certain amount of variance because they share a common method, i.e. self-report. It may have been advisable to have collected relatives' views upon depression and anxiety as well as the subjects' own in view of these difficulties.

iii. The Method

Perhaps the main criticism which can be levelled at the methodology is of course the heavy reliance on self-report information. The majority of the data collected for the survey was done so postally (83.6% of responses). This meant that the majority of the subjects answered the questionnaires in total isolation with the help of only brief guidance notes. If difficulties regarding responses were encountered, the subject had to deal with these as he/she saw fit. Indeed, the fact that some responses were collected at a more personal level (i.e. during visits to outpatient clinics) meant that these subjects did have a chance to ask questions which would have guided their responses. It may perhaps have been

wise to compare results gathered using these two methods to ensure that no differences emerged in the responses.

An alternative approach to the remote survey technique which would have given the subjects some chance to discuss their responses to these rather taxing questions would have been to use a semi-structured interview. However, there are at least two possible drawbacks relating to this technique. First, this logistically more demanding methodology would have meant that fewer responses could have been gathered and a representative sample, including those people who are cared for at the primary care level, would have been more difficult to collect. Second, there is always the possibility when using interview techniques, that 'experimenter effects' will be increased. The subject may either be directly influenced by the experimenter's comments or, they may be more inclined to report in terms of how they think they ought to please the experimenter who is no longer a faceless researcher.

iv. The Analysis

The choice between using parametric or non-parametric analysis with questionnaire data is difficult and in practice appears to depend largely upon the discretion of the researcher. The nature of the MQ with its six-point discrete rating scale along with the fact that responses from people with epilepsy were likely to be (and were

found to be) positively skewed away from the normal distribution indicated the use of non-parametric statistical tests (Seigel and Castellan Jr 1988). The large numbers within the survey are likely to have counterbalanced any great differences in the power of non-parametric as opposed to parametric techniques but, the choice of tests is somewhat limited by those available on statistical computer packages. Multivariate analysis is particularly difficult with data which does not conform to requirements for parametric analysis. However, the need to establish which dependent variables were having the greatest impact on memory complaints governed the decision to use multiple regression as a final analytical step. This technique which relies upon partial correlations to rule out effects of spurious and intervening variables could therefore lend strong supporting evidence to the results of the bivariate non-parametric analysis. Therefore, although it was considered most appropriate to use non-parametric techniques, some deviation from this chosen strategy was able to provide important information pertaining to the overall interpretation of the results.

STUDY B : THE MEMORY CHECKLIST STUDY

The Rationale

A prospective recording technique should render more reliable data on everyday memory failures than that which is collected by a retrospective questionnaire. A one week checklist was therefore devised for the purpose of collecting prospectively recorded data. Although subject to some of the inherent difficulties of 'subjective' methods, particularly the 'memory introspection paradox', the method has greater face validity than the metamemory questionnaire because of its active monitoring requirements and the reduced role of pro- and retroactive interference upon the forgetting of relevant information.

It will be recalled that subjects with epilepsy reported higher levels of memory difficulty on the questionnaire than did those without epilepsy. Study B aimed to discover if the difference would still exist when a method relying upon more active monitoring of memory functions was used. Furthermore, the nature of the relationship between retrospective and prospective reports of memory functions should be examined to establish whether any major differences in profiles of complaints arise from the two methods. Finally, neuroepileptic and psychosocial variables could be explored in relation to the level of

memory failures recorded in this more systematic fashion.

Hypotheses

Eight hypotheses were subject to analyses.

1. Subjects with epilepsy would record more memory failures than those without epilepsy.

2. Observers of the subjects with epilepsy would record more failures than their non-epilepsy counterparts. On the whole however, observers would report fewer problems than the subjects themselves but correlations between self and observer's reports would be strong.

3. The type of difficulties arising most frequently would be similar in those with and without epilepsy.

4. In the comparison of the findings using prospective versus retrospective techniques, it was expected that people with epilepsy would be overestimating their failures when reporting their beliefs retrospectively. This prediction would be expected from clinical speculation about the exaggeration of difficulties and also if one accepts the a role for depression in producing negative cognitions about self.

5. Upon examining the profile of specific types of

failures recorded by retrospective and prospective methods, it was expected that some differences would exist. In particular, the more memorable failures, i.e. those with more social and/or professional repercussions, would be reported less often by the prospective method while the least memorable failures would be reported more often by this technique.

6. It was expected that the neuroepileptic and treatment variables found to be associated with beliefs of poor memory in Study A would also be related to the prevalence of memory failures discovered using the prospective method.

7. In line with the MQ findings, the use of supportive memory strategies was expected to be higher in those subjects who recorded the most memory failures.

8. The moods of anxiety and depression were expected to be found in association with higher levels of memory failures recorded by the prospective checklist.

Method

Design

Data was collected postally from a subsample of Study A subjects, with and without epilepsy who had indicated a

willingness to participate further. A covering letter explained what was required of the subjects and particular emphasis was placed upon the need to complete the measure prospectively over a consecutive seven day period. Furthermore, subjects were again requested to get observers to complete their measure independently.

Subjects

Details of subjects, with and without epilepsy, can be seen in Table B1. Response rates were generally quite acceptable. Of the fifty-three subjects without epilepsy who were sent checklists, thirty-five completed and returned useful data. This corresponds to a 66% response rate. Of the two hundred and eighty-eight checklists sent to subjects with epilepsy, one hundred and eighty were returned complete, a 62.5% response rate. A brief examination of the demographic, medical and MQ data revealed no differences between responders and non-responders to this measure.

Table B1 : The demographic and medical characteristics of the checklist subjects

	<u>Epilepsy (n = 180)</u>		<u>Non-epilepsy (n = 35)</u>		
\bar{x} Age (sd)	41.3	(14.2)	44.2	(12.75)	
Male	79	43.9%	6	17.1%	
Female	101	56.1%	29	82.9%	
Occupation	missing n = 6				
Professional	17	9.8%	5	14.3%	
Intermediate	24	13.8%	3	8.6%	
Skilled	10	5.7%	6	17.1%	
Semi-skilled	15	8.6%	7	20.0%	
Unskilled	19	10.9%	1	2.9%	
Student	6	3.4%	1	2.9%	
Unemp/h-w/retired	83	47.5%	12	34.3%	
Education	missing n = 6				
Degree	32	20.3%	11	31.4%	
Prof.Qual.	16	10.1%	5	14.3%	
'A' levels	26	16.5%	10	28.6%	
'O' levels	35	22.2%	6	17.1%	
CSEs	8	5.1%	1	2.9%	
None	41	25.9%	2	5.7%	
Seizure Frequencies	Daily	Weekly	Monthly	<Monthly	<Yearly
Primary tonic-clonic	1	1	3	8	9
Second.tonic-clonic	4	6	9	12	28
Absence	4	1	0	4	2
Generalised other	2	1	0	3	2
Complex partial	11	21	13	11	12
Simple partial	4	4	7	2	1
Unknown	0	4	12	2	13
\bar{x} Age of Onset (sd)	22.4	(16.7)			
\bar{x} Duration (sd)	19.01	(14.6)			
Focal Onset Details	n = 88		49%		
No focus	25	28.4%			
Left temporal	25	28.4%			
Right temporal	13	14.8%			
Bilateral temporal	8	9.1%			
Temporal side unknown	9	10.2%			
Left frontal	3	3.4%			
Right frontal	5	5.7%			
Information unknown	92	51.0%			

Table B1 continued

Monotherapy 84/175 (48%)

CBZ monotherapy	40	22.85%
DPH monotherapy	24	13.7%
NaV monotherapy	17	9.7%
Phb/Prim.monotherapy	3	1.7%

No. of drugs n = 175

0	7	4.0%
1	89	50.9%
2	58	33.1%
3	19	10.9%
4	2	1.1%

Materials

The checklists comprised the same eighteen items which make up the MQ. In checklist A (CL), subjects are asked if they have suffered any of the memory failures referred to during the particular day and, if so, how often? Responses are supplied by the subject over one week. Checklist B (RCL) is the corresponding form to be completed by the close observer. The total number of memory failures over the seven day period is calculated and information can also be obtained on the frequency of individual problems over the week and daily (see Appendices IX and X). This data was collected between one week and three months following the completion of the survey questionnaires.

Statistical and Arithmetic Treatment of the Data

Non-parametric statistical tests were used to analyse differences between the checklist scores of subjects with and without epilepsy since data from neither group was found to be normally distributed (skewness epilepsy group = 1.169; skewness non-epilepsy group = 2.4). Similarly, the relationship between MQ and checklist responses were analysed using non-parametric techniques as were investigations of the roles of the medical and psychosocial variables. Again, in order to clarify the non-parametric findings, multiple regression analysis was

conducted as a final step. A 5% level of significance was adopted for the checklist study.

In order to allow meaningful comparisons between the total scores on the prospective checklists and the retrospective questionnaires, it was necessary to arithmetically adjust each. First, to estimate the incidence of memory failures collected prospectively over a three month period the median scores of the one week checklists (assumed to represent normal functioning) were multiplied by twelve. Furthermore, since a comparison of these adjusted prospective scores against the original MQ and RMQ scores would be inappropriate, given the 1-6 point rating scale used in the questionnaires, the system of scoring the questionnaires was adjusted to reflect the 'real' believed incidence of failures. Thus, the 1-6 point rating scale was adjusted as shown in Table B5.

RESULTS

The Nature and Extent of Memory Failures recorded over one week in people with and without epilepsy.

In order to check the validity of regarding the summed responses on the CL as a general index of impairment, Kendall's Tau correlations were computed between the responses to each item and the total CL score for both

groups and for self-report and observers' measures. All correlations were positive and for both groups all exceeded +0.3 for the CL except items 10 and 18 which reflected affirmation bias. For the relative's version all correlations for the epilepsy group exceeded +0.25 with the exception of the same two items. Relatives' responses from the non-epilepsy group all exceeded +0.2 with the exception of items 10, 18 and 16. Item 16 had a very low positive correlation with RCLtot (0.03) which failed to reach significance. This may reflect the inability of the relative to observe failures such as this (see Appendix X).

As can be seen in Table B1, demographic characteristics differed between the epilepsy and non-epilepsy groups. The influence of these variables upon the main dependent variables must therefore be assessed. The non-epilepsy group consisted almost entirely of females while the sex distribution within the epilepsy group was more even. Differences in occupation and education classification were less marked and Chi square analysis detected no differences at the 5% level although it was necessary to collapse the data to allow this frequency analysis. The major demographic difference lay, therefore, in the sex distribution. Table B2 displays the median and ranges of the CL and RCL total scores (CLtot and RCLtot) of the sexes in both groups.

Table B2 : Median and range scores of the memory scales for those with and without epilepsy divided according to sex.

	Males		Females	
	Epilepsy	Non-Epilepsy	Epilepsy	Non-Epilepsy
CLtot	40 (2-168)	11 (3-35)	45 (0-189)	17 (3-107)
RCLtot	27 (0-146)	10.5 (0-22)	23 (0-188)	12 (1-131)

CLtot scores did not differ across sexes in either the epilepsy or non-epilepsy groups (epilepsy: $z = -0.88$; 2 tailed; ns. Non-epilepsy: $z = -0.55$; 2 tailed; ns). Observer's reports were similarly unaffected by the sex of the subject (epilepsy: $z = -0.73$; 2 tailed; ns. Non-epilepsy: $z = -0.67$; 2 tailed; ns). It does not seem therefore that the sex difference between the groups is influencing the reports of memory failures.

a. The Extent of Memory Failures

Table B3 shows descriptive statistics of the CLtot and RCLtot scores for the two groups. Differences were statistically significant for both measures with the epilepsy group scoring higher than those without epilepsy (CLtot: $z = -4.67$; 1 tailed; $p < 0.0001$. RCLtot: $z = -3.03$; 1 tailed; $p < 0.001$).

Table B3: Medians and ranges of CLtot and RCLtot.
Kendall's Tau correlations between CLtot and RCLtot.

	Epilepsy		Non-epilepsy
CLtot median	42	**	14
range	0-189		3-107
RCLtot	24	*	12
range	12-97		0-131
CLtot x RCLtot	0.474	**	0.42 *
**p < 0.0001	*p < 0.001		

Observer's reports of failure are clearly lower than self-reports in the epilepsy group. The difference is however negligible within the non-epilepsy group. The correlations between self and observer's measures were strong, positive and significant in both groups.

b. The Nature of the Memory Failures

Figure B1 shows the profiles of daily memory failures in the two groups. Of the ten items upon which it was possible to conduct Chi square analysis, six produced significant results, indicating that subjects with epilepsy reported them occurring significantly more often on a daily basis (see Figure B1). Viewed as a whole, the profiles of failure look rather similar. However, differences in two items are striking. While these arise daily rather frequently in the epilepsy group, they do not

Profiles of daily memory failures: epilepsy and non-epilepsy groups

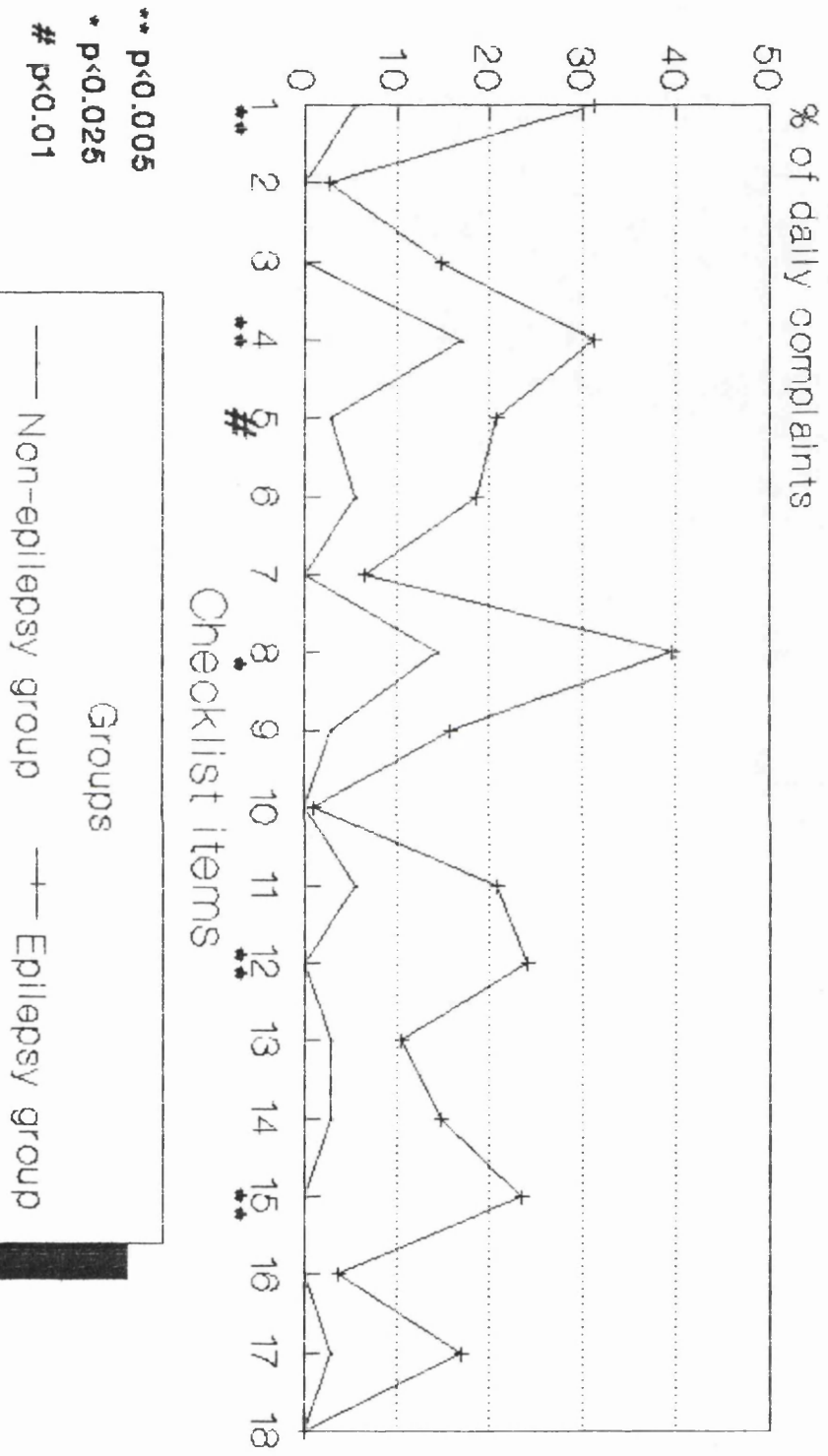


Figure B1

occur daily at all in the non-epilepsy group. They are items 12 (losing track of a story) and 15 (forgetting people's names). These may represent particular difficulties peculiar to people with epilepsy. Both of these arise in the top five daily memory failures of the epilepsy group. The three other failures (i.e. tip-of-the-tongue difficulties, going back to check if you've done something and losing things) also appear as the top three daily failures of the non-epilepsy group.

Comparing the prospective and retrospective reporting of memory failures

a. The Total Scores

Non-parametric correlations were computed between the questionnaires and memory checklists of subject and observers in both groups. The relationships can be seen in Table B4.

Table B4: Kendall's Tau correlations between the questionnaire scales of memory beliefs and prospectively recorded failures.

	Epilepsy	Non-Epilepsy
CLtot x MQtot	0.47 (p < 0.0001)	0.27 (p < 0.05)
CLtot x RMQtot	0.3 (p < 0.0001)	0.27 (p < 0.05)
RCLtot x MQtot	0.28 (p < 0.0001)	0.05 (ns)
RCLtot x RMQtot	0.39 (p < 0.0001)	0.13 (ns)

All relationships were highly significant for the epilepsy group while the strength and significance of the correlations for the non-epilepsy group were not as notable.

In order to establish, in a more precise manner, the relationship between the two memory measures, the total scores derived for the prospective and retrospective measures were adjusted as described earlier. The resulting figures can be seen in Table B5.

Table B5: Summary statistics of the adapted three month checklists and MQs.

		<u>Adjusted 6-point MQ rating scale</u>					
		A	B	C	D	E	F
MQ value		1	2	3	4	5	6
Adjusted value		0	1	3	12	84	168
		Adapted	Adapted	Adapted	Adapted		
		CL	RCL	MQ	RMQ		
Epilepsy							
Median		504	288	328	151.5		
Range		0-2268	144-1164	0-2940	0-2604		
\bar{x}		618	421.1	511.2	340.7		
sd		480.3	418.8	524.2	460		

Table B5 (cont)

Non-epilepsy

Median	168	144	78	42.5
Range	36-1284	0-1572	2-1292	0-1519
\bar{x}	262.8	206.4	187.8	136.56
sd	258	284.4	247.3	233.1

Contrary to expectation, these adjusted scores suggest an underestimation of the incidence of memory failures on the retrospective questionnaire by both epilepsy and non-epilepsy groups.

The final piece of analysis concerned with the CLtot makes use of the four point nuisance rating scale which had been gathered during Study A. The checklist subjects were divided according to the degree of nuisance they regarded their memories as presenting to them in their daily lives. Kruskal-Wallis analysis found that within the epilepsy group, CL scores differed significantly between nuisance rating groups with those reporting no nuisance scoring the lowest and those reporting a serious nuisance the highest ($\chi^2 = 36.4$; $p < 0.0001$). A similar pattern was observed in the non-epilepsy group though no subjects reported a serious nuisance and findings were less significant ($\chi^2 = 11.3$; $p < 0.035$). Relevant descriptive statistics can be seen in Table B6.

Table B6: Median and range CLtot scores according to nuisance ratings.

	Epilepsy	Non-epilepsy
No nuisance	14 (2-59)	13 (6-35)
Slight nuisance	26 (0-133) *	12 (3-53) @
Moderate nuisance	47 (5-158)	36 (19-107)
Serious nuisance	77 (4-189)	-
*p < 0.0001	@ p < 0.05	

b. The Specific Memory Failures

To explore the apparent underestimation of difficulties, the individual memory failures were examined in terms of their frequencies reported on the questionnaire and checklist. The modal rating given on the MQ for the eighteen items was compared to the median report for each item on the checklist. This information can be seen in Table B7.

Table B7: Comparing the Modal MQ responses to the median CL responses.

Epilepsy			Non-Epilepsy		
	MQ	CL		MQ	CL
1	1/week	4/week	1	1/week	2/week
2	0/3month	0/week	2	0/3month	0/week
* 3	0/3month	1.5/week	3	0/3month	0/week
4	1/day	4/week	4	1/month	3/week
5	1/week	3/week	5	1/3month	1/week
* 6	0/3month	1/week	6	0/3month	0/week
7	0/3month	0/week	7	0/3month	0/week
8	1/week	5/week	8	1/week	1/week
* 9	0/3month	1/week	9	0/3month	0/week
10	0/3month	0/week	10	0/3month	0/week
*11	0/3month	2/week	11	1/3month	1/week
*12	0/3month	2/week	12	0/3month	0/week
*13	0/3month	1/week	13	1/3month	1/week
*14	0/3month	2/week	14	0/3month	0/week
15	0/3month		15	0/3month	
	+ >1/day	3/week		+ 1/week	2/week
16	0/3month	0/week	16	1/3month	0/week
*17	0/3month	2/week	17	1/3month	0/week
18	0/3month	0/week	18	0/3month	0/week

*Clear underestimations of the frequency of failures.

Of the eighteen memory failures, the occurrence of eight are clearly underestimated by the epilepsy group (i.e.

arising once in the week or more but reported as not occurring at all in three months on the retrospective checklist). The nature of these particular items does not suggest that they are less memorable types of failure, indeed, some could presumably have repercussions on professional and/or social life (e.g. forgetting to pass on a message and failing to remember a change in routine). No items were over-emphasised on the retrospective questionnaire according to this analysis.

Checklist data relating to the proportion of subjects reporting daily failures corresponds well with the top five complaints reported using the retrospective questionnaire. The comparison is shown in Table B8.

Table B8: The top five daily failures reported on the CL and MQ by the epilepsy and non-epilepsy groups.

EPILEPSY

MQ		CL
I	Tip-of-the-tongue	I Tip of the tongue
II	Going back to check	II Going back to check
III	Losing things	II Losing things
IV	Forgetting names	IV Losing track of a story
V	Forget told something	V Forgetting names

Table B8 (cont)

NON-EPILEPSY

MQ	CL
I Going back to check	I Going back to check
II Losing things	II Tip-of-the-tongue
III) Forgetting Names	III) Losing things
III) Tip-of-the-tongue	III) Rambling on
V Rambling on	III) Forget what saying

Some differences do exist however. Within the epilepsy group, losing track of a story is apparently arising more often on a daily basis according to the prospective CL than was reported by the retrospective MQ. Forgetting that you were told something happens rather less often according to the CL than is suggested by retrospective recording of difficulties. In the non-epilepsy group, forgetting what you were saying replaces forgetting names in the top five daily problems reported on the CL.

Extracting variables which are found in association with everyday memory failures

a. The Neuroepileptic Variables

i. Age of onset. The mean age of onset for the checklist group was again high ($\bar{x} = 22.4$; $sd = 16.7$).

A Kendall's Tau correlation was computed between CLtot and

age of onset. This was found to be positive and statistically significant though rather weak (see Table B9).

Given this weak but significant correlation, group analysis was conducted by splitting the subjects according to the mean onset age. Group one consisted of those with onset between 0 and 22 years, while group two comprised those with onset at 23 years or older. This revealed a significant tendency for group two subjects to score higher on the CL than those in group one ($z = -2.146$; $p < 0.05$). Median and ranges of CLtot for the two onset groups can be seen in Table B9.

Table B9: Kendall's Tau correlation between CLtot and age of onset. Median and range CLtot for the two onset groups.

	Group One		Group Two
N	107		69
Median CLtot	27.5	*	48
Range	5-125		3-189

Kendall's Tau B CLtot x Age of onset 0.091; $p < 0.05$

* $p < 0.05$

ii. The Frequency of Seizures. The five seizure frequency groupings were analysed in terms of their relationship with CLtot scores for subjects with primary

generalised, secondary generalised and complex partial seizures. Using the Kruskal-Wallis non-parametric one way analysis of variance test, a significant difference was detected for subjects with complex partial seizures ($\chi^2 = 11.64$; $p < 0.05$). Multiple comparisons between the frequency groups revealed that the significant comparison lay between subjects with complex partial seizures of less than monthly frequency and those with yearly or less frequent seizures. The former group scored significantly higher on CLtot. No other comparisons were significant at the 5% level. Table B10 gives the relevant descriptive statistics of CLtot for these subjects.

Table B10: Median and range CLtots in those with complex partial seizures of varying frequencies.

	Frequency of Complex Partial Seizures				
	Daily	Weekly	Monthly	<Monthly	≤ Yearly
Median					
CLtot	38	35	53	92	* 19
Range	22-148	4-137	10-107	3-158	6-76

*p < 0.05

No significant differences in CLtot were found when the variables of duration of epilepsy; type of seizures; the number of different seizures types; type of monotherapy (carbamazepine vs phenytoin vs sodium valproate) or the

number of drugs being taken (0, 1, 2 or 3) were considered. It seems that these variables are not influential in determining the frequency of prospectively recorded memory failures.

b. The Use of Memory Aids and Strategies

The use of memory aids and mnemonics was similar in subjects with and without epilepsy. The epilepsy group reported using an average of 3.9 (sd = 1.8) external aids and 2.04 (sd = 1.4) internal strategies. This compared to figures of 3.8 (sd = 1.6) and 2.7 (sd = 1.45) for the non-epilepsy group.

Kendall's Tau correlations of CLtot with use of external and internal memory strategies produced weaker relationships in the epilepsy group (see Table B11). Group analysis was performed upon epilepsy and non-epilepsy groups by dividing each at their respective median CLtot scores. This showed that for both epilepsy and non-epilepsy subjects, those with the higher CLtot scores made more use of external aids, but their use of internal strategies did not differ from those with less frequent memory failures. (Epilepsy external: $t = -2.76$; 172 df; $p < 0.01$ 1 tail test. Non-epilepsy external: $t = -2.36$; 32 df; $p < 0.025$ 1 tail test). Summary statistics of the use of memory strategies can be seen in Table B11.

Table B11: Kendall's Tau correlations between use of external and internal memory strategies and CLtot. The use of aids by groups split at the median CLtot scores (Group 1 < median CLtot; Group 2 > median CLtot).

	Epilepsy	Non-epilepsy
CLtot x external aids	0.19 (p=0.0003)	0.29 (p=0.01)
CLtot x internal aids	0.024 (ns)	0.205 (p=0.06)
\bar{x} (sd) external Group 1	3.53 (1.8)	3.2 (1.4)
	**	*
\bar{x} (sd) external Group 2	4.27 (1.6)	4.4 (1.6)
\bar{x} (sd) internal Group 1	1.94 (1.4)	2.44 (1.6)
\bar{x} (sd) internal Group 2	2.14 (1.4)	2.88 (1.3)
	**p = 0.006	*p = 0.025

c. Mood and Memory Failures

i. Anxiety. Kendall's Tau correlations were computed between the HAD scale anxiety score and CLtot for subjects with epilepsy and those without. These can be seen in Table B12. The relationship was positive in both groups but did not reach significance at the 5% level for the non-epilepsy group. Given this, the epilepsy group was divided according to the anxiety cut-off score. This analysis revealed that anxiety was indeed related to more recorded memory failures in the epilepsy group ($z = -4.4$; $p < 0.0001$ 1 tailed test). Summary statistics can be seen in Table B12.

Table B12: Kendall's Tau correlations between mood and CLtot. The median and range CLtots for groups divided according to mood scale cut-offs.

	Epilepsy	Non-Epilepsy
HAD-A x CLtot	0.27 (p=0.0001)	0.18 (ns)
HAD-D x CLtot	0.34 (p=0.0001)	0.23 (p=0.05)
BDI x CLtot	0.23 (p=0.0001)	0.15 (ns)
Median and range		
CLtot for HAD-A <9	37.5 (0-158)	14 (3-67)
Median and range	**	
CLtot for HAD-A ≥9	62.5 (8-189)	18 (4-107)
Median and range		
CLtot for HAD-D <9	40.5 (0-172)	14 (3-107)
Median and range	*	
CLtot for HAD-D ≥9	78 (10-185)	17 (n = 1)
Median and range		
CLtot for BDI <13	37.5 (0-172)	14 (3-107)
Median and range	*	
CLtot for BDI ≥13	63 (7-189)	18 (14-59) (n=4)

**P < 0.0001 *p < 0.001

ii. Depression. Tau correlations between CLtot and depression scores on both the HAD scale and the BDI for subjects with and without epilepsy can be seen in Table B12. Again, all relationships were positive and, for the HAD scale, both group correlations reached significance.

Applying the appropriate cut-off scores for the depression scales, group analyses showed that for the subjects with epilepsy, depression assessed on both scales was related to more frequent memory failures (HAD-D: $z = -3.4$; $p < 0.001$; 1 tailed test. BDI: $z = -3.6$; $p < 0.001$; 1 tailed test). Numbers of subjects scoring as depressed within the non-epilepsy group were small, making group analyses rather inappropriate.

Multivariate Analysis

A stepwise multiple regression equation was computed to clarify which - epilepsy related and mood variables influenced the CLtot of people with epilepsy to the greatest extent. Square root transformations were again used to normalise the data. Results indicated the greatest role for depression (assessed by the HAD scale). 19.09% of the variance within CLtot could be accounted for by the depression scores. Anxiety levels accounted for a further 2.8% of the variance. No other variables, including age of onset, were considered influential enough to be included in the equation.

Summary of the Memory Checklist Findings

The findings reported here confirm that the subjects with epilepsy record significantly more everyday memory

failures over a one week period than the non-epilepsy subjects. Although the two groups were not well matched for sex, this variable was not found to affect scores on either the CL or the RCL. Observers in both groups are quite reliable in their reports of the subject's memory failures. Fewer failures are recorded overall by the observers as expected, but correlations with self-report are reasonably strong and significant in both groups. Profiles of failures occurring on a daily basis appear similar with the major differences lying in the overall incidence of the daily problems. There is evidence to suggest that a high incidence of two particular failures (i.e. losing track of a story and forgetting people's names) may be specific to people with epilepsy.

Based upon the assumption that prospective recording gives rise to more accurate judgements of the incidence of failures than retrospective recording, the evidence shows that people with epilepsy (and those without) are underestimating the occurrence of memory failures when reporting their beliefs retrospectively. This under-emphasis may be as much as 14.5 incidents a week for people with epilepsy and this is spread across the failures which are comparatively less troublesome (i.e. not the top five problems). As a whole, both epilepsy and non-epilepsy groups appear to be capable of reliably judging the frequency of their major memory difficulties

on the retrospective measure.

With regard to the roles of neuroepileptic and psychosocial variables, there seems little doubt that both anxiety but particularly depression are more closely related to memory difficulties than is the nature of the epileptic condition. Of the epilepsy and treatment variables considered in the non-parametric bivariate analysis, only older age of onset and the frequency of complex partial seizures were associated with an increased frequency of memory failures. However, neither of these variables were indicated by multiple regression analysis.

There was statistical support for the notion that external aids to memory are used to a greater extent by subjects, with and without epilepsy, who report more memory failures. The same relationship did not however apply to the use of internal mnemonic strategies. As was the case with Study A findings, no deductions about the efficiency of the use of these techniques could be made from the data provided.

Considerations of Design, Methodology and Analysis of the Checklist Study

i. The Sample

The subjects who completed the checklist measure comprised a sub-set of the original large survey sample. They were therefore volunteers and, one could argue, highly motivated volunteers since they were selected because they had indicated a wish to participate further in this research. Again therefore, as with the survey responses, it may be wise to regard the results relating to the prevalence of prospectively recorded memory failures as overestimates of the true population prevalence. However, it should be borne in mind that this sample is still more representative in terms of chronicity and severity of the seizure disorder than are those usually gathered in studies examining memory -functions in epilepsy. Nevertheless, the analysis regarding the role of neuroepileptic and treatment variables should be considered with caution. A larger sample size may have proved more sensitive to the effects of these diverse variables and, it should again be stressed that these details were self-reported.

The non-epilepsy control group data was unsatisfactory for two reasons. First, as with the questionnaire data, it may have been advisable to collect responses from groups of subjects with another non-neurological chronic disability, and from subjects with a different neurological condition in order to extract the memory effects of the epileptic condition itself. Second, the sex distribution of the epilepsy and non-epilepsy groups were quite

different. Initial attempts were made to sample equal numbers of males and females in both groups. Unfortunately, with only six 'normal' male respondents, any judgements about how healthy males function from day to day would be rather premature. Clearly, responses of this sort must be more actively sought from male 'controls'.

ii. The Instruments

Perhaps the crucial point which needs clarifying is whether one should consider responses given over a single consecutive seven day period as being representative of respondents' normal functioning. To examine this, comprehensive test-retest data should perhaps have been collected on the checklist measures.

There can be little doubt that information collected on memory failures using a prospective recording technique are likely to give a more accurate reflection of everyday functioning than is the data obtained using a retrospective questionnaire. This does not, however, mean that the method is a perfect one. The memory introspection paradox will still play a role in determining the accuracy of responses given on this measure by subjects with memory difficulties, although its impact is less because of the reduced burden upon memory

posed by prospective recording.

A final point to make about the adequacy of the instrument relates to the ability of the observers to prospectively record the target subject's memory failures. Clearly, observers' responses will reflect the target subject's memory most accurately if they are in a position to observe for a good part of the target subject's week. If the subject or observer is employed or, for other reasons they are separated for a good part of the time, the accuracy of the observer's records will be compromised. For this reason, the reliability of the observer's prospective data may be questioned.

iii. The Method

Perhaps the major weakness of the checklist studies involves the inconstant time lapse between the collection of the dependent and independent variables. Medical and mood information gathered at the time of the survey may have altered quite substantially by the time the checklist information was collected. The failure to enquire again about those details which are liable to change with time may be crucial. Had this been done, more convincing relationships between the incidence of prospectively recorded memory failures and variables such as seizure frequency may have been found. Similarly, the comparison

of questionnaire and checklist data gathered at different points in time implies that both measures are reasonably stable over time. This assumption should of course be tested.

iv. The Analysis

As with the MQ responses, the data on the checklist total was analysed using non-parametric techniques. Both the epilepsy and non-epilepsy group data was found to be positively skewed away from the normal distribution. Again, suitable tests are limited on the statistical package. Therefore a multiple regression analysis was used as a final step to establish the importance of the dependent variables in influencing the memory data.

STUDY C: NEUROPSYCHOLOGICAL TESTS AND EVERYDAY MEMORY

The Rationale

Examining both self-report and 'objective' test memory allows a broader view of subjects' strengths and weaknesses to be derived. Furthermore, it is clearly necessary to consider the relationship between the two types of assessment and their relations with other influential variables.

From the findings of Study A, it seems that while a characteristic of the non-epilepsy group is to report no or only slight nuisance from their memories, it is more a feature of the epilepsy group to report moderate or serious nuisance from their memories (54% of the epilepsy sample reported moderate or serious nuisance from their memories compared to 23% of the non-epilepsy sample). Furthermore, these simple 'nuisance' reports correlated significantly with the overall MQ scores in both groups. It was decided therefore to examine the neuropsychological test performance in two sub-samples of the epilepsy group who were classified according to the level of nuisance they reported from their memories. It was hoped that this would clarify where the cognitive difficulties of the subjects who complain of significant (i.e. a greater degree than the majority of healthy people without epilepsy) memory problems lie. A battery of tests was

constructed which, of course, concentrated heavily upon assessing 'traditional' memory skills but also incorporated tests of other skills which were expected to be associated with some of the specific everyday difficulties which subjects with epilepsy report. In particular these were those of prospective recall, naming and organisation/forward planning. The efficiency of naming skills should be reflected in the frequency of reported 'tip-of-the-tongue' states. Tests of organisation and planning as well as prospective recall should be associated with everyday memory failures with a prospective component. In addition, it has been argued by some authors that the reason for the lack of association between self-report and performance measures of memory is that different skills are required by the two settings. It is possible that the skills required more often by the day-to-day setting are those referred to above.

Hypotheses

Six hypotheses were put to the test:-

1. It was expected that subjects who complained of greater memory difficulties would perform rather more poorly on the memory tests than those with lesser or no difficulties.

2. Correlations between the self-report and objective measures were expected to be weak in line with findings from other research and clinical observation of people with epilepsy.

3. It was expected that subjects who complain of more memory difficulties would perform more poorly on the tests of naming, forward planning and prospective memory. In particular, performance on these tests would relate to the frequency of 'tip-of-the-tongue' and prospective memory failures.

4. As in the foregoing studies, the use of memory support strategies would distinguish those who complain of significant memory difficulties from those who do not, with the former group reporting more use of these techniques.

5. Again, in line with the findings of the previous studies, levels of anxiety and depression were expected to be elevated amongst those subjects who complain of memory problems.

6. Epilepsy-related and treatment variables were not expected to differ between the two groups with the exception of age of onset which was found to be related to memory difficulties in Study A.

METHOD

Design and Subjects

Two groups of thirty subjects were collected, all of whom had epilepsy, had provided data for the questionnaire survey and had indicated a desire to participate in further research. All of these volunteers lived within easy travelling distance of the location of testing but were otherwise unselected. The subjects were grouped according to the statement of memory nuisance given in the memory questionnaire which had been completed along with the other questionnaire measures sometime within the preceding six month period. The 'complaining' group consisted of subjects who reported that their memories presented a moderate or serious nuisance to them in their daily lives. The 'non-complaining' group consisted of subjects who reported that their memories were only a slight nuisance or presented no nuisance at all. The two groups were matched for sex, occupation, educational status and level of ability. At the end of the testing session, which lasted approximately one and a half hours, subjects were asked if they still agreed with the nuisance ratings given in the survey. All did. Demographic and epilepsy details of these subjects can be seen in Table C1.

Table C1: Demographic, Epilepsy and Treatment Characteristics of the Two Test Subject Groups.

	<u>Complainers</u>		<u>Non-complainers</u>	
Age (mean, sd)	38	12.3	33	11.2
Number of males	16		17	
Number of unemployed	11		10	
Age of onset (mean sd)	20	13.2	14	11.2 *
Duration (mean sd)	18	12.7	19	11.1
Number with partial seizures with or without secondary generalisation	25		23	
Seizure frequency				
Daily	7		7	
Weekly	13		10	
Monthly	9		9	
< Monthly	9		7	
≤ Yearly	5		7	
Two or more seizure types	21		14	
EEG Evidence				
Left temporal	5		3	
Right temporal	2		6	
Bilateral temporal	4		5	
Right frontal	1		3	
Medication				
0 Drugs	1		1	
1 Drug	8		11	
2 Drugs	16		11	
3 Drugs	5		7	
CBZ/Nav mono	5		7	
IQ	110	(12.8)	105	(12.6)

*p < 0.025, 1 tailed)

The Test Battery

1. Memory Tests

The battery incorporated six conventional memory tests. These assessed immediate and delayed recall, learning and

recognition for verbal and non-verbal material. They were as follows:-

i. Story Recall (Adult Memory and Information Processing Battery, AMIPB; Coughlan and Hollows 1985). The subject is requested to listen carefully to a short story. Immediate and delayed recall, after 25-30 minutes, are assessed according to details remembered. Incorrect or additional details are scored 0. Partially recalled details are given a score of 1 and a score of 2 is credited for correctly recalled details. The maximum obtainable score is 60. After immediate recall, the subject is told that he/she will be asked to recall the story some time later. In both tests, when the subject appeared to have finished recalling, the experimenter prompted for any further details. The test was not timed but, generally no more than two-three minutes was required for recall.

ii. The Revised Visual Retention Test-Form C (Benton 1974). The subject is told that he/she will be shown a set of pictures for ten seconds each and, that when each picture is taken away, he/she is required to draw what is remembered. Subjects were warned of the increasing complexity of the designs and encouragement was given if required. The test was not timed but completion was usually within 5-10 minutes. The responses are scored simply on the basis of number correct with judgement

relying upon errors outlined in the Test Manual.

iii. Design Learning (AMIPB). A design comprising nine lines which connect dots in a four by four array is presented to the subject for ten seconds. When the design is taken away, the subject must try to reproduce it on the same four by four dot matrix. The procedure is repeated up to four more times or until the subject successively reproduces the design on two consecutive trials. A different design (B) is then shown to the subject, once only, and he/she is requested to reproduce this also. Following this interference trial, the subject is asked to draw once more what he/she can remember of the first design. The subject was informed at the outset that more than one trial is usually necessary for perfect reproduction and this was reinforced throughout the procedure if the subject appeared anxious that he/she was not doing well. Praise and encouragement were given where appropriate. Each line correctly reproduced scores 1 point giving a total score out of 45 for A1-5 learning. Design B and Trial A6 (Delayed Recall) are scored separately.

iv. List Learning (AMIPB). The subject is asked to attend carefully while a list of 15 words is read out. He/she is informed that recall of these words will be required. The reading and recall procedure is repeated up to four more times or, if sooner, when the subject

recalls all 15 words on two consecutive trials. An interference list is then presented, once only, with immediate recall. Subsequently, the subject is asked to recall as much of the first list as possible. The instructions emphasised the fact that several presentations would be necessary for learning and this was reiterated if the subject showed signs of anxiety about his/her performance. Praise and encouragement was given when necessary. The test was not actively timed but if reluctance to terminate a trial occurred, then it was ended by the experimenter. A total learning score out of 75 is derived from Trials A1-5. Scores from the interference list and post-interference recall are considered separately.

v and vi. The Recognition Memory Test (Warrington 1984). Visual and verbal recognition memory are assessed by separate tests. Within this battery, visual retention was tested first. The subject is shown 50 photographs of unfamiliar male faces. Attention to the stimuli is ensured by requesting the subject to rate every face as pleasant or not so pleasant. Thus, the information is processed semantically and, is encoded at a deeper level (Craik and Lockhart 1972). Following presentation, recognition of the faces is tested by presenting stimulus and distractor items side by side in a two forced-choice format. The subject has to indicate which face was present in the stimulus list. The subject is encouraged

to guess if failure to recognise either item is implied. Brief exposure to the stimuli is the aim. Difficulties initially arose for this sample of subjects because they were unwilling/unable to classify the stimuli along these perceived 'judgemental' lines. Hence, an additional attitude choice was added. 'Neutral' was to be used only when the subject found it impossible to classify a stimulus according to original rules. Correct choices are added up and the subject's performance scored appropriately. The procedure for verbal recognition is analogous to that for visual with the exception that forced-choice stimuli are presented on a word card for recognition responses. Similar difficulties arose with regard to the semantic judgement of the pleasant/not so pleasant dichotomy, even when it was stressed that the judgement itself was not important. Hence the category of 'neutral' was again allowed.

vii. The Belonging Test of the Rivermead Behavioural Memory Test (Wilson et al 1985). This additional memory test was used to assess, in an ecologically valid manner, the subject's prospective memory ability. The subject is asked to give the experimenter a (non-valuable) possession for the duration of the testing session. The item is placed somewhere in the room and the location is known to the subject. The subject is subsequently asked to remind the experimenter

to give the item back at the end of the session. The test is scored as 0 if the subject forgets to do this, 1 if the subject requires a non-specific cue to recall, and 2 if the subject successfully remembered to ask for his/her possession back. The test was performed by twenty-six subjects within each subgroup.

2. Other Tests

Four other tests were incorporated into the battery to detect alternative deficits which may underlie self-reported memory problems. They were:-

viii. The Boston Naming Test (Kaplan, Goodglass and Weintraub 1983). This test was included as a brief assessment of naming skills and, as such, as a way of reflecting tip-of-the-tongue occurrences in daily life.

The subject is asked to go through a booklet containing sixty line drawings of objects, the names of which range in familiarity and therefore difficulty of retrieval. Speed of response is emphasised but the subject is told that there is a maximum of twenty seconds to look at each picture. If the subject came across a picture that was completely unfamiliar to him/her, he/she was asked to respond 'don't know' and continue. If, however, the picture produced a 'tip-of-the-tongue' state, he/she was asked to persevere until either the name was recalled or

the experimenter informed the subject. No clues were given. The number of correctly identified pictures within the twenty seconds is taken as the assessment score.

ix. The Modified Wisconsin Card Sorting Test (Nelson 1976). This test was incorporated in order to detect possible organisational skills deficits which may underlie 'absentmindedness' or prospective memory problems.

Forty-eight stimulus cards and four key cards are used. The key cards are laid out before the subject at the start. The cards can be sorted according to three simple rules; colour, shape and number. The subject is asked to sort the stimulus cards out on top of the key cards according to certain rules which the subject must work out. The first card placed by the subject is always accepted as correct and he/she is told to continue. After six correct consecutive placements, the used cards are removed and the subject is told that the rule has changed and a new rule is now needed. This procedure continues until the subject has worked out the further two rules. Only three trials were used in this battery in order to reduce the time taken in an already lengthy testing session and because it was considered that if difficulties existed, they would be detected within the

first three trials. Scoring depended on three factors, the time taken, the number of correct trials out of three, and the number of perseverative errors made. The test was terminated if the subject displayed anxiety or prolonged confusion and was clearly having difficulty with the test or, if all forty-eight cards had been used up.

x. The Porteus Mazes (Porteus 1965). Two Mazes were incorporated into the battery. The Adult 1 version of the extension series was used for practice purposes followed by Adult 1 version of the supplement series. The Maze was analysed in terms of number of wrong directions taken, the number of pencil lifts made and the time taken to complete the maze. The qualitative variables are considered indicative of planning/organisation ability and indecision. The subject is simply told to trace through the maze with a pencil from beginning to end using any chosen strategy. Porteus (1959) argues: "...the process of choosing, trying and rejecting or adopting alternative courses of conduct or thought. At a simple level, this is similar to solving a very complex maze".

xi. The Standard Progressive Matrices - Section 3 (Raven 1983). These matrices were used to yield a quick and memory-free measure of IQ. They are often used as an IQ measure and the manual maintains the ability of the scale to assess intellectual capacity in a bias-free

manner.

The scale consists of sixty problems divided into five sets of twelve. The first two examples in the matrices were explained thoroughly to the subjects and then they were requested to continue by indicating which solution they considered best for each problem. The scale was not timed and the total score was calculated and converted into an IQ equivalent.

The Memory Questionnaire Data

As well as computing the total score from the MQ, certain specific items were also considered separately. First, item 8, the naming difficulty was to be considered in relation to the score obtained on the naming test. Furthermore, five items were considered to reflect a strong prospective recall component. These were:-

LOST - Forgetting where you have put something, e.g. losing things around the house (item 1).

ROUTINE - Failing to remember a change in your daily routine (item 3).

CHECK - Having to go back to check whether you have done something you meant to do (item 4).

TALK - When talking to someone, forgetting what you

were saying (item 11).

MESSAGE - Forgetting to tell someone something important, e.g. forgetting to pass on a message (item 13).

The frequency of occurrence of all of these items was examined in relation to performance on the belonging test, the card sorting test and the Porteus Mazes.

Statistical Treatment of the Data

Where memory and mood questionnaire data was being considered, non-parametric statistical tests were used to examine correlational relationships and test for group differences. When scores on performance measures were compared between the two groups, parametric tests were considered appropriate. A 5% significance level was adopted for this study.

RESULTS

As expected, the two groups differed significantly with respect to the total scores obtained on the MQ and the RMQ. The complaining group scored higher on both measures confirming that these subjects do indeed report more memory failures than the 'non-complaining' group (MQ: $z = -4.42$, $p < 0.0001$, 1 tail. RMQ: $z = -3.04$, $p < 0.005$, 1 tail). Qualitative analysis of the MQ responses upholds this difference with only three complainers

reporting no daily failures compared to fourteen non-complainers. The five most frequent daily problems appear quite similar with three common to both groups. Table C2 gives details of the MQ and RMQ responses for the two groups.

Table C2: The MQ and RMQ data for the two groups of test subjects.

	<u>Complainers</u>	<u>Non-complainers</u>	
Median MQtot	64	38	**
range	31-92	18-69	
Median RMQtot	48	34	*
range	24-86	18-66	

Top Five Problems:

1	Tip-of-the-tongue)	Tip-of-the-tongue
2	Losing things)	Rambling on
3	Go back to check	Go back to check
4	Forget told something)	Forgetting names)
5	Forgetting names)	Repeating things)

**p < 0.0001 *p < 0.005

The Memory Tests

i. Group Analysis

Only three of the objective memory tests discriminated the groups. Complainers scored significantly more poorly on

prose recall in both immediate and delayed conditions compared to non-complainers ($t = 3.37$, $p < 0.001$, 1 tail and $t = 3.13$, $p < 0.0025$, 1 tail respectively). The learning of a geometric design was also significantly poorer in the complaining group ($t = 2$, $p < 0.05$, 1 tail test). Means and standard deviation scores of the seven memory tests with their component scores can be seen in Table C3.

Table C3: Descriptive statistics of the memory test scores of complainers and non-complainers.

	<u>Complainers</u>		<u>Non-complainers</u>	
	Mean	(sd)	Mean	(sd)
Story Immediate	17	(8.65) **	25.9	(11.51)
Story Delayed	15.1	(8.99) *	23.5	(11.55)
Story % Retained	85.4%		92.7%	
B.V.R.T.	6.7	(1.65)	7.3	(1.66)
List Learning Tot.	51.07	(7.8)	49.8	(7.46)
Interference List	6.2	(1.74)	6.6	(2.13)
List Delayed Recall	9.6	(2.48)	10.1	(2.54)
Design Learning Tot.	28.3	(8.45) @	32.6	(8.24)
Interference Design	4.97	(1.88)	5.6	(2.06)
Design Delayed Recall	6.07	(2.77)	7.1	(2.02)
RMT Words	45.5	(5.22)	45.7	(4.93)
RMT Faces	41.8	(5.28)	39.23	(6.08)

Table C3 (cont)

Belonging (frequencies)

Forgotten	6	1
Recalled	17	22
Cued Recall	3	4

**p < 0.001 *p < 0.0025 @p < 0.05

ii. Correlations

The Kendall's Tau correlations between MQtot and the memory tests can be seen in Table C4. The scores from the two groups were combined to increase the sensitivity of these analyses (all-correlations for N = 60). All of the relationships were expected to be negative, indicating poorer test scores accompanying the higher levels of self-reported memory failures.

Table C4: Kendall's Tau correlations between MQtot and the memory tests.

	MQtot (N = 60)
Story Immediate	-0.25 (0.003)
Delayed	-0.22 (0.008)
% Retained	-0.059 (ns)
B.V.R.T.	-0.06 (ns)
List Learning	-0.005 (ns)
Interference	0.03 (ns)
Delayed List	-0.09 (ns)
Design Learning	-0.15 (0.05)

Table C4 (cont)

Interference	-0.03 (ns)
Delayed Design	-0.21 (0.013)
RMT Words	0.13 (ns)
RMT Faces	0.006 (ns)

The correlations are generally weak and thus agree with previous studies examining relationships between 'objective' and self-report memory (e.g. Baddeley et al 1987, Lincoln and Tinson 1989). Only four correlations reach significance at the 5% level. These were between MQtot and immediate and delayed story recall, design learning and the delayed recall of the learned design. It is of note that for story recall, the smallest contribution toward significance of the combined data appears to be from the complaining group (MQtot x immediate story recall, Tau = -0.06 for complainers and -0.18 for non-complainers. MQtot x delayed story Tau = -0.08 for complainers and -0.16 for non-complainers).

Correlations were also computed between RMQtot and performance measures. Relationships were of similar strengths and significance as the self-report data. This is contrary to the findings of Sunderland et al (1983) who found that relative's questionnaires correlated better with subject's test performance than the subject's own reports (see Appendix XIX for RMQ and performance correlations).

Naming, Prospective Memory and Organisational Skills

i. Naming Skills

Scores obtained on the Boston Naming Test failed to discriminate the two groups in spite of the fact that the complainers did report more frequent daily naming problems on the MQ than non-complainers ($\chi^2 = 5.4$, 1df, $p < 0.025$). Furthermore, when a comparison of the naming test scores between those reporting daily naming difficulties and those whose difficulties are apparently not as frequent, no difference was detected ($t = 0.69$ ns). It does not seem that this test of naming skills is sensitive to these memory difficulties reported by some people with epilepsy.

The summary statistics of the naming skills data can be seen in Table C5.

Table C5: Details of daily word finding difficulties and Boston Naming Test scores in complaining and non-complaining groups.

	<u>Complainers</u>	<u>Non-complainers</u>
Frequency reporting		
daily TOT states	20 (66.7%)	10 (33.3%) *
\bar{x} Boston test	48.2	49.9
(sd)	8.38	6.26

* $p < 0.025$, 1 tail

ii. Prospective Memory - The Belonging Test

No difference was found between complainers and non-complainers in the performance on the Belonging Test. This is in spite of the fact that complainers were significantly more likely to report the occurrence of daily failures on one or more of the five prospective MQ items than non-complainers ($x^2 = 6.28$, 1df, $p < 0.025$). The pertinent frequency data can be seen in Table C6. Further frequency analysis revealed no significant relationship between performance on the Belonging test and the report of 0 compared to ≥ 1 daily prospective memory failures when all subjects were combined. It must be concluded that this particular test of prospective memory is not sensitive to the increased level of prospective recall difficulties reported by some people with epilepsy.

Table C6: The frequency of daily prospective memory failures with corresponding performance on the belonging task.

	<u>Complainers</u>	<u>Non-complainers</u>
Number reporting ≥ 1 prospective memory failures daily	17	9 *
Number recalling belonging	17	21

Table C6 (cont)

Number forgetting or
requiring a cue to
recall on RBMT

9

5

*p < 0.025

iii. Prospective Memory - Tests of Organisation and
Planning

No differences were detected between the groups in their performance of the card sorting or maze tests in terms of time taken or the other qualitative performance measures recorded (see Table C7). Again, the difference between complainers and non-complainers in the frequency of self-reported prospective memory failures should be stressed.

Table C7: The frequency of daily prospective memory failures in the two test groups and corresponding performance on the WCST and Maze test.

	<u>Complainers</u>	<u>Non-complainers</u>
Number reporting > one prospective memory failure daily	17	9 *
\bar{x} time on WCST (sd)	130 secs (81.3)	118 secs (62.9)

Table C7 (cont)

\bar{x} perseverative

errors WCST	0.68	0.83
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\bar{x} time on maze (sd)	88.75 secs(68.4)	67.4 secs (39.9)@
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\bar{x} wrong

direction maze	1.1	1.07
----------------	-----	------

\bar{x} pencil lifts maze	2.5	1.9
-----------------------------	-----	-----

*p < 0.025

@the large difference in variance of the group scores is due to the very poor performance of one woman within the complaining group.

Further analyses compared the time taken to complete the card sorting and maze tasks in subjects reporting daily failures of each of the five prospective questionnaire items to those reporting less frequent difficulties in these areas. T-tests detected no differences for any of these comparisons. Table C8 gives the relevant summary statistics. It appears that the card sorting and maze tests are failing to distinguish those who report frequent prospective recall difficulties from those who do not.

Table C8: Numbers or subjects reporting daily and less frequent prospective memory problems with corresponding performance (time in seconds) on the WCST and the maze test.

	Daily Occurrence	Less than daily occurrence
LOST frequencies	10	50
WCST time \bar{x} (sd)	130.3 (76.2)	120.9 (70.8)
Maze time \bar{x} (sd)	76.3 (36.9)	78.9 (64.8)
ROUTINE frequencies	7	53
WCST time \bar{x} (sd)	157.1 (96.6)	118.75 (67.2)
Maze time \bar{x} (sd)	74.9 (50.9)	78.5 (57.8)
CHECK frequencies	23	27
WCST time \bar{x} (sd)	138.1 (71.7)	114.1 (71.8)
Maze time \bar{x} (sd)	70.8 (36.9)	82.4 (65.7)
TALK frequencies	13	47
WCST time \bar{x} (sd)	107.3 (38.2)	128.6 (78.6)
Maze time \bar{x} (sd)	59.1 (34.1)	82.7 (60.2)
MESSAGE frequencies	8	52
WCST time \bar{x} (sd)	135.0 (49.8)	122.3 (72.2)
Maze time \bar{x} (sd)	56.7 (28.8)	81.1 (59.0)

The Use of Supportive Memory Strategies

In line with the findings of studies A and B, the use of memory aids and strategies (external plus internal) differed between the groups. Complainers reported using significantly more aids to memory than non-complainers ($t = 3.12, p < 0.0025, 1 \text{ tail}$). The mean number of memory aids used by the two groups can be seen in Table C9.

Mood

Complainers scored significantly higher on the BDI than non-complainers ($z = -3.54, p < 0.0005, 1 \text{ tail}$). Seventeen complainers compared to four non-complainers scored at or above the cut-off adopted in this research for the BDI. The HAD scale also differentiated the groups. Complainers were significantly more depressed and anxious according to this scale ($z = -2.99, p < 0.005; z = -4.37, p < 0.005, 1 \text{ tail tests}$). Using the HAD scale cut-off, eight complainers compared to one non-complainer scored as depressed and twenty-two complainers compared to four non-complainers scored as anxious. Median and ranges of the mood scale scores can be seen in Table C9.

Table C9: Use of memory aids and mood summary scores for complainers and non-complainers.

	<u>Complainers</u>	<u>Non-complainers</u>	
\bar{x} memory aids (sd)	6.5 (2.1)	4.7 (2.5)	*
Median BDI _{tot}	13.5	4.5	***
range	1-26	0-22	
Median HAD-D	6	4	**
range	1-12	1-10	
Median HAD-A	11	5.5	***
range	3-17	1-13	

*p < 0.0025 **p < 0.005 ***p < 0.0005 -

Mood and Memory Performance

Given the documented relationship between mood and self-report memory, it was considered appropriate to analyse the findings in terms of the significance of negative mood in relation to objective test performance. Thus, subjects were categorised according to whether or not they reported being depressed or anxious. Performance on the three tests which were found to discriminate complainers from non-complainers was then examined. A score of thirteen or more on the BDI was found to be associated with poorer immediate story recall (t = 2.2, p < 0.025, 1 tail test) and poorer design

learning ($t = 1.99$, $p < 0.05$, 1 tail test). Anxiety as assessed by the HAD scale, was related to poorer prose recall in immediate and delayed conditions ($t = 3.01$, $p < 0.0025$, 1 tail and $t = 2.53$, $p < 0.01$, 1 tail). Too few subjects scored as depressed on the HAD scale for meaningful analyses in these terms. It seems therefore that the negative mood characteristic of the complaining group may be influencing scores upon the memory tests which discriminate these subjects from those whose memory difficulties cause no, or only slight, nuisance.

The Epilepsy Related and Treatment Variables

Table C1 gives details of the medical information relating to the two groups of test subjects. No differences were found between the groups in terms of the duration of epilepsy, seizure frequency, and the number of subjects with more than one seizure type. Furthermore, no clear differences emerged between the groups when seizure type was considered. In two cases from each group, seizure type could not be identified with confidence. The number of patients with partial seizures with or without secondary generalisation numbered twenty-five complainers and twenty-three non-complainers. Focal EEG evidence was available for seventeen non-complainers and twelve complainers. No obvious differences existed between the groups in terms of temporal lobe onset, although slightly more subjects in the non-complaining group had right

temporal lobe involvement. Five non-complainers and three complainers were considered to have primary generalised epilepsy and therefore no focal onset. Of all the epilepsy related variables considered, only the age of seizure onset distinguished the groups. The complaining group were found to be significantly older at onset than the non-complaining group ($t = 1.9, p < 0.05, 1$ tail test). This result agrees with the findings of Studies A and B.

With regard to anticonvulsant therapy (see Table C1), analysis revealed no significant differences between the groups in the numbers on mono versus polytherapy nor in the numbers treated with carbamazepine or sodium valproate monotherapeutically. Analysis of other drugs and combinations was not possible because of small numbers.

Summary of Study C Findings

As expected, significant differences existed between complainers and non-complainers on MQtot and RMQtot scores. Three objective memory tests discriminated the two groups. Story recall in immediate and delayed conditions was performed more poorly by the complaining group. Design learning was also poorer in the complaining group. The relationships between self-reported memory and 'objective' test performance were, in general, found to be weak. Combined data on the

sixty test subjects revealed significant, though modest, correlations between MQtot and immediate and delayed story recall, design learning and delayed recall of the design.

No differences in the performance of tests assessing prospective memory, naming and organisational/planning skills were found between the two groups of subjects. However, the complainers reported significantly more naming and prospective recall failures in their daily lives.

In accord with the findings of Studies A and B, both the use of memory support techniques and the existence of negative mood discriminated the groups in the expected fashion. Epilepsy related and treatment variables, with the exception of age of seizure onset, did not differ between the groups. It may again be argued therefore that memory related behaviour and mood variables play more of a role in influencing memory complaints than do medical and treatment characteristics.

Considerations of Design and Methodology of the Memory Test Studies

i. The Sample

Sixty subjects with epilepsy were selected for this study. It could be argued that findings from this small sample may be unreliable. Constraints of time alone largely

determined sample size in this study. However, a further consideration is whether it was justified to select subjects according to the memory nuisance rating alone and to cast them into two groups of complainers and non-complainers on this basis. The memory nuisance rating, although a rather simple and subjective measure, was nevertheless considered to be fairly reliable because of its ability to correlate with MQtot responses in the survey. Furthermore, the dichotomy was regarded as justified because the survey analysis often emphasised the similarities between those who reported moderate and serious nuisance and those who reported no and slight nuisance. It is doubtful whether comparing the results of four smaller groups on the basis of their memory nuisance ratings would have added anything further of interest to the findings.

ii. The Tests

The test battery was fairly lengthy and comprehensive and efforts were made to minimise the effects of subject stress and fatigue. These factors should always be considered when people are asked to perform what are quite arduous tasks for any length of time. Bearing in mind the negative effects of fatigue, perhaps the presentation of individual tests within the battery should have been balanced instead of using a standard order of test presentation for all subjects.

A few comments about the choice of tests should be made. First, the battery failed to assess delayed visual recall. The figure recall test of the AMIPB (Coughlan and Hollows 1985) would have measured this skill. It was excluded because it was expected that all subjects would find the task difficult and therefore its inclusion would have added little to the outcome. In retrospect, given the significance of the design learning test, assessment of this skill may have been worthwhile. Second, it was noted that subjects for whom epileptogenic localising details suggested right frontal foci, appeared to find the Raven's Progressive Matrices disproportionately difficult, implying poor non-verbal reasoning skills in these subjects. This measure of IQ may be inappropriate for this particular group of subjects and the possibility of underfunctioning on this test for subjects with right frontal lobe epilepsy should be examined. Third, the choice of tests assessing forward planning and organisation may have been inappropriate. Had other tests been selected, it is possible that more interesting findings could have resulted. For example, the six trial Wisconsin Card Sorting Test procedure should have yielded more data on the frequency of perseverative errors. The Trail Making Test (Halstead-Reitan Neuropsychological Battery) may have been more sensitive for detecting deficits of this sort in people with epilepsy than were the Porteus Mazes. Finally, the Belonging Test from the RBMT may ^{not} have proved taxing enough to adequately

assess prospective memory ability in these subjects. The majority in both groups remembered to ask for their belonging back. Perhaps a more appropriate test of prospective memory functioning would involve the subjects in some longer term 'homework' task such as remembering to post a letter back to the experimenter.

iii. The Method

With regard to the conduct of the testing sessions, some deviations from suggested testing procedures were adopted. These tended to be the elaboration of instructions and also the avoidance of active timing. These deviations were considered acceptable for four reasons. First, normative data was not to be used in the analysis of subject's scores. Second, since all participants were volunteers, endeavours were made to keep the sessions as relaxed as possible. Third, it was hoped to keep levels of test anxiety at a minimum so that performance was influenced as little as possible by this variable. Finally, timing of performance was avoided because it has been argued that certain anticonvulsants, particularly phenytoin, may give rise to a degree of cognitive slowing (Thompson 1981). Since the aim was to assess memory and not speed of processing, active timing was considered unnecessary.

Two observations should be made in relation to the

assessment of subjective memory. First, self-reported information was collected at variable intervals prior to testing. It is possible that subjective responses gathered on the day of testing may have been different. Categorisation according to the memory nuisance rating was checked immediately post-testing but, no other tests of the consistency and reliability of the subjective responses over time were made. The second observation applies to the choice of self-report method used to compare with test performance. The correlations were between retrospectively recorded beliefs about everyday memory functioning and test performance. It may have been useful to have used prospective memory failure data and to have compared this to test performance. Such a comparison may have produced rather stronger correlations as Sunderland et al (1983) had found with their head injured sample.

STUDY D(i) : MEMORY TRAINING TECHNIQUES

The Outpatient Method

The first study examining the efficacy of instruction in the appropriate use of memory aids and strategies involved the design and implementation of a small scale controlled outcome study within an outpatient context.

Previous studies had emphasised the disparity between the overall frequency of reported memory difficulties between subjects with and without epilepsy and the apparent insensitivity of formal memory tests to these complaints. Given these findings, it was decided to concentrate upon improving the subjects' reports of everyday memory difficulties in a direct manner. The more direct approach should also help to insure generalisation of any benefits to everyday life.

Hypotheses

Three hypotheses regarding the outcome of the endeavour were tested.

1. Instructing individuals in the use of memory support strategies would result in a decrease in memory failures.

2. Using programmes which were specifically tailored to meet the needs of the individual and which concentrated upon major areas of difficulty would prove the most

efficacious method of intervention.

3. Personal contact with the 'therapist' would prove beneficial in itself.

Method

Subjects

Subjects were taken from the group of one hundred and eighty people with epilepsy who had supplied CL data for Study B. All had indicated a willingness to participate further. Twenty-seven people were chosen on the basis of certain selection criteria as candidates for intervention. Selection criteria were:-

i) All subjects had reported a moderate or serious nuisance from their memories on the MQ. This insured that subjects were not being selected on the basis of data pertaining to a particularly 'bad week'.

ii) All subjects scored ≥ 80 on the pre-intervention CL. This indicated a high level of everyday memory failure even for this group who had been shown to report more difficulties than a smaller group of subjects without epilepsy using this assessment measure.

iii) All subjects had at least five items on the CL which they reported as occurring at least once a day.

iv) All subjects had returned an observer's CL along with their own. These would be useful as independent sources of intervention efficacy.

These entry criteria should have served to select a highly motivated group of people upon whom to test the intervention methods.

Design

The technique was developed to be suitable for use in outpatient or general practice settings. However, given the often limited available time of the psychologist, it would be sensible to explore the impact of therapist contact itself upon the outcome of the intervention procedures. The group design format of this study reflects this aim with some subjects receiving an initial interview and others having no personal contact. Assessment of the interventions were conducted postally for all groups. The method of instruction in the use of memory aids and strategies was also to be explored. The study design therefore incorporates two methods of intervention. The first makes use of individually tailored procedures and the second is a more general information supplying approach. Accordingly, the twenty-seven subjects were divided into four groups.

The Groups

The High Intervention Interview Group (Hi-Igrp):

Comprised five subjects who were selected for inclusion in this group because, living in the Home Counties, they could reasonably be expected to travel to the pre-intervention interview. The session involved an informal dialogue of their major difficulties and a discussion of the advised supportive strategies. The appointment lasted between thirty and sixty minutes during which time the need for high levels of co-operation in this endeavour was stressed. At the end of the session the subjects were given their personal intervention booklets.

The High Intervention Postal Group (Hi-Pgrp): Five subjects were randomly allocated to this group. These subjects were sent their individually compiled booklets along with a covering letter explaining the study but attended no initial interview.

The Low Intervention Postal Group (Low-Pgrp): This group consisted of nine randomly allocated subjects who were sent a booklet which, while dealing with the amelioration of everyday memory difficulties, did not specifically focus upon the subject's own individual problems. In the covering letter, the subjects were told to apply the strategies reported in the publication whenever they thought appropriate. They were given no clues as to where to concentrate their efforts but were simply expected to work at reducing their memory failures.

The 'Waiting List' Control Group (Cgrp): Comprised eight subjects who were offered no means to ameliorate their memory difficulties.

The four groups were matched for their baseline scores on all measures of outcome and also for age and sex.

The Outcome Measures

i. The self-report and observer's memory checklists, instruments for the prospective recording of memory failures for a seven day period, have been described earlier (see Study B). For the three intervention groups, subjects and independent observers completed and returned these at three stages: baseline, during the first week of the intervention and two months following return of the second checklist. Control subjects completed checklists only at baseline and two months follow-up. It was considered that levels of co-operation may have fallen had they been asked to complete three measures.

ii. The HAD scale measuring levels of both anxiety and depression was described in Study A. This mood inventory was completed by subjects at baseline and follow-up in order to examine whether any mood changes had taken place during, or as a result of, the intervention.

iii. The Use of Memory Aids Questionnaire was compiled to collect subjects' opinions about the usefulness of the

procedure. This included scales from 0-5 upon which the subjects assessed how often they used the aids and strategies and how useful they were considered to be in general. 0 represented 'not at all' and 5 'every day'. Also incorporated in this questionnaire was the four-point nuisance rating scale upon which subjects indicated whether their memories presented no nuisance, a slight, moderate or serious nuisance to them in their daily lives. This information was therefore collected at baseline and follow-up. (For other items on this questionnaire see Appendix XI). Control subjects answered only the nuisance rating scale and a question which asked whether they noted any change in their memory functions over the past two months.

The Memory Booklets

The two high intervention groups received booklets which contained their five most frequent everyday memory difficulties (ascertained from the baseline CL) and descriptions of the strategies they were advised to adopt when these problems arose and/or to prevent the problems from arising in the first instance. All of the five problems in each individual's booklet had been reported as occurring seven or more times during the baseline week. Less structured, more general advice was given in a preface and, in point form within the text (see Appendix XII for all possible contents).

The low intervention subjects were given the Wessex Memory

Manual (WMM, Kapur 1989). This pamphlet is aimed at people who have suffered some kind of cerebral insult and consequently report everyday memory difficulties. Six specific problems are referred to: remembering names; remembering where something was left; remembering to do things; remembering what people tell you; remembering prose and remembering how to get somewhere. Five approaches of alleviating difficulties are applied to these six problems. The five techniques are: using simple aids; paying better attention; rehearsal; recalling things more carefully and practising memory activities. It is a concise but comprehensive booklet which has recently been revised and is now commercially available. However, unlike the booklets described above, it is not tailored to meet individual's particular requirements. Furthermore, because it does not confine its discussion to major difficulties and to just one technique for their amelioration, it may be rather confusing on first reading. For people with difficulty remembering things, it may contain a little too much to be remembered!

Figure D(i)1 gives a diagrammatic representation of the experimental design.

Figure D(i)1: The Outpatient Method: Experimental Design

Groups			
Hi-I	Hi-P	Lo-P	C
<u>T1 Baseline</u>	<u>T1 Baseline</u>	<u>T1 Baseline</u>	<u>T1 Baseline</u>
CL1 + HAD + Nuisance Rating 1	CL1 + HAD + Nuisance Rating 1	CL1 + HAD + Nuisance Rating 1	CL1 + HAD + Nuisance Rating 1
Interview Given booklet and CL2	Sent booklet and CL2	Sent WMM and CL2	No intervention
<u>T2 CL2 returned</u>	<u>T2 CL2 returned</u>	<u>T2 CL2 returned</u>	
2 months	2 months	2 months	2 months
T3 CL3 sent + Use of MAS Questionnaire + HAD2	T3 CL3 sent + Use of MAS Questionnaire + HAD2	T3 CL3 sent + Use of MAS Questionnaire + HAD2	CL2 sent + Nuisance Rating 2

RESULTS

Response Rates

Perhaps the most important result of this controlled trial was the very negative one of low response rates. It will be recalled that the twenty-seven subjects had been specifically selected because they were believed to be highly motivated and were therefore considered to be ideal subjects for remote procedures. However, the number who actually completed the study was disappointing. This low completion rate has implications for more widespread adoption of the technique. Completion rates can be seen in Table D(i)1 below:-

Table D(i)1: Completion Rates for the Four Intervention Groups

Group	Original N	N Completed	% Response
Hi-I	5 (4)	3 (3)	60 (75)*
Hi-P	5	3	60
Lo-P	9	3	33
C	8	5	62.5

* Figures in brackets refer to adjusted response rates excluding the fatality.

From the five subjects in the Hi-I group, three completed the study. One man unfortunately died during the intervention. (The death was not seizure related). The

other man was either not interested in the procedures, or the request for his assistance did not reach him. Of the three respondents, two were male.

Within the Hi-P group, three completed all the necessary measures, two women and one man. Of those who failed to complete, one returned CL2 only and one returned nothing.

Of the nine subjects in the Lo-P group, only three women completed the measures. Of those who failed to complete, one returned CL2 only and five sent nothing back.

Control data arrived from five subjects out of eight, of whom three were men.

Thus, of the nineteen subjects offered advice, nine supplied data for analysis. Inspection of the demographic and baseline outcome measures revealed no clear differences between responders and non-responders in these terms. The small number of respondents will clearly cast doubt upon the validity of group statistical procedures. Hence, some information will be conveyed via case studies as well as limited small group statistical analysis.

Statistical Treatment of the Data

Small numbers within the groups necessitated the use of non-parametric statistical techniques.

Intervention versus Control

Table D(i)2 gives details of the nine intervention subjects in terms of CL totals (CLtot) and frequency of occurrence of the five major problems (Freq5). Corresponding data can be seen for the five control subjects also. Hypotheses testing considered the total number of memory failures and the frequency of the five major problems.

a. Within Group Changes

Changes in the frequency of reported memory failures from baseline to follow-up within the control and intervention groups were examined using the Wilcoxon test. Results showed that the control group data did not change over the two month period. Furthermore, when the intervention subjects were combined into one group, neither the total frequency nor the frequency of the five major problems showed any indication of reduction. The degree of change arising for the three different intervention methods could not be statistically analysed because of small numbers.

Observer's checklist changes from baseline to follow-up were variable. There was no indication of improvement in the observer's data for any of the groups. Furthermore, analysis of the HAD scale scores detected no changes in the mood of the intervention subjects from baseline to follow-up.

Table D(i)2: Details of the nine intervention and five control subjects. CL totals and frequencies of the 5 major problems.

Case & Follow-up Group	Baseline		One week into Intervention		2 Month Follow-up		
	CL.tot	Freq.5	CL.tot	Freq.5	CL.tot	Freq.5	
Hi-I	(1	84	50	39	19	40	15
	(2	81	45	68	49	41	33
	(3	86	45	62	29	58	32
Hi-P	(4	118	59	69	41	106	62
	(5	107	63	148	63	168	61
	(6	137	70	152	56	184	58)
Lo-P	(7	172	69	183	66	122	48
	(8	89	45	53	25	29	16
	(9	137	58	161	58	160	66
Cont- rols	(10	87	57	-	-	81	37
	(11	86	53	-	-	91	49
	(12	120	59	-	-	131	59
	(13	83	59	-	-	111	60
	(14	92	58	-	-	81	35

b. Between Group Differences

Between group differences were analysed using the Mann Whitney U-test. First, when the intervention groups were taken as one, no differences between it and the control group at follow-up was found. Fortunately, it is possible to use the Mann Whitney technique with groups as small as three. Hence, the methods could be analysed separately. From this analysis it was apparent that neither the Hi-P nor the Lo-P follow-up data differed significantly from control group scores. However, the Hi-I subjects did benefit significantly from their intervention when follow-up memory failure frequencies were compared to control data ($p < 0.05$; one tail).

To reinforce the limited statistical findings, some contrasting cases will be presented next.

Case Studies

High Intervention Interview Case

Case One: is a 31 year old man who is unemployed. His epilepsy is supervised by his General Practitioner. He started having seizures at age 28 and presently has tonic-clonic seizures on a yearly basis. At the time of the study he was taking carbamazepine monotherapy.

Before intervention he reported that his memory problems

presented a moderate nuisance to him. Self-report measures of anxiety and depression indicated that he suffered from anxiety and his depression score was borderline. He reported using seven memory aids. These included five external aids and two internal retrieval strategies. Analysis of his pre-intervention checklist, on which he scored a total of 84, showed that his five major problems were:-

- Having to go back to check whether or not he had done something.
- Tip-of-the-tongue difficulties.
- Forgetting important details of what happened the day before.
- Forgetting what he had just said.
- Forgetting to tell someone something important.

The relative's checklist data suggested more problems than did the subject's own. His mother reported a total of 94 failures.

Results of the intervention indicated that this man gained from the procedure. The CL2 total fell to 39 and the follow-up stood at 40. Seventy-seven per cent of the fall from CL1 to CL3 was due to decreases in the frequencies of his five major difficulties. Twenty-three per cent of the reduction came from decreases in other memory failures. This suggests that the positive effects of the techniques generalised across memory failures.

The relative's checklists were in broad agreement with the changes indicated by the subject.

After intervention, he still regarded his memory difficulties as presenting a moderate nuisance to him but, he did report that they were generally less of a nuisance now. He indicated that he found the explanations of the use of memory aids beneficial and he believed he was making more efficient use of them as a consequence. He reported that his overall use of aids was about the same as it was before intervention. When asked if he would continue to use the suggested aids, he indicated that perhaps he would.

On the 0-5 scales examining the use of aids and their usefulness, the subject indicated responses of 2. Mental retracing of events was considered to be the most useful memory aid and was also used most frequently.

Anxiety and depression scores did not change during the intervention period.

In conclusion, this subject appears to have benefited from the procedure even though his reliance upon aids was not as strict as it could have been.

High Intervention Postal Case

Case Five: This woman is 48 years old. She is unemployed and has been educated to 'O' level standard. She has had epilepsy since the age of one and at the time of the study reported having secondary generalised tonic clonic and complex partial seizures on a monthly basis. She takes phenytoin and one other anticonvulsant drug.

Before her involvement in the study this woman reported that her memory difficulties presented a serious nuisance to her. Self-report measures of anxiety and depression revealed that she suffered high levels of both moods. Five memory aids had been used in the past including three external strategies and two internal methods. The pre-intervention checklist revealed a high level of difficulty. The total was 107 and a large proportion of this score was accounted for in the following areas:-

- Forgetting where she had put things.
- Having to go back to check whether she had done something she meant to.
- Forgetting she had been told something yesterday or a few days before (e)
- Rambling on to speak about unimportant or irrelevant things.
- Tip-of-the-tongue difficulties.

Results in this case were poor. The total for CL2 had

raised to 148, an increase of 41 from the pre-intervention measure. Of the five major problems, four increased in frequency and one fell by five. This was the tip-of-the-tongue difficulty. In contrast, the relative's measure fell by 37 during this time. The follow-up score increased again to 168. Again, only one of the five problems showed any degree of improvement. This time item (e) fell by five instances. The relative's follow-up checklist now lay at 168, an increase of 17 since CL2 but still a decrease of 20 from CL1. The relative reported a sustained decrease of the naming difficulty.

Responses on the Use of Memory Aids Questionnaire were mixed. On the 0-5 scales, this subject indicated that she used the memory aids at a rate of 2. She had found them useful at the level of 3. The most useful techniques were reported as being mental retracing and keeping things in special places. The explanations supplied were considered to have been helpful. She used the aids more efficiently and a little more than she had done previously. She did not, however, believe that her memory problems were less of a nuisance now and her nuisance rating remained serious.

Levels of anxiety did not significantly change but depression increased over this time, suggesting that the failure of the attempt might have caused an increase in feelings of depression. For this case, the procedure was not helpful. The attitudes towards the intervention were

on the whole good but, the level of co-operation was perhaps not sufficient.

Low Intervention Postal Cases

Case Eight This is a 33 year old housewife who has been educated to CSE standard. She has had epilepsy for 22 years and reports having secondary generalised seizures less than yearly and complex partial seizures daily. At the time of the investigation she was taking sodium valproate.

This woman's memory difficulties presented a serious nuisance to her prior to intervention. Symptoms of anxiety and depression were both above cut-off levels. She reported using a good many memory aids in her daily life. These included five external and five internal strategies. 89 instances of memory failure were recorded at baseline. The relative reported 80. The five major problems according to the subject's measure accounted for 50% of her difficulties. These were:-

- Failing to remember changes in her daily routine.
- Having to go back and check whether something had been done.
- Rambling on about unimportant or irrelevant things.
- Tip-of-the-tongue difficulties.
- Forgetting people's names.

The subject was sent the Wessex Memory Manual and results were most positive. The total for CL2 had fallen to 53 and the follow-up total fell further to just 29 instances of memory failure, a decrease overall of 60 failures. The relative's CL2 total fell by just two to 78 but CL3 also fell to 29 (self and observer profiles were quite different). Of the total decrease from baseline to follow-up, 48% was due to decreases in the five areas of greatest difficulty.

This woman had not found it necessary to use the strategies advised every day. She responded with a 3 on the 0-5 scale. On the usefulness scale the response of 4 was given. She found lists, rehearsal and using alarms of most use.

This subject reported using aids to memory a little more now than she used to and reported that she would continue to use the techniques. She reported finding the advice beneficial and she believed that she used memory techniques to better effect as a result of the intervention. Furthermore, her attitude towards the reliance upon memory aids improved. Finally, she reported that her memory difficulties were less of a nuisance now. Correspondingly, her rating of memory nuisance fell from serious to slight. Interestingly, her symptoms of anxiety and depression fell dramatically during the intervention period.

This woman apparently derived much benefit from the advice

given in the Wessex Memory Manual. Her attitude was positive and the strategies she chose to apply certainly appeared to work.

Case Nine This is a 44 year old woman who has been educated to 'A' level standard. Her epilepsy is supervised by a neurologist. She started having seizures at the age of 40 and at the time of the study, reported having complex partial seizures on a weekly basis. She was taking phenytoin and sodium valproate during the intervention.

Before intervention the woman reported that her memory problems presented a serious nuisance to her. Self-report measures of anxiety and depression indicated that symptoms of both moods were slightly elevated. She reported having made use of six memory aids in the past, five of which were internal encoding measures and four were external aids. Analysis of the pre-intervention checklist on which she scored a total of 137 showed that her five major problems were:-

- Forgetting where things are left and losing things around the house.
- Having to go back and check whether or not she had done something.
- Forgetting that she had been told something yesterday or a few days ago.
- Feeling that a word is on the tip-of-the-tongue.

- Forgetting what she had just said.

The relative's checklist agreed with the subject's own report, with a total of 146 memory failures and the same five major problems suggested.

Results of this intervention were not good. The CL2 total rose to 161 and 160 at follow-up, an increase of 23 on pre-intervention levels. The relative's report were in agreement. Of the five major difficulties, one remained the same and four increased in frequency by two instances.

After intervention memory difficulties remained a serious nuisance . She reported that 'perhaps' she used aids more efficiently as a result of the intervention. However, she also reported that she used aids much more now than she had done before and that she would continue to make an effort to use them in the future. On the 0-5 scales, she used the aids at a rate of 3 and had found them useful at a level of 2. Of the methods described in the Wessex Memory Manual she reported that she used rehearsal, memory practice and paying better attention the most. Memory practice and recalling more carefully were the most useful techniques.

Anxiety and depression scores did not change from baseline to follow-up.

A few factors interfere with the interpretation of the

data supplied in this case. Apparently, during the course of the intervention, seizure frequency had increased quite dramatically. This woman had been "in and out of hospital" and had another anticonvulsant added to her drug regime. With these changes, it is difficult to interpret the findings with any degree of certainty. However, bearing the difficulties in mind, it can be concluded that in this case no benefit was derived from the intervention procedure adopted. Responses on the Use of Memory Aids Questionnaire were mixed. The strategies had not been used daily but the woman had appeared quite enthusiastic about the benefits of some of the techniques. Perhaps with more practice, time and effort, the methods of choice may prove of some use.

Summary of Study D(i) Findings

In terms of the number of respondents, the Hi-I group fared the best. Excluding the man who died, the response rate was 75%. This is quite acceptable, particularly when such a high degree of effort was expected from the participants without any guarantees of success. The Lo-P group produced the least data for analysis. Only one third of these subjects completed the necessary measures. This was considerably lower than the controls, who, of course, were offered no help. The implications of these findings are clear since it would be difficult to explain the differences in response rates in terms of differences in initial problems since the groups were matched for the variables considered important. Although it cannot be

said that non-responders did not benefit from the advice given, it does seem that personally applicable material which is discussed face-to-face with a psychologist produces the highest number of responses.

The limited analyses tend to support the impression given by the response rate data. The Hi-I group subjects showed measurable benefits from their intervention. By contrast, the post-intervention measures of subjects in the other two groups did not differ significantly from the control data.

Primarily, what the cases demonstrate is the variability of the overall effects. Clearly, memory aids training is more suited to some than others. However, a favourable impression of the Hi-I method is also gained from this evidence. All three subjects involved in the interview method showed some reasonably positive effects (see table D(i)3 for summary case results).

It would seem on the basis of this small study that in order to get both co-operation and some positive results from intervention trials, it is better to use individually tailored procedures. Some 'therapist' contact also seems to help and the focusing of attention upon major areas of difficulty is probably advised. It is best to ask the subject to apply predetermined information which relates exclusively to him/her rather than to ask the subjects to identify his/her own problems, pick strategies and apply them.

Table D(i)3: Case Studies : Summary Responses

Cases	CL1-CL2 *(totals)	CL1-CL3 *(totals)	RCL1-RCL3 *(totals)	ΔMQrat	Less nuis. now	Use MA	A	D
1. Hi-I	+	+	+	No	Yes	No	No	No
2. Hi-I	+	+	+	Moderate to slight	Yes	Use = much more	n/a	n/a*
3. Hi-I	+	+	-	No	No	Reports no but clearly has	No	No
4. Hi-P	+	+	-	No	No	No	Increase	No
5. Hi-P	-	-	+	No	No	Use = a little more	No	No
6. Hi-P	-	-	No change	No	No	No	No	No
7. Lo-P	-	+	+	Serious to moderate	No	No	No	Increase
8. Lo-P	+	+	+	Serious to Yes slight	Yes	Use = a little more	Decrease	Decrease
9. Lo-P	-	-	-	No	No	Use = much more	No	No

+ good result - decrease in memory failures
 - increase in memory failures

ΔMQ rat = change in memory nuisance rating from baseline to follow-up.
 Less nuis.now = does S regard memory as less of a nuisance now in general?
 Use MA = was intervention successful in getting S to increase use of memory aids?
 A = any change in level of anxiety on HAD scale from baseline to follow-up.
 D = any change in level of depression on HAD scale from baseline to follow-up.

* recent death of close relative meant that mood changes were confounded.

Considerations of Design and Methodology of the Outpatient
Memory Training Study

i. The Sample

Of course, the major problem of this outcome study was the small resulting sample sizes. Had data on larger groups been collected then more analysis could have been carried out. This would have necessitated altering the selection criteria with respect to the total number of failures reported on the baseline checklist. It should be stressed, however, that the resulting larger sample would perhaps have contained some subjects who may have lacked the motivation necessary to attempt to conquer their difficulties since they may not have been considered sufficiently debilitating.

One important consequence of the low response rate is that the four groups, which were initially matched for the frequency of baseline memory failures as well as other variables, were no longer matched for original level of difficulty. Thus, interpretation of results became rather more problematic.

A final issue of note regarding the subjects upon whom the techniques were tested is that because they were selected specifically for frequent memory failures, results of the endeavours cannot be extrapolated to the whole population of people with epilepsy.

ii. The Outcome Measures

Again, perhaps the main criticism against using the checklist as an outcome measure in these procedures, is the lack of comprehensive data available on the extent to which checklist totals are likely to change as a function of time alone. Five control subjects did supply two checklist measures which were separated by some months and the results indicated no significant change from baseline to follow-up in these patients. However, data from only five subjects provides insufficient evidence upon which to base assumptions that the checklist is fairly consistent as a measure of trait. This is a particular problem when it is unclear if changes in factors which may affect responses to memory measures changed for these subjects over the intervening time period (e.g. mood, seizure frequency, drug changes).

It is unfortunate that the results regarding mood changes following the intervention were inconclusive. This again was largely due to small numbers and because some subjects reported altered circumstances during the intervention period which may have influenced levels of affect and anxiety. Therefore, important evidence relating to the issue of the primacy of mood over memory functioning (or vice versa) could not be gleaned from the data.

iii. The Method

It was an original intention of this study to assess the

influence of personal contact with a 'therapist' on the outcome of the intervention. It may, therefore, have been appropriate to have encompassed more levels of contact in the original design. As well as assessing the influence of an initial consultation, it may have been useful to have included a group who benefited from a further personal session during the learning of the strategies so that any remaining queries could be cleared up and progress discussed. This increased level of personal contact would have served to increase motivation thus helping to insure that subjects maintained extensive use of the suggested techniques. A larger original sample size would have allowed this and one may argue again that it may have been appropriate to have lowered the baseline checklist criterion level to allow for the collection of a larger sample.

STUDY D(ii) : MEMORY TRAINING TECHNIQUES

The Memory Group

The second study examining memory training techniques again concentrated upon the efficacy of instruction in the use of simple aids and techniques which could be applied to problems typically encountered in day-to-day life. The findings of the previous investigation had suggested the importance of 'therapist' contact to the outcome of the intervention. It was therefore decided to explore the efficacy of a group teaching method which could be adopted by 'support' groups or within tertiary care settings.

Hypotheses

Four hypotheses were put to the test:-

1. It was expected that group teaching in the use of supportive memory strategies would result in decreases in memory failures for group members.
2. As a result of the group work, participants would regard their memories as presenting less of a nuisance to them in their daily lives.
3. The use of memory aids and strategies would increase as a result of the memory group work.

4. An increase in group members' confidence to cope with memory difficulties would arise as a consequence of the memory 'training' sessions.

Method

Subjects

Logistic difficulties prevented the possibility of gathering a representative cross-section of people with epilepsy who could meet regularly in one place over a number of weeks. An alternative approach was to concentrate efforts upon a sample of people with epilepsy whose attendance could be more easily arranged. Group sessions were therefore organised within a short stay assessment unit.

Generally, patients who require such a level of care are unrepresentative of the population of people with epilepsy. Within this particular unit, the majority of patients have attended special schools, attaining few, if any, qualifications and are unemployed. Many are functioning within the borderline mental handicap range according to WAIS-R scores. Rationalisation of drug therapy is the predominant reason for attendance at the unit and most of the patients have poorly controlled partial epilepsy.

The course was intended for anyone who believed that they would benefit from joining sessions working on ways to

ameliorate memory difficulties. Hence, each session was voluntary. This, along with frequent and often severe seizures meant that numbers fluctuated from session to session.

It was clear that the majority of those who attended the group would not be suitable for entry into the outcome study. The analyses presented here is based upon data supplied by nine participants whose level of ability, co-operation and attendance were sufficient to insure some meaningful results. Table D(ii)1 gives a summary of the demographic and medical details of the subjects who presented data for the study.

Design

Aims and Objectives

The memory group was designed with the following 'therapeutic' aims in mind:

- i. To provide a supportive environment for discussion of individual's problems and exchange of ideas.
- ii. To examine the usefulness of various means by which to cope with and/or tackle memory problems.
- iii. To increase confidence in the participants' abilities to confront their difficulties in an independent and rational manner.

Sessions

The rapid turnover of patients within the unit meant that a one month teaching schedule was the only feasible timetable. Therefore, four, hour long sessions spread over four weeks were allocated to the memory group. Each session was largely devoted to discussion of specific difficulties, practising some of the more complicated methods (e.g. face-name association) and discussion of other factors which can effect how well memory will function (e.g. anticonvulsants, seizures, level of motivation and mood). During sessions one and four, some time was of course spent collecting baseline and outcome

measures.

Printed Material (see Appendices XIII to XVI)

Four sets of printed handouts were distributed to group members at the beginning of the appropriate sessions. The first set examined applications and the proper use of the seven external memory strategies referred to in the external memory aids checklist (see Appendix IV). The second document examined the use of five widely used internal strategies: the mental retracing of events; alphabetical searching; face-name association; noticing landmarks and the study method. Handout three discussed the use of other internal strategies which help in the recall of items in lists (i.e. the story method, first letter mnemonics and the rhyming peg method). The final set of notes emphasised the importance of concentration and referred to ways of promoting better concentration. All handouts were read through and elaborated upon during the sessions but, it was stressed that members should re-read them before the next session. Both sessions and handouts emphasised direct applications of the techniques to the memory failures described in the MQ (see Appendix II). Thus, by insuring the direct applicability to everyday failures, generalisation of benefits could be expected.

Outcome Measures

Assessment of the efficacy of memory groups for people

post-CNS trauma is reported as being difficult (Baddeley 1984). The same is true for people with epilepsy. It was considered neither appropriate nor relevant to assess changes in memory using a neuropsychological battery since the aim of the 'therapy' was to ameliorate everyday memory difficulties and not to improve scores on objective tests. Thus, four measures were chosen as repeatable indices of evaluation:-

1. The Memory Checklist. The group members were asked to complete a checklist during the week following session one. This was to act as a baseline measure of everyday memory failures. The subjects who returned this checklist were given a second one to complete at the end of the course.

2. The Memory Nuisance Rating. This simple four-point memory nuisance rating had been collected on those subjects from whom self-report information was considered valuable during neuropsychological screening on entry into the unit. This was used as the baseline indicator. Subjects were asked to rate their memories again at the end of the fourth session.

3. The Memory Aids Checklists (MACLs). As in the survey, subjects were simply asked to tick the memory aids and strategies they used. Any change in the use of memory aids would be highlighted by comparing the MACLs completed in session one with those completed at the end of the course.

4. Written Story Recall. This was chosen as a method of evaluation because of the apparent sensitivity of prose recall to subjective memory complaints in epilepsy (see Study C). In sessions one and four, a short story was read out to the group. Members were then asked to write down what they could remember of it immediately, and after a delay of fifteen to twenty minutes. The stories used were adapted from the WMS stories. The changes made them more appropriate for British subjects (Kapur 1989; see Appendix XVII).

As well as these four repeated measures, a questionnaire was used to gather the opinions about the usefulness of the memory group (The Memory Group Questionnaire (MGQ); see Appendix XVIII). The questions asked about attendance at group sessions; the most useful strategies; intentions regarding future use of the strategies; use of visual imagery; coping with memory difficulties and confidence in memory abilities. This questionnaire was completed at the end of session four.

Statistical Treatment of the Data

It should be borne in mind that it may be unrealistic to evaluate small group therapy using statistical procedures since patients with epilepsy, particularly this sample of patients, are very heterogeneous with regard to their condition and abilities. The underlying damage, the frequency of seizures as well as the education and

intelligence of the patients will affect outcome very greatly. However, small group analysis was performed but the foregoing remarks must be considered. Where the data indicated, repeated measures 't' tests are used to detect significant changes from baseline to follow-up.

Results

The Checklist. Of the nine subjects considered, seven returned the baseline checklist (CL1). Of these, only one subject returned a completed follow-up checklist (CL2). A further three returned partially completed CLs. As an outcome measure therefore, the checklist was unsuccessful. The subject who did return both checklists showed no improvement as a result of the group work. In fact, her checklist total had increased by 13 from CL1 to CL2. This woman had, however, recently undergone changes in her drug regime.

CL1 totals are nevertheless useful for demonstrating the heterogeneity of the subject group in terms of everyday memory performance. The median checklist score was 47, with a corresponding wide range of scores (19-135). This compares to a median of (42) for the subjects who provided data for Part B of this project (range = 0-189). In spite of the large difference in numbers, the spread of scores are quite similar.

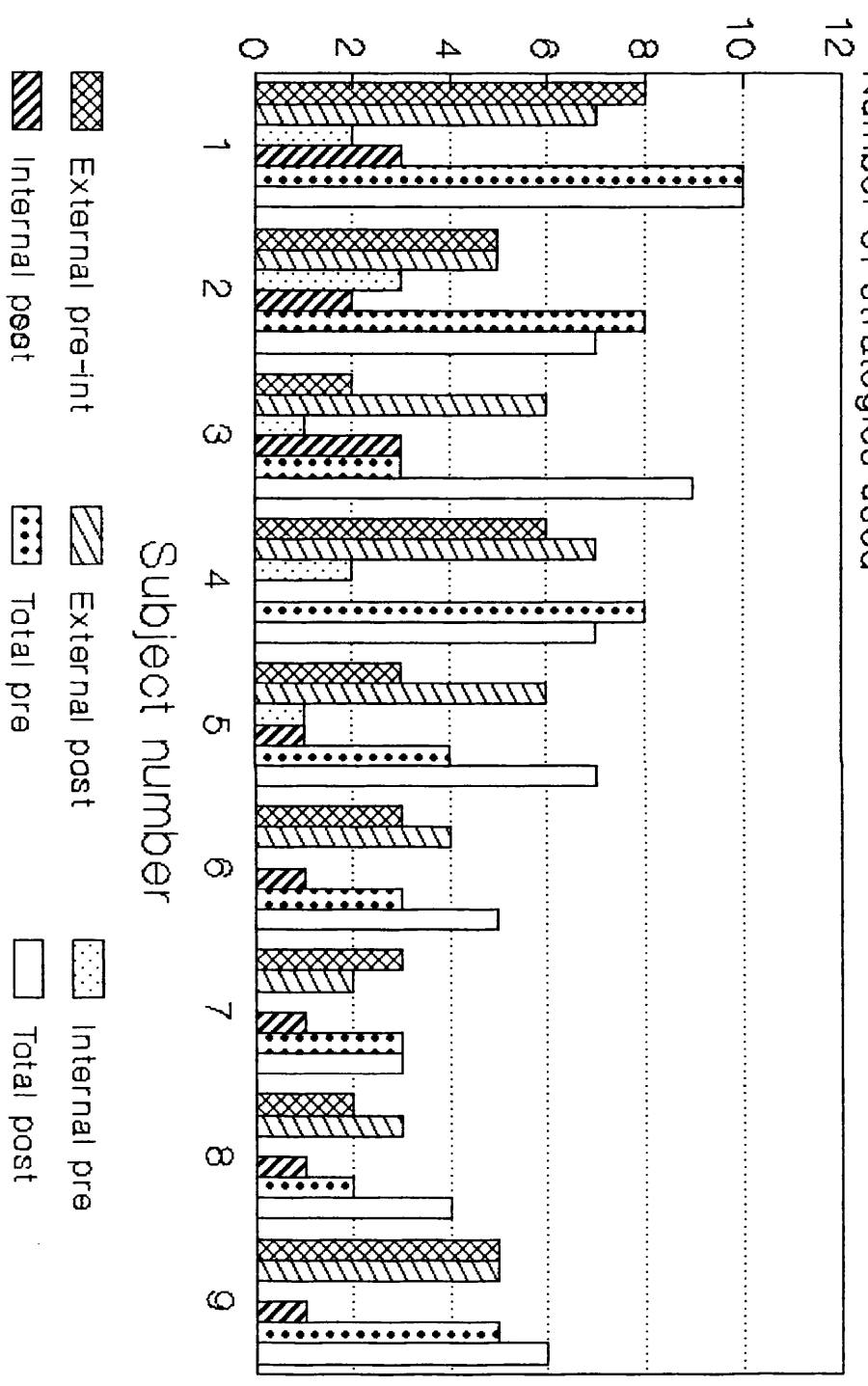
The Memory Nuisance Ratings. Five of the nine subjects

had completed the memory nuisance rating during psychometric screening. Two subjects had reported that their memories were no nuisance to them and therefore could not be expected to benefit from the group procedures. Another subject reported his memory to be a slight nuisance and the final two complained of a moderate degree of nuisance. None of these ratings changed post-intervention. Hence, according to this variable, no benefits were derived from the group procedures for these subjects.

The Memory Aids Checklist. Figure D(ii)1 gives details of the subjects' reported use of memory aids before and after intervention. It should be emphasised that whereas pre-intervention figures refer to 'ever used', post-intervention figures reflect the number of aids and strategies used since hearing about them in the group.

Repeated measures t-tests were performed upon the external, internal and combined total use of strategies. Results of these analyses revealed non-significant trends towards greater use of strategies ($p < 0.1$; 1 tail). It is also useful to note the changes in the frequency of reported use for each individual strategy discussed in the sessions. This can give some idea of where changes in behaviour actually occurred. Table D(ii)2 gives details of the number of subjects who reported using the methods before and after the group. Unfortunately, changing patterns of strategy use could not be statistically analysed using the Chi square test because numbers were

Figure D(11): External, internal and total use of memory aids and strategies pre-and post-intervention.



too small.

Table D(ii)2: Number of subjects who report using each memory support strategy before and after intervention.

Number of subjects reporting use at	Baseline	Follow-up
Diary/calendar	8	9
Ask someone to remind you	7	7
Lists	6	8
Personal memos	4	7
Alarms	4	6
Keeping things in special places	3	4
Writing on hand	4	4
Other type of external aid	1	0
Mental retracing of events	4	7
First letter mnemonics	3	0
Alphabetical searching	1	1
Face-name association	1	1
Rhymes	0	1
Story method	0	1
Peg method	0	2
Method of loci	0	1

It can be argued that the data shows some evidence of changing pattern of use of memory aids which is spread across different aids and not confined to one particular method. An altered pattern supports the notion that a

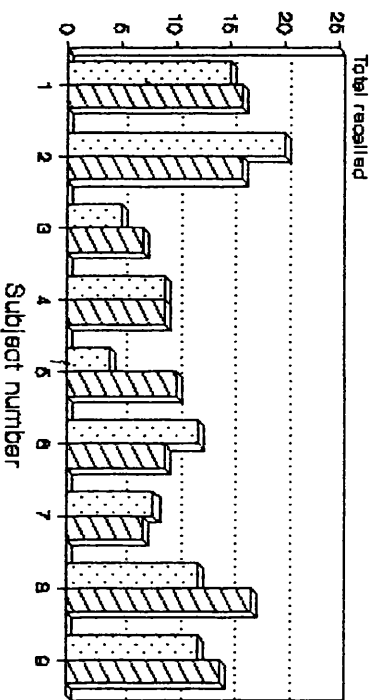
degree of change in 'memory behaviour' did occur over the course of the memory group.

Written Story Recall Figure D(ii)2 shows subjects' scores before and after the intervention.

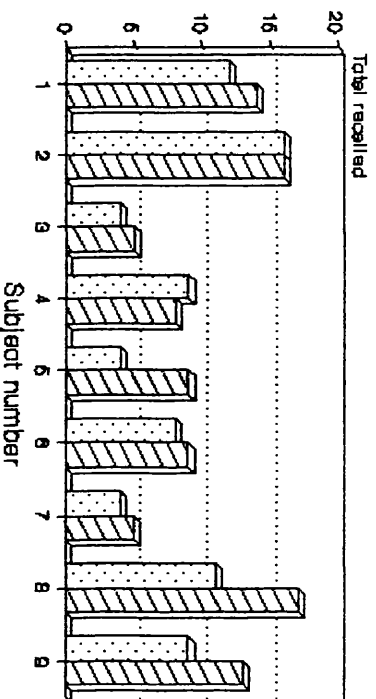
For immediate written recall, five improved while four performed more poorly or remained stable from pre- to post-intervention. For delayed recall, seven improved while two did more poorly or remained stable. Finally, for percentage retained over time, six improved while three worsened. Repeated t tests were performed upon the three sets of scores and revealed that while immediate recall showed no evidence of improvement after the intervention ($t = 0.81$, ns, 1 tail), delayed recall significantly improved post intervention ($t = 2.66$; $p < 0.05$; 1 tail). Retention scores revealed a non-significant trend toward better performance after the memory group ($t = 1.67$, $p < 0.1$).

The Memory Group Questionnaire (MGQ) Responses to the MGQ were mixed but, on the whole, quite favourable. This is particularly so for responses to question 7 which relates to increased memory confidence. A summary of the subjects MGQ responses can be seen in table D(ii)3 .

Immediate recall pre and post scores



Delayed recall pre and post scores



% retained pre and post scores

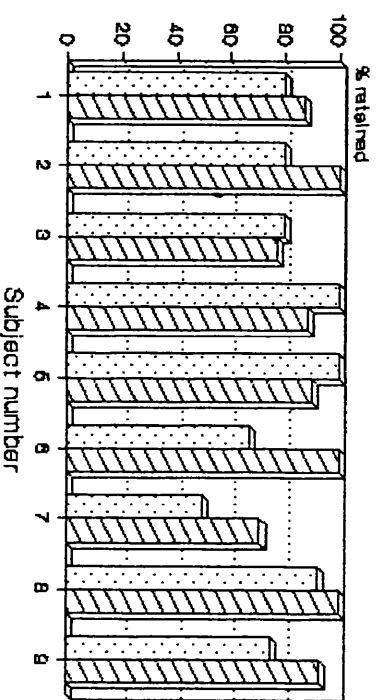


Figure D02 Subjects scores on written story recall before and after intervention. (Max. score= 32)

Table D(ii)3: Summary of the MGQ responses for each subject

Subject Number	Attendance of sessions	Most Useful Techniques	Use of Visual Imagery	Future use of Strategies	Improved Memory Coping	More Memory Confidence
1	1,3 & 4	Face-name Alphabetic search	Quite easy	Yes	Yes	A little
2	All	None	Quite easy	Perhaps	No	A little
3	All	Not specified	Quite easy	No	Yes	No
4	All	Not specified	Very difficult	Perhaps	Yes	A little
5	All	Not specified	Quite easy	No	Yes	No
6	All	Mental retracing	Quite easy	Yes	Yes	A little
7	All	Mental retracing	Easy	Yes	No	A little
8	All	Face-name assoc.	Quite easy	Perhaps	No	A little
9	All	Face-name Story method Mental retracing	Quite Difficult	Yes	Yes	A lot

When asked about the techniques they found most useful to learn about, three group members said mental retracing and face-name association, one said alphabetic searching and the story method, three specified none and one responded by saying that none of them were useful to learn about. It is interesting that seven of the group members found it 'easy' or 'quite easy' to use visual imagery. This technique was quite heavily stressed in the group but, it is generally not considered appropriate for people with right hemisphere damage. Two of the group members were considered, on current EEG evidence, to have right temporal lobe epilepsy. Both of these subjects found using visual imagery 'quite easy'.

Regarding the question of future use of the methods, responses were reasonably positive. Four group members indicated that they would use some of the techniques in the future. Three responded by saying that 'perhaps' they would and two said they would not. It is of note that the two who reported negatively here also reported that their memories were a moderate nuisance to them pre and post-intervention. Their negative responses could have been interpreted in a more favourable light had they described their memories as being no nuisance to them. Nevertheless, seven subjects were apparently ready to apply their knowledge to 'real world' difficulties.

The final two questions on the MGQ asked about coping with memory difficulties and confidence in memory abilities. Six of the subjects said that they felt more able to cope

with their memory problems as a result of the group work, while three reported that they did not. Regarding confidence, six subjects reported feeling 'a little' more confident about their memories and one subject reported feeling 'a lot' more confident about his memory after the group sessions. Two subjects, on the other hand, said that they did not feel more confident about their memories post-intervention. Using the Binomial Test, the probabilities of these results occurring by chance can be determined. In fact, the probability of the coping result occurring by chance is 0.251 and for the confidence result, 0.09. Neither of these results reach the 5% level of significance but the confidence result is probably reflecting a promising trend which may have reached significance given a larger sample.

SUMMARY OF STUDY D(ii) FINDINGS

In summary, results obtained from the nine subjects using the five outcome measures are mixed. There are a few quite positive findings but perhaps rather more disappointing ones.

There was little in the way of direct evidence to suggest positive changes in everyday memory functions. The group procedures were largely unsuccessful in reducing the nuisance that memory problems caused the subjects.

Findings relating to the use of memory aids was reasonably encouraging. Changes in memory behaviour may have

occurred as a result of the group procedures and there was some evidence to suggest that subjects tended to use more aids to memory post-intervention (a non-significant trend).

The MGQ responses referring to increased confidence in memory, showed a promising trend in the data.

Increases in the delayed story recall were again encouraging but may have been due to other therapeutic changes taking place while subjects attended the unit.

Considerations of Design and Methodology of the Memory
Group Study

i. The Sample

The subject sample collected for this study was certainly not ideal for the purposes of assessing the efficacy of a group method of memory training. While attendance at the sessions could be assured and the collection of reliable and up-to-date epilepsy related and treatment information was possible, the sample was far from representative of the population of people with epilepsy as a whole. Furthermore, in general the group was characterised by fairly low ability levels and this may have limited the subjects' capacity to benefit from the information supplied within the groups. It is largely because of the nature of the sample that very little can be concluded about the usefulness of group procedures for the general population of people with epilepsy where these methods might be considered in local support groups or within an outpatient memory clinic.

ii. Materials and Outcome Measures

The handouts supplied to all group members may have been rather inappropriate for a subject group with poor literacy skills. The original intention in compiling them was to cover thoroughly the failures referred to in the checklist and to advise on the use of appropriate strategies to ameliorate these. As such, the notes were

strategy centred. With the benefit of hindsight, it might have been more worthwhile to have produced one large problem centred booklet along the lines of those compiled for the subjects in the outpatient study.

The measures of outcome proved on the whole to be rather ineffective. The seven day checklist, which requires a good deal of commitment from subjects to complete as directed, was unsuitable for this subject group. Perhaps the memory questionnaire would have been a more appropriate measure as it could have been completed by all subjects during sessions one and four. The obvious difficulty with the follow-up MACLs was that subjects were more familiar with the techniques referred to as a result of the group work. A bias in responses may have arisen because of this greater familiarity and responses may not have been a true reflection of an increased use of the strategies in day-to-day terms. Furthermore, both the MACLs and the memory group questionnaire may have been influenced by experimenter effects with subjects responding in the manner they thought was expected. Finally, the written story recall measure while being the only logistically appropriate way of objectively testing verbal recall in a group setting, was difficult for this group with poor literacy skills. The majority of subjects were concerned about spelling and this may have inhibited them from documenting all that could be recalled of the stories.

iii. The Method

Perhaps the most important consideration to note when discussing the effectiveness of these memory groups is that the intervention was taking place in a very artificial setting. Institutions foster dependence in their residents. Appointments were only frequent during the first week of the stay and even then, staff reminded patients of their engagements. Members of staff also kept a memo board in the corridor on which they wrote a schedule of daily events. For example, every group day the list of members was written on this so that people would not forget to attend! Personal memo boards were also supplied next to beds. This is more acceptable and much more in keeping with the philosophy of the memory group. Indeed, subjects reported that these were very useful to them. Nevertheless, within the confines of smoothly run institution, opportunities for memory failures are rare. Patients keep all their belongings in lockers. No shopping is needed, few engagements are pressing and patients are reminded of changes in routine. In short, the patient is cared for. This dependent environment meant that the discussion of individual failures and the opportunity to learn from these was limited. When group members were asked if they had needed to remember anything during the previous week, the typical replies were either 'I can't remember' or 'no'.

Another major limitation placed upon the group method was

time. Four, one hour long sessions is probably insufficient for successful memory training. Other memory groups which have been reported tend to run for a great deal longer. For example, both Moffat (1984) and Wilson (1984) report a fifteen day schedule. Admittedly, their clients are densely amnesic, but they are reported to be of average or above ability. Thus, to efficiently assess the benefits of a memory group within this sample, many more than four sessions are probably required. However, even within this limited schedule it is possible to suggest the use of different teaching techniques which may have increased levels of subject motivation and confidence to a greater extent than those adopted. Higher levels of active participation within the groups could have been encouraged with the use of role play and 'homework' assignments. It may, however, be rather optimistic to assume that any homework would have been done since most subjects failed to read through their handouts during the week even though they had been specifically requested to do so. Furthermore, the overall failure of the subjects to complete the baseline and follow-up checklists also argues against the success of this kind of teaching strategy.

A final comment to make with respect to methodology is the failure to include a placebo group. It was considered unethical to set up placebo groups of subjects who had indicated a wish to participate in the memory group sessions. Furthermore, the intention would probably have been transparent and low participation may well have

rendered any data useless. There was a possibility of asking members of other groups (e.g. social skills and epilepsy groups) to complete the baseline and follow-up outcome measures so that the impact of psychologist attention over and above the benefits of memory training could be assessed. However, group membership overlapped to a great extent and if only those subjects who did not attend the memory group had been sampled then it is likely that the sample would have consisted of those whose memories do not constitute a difficulty to them and any comparisons would be fatuous. Therefore, while placebo sessions would have been ideal in theory, their use was ruled out by practical and therapeutic concerns.

DISCUSSION

I. Interpreting the Findings

The findings of studies A and B make it possible to stipulate ^{some of} the variables associated with memory complaints in people with epilepsy. A diagrammatic representation of the variables and their inter-relationships can be seen in Figure Two.

Figure Two: The variables associated with memory complaints in people with epilepsy and their interconnections.

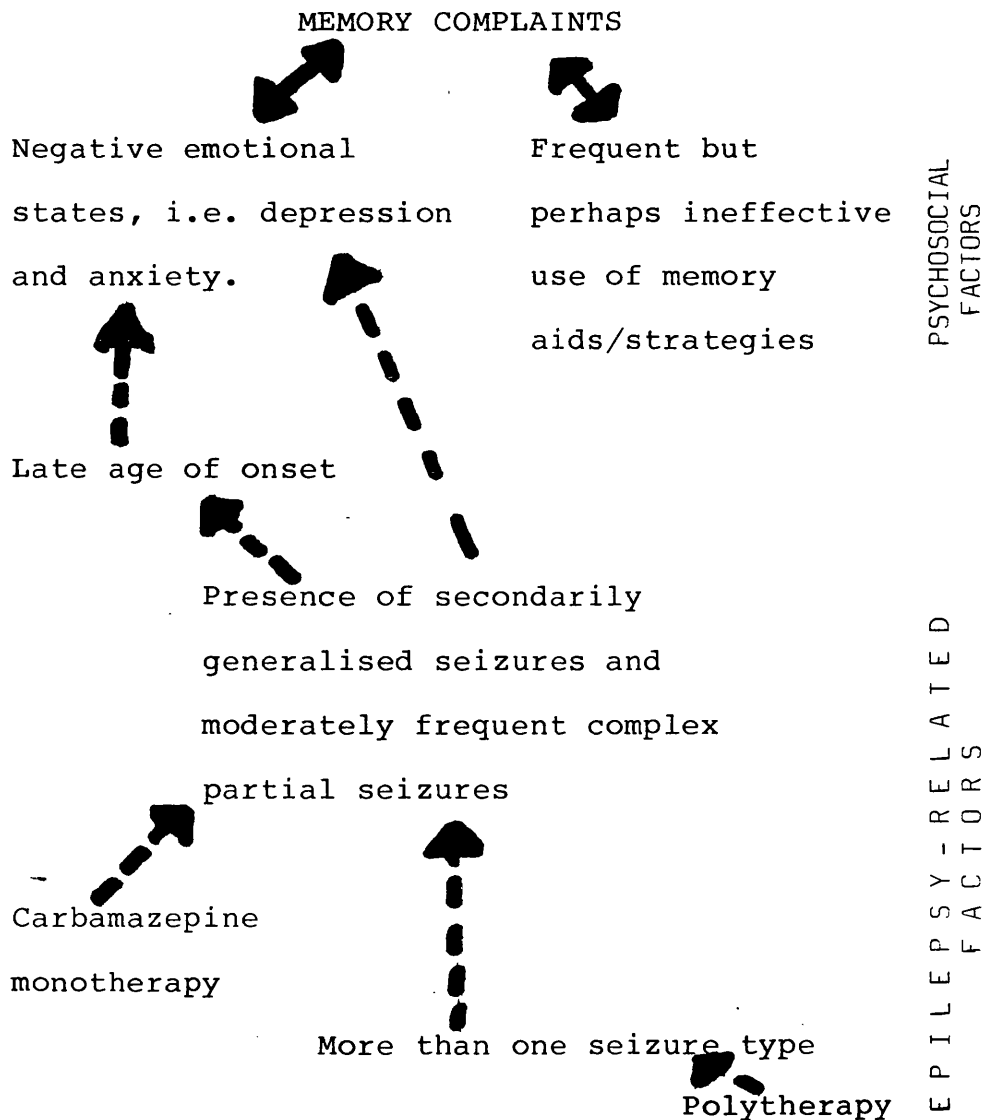


Figure Two stresses that the findings of these studies emphasised the importance of psychological factors in relation to memory complaints. Analysis showed that negative emotional states, particularly depression, had the strongest relationship with memory difficulties. However, the figure also stresses the possible association between negative mood and two apparently important epilepsy-related factors, namely, later age of onset and the presence of secondary generalised seizures. Of course, symptomatic focal epilepsy often presents later in life than idiopathic generalised epilepsy (Shorvon 1984) and, with the high prevalence of temporal lobe epilepsy and more particularly the involvement of medial temporal lobe structures, amongst focal epilepsy, there may be an organic relationship between negative affect and dysfunctional limbic system structures (Gilbert 1984). Therefore, the roles of psychosocial and neuroepileptic variables cannot be compartmentalised and viewed in isolation of each other. Of course, earlier work has also found links between certain anticonvulsants and negative affect notably phenytoin, the barbiturates and perhaps vigabatrin (Robertson et al 1987; Smith and Collins 1987; Victoroff et al 1990; Ring and Reynolds 1990). On the whole, the data does imply an association between everyday memory complaints and partial epilepsy and as such supports earlier work examining test performance (e.g. Glowinski 1973). However, the relationship between depression and epilepsy in general and that found between depression and memory complaints can explain why patients without the 'neurological

predisposing' variables of the temporal lobe epilepsy condition so often complain of difficulties of memory.

The other 'psychosocial' variable examined was the use of memory aids and mnemonic strategies. There was evidence to suggest that the two most popular, and presumably therefore, most successful everyday strategies (i.e. diary and the mental retracing of events) were used less frequently by people with epilepsy than by those without. It could then be argued that people with epilepsy report more memory difficulties than people without because they fail to take effective preventative action to avoid failures. The fact that subjects in the epilepsy group who reported the most difficulties also tended to report using aids to memory more frequently, argues against the notion of insufficient reliance on these techniques. Indeed, this finding does, to an extent, support their claims of poor memory although as mentioned earlier, the association may be due to affirmation bias. The crucial factor would seem to be the effectiveness of the use of these preventative strategies by people with epilepsy. This work did not directly examine that issue but, earlier research by Prevey et al (1988b) has suggested ineffective use of memory support strategies by people with temporal lobe epilepsy. The main aim of the memory training intervention studies reported here was to increase the proficient use of memory strategies. There was some evidence in the OP study that subjects felt they were

using the strategies suggested with greater efficiency as a result of the intervention. The impact of this upon memory complaints seemed to be beneficial in some subjects though the results were rather inconclusive and more data must be collected in this area.

A Psychosocial Model of Memory Complaints in People with Epilepsy

From the results of this research, a model may be proposed which can explain how complaints of poor memory develop and become so prevalent in people with epilepsy. The model takes account of the variables examined in the project and shows how they can act separately or in combination to give rise to memory complaints.

1. On diagnosis, people have negative preconceptions concerning the effects of epilepsy and its treatment upon the brain and its processes. These may particularly relate to memory since it is probably the most 'tangible' cognitive process. These preconceptions may be worse than the actual effects of the condition.
2. Neuroepileptic and treatment factors will predispose some patients to less efficient anterograde memory, new learning and concentration under taxing circumstances.
3. Ictal-related periods of amnesia, clouded consciousness or sub-clinical activity may lead to some anterograde memory difficulties and a degree of

autobiographical memory loss which can be quite lengthy in some cases.

4. The effects of 1, 2 and 3 will have initiated ideas of inefficient memory in the person's mind. Other people may reinforce this notion by referring to specific events in the past which may not be accessible to the person with epilepsy because of 3. This lack of recall prompted by queries of 'Do you remember the time when?' will not only cause more concern in the person with epilepsy, but will also set up beliefs of poor memory in the minds of friends and relatives. They may consequently make understandable but unhelpful statements like, 'You know how awful your memory is'. This will further reinforce the patient's belief to the extent that poor memory becomes a complaint.

5. Feelings of depression and anxiety (functional and/or organic in origin) already encompassing the diagnosis of epilepsy and its social and professional repercussions, spreads to negative feelings about poor memory.

6. Everyday memory may worsen under increased emotional strain. This will provide further evidence of difficulties and may cause a vicious cycle to develop between 4, 5 and 6. It is further possible that the heightened emotional state may precipitate more seizures thus giving rise to more ictal-related memory loss. Those who seek professional assessment may be given evidence that their memories are 'patchy' in some areas

though this is often not the case (see Appendix One). Either way, the fact that professionals may often fail to help the patient with his/her difficulties may exacerbate worries and fears.

7. Negative mood, low self-esteem, anxiety and perhaps poor organisational skills may prevent attempts at self-help by adopting effective ameliorative measures to reduce the impact of difficulties.

The above model can effectively deal with the evidence presented by earlier work which stresses test performance deficits in people with epilepsy through the effects of the condition itself, the preconceptions surrounding it and its treatment. It also explains how memory complaints can arise without significant performance deficits by emphasising the role of negative emotional states. It further illustrates the strength and frequency of memory complaints in this population and how memory deterioration may be perceived by the patients themselves. It does so by proposing the vicious cycle of negative mood and its increasing effects on everyday memory and perhaps the role of the former in increasing seizure frequency. Finally, it suggests areas where work can be concentrated to ameliorate memory complaints. Mood may be tackled directly or the patient can be advised on how to help him/herself cope with memory failures. If successful, this should lead to better adjustment to memory difficulties and lower levels of associated depression and/or anxiety.

Mood and Memory: Exploring the Relationship

Having uncovered an association between memory complaints, levels of affect and anxiety, there should be some attempt to define the nature of the relationship between the variables paying particular attention to the study population and the characteristics of the condition.

Perhaps the first point to raise should be that the associations found between mood and memory complaints may be artefactual. Larrabee et al (1991) express concern that the shared variance between reports of memory difficulties and depression arises because both have been recorded using the same self-report methodology (Campbell and Fiske 1959). This interpretational difficulty certainly applies to this work. However the very strong relationships found here between memory difficulties and both depression and anxiety in the epilepsy group would lead one to assume that this methodological explanation cannot fully account for the results. Furthermore, if this factor were entirely responsible for the relationship between negative emotional state and memory complaints, then one would expect a similar degree of association in the non-epilepsy data. This was not found. The association between these variables, although still statistically significant, was much weaker in the non-epilepsy group.

An issue of a similar nature is discussed by Gilewski and Zelinski (1986) who suggest that the reason for the

relationship between self-reported memory difficulties and depression in the elderly lies in the negative wording of most memory questionnaires. Depressed subjects with their low self-esteem, their negative view of themselves, the world and associated events (Betts 1976) are more likely to answer questions referring to failures in a manner which confirms the existence of difficulties or deficiencies. Indeed, one subject in this research did complain of the negative wording of both the MQ and the BDI, reporting that these questionnaires made her feel depressed. This kind of association is likely to be allied to the effects of mood congruence (Blaney 1986). If a subject is depressed then he/she is most likely to recall events which have bad rather than good connotations or implications. With respect to this work, the argument goes thus; subjects who feel depressed are more likely to recall incidents of memory failure rather than incidents of positive recall both in their day to day lives but more so when specifically asked about memory functioning in a retrospective MQ. The influence of this 'mood congruity' effect upon the overall results obtained here is difficult to assess but again it seems unlikely that this type of explanation can account fully for the relationship found, particularly since again it would predict a similar degree of association in the non-epilepsy data. As previously mentioned, results were less significant for that data.

There has been a good deal of speculation regarding the likelihood that the relationship between memory complaints

and depression in the elderly is due to a tendency for depressed subjects to exaggerate the extent of their difficulties (e.g. Kahn et al 1975). Again, this suggestion would be supported by Beck's cognitive theory. The effects of negative self-referent cognitive biases would lead to an underestimation of one's abilities. While this interpretation is perfectly feasible and may indeed be the most intuitively pleasing explanation in cases where frequent serious complaints are not accompanied by supporting performance deficits, the results gathered from this research do not support it. It will be recalled that the comparison of CL and MQ data indicated an underestimation of difficulties when subjects reported failures retrospectively (see also Prevey et al 1988a). Depression scores were strongly related to total reported memory failures on both measures. To clarify this finding, perhaps the CL subjects should have been divided according to the extent of reported depressive symptoms and the arithmetically adjusted MQ scores examined in groups to see if the overall tendency to underestimate failures on the MQ was characteristic of both those with and without depressive symptomatology. However, further evidence which was presented also argues against the 'exaggeration hypothesis'. When the specific MQ and CL items were examined, the major areas of difficulty tended to be estimated quite accurately on the MQ according to prospective responses. If exaggeration of difficulty was occurring in the sample then it might be expected to be reflected in those areas which were considered to be most troublesome. Clearly, this was not

so.

Other areas of debate surrounding the nature of the deficit cannot be furthered by the findings presented here. It is possible, for example, that memory difficulties are simply a cognitive sign of the symptoms of depression (Davis and Unruh 1980). Given that previous work has suggested that the negative effects of these symptoms upon performance tend to increase with task demands (Cohen et al 1982) it is possible to argue that conditions of incidental recall with frequent episodes of interference, typical of everyday memory, may maximise the effects of these symptoms upon memory performance. Thus, everyday memory functioning may be particularly vulnerable to the effects of depression. Unfortunately Davis and Unruh's (1980) interpretation is rather difficult to test but nevertheless it is a valid explanation of the relationship between these cognitive and emotional variables.

A similar interpretation was presented by Breslow et al (1980). These authors argued that it was the poor concentration and/or attentional capacity associated with depression that compromised memory performance. Furthermore, it was suggested that depressed patients had a deficient 'alerting mechanism'. This is another interpretation which would prove hard to address experimentally but, should an alerting mechanism deficiency prove to exist, then depressed patients would

not show differences in performance between intentional and incidental recall. This should perhaps be investigated. It should be noted, however, that these hypotheses were developed to explain memory test deficits in clinically depressed patients. The severity of the depression, its causes and treatment may make these explanations less applicable to people whose depressed mood is secondary to the consequences of epilepsy.

A question which is of particular interest in people with epilepsy is whether the effects of negative affect upon memory are specific or general in nature. Some research suggests general impairment (Calev et al 1986; O'Connor et al 1990) while other work has found verbal deficits (Miller and Lewis 1977; Breslow et al 1980) and still other authors argue for deficiencies in non-verbal functions (Depulta and Yozawitz 1984). General widespread impairments would be expected if memory difficulties arose from poor concentration and/or attention or from low motivation and lethargy. The limited findings of this research in this area would perhaps support non-specific effects of depression on test performance with both story recall and design learning apparently being compromised by depression. However, the specificity of memory deficits in relation to depression leads naturally to the issue of organicity and has particular significance for people with epilepsy, depression and memory problems. An organic argument would suggest that both depression and memory problems arise from the same area of dysfunctional CNS (e.g.

Fergusson et al 1969; Czernasky et al 1990). For example, the depression may arise from damaged limbic structures with involvement of the hippocampus in both memory problems and epilepsy. Indeed, early investigations of psychopathology in epilepsy associated depressive symptomatology with right temporal lobe epilepsy in particular (Flor-Henry 1969). This, of course, would imply impairment of non-verbal memory and learning in those with depression. However, the original notion of the cerebral asymmetry of depression has been questioned (Trimble and Robertson 1987). While most authors have failed to find a relationship, others have suggested that depression more typically characterises those with left temporal lobe epilepsy (Nielsen and Kristensen 1981; Pereni and Mendius 1984; Robertson et al 1987). Verbal memory deficits would be more readily witnessed in relation to depression in people with epilepsy if this were the case. Unfortunately, work examining everyday memory difficulties cannot advance this area of debate since everyday experiences are predominantly characterised by verbal demands and therefore any specific problems identified would be most likely to have a verbal content. However, authors who have investigated mood in epilepsy generally accept that both depression and anxiety have origins in both organic and functional causes (Betts 1981, 1988; Robertson 1988, 1991) and aetiology will vary from case to case. As such, it is perhaps most likely that negative affective state gives rise to general non-specific memory complaints and performance deficits.

As with depression, earlier research has demonstrated that state anxiety clearly plays some role in determining short-term memory test performance (e.g. Wright 1954; Haynes and Gormley 1977). However, since the great majority of studies have used the digit span test, it is unclear if anxiety has its main effect upon concentration rather than short-term memory per se (Finch et al 1976). However, negative effects of anxiety have been demonstrated using tests of incidental recall or learning (e.g. Silverman and Blitz 1956; Hamilton 1975). As argued earlier, incidental recall paradigms probably have more in common with most everyday memory situations than intentional recall methods although everyday prospective memory is clearly intentional.

The exact nature of the relationship between anxiety and poor memory is unclear. Results from a study by Yesavage and colleagues (1982) would argue a direct causative link since relaxation training proved to increase the performance of a memory and concentration task in subjects high in original state anxiety. However, whether memory per se or concentration was improved is unclear. The report by Watts and Sharrock (1985) favours an everyday concentration effect of anxiety although in their work with depressed patients who also suffered high levels of concurrent anxiety they were not able to separate the effects of anxiety and depression.

Further difficulties of interpretation arise when one considers the studies of Broadbent and others (1982) on

their CFQ. These authors argue that a large number of cognitive failures predispose individuals to the negative effects of stress. These results do not support the interpretation that high levels of anxiety give rise to everyday cognitive failures. This appears to be contrary to the classic findings of Yerkes and Dobson (1908) who found that performance on tasks does decrease in the face of levels of arousal above the optimal level. The difficulty, of course, lies in determining the 'optimal level' which is likely to vary from person to person. Clearly, more research is required to determine the nature of the relationship between levels of anxiety and memory performance.

The results of this series of investigations do suggest a link between anxiety and everyday memory in people with epilepsy. Furthermore, anxiety appears to be playing a role in isolation of the effects of depression since both the multiple regression analysis and the non-parametric group analysis suggested the significance of anxiety as an individual variable. From these results it may be most parsimonious to argue that anxiety has its main effects upon everyday memory by compromising the ability to concentrate, possibly causing frequent episodes of 'mind wandering' as Watts and Sharrock (1985) have argued. What is clear is that anxiety as a single emotional state does not have such harmful effects upon everyday memory as depression but that when both are found in combination, everyday memory performance is likely to be disrupted to the greatest extent. Intuitively, these results imply a

direct role of depression in reducing everyday memory abilities while anxiety has its main effect on memory through its deleterious effects upon concentration.

An interesting explanation of the roles of depression and anxiety in reducing memory capability in daily life has been offered by Reason (1984). It was suggested that absentmindedness and consequent memory failures may result because the attentional resource has been taken up by distracting states of mind. Reason speculates:

"Certain states of mind have the power to tie this resource down so fixedly that there are no custodial reserves to spare."

It is argued that the attentional resource should be regarded as a reservoir of limited capacity. Lapses, slips of action and tongue and absentmindedness can result because distracting depressive or stressful thoughts enlist the residual capacity of this resource so that the necessary attention, which should be devoted to ongoing events, is no longer available. Thus, cognitive failures result. Reason refers to studies examining the absentminded behaviour of alleged shoplifters whose attention was distracted as a consequence of pre-existing harmful emotional states arising from often serious negative life events.

People with epilepsy, who some researchers have suggested

are characterised by poor attentional capacity (e.g. Loiseau et al 1984), may suffer reduction in this capacity because of depressive or anxious cognitions about their condition and its consequences. These unwelcome thoughts may be frequent and intrusive (Beck 1976) and may interfere with ongoing behaviour. It could be argued that this makes them more prone to cognitive failures, including memory, because attentional resources are readily usurped in this way.

It should not be overlooked, however, that the primacy of mood over memory functions, though supported by research in other clinical and non-clinical populations on mood-induction and test anxiety (e.g. Bower 1981; Dunn 1968), cannot be assumed to be the case in this clinical sample. Research which is specifically designed to test whether negative mood has deleterious effects upon everyday memory in people with epilepsy or whether poor memory causes feelings of anxiety and depression is clearly necessary before any hypothesis regarding the nature of the relationship between mood and memory in people with epilepsy can be seriously considered.

The Use of Memory Support Strategies in People with Epilepsy. Ineffective not Insufficient

One of the original arguments postulated to explain the prevalence of memory complaints in people with epilepsy was that those who reported difficulties were making inadequate use of memory aids and strategies. The

suggestion of Prevey et al (1988a, 1988b) that people with temporal lobe epilepsy overestimated their memory abilities and as a result failed to rely upon 'aids' to a sufficient extent was used in support of this notion. Although seemingly paradoxical in light of the high incidence of memory complaints in people with epilepsy, there was some support for an underestimation of difficulties in the findings of these investigations. Prospective recording of memory failures suggested more frequent difficulties than did retrospective reporting.

Other research used to support the contention that people with epilepsy complaining of memory difficulties were making inadequate use of memory support strategies examined patients with frontal lobe damage. It had been shown that these patients failed to use memory aids to improve their functioning (Signoret and Lhermitte 1976; Hirst and Volpe 1988). Furthermore, a lack of insight into how they may improve their memory performance was demonstrated in the same clinical sample (Hirst 1985). These deficits were considered to be related to memory problems arising from deficits in planning and organisation stemming from frontal lobe damage (Mayes 1987). It was considered that some functional frontal lobe deficits due to the spread of the disruptive epileptogenic discharge may give rise to similar deficits in people with epilepsy, i.e. a disinclination to use memory aids arising from a lack of insight into how they may help and also an inability to plan and organise their correct use. However, results from these investigations

failed to support such a notion. No differences were found between the performances of complaining and non-complaining subjects on tests considered sensitive to the skills of planning and organisation. It is possible, as with the memory tests, that these 'objective' tests failed to detect the difficulties because they do not share the same characteristics of planning/organisation requirements found in the everyday situation. Nevertheless, on the basis of these findings it is not possible to argue for involvement of so-called 'frontal lobe functions' in determining the difficulties of these memory complainers.

Furthermore, the examination of the reported use of memory aids and strategies presented little in the way of evidence to suggest an insufficient use of these methods. One exception was that people with epilepsy used the two most popular methods less than those without epilepsy. Rather, the evidence implies, if anything, an ineffective use of strategies since those complaining of problems reported using aids more than those not complaining. This suggests that their greater use may be having little beneficial effect upon memory. The question therefore arises, why should people with epilepsy, particularly those reporting memory difficulties, make less effective use of aids to memory? There are a number of possible explanations.

First, it may be that the learning impairments which have been shown to exist in people with epilepsy, particularly

perhaps temporal lobe epilepsy (Delaney et al 1980, Mungas 1985; Hermann et al 1987) may impede learning to use memory strategies in an effective manner. Second, some people with epilepsy may lack the opportunity to develop effective use of memory strategies. These people may be un- or under-employed (Floyd 1986) and this will limit their need for good 'professional' recall. Furthermore, levels of dependency on others may be high which may foster an environment at home where the patient need not rely upon their own capabilities to recall important daily events.

A third suggestion addresses a possible relationship with the effective use of self-support memory strategies and levels of negative affect. In those with memory difficulties arising in part from depression there may exist feelings of low self-esteem, helplessness and hopelessness. Attitudes such as these are not conducive to the development of good and effective coping strategies and there may be a consequent disinclination to learn effective methods of dealing with memory failures.

A final possibility to consider is that memory aids and mnemonic strategies are ineffectively applied by the majority of people but that the consequences of this inefficient use have greater repercussions for those with pre-existing memory difficulties.

Whatever the explanation may be for the inefficient use of

memory support strategies in these subjects, it is clear that attempts to teach better, more effective use of methods which can be applied to everyday situations should benefit those with sufficient motivation and insight to learn from the advice given. This, of course, was the aim of the memory intervention techniques developed and tested in this research.

The Significance of the Neuroepileptic Variables

This research consistently but, quite contrary to earlier work, emphasised later onset of epilepsy in relation to memory complaints. Furthermore, the results of the survey (Study A) indicated that the presence, but not the frequency of secondarily generalised seizures, was a significant factor in relation to memory difficulties. More perplexing still was the relationship found in Study A between the frequency of reported memory failures and the frequency of complex partial seizures. It was found, not unexpectedly, that subjects reporting complex partial seizures on a yearly or less frequent basis reported the fewest memory failures. A less expected finding was that those with daily complex partial seizures held an intermediate position, while those with less than daily but greater than yearly occurrences of complex partial seizures reported the most frequent problems. Taken at face value, these findings relating to the neuroepileptic factors make little sense but clearly require explanation particularly considering the consistency of the age of onset finding. While some may

argue that these findings should be disregarded because the variables were mostly self-reported, they can however be understood by proposing an interaction between the presence of CNS disturbance/damage and psychosocial factors. The model adopted is of a diathesis-stress nature.

Partial epilepsy occurs when a particular area of the brain, usually one or both temporal lobes, develops a focal epileptogenic disturbance. The cause is often unknown but may be due to biochemical imbalance or the presence of a lesion. The condition is characterised by later onset than idiopathic generalised epilepsy, the occurrence of partial seizures of which the complex partial type are more readily recognisable than the often more subtle effects of simple partial seizures. Often there is a secondary spreading of the epileptic activity which gives rise to secondarily generalised tonic-clonic seizures. It should also be noted that complex partial seizures are more often associated with bilateral hemispheric involvement than are simple partial seizures (ILAE 1981). The spread of the seizure disturbance to cause secondarily generalised convulsions is often well controlled by anticonvulsants (Hart and Shorvon 1990). This may explain why the presence, but not the actual frequency, of secondary generalised seizures was found to be important with respect to everyday memory difficulties. The predisposition to secondary generalisation may be due to a lower seizure threshold arising from the original insult or dysfunction (Laidlaw and Laidlaw 1981). Focal

seizures are often more intractable to drug treatments than are primary generalised seizures (Hart and Shorvon 1990).

That this research uncovered, to some extent, relationships between memory difficulties and the neuroepileptic characteristics of the focal epileptic condition leads to the assumption that memory complaints are indeed associated with partial epilepsy and probably therefore, to the extent of underlying CNS damage. Other findings support this assertion (i.e. memory complaints are found in association with more than one seizure type, carbamazepine as opposed to other monotherapeutic treatments and polytherapy).

The presence and extent of organic CNS damage cannot however totally account for the precise nature of the relationship between memory complaints, age of onset and the frequency of complex partial seizures found in this research. It is usually argued that early seizure onset is associated with cognitive sequelae (e.g. Dikmen et al 1975, 1977. Loiseau et al 1988) because of the more volatile nature of the younger CNS. Furthermore, it is typically argued that more frequent seizures will cause greater cognitive disturbance by increasing neuronal loss or damage (Loiseau et al 1988). This may explain the greater association of memory failures to daily as opposed to yearly complex partial seizures found here. It cannot, however, account for the fact that those reporting most difficulty suffered from intermediate frequencies of

complex partial seizures. Psychosocial stressors are proposed to explain how later onset and intermediate levels of complex partial seizures come to be associated with memory complaints.

The social, professional and psychological implications of teenage and adult onset epilepsy may be greater than those associated with childhood onset. Many direct losses suffered by those with adult or adolescent onset will not arise for those with earlier onset of the condition. Examples include withdrawal of driving licence, stigmatisation and social withdrawal, unemployment, loss of job or reduced promotional opportunities. All of these may result in feelings of depression and/or anxiety which, as has been demonstrated, are the factors most closely associated with memory complaints. Certainly, the person with uncontrolled childhood onset epilepsy will encounter restrictions of opportunity but, they have more time to adjust to their restricted lifestyle. Indeed many need not adjust because they have known nothing different. The chances of negative emotional states persisting into adulthood is limited and therefore, because mood may not be a problem reports of poor memory will be less frequent in those with early onset epilepsy.

The psychosocial explanation of memory complaints being most typical in those with intermediate complex partial seizure frequency similarly relies on the ability to adjust. It may be argued that those with seizures occurring on a yearly or less frequent basis suffer

neither a high degree of neuronal seizure damage nor the consequences of living with the constant and unpredictable threat of seizures. Seizures are so infrequent that the person may forget about them. These people should adjust most easily to their condition and should develop no mood disturbance. Those with daily seizures, on the other hand, do have a burden to deal with. Seizures are very frequent but occur predictably from day to day. These people must learn to cope with their condition and in doing so may benefit from greater professional involvement since their condition is manifestly more troublesome. As a consequence, they may learn more about epilepsy and come to regard it simply as a fact of their lives with which they must cope as best they can. They will, of course, be troubled by the consequences of their seizures and will probably suffer differing degrees of both depression and anxiety. This, along with frequent organic seizure damage, may cause them to suffer more memory difficulties than those with only infrequent seizures. Those who cope least well may be people whose seizures are occurring 'now and then'. They are not predictable daily events but they arise more frequently than yearly and therefore pose a constant threat to their daily lives. They do not have the greater experience with seizures that those who suffer them daily develop and so may have less opportunity to come to terms with them and their consequences. They may also benefit from lower level professional care, receive less useful advice and learn less about their condition. Furthermore, they may try to hide their epilepsy from friends and colleagues and live in fear of being

discovered. All of these factors may cause aggravated levels of negative emotional state. Therefore, although they do not suffer the organic consequences of frequent seizure damage, they will experience high levels of memory difficulties because of their inclination toward depression and anxiety.

Thus, this organic/psychosocial diathesis-stress model can explain the significance of the neuroepileptic variables discovered in this project. It should be noted, however, that no differences in levels of negative mood were detected in patients with differing complex partial seizure frequencies.

The Qualitative Characteristics of the Memory Complaints

Perhaps the most important point to stress with regard to the qualitative characteristics of the memory complaints in people with epilepsy is that the major difficulties are remarkably similar to those of people without epilepsy. Four of the five main failures expressed on the MQ were shared by both groups while three of the five top failures recorded using the CL were the same. For each measure and for both groups, three of the five were of entirely verbal content, one involved prospective memory (having to go back to check whether you've done something) and one was an encoding/concentration failure liable to arise due to interference (forgetting where you've put things). These latter two failures and the 'tip-of-the-tongue' difficulty occur in the top five failures of both groups

on both measures. Clearly, the kinds of failure most likely to arise on a day to day basis are predictable and, in nature, the same as those which disrupt everybody. The high prevalence of verbal memory failures probably simply reflects the fact that our daily lives are so governed by language. However, the profile of major difficulties demonstrates why memory test batteries so often fail to reflect self-reported memory problems. The traditional memory tests satisfactorily cover verbal and non-verbal learning, delayed and immediate recall and recognition. They do not, however, assess naming difficulties, prospective memory or the effects of interference at all adequately. Given that these are specific areas of concern for people with epilepsy, just as they are for those without, there is a clear need to widen the scope of memory assessment in epilepsy.

Mayeux et al (1980) and Hermann et al (1988) have previously argued for the existence of a general linguistic deficit in those with dominant temporal lobe epilepsy and for the resulting need of more searching neuropsychological enquiry to detect this. Furthermore, the evidence presented by Powell et al (1987) from sodium amytal memory testing, suggests the greater susceptibility of verbal memory to epileptic disruption in either temporal lobe. It may be therefore that the prevalence of linguistic and verbal memory difficulties in people with active epilepsy is greater than contemporary neuropsychological explanations may lead one to believe, i.e. they may not be confined to those with left temporal

lobe involvement.

Investigations of memory, particularly in those for whom performance on traditional tests does not support complaints, should include not only tests of linguistic functions but also prospective recall, more in-depth consideration of the effects of interference upon memory performance and tests of incidental learning and recall. Furthermore, it is clear that any assessment of memory in epilepsy would, in the light of the findings presented here, be incomplete without the gathering of everyday evidence through questionnaire and/or checklist and without assessing and taking due account of negative mood.

If such a widespread search does bring forth positive evidence of memory difficulties, it is important that the patient should be offered practical advice on how to ameliorate these problems.

The Amelioration of Memory Difficulties

The interpretation of the findings of the memory intervention studies is severely restricted by small sample sizes in the outpatient study and by the nature of the sample and limitations placed upon the procedures in the memory group investigation. Some promising findings from both studies allows an optimistic view to be taken of these methods but, clearly more data is necessary for a fair assessment of the techniques.

One issue must, however, be addressed and that concerns the possibility of developing a more successful strategy relying upon psychological methods to reduce negative moods. A clear association has been demonstrated between mood and memory complaints but the nature of the relationship is far from clear. If memory complaints could be eradicated by a method directed at tackling and defeating negative mood, then this would further the understanding of what seems to be a very important relationship. More importantly, the practical benefits to people with epilepsy of a method which deals successfully with two problems via one procedure will be great.

II. Suggestions for Future Work

1. Self-Report Measures - MQ and CL

Within clinical settings, self-report measures should be considered useful supplements to an extended neuropsychological memory battery. Their use may be particularly indicated in those contradictory cases where a patient complains of memory difficulties but when performance on standardised tests does not reflect this.

Another use within the realm of clinical management would be in the longitudinal monitoring of treatment approaches. The use of simple and relatively quick self-report measures may be particularly appropriate where detailed testing of cognitive functions is not possible because of poor patient motivation or compliance during these often arduous procedures. The MQ or CL could be collected pre and post lobectomy in patients with drug resistant intractable unilateral temporal lobe epilepsy (Bennett Levy et al 1980; Wands and McGlone 1989; McGlone and Wands 1991). Time series procedures could be adopted in order to chart changes in memory experiences and efficiency which are expected to arise at different stages post-operatively. Results should be considered taking into account such variables as seizure control post surgery, whether anticonvulsants were successfully withdrawn and psychosocial outcome variables such as adjustment to a life without epilepsy and any initial mood alteration occurring as a response to surgery.

Similarly, these self-report measures could be used to assess the impact of anticonvulsant changes on everyday functions (Andrewes et al 1984). Patients often report 'slowing' or 'dulling' of functions in association with such changes and indeed more favourable changes can also arise. It would clearly be of some value to systematically assess these reports using a standardised method. The effects of drug serum level changes as a result of dosage reductions could also be examined in these terms.

There are few research studies of memory in epilepsy which chart the development of the supposed memory deterioration from onset of epilepsy through medication, seizure frequency and seizure type changes as the condition progresses to become chronic and, in some cases, severe and intractable. A longitudinal study recruiting new cases is clearly necessary and any such project should include repeated self-report indicators of memory difficulties in daily life. This kind of knowledge of the day to day cognitive consequences of the condition and its treatment would be extremely valuable and long awaited.

With respect to the preceding two suggestions, it may be useful to use a measure which does not concentrate its enquiry entirely upon memory. This may be particularly valuable in cases where the epilepsy is generalised or originates outside the temporal lobe in areas where more diverse, less tangible cognitive deficits may arise.

Furthermore, even when memory is the principal area of concern, it is possible that deficits in other cognitive skills affect mnemonic functioning, as previously argued. These areas should therefore perhaps be more thoroughly considered within a day to day context. The cognitive failures questionnaire (Broadbent et al 1982) which emphasises other types of cognitive failures as well as memory may be the measure of choice.

There are several areas where future research could elaborate upon the findings of this project. For example, the roles of depression and anxiety in relation to complaints of poor memory should be more systematically investigated. Perhaps a repeated measures or matched group design could test the influence of induced mood upon memory self-reports. This might be particularly valuable in those subjects who do not initially complain of problems in order to see if reports deteriorate after this induction of negative mood. Of course, if repeat measures methodology was chosen for this type of research it would be necessary to establish, with more confidence than was possible in the intervention study reported here, that responses to these self-report measures are not inclined to change as a function of time alone.

The findings implicating older age of onset as a variable influencing memory complaints should be examined with respect to levels of depression and anxiety. Groups of patients with epilepsy differing in age of onset but matched for pertinent epilepsy related and demographic

variables, memory test performance and ability levels should be examined for differences in memory complaint. Levels of anxiety and depression should be established and the effects of these either statistically partialled out or controlled for in the original experimental design. Thus it could be determined with more confidence if older age of onset has its main effects upon self-report ~~and~~ test memory through its association with negative emotional states.

2. Memory Testing

Any future work in this area ought to have the aim of furthering the understanding of the nature of these memory difficulties of which people with epilepsy complain. Earlier work has tended, by and large, simply to document that difficulties do exist (e.g. Mirsky et al 1960; Scott et al 1967; Glowinski 1973; Mohan et al 1976; Delaney et al 1980). In depth analysis of the performance of patients with different types of epilepsy should extend in line with advances in neuroimaging (Jackson et al 1990) and electrophysiology (Binnie 1989) so that, for example, the nature of cortical versus medial memory difficulties could be ascertained in people with active temporal lobe epilepsy (Milner 1978; Delaney et al 1982). Squire et al (1982) and Winnocur (1984) have suggested that the role of the hippocampus in memory is that of consolidation. Tests should be used which are sensitive to this skill. These may include learning and very long-term delayed recall. Results should be contrasted to tests assessing

encoding skills which, if the theory is correct, should be satisfactory in people with medial temporal lobe epileptic foci. Deficits of memory associated with frontal and parietal lobe seizures should be more fully examined with special consideration given to difficulties of planning and organisation and perceptual deficits in determining results of memory tests. The nature of the attentional deficits assumed to be associated with generalised epilepsy (Loiseau et al 1984) should be explored. There should be some consideration of the kinds of performance deficits which would be likely to arise on tests of memory because of poor attentional skills.

Other neglected areas of memory which are not considered useful for lateralisation or localisation of the epileptogenic focus ought to become an area of concern in order to expand findings in what has become a rather static area of research. Incidental recall and learning, so characteristic of everyday memory, is a neglected area which can easily be incorporated into objective memory test batteries or by testing the retention of medical information given during clinics (Thompson and Duncan 1987). Indeed, Milner (1978) reports deficits in incidental learning in patients post unilateral lobectomy. An active epileptogenic focus in the medial temporal lobe may have similarly debilitating effects upon this very important memory function. In the same paper, Milner argues that the primacy effect is reduced in people post temporal lobe surgery. This suggests long-term memory deficits in these people. The case of TB (Baddeley and

Wilson 1990) and some research by Powell et al (1984) suggests an impaired recency effect in epilepsy implying impoverished short-term working memory. On the whole, previous studies of memory in epilepsy have been inconclusive on this issue although deficits in delayed recall are more frequently reported which implies long-term memory difficulties. Certainly, the issue of primacy versus recency ought to be explored using list presentation for recall in people with differential diagnosis of epilepsy, including those with medial temporal lobe involvement. Remote memory has for too long been neglected in this sample. Examinations of very long-term memory could include analysis of rates of forgetting which Martin et al (1988) suggested were increased in people with epilepsy and the effects of pro and retroactive interference should also be considered. Both of these factors have been indicated as problems for patients with medial temporal lobe amnesia thought to involve dysfunctional hippocampi (Winnocur 1984). Autobiographical memory is a focus for concern since during the course of data collection, it became clear that many subjects reported 'gaps' in their memory, sometimes extending into several weeks. These gaps may be due to some kind of fugue state, prolonged ictal confusion or may be related to subclinical activity. Whatever the cause, a proper assessment of autobiographical memory should be attempted. However, autobiographical memory has been generally neglected by psychologists because it is difficult to test in a rigorous manner. Nevertheless, the development of the Autobiographical Memory Interview

(Kopelman et al 1990) should revitalise the area. It is an easy measure to administer and is suitable for the majority of people with epilepsy. Finally, consideration should be given to the efficiency of semantic memory in people with epilepsy. Possible deficits in this area have implications of some importance for underachievement at school (Thompson 1987) and the negatively skewed IQ distribution reported in children with epilepsy (Sullivan and Gahagan 1935; Farwell et al 1985). Tasks which involve pre-test presentation of general knowledge or even epilepsy-related information could be used and the extent of pre-test learning should be varied in order to assess the amount of recall at various intervals post-presentation.

Future work which arises directly from that presented here includes the possibility of developing a behavioural memory battery suitable for people with epilepsy which would be sensitive to their everyday memory complaints. It will be recalled that the Belonging Test used in this research proved rather too easy for the subjects. It may be that the other tests incorporated into the RBMT would be similarly insensitive. It may, however, be possible to use the RBMT as a basis and to adapt the subtests making them more suitable for people with epilepsy.

A second area where this research has indicated a need for further exploration is in the understanding of the effects of negative mood on test performance in this sample. Earlier work on the issue of depression and anxiety and

their effects upon memory has been inconclusive with respect to how these moods influence scores. It seems that both may reduce performance directly through cognitive slowing or over-arousal. Alternatively, the effect of symptoms may be more indirect, for example, low self-esteem giving rise to negative attitudes about one's performance. The differential effects of each should be explored to see which 'area' of memory is most disrupted by depression or anxiety. Matched group methodology should be used for this examination. Perhaps a longitudinal monitoring of performance on the tests most sensitive to negative mood at times before, during and after attempts to alleviate negative moods would prove of value in quantifying the real effects of both anxiety and depression.

3. Memory Training Interventions

Perhaps the most important future work in the area would be to re-test the method reported here. More data is needed for the outpatient method, and the group technique requires both more data and further refinement to make it more generally applicable. It could, for example, be used within the local support group services.

A self-help method, which like the outpatient method, involves the subjects in their own assessment of progress, has been developed. It needs to be tested on a reasonably sized sample to assess its overall usefulness.

When memory rehabilitation is used with patients post head injury, the nature of the neurological deficit is always emphasised when strategies and methods are chosen for a particular patient (e.g. Wilson and Moffat 1984; Prigatano et al 1986; Wilson 1987; Szekeres et al 1987). In this research, the nature of the epileptic condition was not stressed, particularly in the outpatient method, because of inadequate information of this type. It could, however, prove to be discriminative in terms of who does and who does not benefit from the procedures. Thus, practical instruction and subsequent use of strategies should be studied within groups of subjects differing in localisation and lateralisation of the epileptogenic area. It may be that subjects with non-dominant temporal or parietal lobe involvement do not benefit from strategies emphasising the use of imagery, whereas those with left temporal lobe epilepsy find the use of verbal mnemonics too cumbersome to be of practical use. Furthermore, subjects with frontal lobe involvement may lack sufficient levels of insight and planning skills to benefit from procedures of this sort.

One final suggestion for future memory amelioration research concerns the possibility of comparing the efficacy of a method which successfully reduces feelings of depression and anxiety against the method developed here. A carefully matched cross-sectional group study using a placebo technique if possible should be conducted. It should be emphasised, however, that psychological interventions to reduce negative moods are fraught with

difficulty. This is particularly relevant in a condition like epilepsy where negative emotions may have links to organic limbic system damage, to seizures themselves and to their treatment (Betts et al 1981; Robertson et al 1987). The largest part of the work would therefore involve the development of a method, based probably upon cognitive theory, which can successfully dispel negative feelings in this particular population.

III. Conclusion

This thesis attempted to explore the nature and extent of everyday memory difficulties in people with epilepsy. One intention was to determine how justified patients complaints of poor memory are. Indeed, this was regarded as being a particularly important objective because memory complaints are frequently heard from patients without significant corroborative performance deficits. This paradox was previously unexplored in the voluminous literature examining memory in epilepsy. The thesis went on to isolate possible explanatory factors behind these complaints with an aim to discover means by which memory complaints may be ameliorated.

In these aims, the project succeeded. It seems that people with epilepsy do indeed have cause to complain of poor memory. In fact, the evidence presented suggests that far from overstating their problems, people with epilepsy may actually be underestimating the extent of their day-to-day difficulties. The research further demonstrated that memory complaints are not confined to those with more severe and intractable epilepsy, but are characteristic of more representative samples of the population as a whole.

The everyday difficulties encountered by people with epilepsy are those familiar to us all. The difference

lies in the frequency with which these memory failures are believed to arise and the prospective recording of these incidents supports that belief.

The research found that negative mood was related to memory complaints in a strong and consistent way, and to a more significant extent than are neurological and treatment variables. The isolation of mood factors in relation to these complaints is a significant advance in a sample where considerations such as these have been previously neglected. Although the nature of this relationship requires more in-depth investigation, the association suggests a channel through which memory complaints may be ameliorated by psychological means.

The findings presented here with respect to the use of memory support strategies imply an ineffective use of these devices and techniques by people with epilepsy, a view supported by earlier research (Prevey et al 1988a and 1988b). Again, this finding has direct implications for psychological interventions aimed at amending these difficulties. Indeed, the methods of intervention presented here, though small scale and fraught with methodological drawbacks, have shown that memory difficulties need no longer be regarded as something which people with epilepsy simply have to learn to live with.

Both the roles of mood and 'memory behaviour' as well as

the underlying differences in the nature of the memory skills required in everyday and test situations (Herrman 1982; Sunderland et al 1983), can explain why people with epilepsy often complain of memory difficulties and yet perform adequately on neuropsychological tests.

Many future uses of the techniques and methods developed in this project are suggested. This should insure the prolonged consideration of patients' self-reports of memory functions. In addition, several suggestions for future research arise from this work and this should allow a widened and, perhaps more fruitful search, for the nature of the memory deficit(s) in people with epilepsy.

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Appendix I. Letter received from a subject which encapsulates the main concerns of this project.

Appendix II. The Self-Report Memory Questionnaire (MQ).

Appendix III. The Observers Memory Questionnaire (RMQ).

Appendix IV. The External Memory Aids Checklist (EMACL).

Appendix V. The Internal Memory Aids Checklist (IMACL).

Appendix VI. The Hospital Anxiety and Depression Scale (HAD).

Appendix VII. The Beck Depression Inventory (BDI).

Appendix VIII. The Personal Details Form.

Appendix IX. The Self-Report Memory Checklist (CL).

Appendix X. The Observers Memory Checklist (RCL).

Appendix XI. The Use of Memory Aids Questionnaire.

Appendix XII. All possible contents of the individually compiled memory booklets.

Appendix XIII. Group Material 1. Using External Memory Aids.

Appendix XIV. Group Material 2. Using Internal Memory Aids.

Appendix XV. Group Material 3. More Internal Memory Aids. Remembering to do things and items in a list.

Appendix XVI. Group Material 4. The Importance of Concentration.

Appendix XVII. The Adapted Wechsler Stories (Written Story Recall used in the group work).

Appendix XVIII. The Memory Group Questionnaire.

Appendix XIX. Kendall's Tau correlations between RMQ_{tot} and the memory tests (n = 60).

Appendix I. Letter received from a subject encapsulating the main concerns of this project.

"Your research into memory failure has come to my notice from the latest Annual Report of the British Epilepsy Association, of which I am a member, having suffered with epilepsy since birth as a consequence of meningitis.

For some time, I have been trying to understand my own memory problems which seem to date from the mid seventies when my temporal lobe epilepsy began to give me deja vu, depression and detachment. Now, at forty-five years of age, I am no nearer sorting out these difficulties despite consulting specialists in memory failure, one of whom recently (March '89) concluded, after testing me, that 'there is nothing to suggest severe memory deficits', and that my memory 'is within the normal range for a man of your age'.

Friends and colleagues are aware of my memory difficulties and recognise the extent to which they are a handicap. My concern is to know whether or not they are drug induced, or an inevitable manifestation of my condition. Whatever the cause, I need advice as to how the difficulties may be alleviated. I should, therefore, be pleased to take part in any trials or clinical assessments which you may be undertaking in your research."

MEMORY QUESTIONNAIRE

APPENDIX II

Response key:-

- A = Not at all
- B = About once in last three months
- C = About once a month
- D = About once a week
- E = About once a day
- F = More than once a day

HOW FREQUENTLY DO YOU

1. Forget where he/she has put something?
Losing things around the house
2. Fail to recognise places that he/she has been told they have been to often before?
3. Fail to remember a change in his/her daily routine, such as, a change in the place where something is kept or a change in the time something happens?
4. Have to go back to check whether he/she has done something he/she meant to do?
5. Forget that he/she was told something yesterday, or a few days ago and maybe have to be reminded about it?
6. Let himself/herself ramble on to speak about unimportant or irrelevant things?
7. Have difficulty picking up a new skill, e.g. finding it hard to learn a new game or to work some gadget after he/she has practiced once or twice?
8. Find that a word is "on the tip of his/her tongue" he/she knows what it is, but cannot find it?
9. Forget important details of what he/she did or what happened to him/her the day before?
10. Forget important details about himself/herself, e.g. date of birth, where he/she lives?

Circle appropriate answer:-

11. When talking to someone, forget what he/she has just said? Maybe saying "What was I talking about?"
12. When reading a newspaper or magazine, being unable to follow the thread of the story, losing track of what it is about?
13. Forgetting to tell somebody something important. Perhaps forgetting to pass on a message or remind someone of something?
14. Get the details of what somebody has told him/her mixed up and confused?
15. Forget people's names?
16. Get lost or turn in the wrong direction on a journey, on a walk, or in a building he/she has been only once or twice before?
17. Repeat to someone what he/she has told them or asked them the same question twice?
18. Fail to recognise by sight a close relative?

Circle appropriate answer:-

1. A B C D E F
2. A B C D E F
3. A B C D E F
4. A B C D E F
5. A B C D E F
6. A B C D E F
7. A B C D E F
8. A B C D E F
9. A B C D E F
10. A B C D E F
11. A B C D E F
12. A B C D E F
13. A B C D E F
14. A B C D E F
15. A B C D E F
16. A B C D E F
17. A B C D E F
18. A B C D E F

ANY OTHER MEMORY OR CONCENTRATION PROBLEMS? If YES, please specify:-

ARE _____ MEMORY AND CONCENTRATION DIFFICULTIES:-

1. A serious nuisance
 2. A moderate nuisance
 3. A slight nuisance
 4. No nuisance at all
- (Tick appropriate answer)

- A B C D E F

Appendix IV. Checklist for External Memory Aids

Please tick which of the following memory aids you use:-

1. Shopping lists?
2. Personal memos?
3. Writing on hand?
4. Alarm clock/digital watch with alarm facility?
(other than for getting up).
5. Calendars, year planners, diaries?
6. Ask someone to remind you?
7. Leave something in a special place where it will
be encountered next time?
8. Others. Please specify:-

If you use a diary do you look at this:-

1. Daily
2. Weekly
3. Less than above?

Appendix V. Checklist for Internal Memory Aids

Please tick off which of the following you have used before to help you to remember to do things:-

Mental Retracing. i.e. Retracing a series of events or actions, in order to aid memory as to something that happened or where you last had something that you are now looking for. Do you use this method?

Alphabetical Searching. i.e. When trying to recall a name or word, do you go through the alphabet letter by letter to find the first letter of the name or word?

Rhymes. e.g. 'In fourteen hundred and ninety-two Columbus sailed the ocean blue', helps you to remember the date.

First Letter Mnemonics. e.g. 'Richard of York Gave Battle In Vain'. The first letters giving the colours of the rainbow.

The Place Method. i.e. When trying to remember items in a list, do you imagine them in a series of familiar locations and then when you have to recall them you image them again in these familiar places?

Face-Name Association. i.e. When you are trying to

learn someone's name, do you change their name into something meaningful and then look for an unusual feature of their face, and then make an association between the two, e.g. redbearded Mr. Hiles may be imagined with hills growing out of his beard.

The Story Method. i.e. When you have to learn a list of items in order, do you make up a story so as to link them?

The Peg Method. Before this method can be used, the person has to learn to associate a word with each number up to say 50. e.g. 'one is a bun; two is a shoe; three is a tree; four is a door.....' etc. Once this is learned, lists of items may be learned in the following way:- the first item in the list is imagined in association with a bun; the second item is associated with a shoe; the third with a tree, and so on. Do you use this method?

HAD Scale

Name: _____

Date: _____

Doctors are aware that emotions play an important part in most illnesses. If your doctor knows about these feelings he will be able to help you more.

This questionnaire is designed to help your doctor to know how you feel. Read each item and place a firm tick in the box opposite the reply which comes closest to how you have been feeling in the past week.

Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought-out response.

Tick only one box in each section

I feel tense or 'wound up':

- Most of the time
- A lot of the time
- Time to time, Occasionally
- Not at all

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

I feel as if I am slowed down:

- Nearly all the time
- Very often
- Sometimes
- Not at all

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

I still enjoy the things I used to enjoy:

- Definitely as much
- Not quite so much
- Only a little
- Hardly at all

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

I get a sort of frightened feeling like 'butterflies' in the stomach:

- Not at all
- Occasionally
- Quite often
- Very often

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

I get a sort of frightened feeling as if something awful is about to happen:

- Very definitely and quite badly
- Yes, but not too badly
- A little, but it doesn't worry me
- Not at all

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

I have lost interest in my appearance:

- Definitely
- I don't take so much care as I should
- I may not take quite as much care
- I take just as much care as ever

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

I can laugh and see the funny side of things:

- As much as I always could
- Not quite so much now
- Definitely not so much now
- Not at all

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

I feel restless as if I have to be on the move:

- Very much indeed
- Quite a lot
- Not very much
- Not at all

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Worrying thoughts go through my mind:

- A great deal of the time
- A lot of the time
- From time to time but not too often
- Only occasionally

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

I look forward with enjoyment to things:

- As much as ever I did
- Rather less than I used to
- Definitely less than I used to
- Hardly at all

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

I feel cheerful:

- Not at all
- Not often
- Sometimes
- Most of the time

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

I get sudden feelings of panic:

- Very often indeed
- Quite often
- Not very often
- Not at all

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

I can sit at ease and feel relaxed:

- Definitely
- Usually
- Not often
- Not at all

<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

I can enjoy a good book or radio or TV programme:

- Often
- Sometimes
- Not often
- Very seldom

<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

Do not write below this line

APPENDIX VII.

Beck Depression Inventory.

Choose one statement out of each set of four. Choose the one which is most true for you these days. Circle the number (0,1,2 or 3) by the one you choose.

1. 0 I do not feel sad.
1 I feel sad.
2 I am sad all the time and I cant snap out of it.
3 I am so sad or unhappy that I cant stand it.
2. 0 I am not particularly discouraged about the future.
1 I feel discouraged about the future.
2 I feel I have nothing to look forward to.
3 I feel that the future is hopeless and things cannot improve.
3. 0 I do not feel like a failure.
1 I feel I have failed more than the average person.
2 As I look back on my life all I can see is a lot of failures.
3 I feel I am a complete failure as a person.
4. 0 I get as much satisfaction out of things as I used to.
1 I don't enjoy things the way I used to.
2 I don't get real satisfaction out of anything anymore.
3 I am dissatisfied or bored with everything.
5. 0 I don't feel particularly guilty.
1 I feel guilty a good part of the time.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.
6. 0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.
7. 0 I don't feel disappointed in myself.
1 I am disappointed in myself.
2 I am disgusted with myself.
3 I hate myself.
8. 0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.
9. 0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had a chance.
10. 0 I don't cry any more than usual.
1 I cry more now than usual.
2 I cry all the time now.
3 I used to be able to cry, but now I can't even though I want to.
11. 0 I am no more irritated now than I ever am.
1 I get annoyed or irritated.
2 I feel irritated all the time now.
3 I don't get irritated at all by things that used to irritate me.
12. 0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all my interest in other people.

13. 0 I make decisions about as well as I ever could.
 1 I put off making decisions more than I used to.
 2 I have greater difficulty making decisions than ever before.
 3 I can't make decisions at all any more.
14. 0 I don't feel I look any worse than I used to.
 1 I am worried that I am looking old or unattractive.
 2 I feel there are permanent changes in my appearance that make me look unattractive.
 3 I believe I look ugly.
15. 0 I can work as well as before.
 1 It takes extra effort to get started at doing something.
 2 I have to push myself very hard to do anything.
 3 I can't do any work at all.
16. 0 I can sleep as well as usual.
 1 I don't sleep as well as I used to.
 2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
 3 I wake up several hours earlier than I used to and cannot get back to sleep.
17. 0 I don't get more tired than usual.
 1 I get tired more easily than I used to.
 2 I get tired from doing almost anything.
 3 I am too tired to do anything.
18. 0 My appetite is no worse than usual.
 1 My appetite is not as good as it used to be.
 2 My appetite is much worse now.
 3 I have no appetite any more.
19. 0 I haven't lost much weight if any recently.
 1 I have lost more than 5 pounds.
 2 I have lost more than 10 pounds.
 3 I have lost more than 15 pounds.
 I am purposely trying to loose weight by eating less
 Yes ___ No__.
20. 0 I am no more worried about my health than usual.
 1 I am worried about physical problems such as aches and pains; or upset stomach or constipation.
 2 I am very worried about physical problems and it is hard to think of much else,
 3 I an so worried about my physical problems that I cannot think about anything else.
21. 0 I have not noticed any change in my interest in sex.
 1 I am less interested in sex than I used to be.
 2 I am much less interested in sex now.
 3 I have lost interest in sex completely.

Appendix VIII. The Personal Details Form

NAME (Optional)..... There are other
SEX: parts in this
AGE: study. If you
PRESENT OCCUPATION: would like to
participate
further then tick
the box.

Thanks!

EDUCATION: Do you have:-

- i) CSE's ii) 'O'levels iii) 'A' levels
- iv) Degree v) none vi) Others - please specify:-

-----CONTROL SUBJECTS STOP HERE-----

How old were you when you started having epilepsy?

How long have you had epilepsy?

What type of seizures do you have?

- Circle as appropriate. i) Primary Tonic-Clonic
Generalised/Grand Mal ii) Secondary generalised
iii) Absences iv) Complex partial v) Simple partial
vi) Myoclonic jerks vii) Unsure/don't know

How often do you have seizures at the moment?

Circle the best approximate answer.

- i) Daily ii) Weekly iii) Monthly
- iv) Less than monthly v) Yearly or less

Do you know the focus of your seizures?

If at all unsure, circle 'don't know'.

- i) Left temporal ii) Right temporal iii) Bilateral temporal
iv) Left frontal v) Right frontal
vi) Bilateral frontal vii) No focus, i.e. primary generalised epilepsy
viii) Other focus ix) Don't know
-

What anticonvulsant medication are you taking at the moment?

How often do you forget to take your medication for the day?

- i) Often ii) Sometimes iii) Rarely iv) Never
-

Is your epilepsy supervised by:-

- i) Your G.P. ii) A neurologist
iii) Other specialist/consultant
-

Any other information you may think important, e.g. have you had a lobectomy or other surgery?

- 0 = Not at all on that day
 1 = About once on that day
 2 = ~~Once~~ ^{More} once on that day
 3 = ~~Once~~ ^{More} once on that day
 4 = ~~Once~~ ^{More} once on that day

Appendix IX
 CHECKLIST A

Please choose the most appropriate answer for days 1 - 7

DAYS

DID YOU ON DAY:-	1	2	3	4	5	6	7
1. Forget where you put something, e.g. losing something around the house?							
2. Fail to recognise places that you are told you have been to often before?							
3. Fail to remember a change in your daily routine, such as, a change in the place where something is kept or a change in the time something happens?							
4. Have to go back to check whether you had done something you meant to do?							
5. Forget that you were told something yesterday, or a few days ago and maybe had to be reminded of it?							
6. Let yourself ramble on to speak about unimportant or irrelevant things?							
7. Have difficulty picking up a new skill, e.g. finding it hard to learn a new game or to work some gadget after you had practiced once or twice?							
8. Find that a word is 'on the tip of your tongue', you know what it is, but cannot find it?							
9. Forget important details of what you did or what happened to you the day before?							
10. Forget important details about yourself, e.g. date of birth, where you live?							
11. When talking to someone, forget what you had just said, maybe saying "what was I talking about?"							
12. When reading a newspaper or magazine, being unable to follow the thread of the story, lose track of what it was about?							
13. Forget to tell somebody something important. Perhaps forget to pass on a message or remind someone of something?							
14. Get the details of what somebody has told you mixed up or confused?							
15. Forget people's names?							
16. Get lost or turn in the wrong direction on a journey, on a walk, or in a building you had been only once or twice before?							
17. Repeat to someone what you have told them or asked the same question twice?							
18. Fail to recognise by sight a close relative?							

- 0 = Not at all on that day
- 1 = About once on that day
- 2 = ~~More~~ once on that day
- 3 = ~~Even~~ etc.

Appendix X
CHECKLIST B

Please choose the most appropriate answer for days 1 - 7

DAYS

DID	ON DAY:-	1	2	3	4	5	6	7
1.	Forget where he/she put something, e.g. losing something around the house?							
2.	Fail to recognise places that he/she has been to often before?							
3.	Fail to remember a change in his/her daily routine, e.g. a change in the place where something is kept or a change in the time something happens?							
4.	Have to go back to check whether he/she had done something he/she meant to do?							
5.	Forget that he/she was told something yesterday, or a few days ago and maybe have to be reminded of it?							
6.	Let himself/herself ramble on to speak about unimportant or irrelevant things?							
7.	Have difficulty picking up a new skill, e.g. finding it hard to learn a new game or to work some gadget after he/she had practiced once or twice?							
8.	Find that a word is "on the tip of his/her tongue", he/she knows that it is but cannot find it?							
9.	Forget important details of what he/she did or what happened to him/her the day before?							
10.	Forget important details about himself/herself e.g. date of birth, where he/she lives?							
11.	When talking to someone, forget what he/she had just said maybe saying "what was I talking about?"							
12.	When reading a newspaper or magazine, being unable to follow the thread of the story, lose track of what it is about?							
13.	Forget to tell somebody something important. Perhaps forget to pass on a message or remind someone of something?							
14.	Get details of what someone has told him/her mixed up and confused?							
15.	Forget people's names?							
16.	Get lost or turn in the wrong direction on a journey, on a walk, or in a building he/she had been to only once or twice before?							
17.	Repeat to someone what he/she has told them, or asked the same question twice?							
18.	Fail to recognise by sight a close relative?							

Appendix XI. Use of Memory Aids

Please circle the best answer.

1. How often during the last two months did you attempt to use the aids?

Not at all 0 1 2 3 4 5 Every day

Which of the strategies did you use the most?

1 = 2 = 3 =

2. Did you find the strategies useful, i.e. did they help you overcome some of your difficulties?

Not at all 0 1 2 3 4 5 Every day

Which of the strategies did you find most of use?

1 = 2 = 3 =

3. Do you think you use the strategies more now than you used to?

0 = about the same 1 = a little more 2 = much more

4. Will you continue to make an effort to use the strategies?

0 = No 1 = perhaps 2 = Yes

5. Did you find it beneficial to have an explanation of how and when to use the aids? Did you find you were using them more efficiently because of this?

0 = No 1 = perhaps 2 = Yes

6. After participating in this memory aids procedure, do you regard the use of aids as:-

1 = a good thing, i.e. helping you to overcome your difficulties.

2 = a bad thing, i.e. their use is just an indication of your poor memory.

7. Before participating in this memory aids procedure, did you regard the use of aids as:-

1 = a good thing 2 = a bad thing

Additional Questions

i. Do you think your memory difficulties are less of a nuisance now in general?

1 = Yes 2 = No

ii. Do you consider your memory concentration difficulties to be:-

0 = No nuisance 1 = a slight nuisance

2 = a moderate nuisance 3 = a serious nuisance

Any comments?

Appendix XII. Contents of the individually compiled booklets

Preface

This booklet has been especially devised for you and deals with the five most common problems which you have reported to us. It is hoped that the strategies will be of use to you now and in the future. It must be stressed that this is an experimental procedure and we are as unsure as you at this stage as to how successful this is going to be. We obviously need your co-operation in order to establish how beneficial these ideas are. This will require a good deal of effort on your part and you may find that using the strategies advised in this booklet will significantly change your lifestyle but, with luck, it should reap many benefits.

The aids listed in this booklet are just that. There are, to date, no procedures available which will undoubtedly improve your memory. Aids to memory will generally only alleviate the 'nuisance' of your memory and will lessen the impact of the failures on your daily life.

It is important to stress that your attitude to the use of aids is just as important as the effort you put in to using them. It is essential that you do not regard your reliance upon aids as negative. If by using the strategies suggested, your memory performance is improved and the nuisance of it lessened, this is to be regarded as positive and not negative.

With regard to other peoples attitudes to your reliance upon aids, this is not necessarily negative either. Often people will be impressed by your organisation, strategies and devices and will believe you to be a busy and active person! You may find that colleagues and those around you will even start to use the aids as well and may consequently thank you!

Finally, you must bear in mind that everyone has the problems you have described (perhaps not quite so often) and that they do understand the problems you face. Embarrassment, anxiety and depression will only tend to make matters worse, so try to combat these feelings.

We wish you all the best with your endeavours and will be in touch again soon to find out how you have fared.

PROBLEM: Forgetting where you have put something/losing things.

STRATEGY 1: Keeping things in special places

METHOD:

You should designate special places where you will keep things and make a real effort to put things in their special places when you have finished using them for the time being. This method can be applied to almost anything that seems likely to get mislaid.

OTHER POINTS:

- a. Special places should be accessible and convenient, don't for instance, keep your spectacles under a pot in the potting shed! It is best if the places are likely to be in view when you find that you need the item again.
- b. Above all, the special places must be memorable.

SUCCESS: Judge this method to be successful when you know where something is whereas before you think you would probably have had to look for it.

STRATEGY 2: Mental retracing

METHOD: You must retrace your actions or steps in your mind, in as much detail as you can, up to the point where you left the thing that you are now looking for and after that point if necessary. When you do this, usually you remember precisely where the thing is but sometimes it may just be helpful by giving you various options of where to look.

OTHER POINTS:

- a. Mislaying things will often happen when you allow yourself to get interrupted - try to avoid interruptions.
- b. Concentration is vital here and an effort to concentrate harder will be helpful in all situations.

SUCCESS: Judge this method to be a success if, by retracing your steps or actions, you eventually remember where you had put the thing.

PROBLEM: Forgetting to remember a change in your daily routine.

STRATEGIES: Diaries/memos/alarms.

METHOD:

Note down the change when you hear about it and leave the memo in an observable place where you will be bound to see it on the day in question or at the relevant time. 'Post It' notes are useful. If you have a digital watch then set your alarm to go off at the appropriate time and this will then remind you of the change. Similarly, you can ask someone to remind you of the change as an extra line of defence.

SUCCESS: If by using the strategies you become less likely to forget changes in your daily routine.

PROBLEM: Feeling that you have to go back and check whether or not you have done something you meant to do.

STRATEGY 1: Ask someone to remind you to do it.

METHOD:

Make a special effort to ask someone (if someone is available) whether or not they think that you have done that thing. If they are reasonably sure that you have, take their word for it and don't go back to check.

OR

If you are inclined to check once or twice whether or not you have done specific things (e.g. have your door key with you before you go out), then ask someone to remind you to bring your keys (or whatever else it might be). If they do remind you and you had forgotten, you will not have to check again because you will be sure that you actively went to get them.

SUCCESS: Judge the technique as successful every time you feel you don't have to go back and check!

STRATEGY 2: Mental Retracing

METHOD: Retrace your actions or steps in your mind in as much detail as you can up to and including the time when you thought you may have done the thing you meant to. This will generally remind you whether you did or didn't do it.

SUCCESS: Judge this method successful if it does remind you, i.e. if it prevents you from having to go back and check.

OTHER POINTS:

- a. The more organised and orderly you are, the less often you will feel that you have forgotten things.
- b. Always make sure you do things immediately you think of it. Procrastination is not only the thief of time but also the thief of memory!

PROBLEM: Forgetting that you have been told something recently.

STRATEGY: Use of diaries or memos.

METHOD:

Jot the relevant information down in a diary or a note pad, etc. A few simple key words is usually all that is required unless the message is very elaborate.

OTHER POINTS:

a. Some theories suggest that exercising the memory can help to improve it. Evidence confirming this notion is sparse but, the technique can certainly do no harm! It may be an idea for you to make your message jottings progressively less detailed so that you eventually come to rely on just a few simple key words. This will exercise your memory and increase your confidence in your ability to remember.

b. Often, simply the act of writing will help you remember the things you have been told.

c. Be careful not to lose these external aids. It is best to keep them with you at all times so that you can refer to them whenever you need to. This is obviously not always possible, so in such situations, be sure to leave your aid in a special place so that you always know where it is.

SUCCESS: Judge this to be successful if by referring to your jottings you insure that you remember these things you have been told.

PROBLEM: Speaking about unimportant or irrelevant things - rambling on.

STRATEGY: Increasing mental discipline.

METHOD: Before starting to speak, plan what you are going to say. Number the points you intend to make in your mind and make a concerted effort not to be side-tracked.

OTHER POINTS:

a. By disciplining yourself in this way you will not only be less likely to ramble, but consequently will be less likely to forget what you've just said and therefore less likely to repeat things as well.

b. Often you may appear to be rambling on to others because you are not making your conversational/argumentative connections clear enough for others to catch or understand. You should always direct your conversation to others and not just say the first thing that comes into your head - it may well be relevant but the link may appear tenuous to others.

SUCCESS: Judge this to be successful if, by disciplining yourself you become less likely to 'ramble on'.

PROBLEM: Finding a word or name that is on the 'tip-of-the-tongue'.

STRATEGY: Alphabetical Searching.

METHOD:

1. Go through the alphabet asking yourself 'does the name/word that I am looking for begin with 'a'/'b' ... etc?
2. Progress to step 2 if 1 is not successful. Concentrate on the letters that seemed to be more likely and think about/mouth/vocalise the letter or combination of letters.
3. Progress to step 3 if 2 is not successful. If step 2 has not helped within about five minutes, you are experiencing what is termed a 'blocked' tip-of-the-tongue (T.O.T.). In this case, do your best to stop thinking about the word/name and it should eventually come to you in time.

OTHER POINTS:

- a) Try not to get anxious/annoyed or frustrated as this will just make the difficulty worse.
- b. If you experience word finding difficulties within a business and/or social setting of some importance, then use a suitable alternative word and explain to your associate that the word was not exactly the one you were looking for. People are usually understanding and will often supply just the right word. This is probably the best policy in these situations as methods like alphabetical searching may take some time to be of help.
- c. Problems like this are common to everyone and you should not feel embarrassed or 'stupid' just because it happens to you.

SUCCESS: Judge the method to be a success if during either step 1 or step 2, you were able to find the word/name that you were looking for.

PROBLEM: Forgetting important details of what happened one or two days before.

STRATEGY 1: Diaries/memos.

METHOD: Important details should be written down in a diary or memo pad and you should refer to the message when you want to recall. Often simply the act of writing will help you to recall.

SUCCESS: If by writing the information down and referring to it if necessary, you remember the important details of the day before.

STRATEGY 2: Mental retracing

METHOD: Retrace the events of the day before in your mind as fully as you can. This will act as a cue for supplying the important details you need.

OTHER POINTS:

a. Clearly, such memory failures are only of consequence if the forgotten details are important in nature. Everyone is inclined to forget what they had for lunch yesterday for example.

SUCCESS: Judge this method to be successful if by retracing the events of the relevant day you consequently remember the important details.

PROBLEM: Forgetting what you have just said.

STRATEGY: Making an effort to concentrate harder.

METHOD:

The only way to avoid this problem is to be sure that you are concentrating enough on what you are talking about!

OTHER POINTS:

a. This problem will often happen when people interrupt or side-track you. Try not to give others the opportunity to do this. Take notice of an expert - Margaret Thatcher!

b. Often you will lose your flow of speech or thought when you are inclined to ramble on. Self-discipline is needed to prevent rambling.

SUCCESS: If, because of your increased effort, fewer or no failures of this kind occur.

PROBLEM: Losing track of a story in a newspaper or magazine.

STRATEGY: Improving concentration - the study method.

METHOD: The strategy is an indirect one requiring a good deal of effort and discipline to put into practice. It is called the PQRS method and its aim is to insure full comprehension and recall of written texts. You may or may not find that it prevents you from losing track. Try it and see!

Preview - establish the general order of the text.

Question - think of the main questions about the material.

Read - read the text carefully.

State - repeat the information that has been read.

Test - check that the text has been understood and the questions which were posed have been satisfactorily answered.

You may like to try this method as a means of improving your concentration. Otherwise:

OTHER POINTS:

a. You will find that you lose track less if you read in quiet conditions where little interruption is invited.

b. If your mind is engaged with other problems, losing track of written material is likely to happen anyway as your thoughts will wander to more pressing or interesting issues. Try to read at times when you don't have too many other things on your mind!

c. It may be that you find what you are reading boring or written in a way that doesn't inspire you. In this case leave it either temporarily or completely.

SUCCESS: Judge this to be a success if, by insuring concentration you find that this problem occurs less often.

PROBLEM: Forgetting to pass on important messages.

STRATEGY: Memos/notepads

METHOD: Take notes of messages in as much detail as you require. Refer to your memo pad as often as you can to remind yourself of the message and who it was for. 'Post It' notes are good at work because they can be stuck to things where you or the other person are likely to see them.

OTHER POINTS:

- a. You can also ask someone to remind you to pass the message on. A burden shared is a burden halved!
- b. It is always best to pass any messages on as soon as possible or immediately if you can. If you put it off until later, you are much more likely to forget.

SUCCESS: Judge this successful if by using memos or asking someone to remind you, you become more reliable at passing messages on.

PROBLEM: Getting details mixed up or confused.

STRATEGY: Memo pad - taking notes

METHOD: Use a memo pad to order or number details of information given to you and refer to these notes when you need to. The more complex the information the more detailed your notes should be.

SUCCESS: Judge this to be successful if, by noting down and ordering details and subsequently referring to them, you become less inclined to confuse them or get them mixed up.

PROBLEM: Forgetting people's names.

STRATEGY 1: Face-name association

METHOD: When you have been introduced to someone whose name you think you will have to remember, look at their face and pick out an unusual or outstanding feature, e.g. a big nose. Think of the person's name, e.g. Mr. Robinson or Robin and then conjure up an appropriate image to link the face with the name. In the above example, think of an enormous robin with a big red nose instead of a red breast. The method can be simplified but, the more bizarre the image, the more memorable it will be. You may find this technique very difficult at first but the more you practice, the easier it becomes.

OTHER POINTS:

a. You can practice this method by looking at pictures in magazines and fitting names to faces. Test your memory by coming back to them later and thinking of the name you gave them by remembering the image you used.

SUCCESS: Judge the method to be successful if you remember the image you applied and as a consequence, you remember the name of the person.

STRATEGY 2: Remembering the initials

METHOD: Lessen the burden on your memory by remembering less, i.e. just make an effort to remember the initials. The person's initials will act as a cue to the whole name. You could also try to fit an appropriate phrase to the person which has the initials as its first letters.

OTHER POINTS:

Within a busy or stressful social situation, you will find it difficult to use strategy 1. In this case apply the easier method of initials.

PROBLEM: Going in the wrong direction on a journey or walk.

STRATEGY: Notice landmarks

METHOD: Take notice of landmarks, e.g. buildings or unusual objects so that you can recognise them on the way back or when you next return.

OTHER POINTS:

a. Getting lost or 'having no sense of direction' can be connected to difficulties with right/left orientation which is, in fact, quite a common problem. It is useful then to make an effort to orient yourself with respect to turning right or left and remember the reversal on the way back.

SUCCESS: Judge this to be successful if by taking extra notice of landmarks and by orientating yourself with respect to right and left changes, you find you are less likely to get lost or lose your way.

PROBLEM: Repeating things or asking the same question twice.

STRATEGY: Improving concentration.

METHOD:

The only way to avoid this problem is by insuring that you are concentrating enough on the ongoing dialogue. You must be sure to pay attention to the reply of answer that is given and make sure that it satisfied you.

SUCCESS: If by your increased effort, fewer or no instances of this kind occur.

Using External Memory Aids

External memory aids are devices or techniques that you use to help you remember to do things. They are called 'external' because they transfer the burden of memory on to something or someone else.

We will look at seven external memory aids although there are others:←

1. Diaries

Diaries are probably the most widely used of memory aids. The majority of people use them, especially at work. Most people with epilepsy are advised to use diaries to monitor their seizures, but, this does not constitute good and complete use of them.

Diaries should, of course, be used as a back-up to your memory. They should be referred to once a day at least and written in whenever the occasion arises. Diaries should be well organised and clear. Lengthy reminders are not ideal because diaries have limited space. Try using key words. For example, if you are invited to a friend's party, just write 'Nick's 7.30'. You can devise some key words which you can use time and time again for routine things.

A badly organised and/or overcrowded diary is only slightly better than no diary at all because messages are likely to be missed.

Points for Diary Use

- 1) Keep diary organised. Messages should be clear and brief.
- 2) Refer to it at least once a day.
- 3) Use key words.
- 4) Write in the diary immediately.

2. Lists

Lists are useful for many things other than shopping. They can be used to help you remember the things you have to do over a busy day. Lists can be used in various ways and they bridge the gap between external and internal techniques.

There are just a few tips to consider for written lists. First, it is a good idea to write them up all at once. Shopping lists should be done in an organised fashion. Go through all the things that you know you need. Then go from room to room (mentally or physically) adding to it. Group things in categories, e.g. food, cleaning stuff, etc. It is also a good idea to number the list

so you know how many items you need. When listing the day's schedule, do it so that the most important things are tackled first, and so on. Also, try to tie it in so that it makes sense; if one thing depends upon the doing of another. You could also, if you like, timetable yourself through your list to be sure that you do it all.

These are all matters of organisation. We see how important good organisation is to good memory.

Lists can also be remembered without needing to write them down. Again, the ability to do this depends upon good organisation. In everyday settings, these techniques are most useful for shopping or remembering things you need to do while out. There are two ways to remember items in a list without writing them down.

First, you can construct a story which contains all of the 'to be remembered' things.

e.g. You go out to pick up a birthday card; go to the bank; get shoes fixed and go to the dentist.

Story: A poor dentist with holey shoes pops into the bank to arrange an overdraft. While he is in there, he sees his friend who is a clerk. He goes over to wish him happy birthday and gives him the card that he brought.

Another method is to use first letter mnemonics and visual imagery.

e.g. You need to buy: fruit, ice cream, sausages, ham, bread, eggs and dogfood.

Take the first letters of these items FISHBED and imagine a fish lying in bed.

You will probably need to jiggle the first letters around a bit before this method can be used.

You can also use first letter mnemonics without visual imagery.

e.g. You need to buy: rice, beans, mince, oranges, apples, eggs, tissues, soap and deodorant.

First letters = R B M O A E T S D. Juggle them around to get TOM'S BREAD or TOM'S BEARD. Both are easier to remember than the whole list and the letters act as cues to the whole word.

Points for Use of Lists

1. Write down the items immediately.
2. Construct list in organised fashion.
3. Number the items.
4. Lists can be timetabled.
5. Lists need not be written down < stories or first letter mnemonics.

3. Personal Memos

Using personal memos is a popular way to reduce the burden upon memory. Notebooks or scraps of paper can be used. The particular difficulty is that memos will not be referred to or they may be lost. It is important therefore to ensure that memos are always present and visible. 'Post it' notes are particularly good for these purposes. They can be stuck to telephones for example to remind you to make a call.

Again, with memos, key words are sufficient. Using key words will also prevent you becoming totally reliant upon these aids. The key word will act only as a cue to your memory. Using cues like this will increase your confidence in your memory ability.

The important thing about personal memos is that they must be written immediately. When memory is a problem, never put things off till later. You are much more likely to forget even to write the memo if you don't do it immediately.

Points for Use of Personal Memos

1. Write them immediately.
2. Use key words.
3. Keep them visible and in appropriate places < 'post it' notes.

4. Special Places

This is a good reliable technique for those of us who forget where we have put things. Losing things is again another indication of poor organisation. Things are put down in an absent-minded fashion and forgotten. Concentration and thought is not given to where things are put. Mislaying things can often happen when we have been interrupted, e.g. someone at the door or a phone call. Don't be flustered by interruptions. Always concentrate upon where you have put something.

In situations when you haven't just been interrupted, it is a good idea to designate special places to keep things. These places should be memorable, convenient and, as far as possible, visible at most times. For instance, it is not a good idea to keep your specs under a pot in the garden shed! This would be memorable but hardly convenient!

Three or four special places can be designated in the house or at work where most things can be kept. Make a concerted effort to use the places and never put it off. Discipline is needed.

Points for Use of Special Places

1. Designate places beforehand.
2. Places should be memorable, convenient and visible.
3. Makes sure that you use the places immediately. Never tell yourself you'll put it there 'in a minute'.

5. Ask Someone Else to Remind You

This is another very common strategy. However, it may be very unreliable. You may ask someone whose memory is no better than, or even worse, than your own. There would of course be little point in doing this!

You can ask a reliable person to remind you to do something or remind you whether or not you have already done something you had meant to.

However, by relying too much on someone else, you will not develop confidence in your own memory. It is not a good thing to become too dependent upon someone else's skills. It is also difficult to ensure that someone is always there when your memory needs them!

Asking someone else to remind you is a good strategy for avoiding the occasional incident but should not be used too much.

Points for Asking Someone Else to Remind You

1. Make sure that the other person is reliable.
2. It is better for your memory and confidence to rely upon your own devices and skills.
3. Don't use it too often.

5. Writing on Your Hand

This is not a widely used strategy as it is generally considered untidy and scruffy! It is, however, a very good memory aid since you cannot usually avoid looking at your hand and because of this the 'to be remembered' thing is likely to be remembered. What is more, you cannot lose your hand like you can memos and notepads!

A few tips can be given. First, write on the back of your hand, not the palm. Palms can get sweaty and the message may be lost. Similarly, be careful when you are washing your hands that you do not completely remove the message. Second, as it doesn't give a good impression to others to see your hands covered in large and lengthy messages, use small key words or single letters. These are not as noticeable and are just as

effective as cues to your memory. If you wear a watch, put messages on this hand.

Points for Use of Writing on Hand

1. Use back of hand.
2. Use key words or single letters.
3. Use hand with watch on.

7. Alarms

Using alarms (e.g. on digital watches) is a great way to remind you to do things which have set times. Taking tablets is a good example. If you get into the habit, this is a very good strategy. However, it does have its drawbacks. For instance, say you set your alarm to remind you to phone someone. The alarm goes off but you've forgotten what for! In this case, you could use alarms in conjunction with memos. Leave a 'post it' note saying what the task was on the clock. This will make the memory aid much more specific. Specific aids are much more useful than non-specific ones.

Points for Use of Alarms

1. Get into the habit.
2. Use alarms and memos together.
3. Don't forget to set the alarm!

General Points

Organisation is stressed. Good organisation is a key to good memory.

Don't be embarrassed about having to rely on aids. Most people use them much more than they admit - take the filofax fashion.

Using memory aids effectively is a matter of getting into the habit or using them.

External memory aids are good things, but they are no substitute for concentration and good encoding of the remembered things.

Appendix XIV.

Using Internal Memory Aids

Internal memory aids are the strategies which memory experts advise people to use to improve their memories. Experts swear by these techniques. What they do is to insure strong encoding, organised storage of information and easier retrieval of the to be remembered things. These strategies differ from external memory aids because the burden of remembering is still firmly on your own shoulders. You need not rely on anyone or anything outside of your own self. This hand-out looks at five ways of tackling different types of memory problems.

1. Mental Retracing of Events

Mental retracing is a retrieval only technique. Its use, by definition means that a memory failure has already occurred. There are at least three incidences when mental retracing can be helpful. These are:-

- i. When you have forgotten where you have put something.
- ii. When you feel that you have to go back to check whether you have done something you meant to.
- iii. When you have forgotten important details of what happened one or two days before.

We will deal with these incidents separately.

i. Forgetting where you have put something

METHOD: You must retrace your actions or steps in your mind, in as much detail as you can, up to the point when you left the thing that you are now looking for and, after that point if necessary. When you do this, usually you will remember precisely where the thing is. Otherwise, it may just be helpful by giving you various options of where you can go and look.

Other Points

- a. You should not need to use this technique if you have already started to keep things in special places!
- b. Mislaying things often happens when you allow yourself to be interrupted and side-tracked. If you do get interrupted, don't get flustered. Try to concentrate and think about where you are leaving things. Efforts to improve your concentration will be helpful in all areas.

ii. Having to go back to check whether you have done something

METHOD: Retrace your actions or steps in your mind in as much detail as you can up to, and including, the time when you thought you may have done the thing. This

will generally remind you whether or not you did do it.

Other Points

a. The more organised and orderly you are, the less often you will feel that you have forgotten things.
b. Always make sure that you do things immediately you think of them. Procrastination is not only the thief of time, but also the thief of memory.
c. Feeling that you have to go back and check has often got nothing to do with forgetfulness. You may find yourself doing this just because you are anxious. For instance, every time I leave my house I always check if I've got my key even though I know very well that I do have it! You should be aware that this is not a memory failure, although it does look like one to other people.

iii. Forgetting important details of what happened one or two days before

METHOD: Retrace the events of the day in your mind as fully as you can. This will act as a cue for supplying the important details that you need.

Other Points

a. Clearly these kinds of failures are only of consequence if the forgotten details are important in nature. Everyone is inclined to forget what they had for lunch yesterday, for example!

2. Alphabetical Searching

This technique is another one which only helps with the retrieval of information. This means that it helps to resolve memory failures which have already happened. There are two problems which the alphabetical search technique can help with. These are:-

- ..Finding that a word is on the tip-of-the-tongue.
- ..Forgetting people's names.

We will deal with these together as the technique is just the same.

METHOD (i) Go through the alphabet asking yourself "does the name/word I am looking for begin with 'a'/'b'/'...etc. Getting the first letter acts as a cue to the rest of the name/word.

(ii) Progress to step (ii) if (i) is not successful. Concentrate on the letters that seemed to be more likely. Think about/mouth/vocalise the letter or combination of letters.

(iii) **I**f step (ii) is not successful within about five minutes, you are having what is known as a 'blocked TOT', In this case the best thing to do is to stop thinking about it. Eventually, the word or name that you are looking for will come back!

Other Points

- a. Try not to get anxious, annoyed or frustrated as this will just make the difficulty worse.
- b. The problem with alpha search is that it takes some time to work through. It is not therefore appropriate to try it in an important social or business setting! If you do experience word finding difficulties in this kind of situation, then it is best to use a suitable alternative word. Explain to the person that the word was not exactly the one you were looking for. People are usually very understanding and may often supply just the right word for you. If you forget someone's name in this kind of setting, just apologise - "I'm terribly sorry I've forgotten your name". (Make a joke of this if you think it appropriate).
- c. A good way to insure that you don't forget someone's name is to use it a lot in your original conversation. You may feel daft doing this but, in fact, people actually like to hear their names. They feel flattered!
- d. Word and name finding difficulties are common to everyone. You should not feel embarrassed or stupid just because it happens to you.

3. Face-Name Association

This is a technique which helps when you are taking in the information to be remembered. Retrieving it becomes easier because the information is put into store in a more memorable way. This method involves visual imagery. You conjure up a picture which associates a name to a particular face.

METHOD: When you meet someone whose name you think you will have to remember, look at their face and pick out an unusual or outstanding feature, e.g. a big nose. Think of the person's name, e.g. Mr. Robinson or Robin. Conjure up an appropriate image to link the face with the name. In the example above you could think of an enormous robin with a big red nose instead of a red breast. The more bizarre the image, the more memorable it will be. You may find this technique very difficult at first but the more you practice, the easier it becomes.

Other Points

- a. You can practice this method by looking at pictures in magazines. Give the pictures names and think of an image associating the name with the face. Test your memory by coming back to them later and see if you can remember the name you gave them by calling up the image.
- b. Some people find visual imagery very difficult. If the technique is too difficult for you, you can just try to simply remember the initials. This will lessen the burden on your memory. The person's initials will act

as a cue to the whole name. You may also try to fit an appropriate phrase to the person which has the person's initials as its first letters. For example, Cathy Pritchard has just come over here from Canada. You can remember her as Canadian Person.

c. Again, in busy or stressful social situations, you may find face-name difficult and too slow at first. Initials will be a better technique here.

4. Noticing Landmarks

This is a way of preventing yourself from getting lost or going in the wrong direction during relatively unfamiliar journeys or walks.

METHOD: Make an effort to look for landmarks like unusual buildings, parks, squares, phone boxes, shops, etc. On the way back or, when you make the same journey again, you will recognise these same things. If you like, you can write these details down in a sort of verbal map. For example, "At the train station carry straight on. Turn left into the road beside the huge blue office block. Carry on till come to the Off Licence, then cross the road. Carry on up the same road until the square and turn right down the road with the phone box. Fred's house is two doors down from the Shish Mahal curry house".

Other Points

a. Getting lost or 'having no sense of direction' can be connected to difficulties with right/left orientation. This is, in fact, quite a common problem. It is useful then to make an effort to orientate yourself with respect to making right and left turns. Remember the reversal on the way back though.

5. The Study Method - PQRS

This is a technique which will help you to remember things which you have read. It is a complicated and lengthy process which requires a good deal of effort to put to use effectively. It is indirectly aimed at preventing you from losing the thread of stories or articles which you read. It certainly insures full comprehension and better recall of written texts.

METHOD:

Preview - establish the general order of the text.

Question - think of the main questions about the material.

Read - re-read the text carefully.

State - repeat the information that has been read.

Test - check that the text has been understood and the questions which were posed have been satisfactorily answered.

For example, "Aids to memory are generally divided into external and internal upon the basis of where the onus is placed. External strategies partially transfer the burden of memory on to someone or something else. Internal strategies are devices developed to aid recall and/or encoding within the mind itself".

Preview - Talking about memory aids. Difference between external and internal strategies. Defines them both.

Question - (1) How many categories of memory aids?
(2) How do external devices work?
(3) How do internal devices work?

Read - re-read the text now.

State - two categories of memory aids.
Divided on the basis of where the load of memory is. External strategies - load handed over to someone or something else. Internal strategies - aid recall and/or encoding within the mind.

Test - Have understood the text and have answered my three questions.

Other Points

a. This is a very good technique for people who are studying. Otherwise, for just plain reading it is probably a little time consuming.

b. The study method tries to improve your concentration. Other ways to improve concentration are:

- ..to read in quiet conditions where you won't get disturbed or interrupted.
- ..to read at times when you don't have too many other things on your mind. If your thoughts are engaged with other things, then you will be bound to lose concentration on written material.
- ..If you find what you are reading boring or badly written, your concentration will go. This is the writer's fault, not yours. (I bet you are yawning now!).

Appendix XV. More Internal Memory Aids. Remembering
to do things and items in a list.

There are a few strategies which you can use to help you remember what you were planning to do or for remembering items in a list. Although these techniques are very good, it is sometimes difficult to apply them to memory problems of an everyday kind. Still, we will have a go!

1. STORIES

For remembering items in a list and things that you have to do.

METHOD: Make up a story which contains all of the things which you have to remember.

Example: You have to go to town to do a few things.

These are:

- buy a birthday card
- go to the bank
- get your shoes fixed
- go to the dentists to make an appointment

STORY: There was once a poor dentist (a rare breed!) who was so hard up that he had to walk around in shoes which were full of holes. One day he decided that he had had enough of this state of affairs. He set off for the bank to arrange an overdraft. The manager happened to be a friend of his so he didn't think he should have any

problems. When he got there, the staff were having a party to celebrate the managers birthday. The poor dentist decided that he had better leave before he was spotted because he had forgotten to buy his friend, the manager, a birthday card!

Points for using Stories

- a. You can make them brief and to the point.
- b. The more bizarre the story is, the more memorable it will be.

2. FIRST LETTER MNEMONICS

Using initials to help you to remember things in a list.

METHOD: Take the first letters of the items and juggle them around to make a word or phrase. Use visual imagery to remind you of that word or phrase.

Example: You go to the shops but have forgotten your list. You know that you need to buy some: fruit; ice-cream; sausages; ham; bread; eggs and dog food.

Take the first letters of the items - FISHBED.

Construct a visual image about a fish lying in bed.

You can also use first letter mnemonics without visual imagery.

Example: You need to buy: rice; beans; mince; oranges;

apples; eggs, tissues; soap and some dish cloths.

Take the first letters of the items - RBMOAETSD.

Juggle them around to get TOMS BREAD or TOMS BEARD.

Both are easier to remember than the whole list and the letters act as cues to the whole words.

Points for first letter mnemonics

1. Can use it with or without visual imagery.
2. It might need a bit of practice to perfect.
3. It is best to use for shopping lists although it can be used for things to do.
4. Bizarre words/phrases and/or images are the best.

3. THE PEG METHOD

This is more of a fun technique which is difficult to apply to common everyday situations. However, it is a very good way of remembering things in an ordered list up to 10. It uses visual imagery and rhyming techniques.

METHOD: First you have to remember peg words associated with the numbers 1 - 10. This is not difficult because the peg words rhyme with the numbers.

Remember these:

one = a bun

two = a shoe

three = a tree

four = a door five = a hive six = sticks
seven = heaven eight = a gate nine = a line
ten = a hen

Now if you ever need to remember things in an ordered list all you have to do is associate the thing to be remembered with the peg word by using a visual image to connect them in your mind.

Have a go with these items:

- | 1. Scissors | <u>Points for using Peg Method</u> |
|---------------|---|
| 2. Plant | a) You can impress your friends with your amazing powers of memory! |
| 3. Doll | |
| 4. Paper | |
| 5. Sand | b) This may be a good technique for remembering facts for exams, etc. |
| 6. Book | |
| 7. Chair | |
| 8. Toothbrush | |
| 9. Window | |
| 10. Sponge | |

Appendix XVI. The Importance of Concentration

Memory will always seem to be poor if concentration is not good. Improving your concentration and attention is therefore essential. It is not easy to advise on how this can be done. It is up to you!

As long as you are making every effort to concentrate on things you want to remember then your performance should benefit.

Three problems of an everyday kind come to mind which you may think are memory problems. They are really due more to lack of concentration. These are:-

- I. Forgetting what you were talking about.
- II. Repeating things, e.g. asking questions twice.
- III. Speaking about unimportant things (rambling on).

We will deal with these separately.

I. Forgetting what you were talking about

The only way to avoid this problem is to be sure that you are concentrating enough on what you are talking about!

Tips:

- i. Don't let others interrupt you. If you have

something to say, or a point to make, they should be courteous enough to let you say it. Don't give others any opportunity to interrupt you. Look at Margaret Thatcher - she certainly doesn't stand for it!

ii. Train yourself to say what you mean clearly and concisely. Think before you speak.

II. Repeating things

To avoid this, just be sure that you are paying full attention to the ongoing dialogue. If you don't pay attention to replies or answers, you will be bound to repeat questions. If you are inclined to ask questions twice, make sure that you are satisfied with and understand the answer given to you question.

III. Rambling on

Rambling is only embarrassing or a nuisance to you if you are talking to people who you don't know. People who know you may expect you to ramble during chats and probably regard it as just part of your character. Rambling on only becomes a problem in situations where you feel you shouldn't be doing it.

In these situations: Plan what you are going to say. Number the points you want to make if necessary. Make a

real effort not to be side-tracked. By this kind of discipline you will be:-

- a) Less likely to ramble.
- b) Less likely to forget what you were talking about.
- c) Less likely to repeat things.

Concentration problems can be embarrassing at certain times but their consequences are not as drastic as, say, losing your way or forgetting to pass on important messages. If you want to tackle these difficulties you can. Concentration, attention, organisation and your own motivation to change are the things you ought to be working on.

Appendix XVII. The Adapted Wechsler Stories

Version One

Ann Thompson / of South Brighton / employed as a cook / in a school canteen / reported at the police station / that she had been held up / on High Street / the night before / and robbed of fifty-six pounds. / She had four small children / the rent was due / and they had not eaten for two days. / The detectives / touched by the woman's story / took up a collection for her / which came to fifty pounds.

Version Two

Robert Miller / was driving a ten-ton truck / down a motorway / at night / in the Thames Valley / carrying eggs / to Bristol / when his axle broke./ His truck skidded off the road into a ditch./ He was thrown against the dashboard / and was badly shaken./ There was no traffic / and he doubted that help would come./ Just then his two-way radio buzzed./ He quickly answered "This is Grasshopper".

Score 2 for each idea.

Total = 32

Appendix XVIII. Memory Group Questionnaire

NAME:

1. Circle the sessions that you have been to.

Week one Week two Week three Week four

2. Circle the session(s) which you found most useful.

Week one Week two Week three Week four

3. Write down the techniques which you found most useful to learn about.

4. Did you find it

a) Easy b) Quite easy c) quite difficult

d) very difficult to use 'visual imagery' in the ways that you have been taught?

5. Will you use some of the techniques in the future?

Yes Perhaps No (circle your answer)

6. Do you feel more able to cope with your memory now?

Yes No (circle your answer)

7. Do you feel more confident about your memory because of the work you have done in the groups?

No - not at all Yes - a little Yes - a lot

(circle your answer)

8. Are your memory and concentration difficulties:

No nuisance A slight nuisance

A moderate nuisance A serious nuisance to you?

(circle your answer)

Appendix XIX. Kendall's Tau correlations between RMQtot and the memory tests (n = 60).

	RMQtot
	n = 60
Story Immediate	-0.2 (0.02)
Story Delayed	-0.19 (0.025)
% Retained	-0.1 (ns)
BVRT	-0.16 (ns)
List Learning	0.202 (0.04)
Interference	-0.012 (ns)
Delayed List	-0.06 (ns)
Design Learning	- 0.135 (ns)
Interference	-0.003 (ns)
Delayed Design	-0.08 (ns)
RMT Words	0.08 (ns)
RMT Faces	-0.13 (ns)