INFORMATION TO USERS

This reproduction was made from a copy of a document sent to us for microfilming. While the most advanced technology has been used to photograph and reproduce this document, the quality of the reproduction is heavily dependent upon the quality of the material submitted.

The following explanation of techniques is provided to help clarify markings or notations which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting through an image and duplicating adjacent pages to assure complete continuity.

2. When an image on the film is obliterated with a round black mark, it is an indication of either blurred copy because of movement during exposure, duplicate copy, or copyrighted materials that should not have been filmed. For blurred pages, a good image of the page can be found in the adjacent frame. If copyrighted materials were deleted, a target note will appear listing the pages in the adjacent frame.

3. When a map, drawing or chart, etc., is part of the material being photographed, a definite method of "sectioning" the material has been followed. It is customary to begin filming at the upper left hand corner of a large sheet and to continue from left to right in equal sections with small overlaps. If necessary, sectioning is continued again—beginning below the first row and continuing on until complete.

4. For illustrations that cannot be satisfactorily reproduced by xerographic means, photographic prints can be purchased at additional cost and inserted into your xerographic copy. These prints are available upon request from the Dissertations Customer Services Department.

5. Some pages in any document may have indistinct print. In all cases the best available copy has been filmed.

University Microfilms International
300 N. Zeeb Road
Ann Arbor, MI 48106

Luck, Dana Zaret

ASSESSMENT OF THE CONTINUITY HYPOTHESIS IN CHRONIC ALCOHOLICS AND ALCOHOLIC KORSAKOFFS BY MEANS OF VERBAL MEMORY TESTS

City University of New York

PH.D. 1984

PLEASE NOTE:

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark __√__.

1. Glossy photographs or pages _____
2. Colored illustrations, paper or print _____
3. Photographs with dark background _____
4. Illustrations are poor copy _____
5. Pages with black marks, not original copy _____
6. Print shows through as there is text on both sides of page _____
7. Indistinct, broken or small print on several pages __√__
8. Print exceeds margin requirements _____
9. Tightly bound copy with print lost in spine _____
10. Computer printout pages with indistinct print _____
11. Page(s) _____ lacking when material received, and not available from school or author.
12. Page(s) _____ seem to be missing in numbering only as text follows.
13. Two pages numbered _____. Text follows.
14. Curling and wrinkled pages _____
15. Other Dissertation contains pages with print at a slant, filmed as received.

ASSESSMENT OF THE CONTINUITY HYPOTHESIS IN CHRONIC ALCOHOLICS AND ALCOHOLIC KORSAKOFFS BY MEANS OF VERBAL MEMORY TESTS

by

DANA ZARET LUCK

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1984

This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

4/9/84
date

Steven Mattis Ph.D.
Chairman of Examining Committee

4/10/84
date

Herbert D. Saltzstein
Executive Officer

Louis Gerstman, Ph.D.

Elkhonon Goldberg, Ph.D.

Richard Kovner, Ph.D.

Richard Frances, M.D.
Supervisory Committee

The City University of New York

Abstract

ASSESSMENT OF THE CONTINUITY HYPOTHESIS
IN CHRONIC ALCOHOLICS AND ALCOHOLIC KORSAKOFFS
BY MEANS OF VERBAL MEMORY TESTS

by

Dana Zaret Luck

Advisor: Dr. Steven Mattis

The continuity hypothesis presumes that there is a behavioral and neuropathological continuum extending from normal functioning to the alcoholic Korsakoff syndrome. The validity of the continuity hypothesis was evaluated by administering a battery of verbal memory tests to three groups of subjects: nonalcoholic controls; chronic alcoholics; and alcoholic Korsakoffs. The chronic alcoholics were long-term alcoholics who had been detoxified for a minimum of one month prior to testing. They were "intact" in that they exhibited no signs of cognitive dysfunction either clinically or on a mental status evaluation, and had no history of even mild head trauma.

Both recall and recognition functions in short term and long term verbal memory were assessed. Attention was given to the subprocesses that have been implicated as causal deficits in the alcoholic Korsakoff syndrome. Quantitative and qualitative comparisons were made among the three groups.

The chronic alcoholics presented with the following cluster of deficits: impaired recall for both meaningful and novel material in short term verbal memory; impaired recognition for novel material in short term verbal memory; and impaired recall in long term verbal memory. The alcoholic Korsakoffs shared the above deficits and also demonstrated impaired recognition for meaningful material in short term verbal memory, a semantic encoding deficit that was susceptible to the effects of proactive interference, a deficit in semantic information processing, a generalized retrieval deficit, and impaired recognition in long term verbal memory.

Little support appeared for the continuity hypothesis. On only one measure (assessing recall in short term verbal memory for meaningful material) did the chronic alcoholics perform at a level that was intermediate between those of the other two

groups. Qualitatively, the chronic alcoholics failed to share any distinctive similarities in their pattern of performance with the alcoholic Korsakoff group. Overall, the chronic alcoholics appeared to be functioning like inefficient (or mildly toxic) nonalcoholic controls.

Methodological issues were raised concerning the need to develop standardized criteria for identifying subgroups of alcoholics, and to control for the effects of powerful between-group variables (such as mild head trauma, depression and general intelligence).

Acknowledgements

I am greatly indebted to a number of individuals for facilitating the completion of this dissertation. As my mentor and Dissertation Chairman, Steven Mattis guided me through some rough passages by encouraging me to meet the challenges of research through perseverance. Richard Kovner served as an example of a dedicated, meticulous scientist. I am thankful to both of them for sharing their ideas and data, and for inspiring this series of experiments through their innovative research.

I am grateful to Nick Goldberg, Lou Gerstman and Richard Francis for their thoughtful and speedy review of the manuscript and their insightful comments and questions. I am honored to have had such a talented and responsive Dissertation Committee.

Thanks to Dr. Erich Goldmeier and Dr. Boris Segal, I was able to gain access to the patient population at the Veteran's Administration Hospital in Montrose, New York. Through the statistical acumen and sheer number-crunching power of Dr. Raymond Pass, my raw data took on a level of significance. Under the auspices of the United Nations Association of the

United States of America, and with the expert secretarial skill of Ms. Rose Carcaterra, more words of mine were processed than I ever thought I could write.

I am blessed with the best family and network of friends in the whole world. I thank all of you for your love, encouragement and support. A special thank you is due to Edward and Jessica Robin Luck for enduring my many moods, making many sacrifices when I became preoccupied with my work, and always welcoming me home. I am deeply grateful for endless hours of child care (and mother care) so willingly provided over the past four years by my mother, Mrs. Claire Davis Zaret and my dear friends, Mrs. Karmela and Ms. Viola Andrycich.

Table of Contents

List of Tables

List of Figures

List of Appendices

Introduction

The existence of the Wernicke-Korsakoff syndrome is striking evidence that at least in some cases chronic alcoholism can result in severe, irreversible memory impairment. This amnesic disorder has received a great deal of investigation, and there is a general consensus among researchers as to its major features (Barbizet, 1970; Butters and Cermak, 1980; Talland, 1965; and Victor, Adams and Collins 1971). In the acute stage, alcoholic Korsakoff patients present with a global confusional state, ataxia, ocular paralysis, disorientation and confabulatory ideation. In the chronic stage, significant impairments in both anterograde and retrograde memory persist, while there is a remarkable sparing of overall intellectual functions.

The precise nature of the amnesia associated with the alcoholic Korsakoff syndrome has undergone extensive examination (Butters and Cermak, 1974, 1975; Cermak, 1979, 1982; Kovner, Mattis, Goldmeier and Davis, 1981a; Lhermitte and Signoret, 1972; Mattis, Kovner and Goldmeier, 1978; Milner, 1966; Milner, Corkin and Teuber, 1968; Oscar-Berman and Samuels, 1977;Warrington, 1970; and Weingartner, Faillace and Markley, 1971). Specific attention has been focused on the underlying semantic encoding deficit

associated with the anterograde amnesia (Cermak, Butters and Moreines, 1974; Kovner et al., 1981a; and Mattis, Kovner and Goldmeier, 1978). Investigation of the retrograde memory deficit has focused on the development of appropriate measurement techniques, with some controversy as to the presence and meaning of a temporal gradient (Albert, Butters and Levin, 1979a; Cohen and Squire, 1981; Marslen-Wilson and Teuber, 1975; Sanders, 1972; Sanders and Warrington, 1971,1975; Squire, 1975; Squire and Cohen, 1982; Squire, Slater and Chace, 1975; and Warrington, 1970).

Impairments in visuoperceptive abilities (Butters, Cermak, Montgomery and Adinolfi, 1977; Glosser, Butters and Kaplan, 1977; and Kapur and Butters, 1977), olfactory and gustatory capacities (Jones, Butters, Moskowitz and Montgomery, 1978), and hypothesis testing and focusing behavior (Oscar-Berman, 1973) have also been reported in alcoholic Korsakoffs.

Neuropathological findings on autopsy of alcoholic Korsakoffs characteristically reveal lesions in the mamillary bodies, the periventricular gray matter surrounding the third ventricle as well as prominent lesions in the dorsomedial nucleus of the thalamus (Victor, Adams and Collins, 1971). While it is generally accepted that the alcoholic Korsakoff syndrome occurs in approximately 2-3% of chronic alcoholics whose drinking has led to nutritional neglect and avitaminosis, recent evidence suggests that a

genetic predisposition for developing the alcoholic Korsakoff syndrome may be linked to a deficiency in the thiamine-dependent enzyme "transketolase" (Blass and Gibson, 1977).

Numerous investigators have found associations between alcoholism and a variety of cognitive impairments (for a review of this literature see Oscar-Berman, 1980; Parsons and Farr, 1981; Ryan and Butters, 1983; and Tarter, 1975). However, methodological issues inherent to the investigation of alcoholism often make it difficult to draw conclusions across studies. The selection criteria used to establish subject groups and the behavioral measures employed to assess differences among groups reflect diverse interests, and are likely to have individual and possible interactive effects on the findings. Subject variables such as age, sex, the existence of premorbid difficulties (i.e., psychopathology or genetic factors), and the possible consequences of prolonged alcoholism (i.e., liver disease and head trauma) are likely to influence the results. Consumption variables such as the duration of alcoholism, the pattern of drinking, eating habits during intoxication, and the period of abstinence are equally important considerations. Nevertheless, there is a general consensus that acute intoxication produces impairments in motor control, problem-solving and memory. Deficits associated with chronic abuse include impairments in visuoperceptive

skills, abstract reasoning, perception, and learning and memory. The degree to which these deficits are reversible has also drawn considerable attention.

The development of computerized technology to assess both structural and functional deficits has stimulated research on the direct effect of alcohol on the brain. Reviews of this literature have highlighted the major findings (Porjesz and Begleiter, 1983; Tarter, 1980; and Wilkinson and Carlen, 1982). Both acute and chronic exposure to alcohol is known to produce a direct toxic effect on the brain. Cortical and subcortical structures have been implicated. There is evidence of bilateral cerebral atrophy that is diffuse, with a preponderance in the frontal areas. Partial reversibility has also been reported. Some correlational studies between organic and cognitive deficits have been conducted. However, the etiological factors associated with the organic brain damage have not yet been delineated (Porjesz and Begleiter, 1983; and Tarter and Alterman, 1984).

Several theories have been advanced to explain the mechanism underlying the cognitive and organic effects of alcohol. Early notions suggested that alcohol produces a generalized deterioration in functioning. The postulation that alcohol differentially affects the right hemisphere of the brain has also been proposed. Current hypotheses include the possibility that alcohol creates a premature

aging of the brain (Courville, 1966; Kleinknecht and Goldstein, 1972; and Wilkinson and Carlen, 1981), the speculation that alcohol-related deficits involve the frontal systems of the brain (Tarter, 1975), the possibility that alcohol produces acquired limitations in information processing (Ryan, 1980), and the hypothesis that there is a continuum of impairment associated with alcoholism (Ryback, 1971).

In a review of the early literature addressing the question of specific memory impairment associated with alcoholism, Ryback (1971) proposed that a specific short-term memory deficit might be the common thread connecting subtle memory lapses during social drinking with the phenomenon of alcohol amnesia (the so-called "blackout" or "grayout" experience) and the obvious amnesia present in alcoholic Korsakoff patients. The continuity hypothesis, first proposed by Ryback, suggests that there is a behavioral and neuropathological continuum along which the process of alcoholism develops as a function of the degree and duration of alcohol abuse.

In order for the continuity hypothesis to be a valid one, a number of points must be established along the proposed continuum. Quantitative differences and qualitative similarities should exist between groups located at nearby points. Theoretically, it should also be possible

to make predictions about the performance level of an individual as he/she crosses over from one point to another along the continuum as the duration and degree of abuse changes.

Recently, investigators have begun to appreciate some of the similarities between the memory impairments found in alcoholic Korsakoff patients and those evident in alcoholics. Butters et al. (1977) conducted a comprehensive study of visuoperceptive and memory abilities in alcoholics, alcoholic Korsakoff patients and non-alcoholic control subjects. The alcoholics were designated as either long-term alcoholics (whose drinking histories were greater than 10 years) or short-term alcoholics (whose alcohol abuse had existed for less than 10 years). Unlike the alcoholic Korsakoffs, neither group of alcoholics differed significantly from the nonalcoholic control group on a standardized test of verbal memory (the Wechsler Memory Scale). However, on a more challenging test of verbal memory (using consonant trigrams as stimuli in a Peterson distractor paradigm with relatively short delay intervals) there was a tendency for the alcoholics to manifest a more rapid rate of decay than the nonalcholic controls. This difference was not statistically significant, as was the difference between the nonalcoholic controls and the

alcoholic Korsakoffs. Only long-term alcoholics (measured at the longest delay interval of 18 seconds) demonstrated a statistically lower level of performance than the controls.

While the alcoholic Korsakoffs demonstrated the expected effects of susceptibility to proactive interference and a deficit in semantic encoding, the alcoholics failed to demonstrate either of these difficulties. There was evidence of a direct relationship between the length of alcoholism and the degree of impairment on a standardized digit symbol substitution test, even though no clear continuum of impairment appeared on the various memory tests.

By refining the methodology employed in the Butters et al. (1977) study, Ryan, Butters, Montgomery, Adinolfi and Didario, (1979) were able to establish the presence of a significant memory deficit in "intact" alcoholics and to confirm the visuoperceptive deficit observed in the earlier study. Stringent screening of subjects resulted in the selection of an "intact" group of older, long-term alcoholics who had been abstinent for at least one month prior to evaluation. Using a more demanding short-term memory paradigm based on the Brown-Peterson distractor technique, they found that the performance level of the alcoholics was significantly better than that of the alcoholic Korsakoffs and worse than that of the nonalcoholic controls. Impairments in the level of performance of the

alcoholics relative to the other two groups were also evident on paired associate learning tests. The quantitative differences between the groups were acompanied by some qualitative similarities between chronic alcoholics and alcoholic Korsakoff patients, in that both groups tended to employ relatively low level strategies for remembering.

In a subsequent study, Ryan and Butters (1980) identified a possible transitional point along the proposed continuum from normal to Korsakovian functioning. They evaluated a group of long-term alcoholics who complained of memory impairments which persisted after several months of abstinence. While the performance level of this group was not significantly different from that of nonalcoholic controls on standardized tests of memory, on the more sensitive measures employed in the Ryan et al. (1979) study, the alcoholics with complaints of memory performed at a level that was intermediate between those of alcholics without memory complaints and alcoholic Korsakoff patients. Results of planned comparisons revealed that the differences between the two alcoholic groups reached a significant level on both verbal-verbal and symbol-digit paired associate learning tests. With respect to short term memory, the alcoholics with memory complaints performed at a level that was intermediate between those of the alcoholic Korsakoffs and the "intact" alcoholic group, although these differences did not reach statistical significance.

Ryan and Butters designated this group of alcoholics with memory complaints as a "borderline" Korsakoff group. They noted that the "borderline" Korsakoffs had no positive history of Wernicke's encephalopathy. However, they did perform at a level that was intermediate between those of the "intact" alcoholics and the alcoholic Korsakoffs on a clinical mental status evaluation. They also presented with the same discrepancy between I.Q. and memory quotient (derived from the Wechsler Memory Scale) observed in alcoholic Korsakoffs. However, there was no evidence of the disorientation for place and time that is characteristic of the alcoholic Korsakoff syndrome.

Caution must be taken before the alcoholics who present with memory complaints are classified as "borderline" Korsakoffs. Despite undergoing a comprehensive screening procedure, these individuals demonstrated a greater degree of clinical impairment on a mental status examination (Ryan et al. 1979) than their significantly older, "intact" fellow alcoholics.

The diagnosis of "brain damage" in alcoholics is at best imprecise. In a sample of 1100 alcoholics, Horvath (1975) reported the incidence of "organic brain syndrome" to be approximately 9%. Extensive examination of the structural and behavioral deficits present in this group led him to propose that brain damage associated with alcoholism is not a homogeneous disorder, and may represent a spectrum

of syndromes. Lishman (1981) similarly encouraged the consideration of "subclinical" forms of Wernicke-Korsakoff syndrome to replace the concept of "alcoholic dementia", which implies a generalized decline in functioning that is rarely observed.

Since the symptom of memory impairment is often seen in association with other disorders, such as mild depression and head trauma, alcoholism may not be the single factor contributing to the performance decrement in the "borderline" group. Even though these individuals had no positive history of severe head trauma, operationally defined as head trauma with unconsciousness of more than 12 hours and/or hospitalization specifically for head trauma (Ryan and Butters, 1980), they may have sustained minimal brain damage from a mild to moderate head trauma and/or the cumulative effects of several such traumas. Until these factors can be ruled out, it might be more appropriate to consider the alcoholics with complaints of memory difficulty as an "alcoholism-plus" group, rather than as a group of "borderline" Korsakoffs.

Reports of short term memory impairments associated with alcoholism prompted Albert, Butters and Levin (1979b) to investigate long term memory functions in chronic alcoholics. They administered the Albert Retrograde Memory Battery (which includes a test of famous faces and recall and recognition questionnaires) to a group of alcoholics

similar to the one examined by Ryan et al. (1979). They postulated that the retrograde memory deficit seen in alcoholic Korsakoffs might develop secondarily to a primary deficit in short term memory associated with chronic alcoholism. They contrasted this "chronic" alternative with an "acute" one, which presumes that an additional impairment appears acutely during the Wernicke stage of the disease that affects all time periods prior to the onset of the disease equally (Butters and Albert, 1982).

The alcoholics in their study did not demonstrate a significant impairment in retrograde memory and failed to exhibit the characteristic temporal gradient previously found in alcoholic Korsakoff patients (Albert, Butters and Levin, 1979a). Since this finding was upheld when both the "easy" and "hard" items were analyzed separately, the authors claimed that the effect was not an artifact due to task difficulty.

When an updated version of the Albert Famous Faces Test was administered in a different study, these findings were essentially upheld (Squire and Cohen, 1982). Moreover, preliminary testing of Ryan and Butters' "borderline" Korsakoff group revealed that their performance was at a level that was statistically indistinguishable from that of nonalcoholic controls and did not reveal a temporal gradient pattern (Ryan and Butters, 1980).

To date, the evidence in support of the continuity hypothesis is intriguing but not yet convincing. While there is substantial evidence that alcoholics and alcoholic Korsakoffs share difficulties in anterograde memory and visuoperceptive abilities (when sophisticated experimental paradigms are employed), there is no consistent information suggesting that their patterns of performance are similar. In fact, the lack of both quantitative and qualitative similarities between alcoholics and alcoholic Korsakoffs on measures of retrograde memory tends to suggest a dissociation between the process of alcoholism and the alcoholic Korsakoff syndrome, at least for the retrograde amnesia present in the alcoholic Korsakoff syndrome. Findings which bear on this issue have been reported by Fedio and VanBuren (1974). In stimulation studies of epileptic patients, they found differences within the left temporal lobe of the brain whereby stimulation of posterior regions produced retrograde memory deficits and stimulation of the anterior regions produced anterograde memory deficits.

Focus of the Present Study

The major focus of this dissertation was to evaluate aspects of verbal memory in "intact", detoxified, chronic alcoholics. Particular attention was devoted to the specific subprocesses that have been implicated as causal deficits in the amnesia associated with the alcoholic

Korsakoff syndrome (Mattis, Kovner and Goldmeier, 1978; Mattis, Kovner, Gartner and Goldmeier, 1981; Kovner et al., 1981a; Kovner, Mattis, Gartner and Goldmeier, 1981b; and Albert, Butters and Levin, 1979a, 1979b). The continuity hypothesis (Ryback, 1971) served as the basis for the assumptions presented in a series of four experiments.

Overview of the Experimental Design

Alcoholic Korsakoffs, detoxified chronic alcoholics and non-alcoholic controls served as the three groups examined in this study. In Experiment 1, recall and recognition in anterograde verbal memory were evaluated using the Animal and Nonsense Hexagram lists from the Mattis-Kovner Verbal Learning Evaluation (Mattis, Kovner and Goldmeier, 1978). In pilot testing of alcoholics, these measures were found to be sensitive to subtle impairments in functioning. In Experiment 2, the Semantic Information Test was employed to assess semantic processing of information (Kovner et al. 1981b). The retrieval of category exemplars was analyzed in Experiment 3 using the Category Exemplar paradigm developed by Mattis et al. (1981). The Recall and Recognition Questionnaires of the Albert Retrograde Memory Battery were administered in Experiment 4 (Albert, Butters and Levin, 1979a) to evaluate recall and recognition in retrograde memory.

Selection of Subjects

Careful attention was devoted to the selection of subjects. Following the standards set by Ryan et al. (1979) and refining them even further, an attempt was made to isolate an almost "pure" group of long-term alcoholics. Pilot testing revealed that almost all potential long-term alcoholic subjects (examined at least one month post-detoxification) presented with at least a mild degree of organicity on a mental status examination.

In order to reduce the possible effects of factors other than alcoholism (particularly mild head trauma), strict criteria for inclusion into the two experimental groups and the nonalcoholic control group were based on the results of a comprehensive prescreening procedure. Prospective subjects underwent a structured clinical interview (Appendix A) to rule out a history of psychiatric disturbance, mild head trauma (with unconsciousness of more than five minutes), childhood learning disability, substance abuse (excluding alcohol), and major medical illness known to affect memory (e.g. stroke, convulsive disorder, etc.). When possible, the history was corroborated by a family member or review of medical records.

All subjects underwent further mental status evaluation with the Mattis Organic Syndrome Screening Examination (MOMSSE, Appendix B). The MOMSSE is a brief test (derived from longer, well-standardized instruments) designed to

assess the presence of cognitive impairment. Pilot testing of chronic alcoholics suggested that those members of this group who were able to meet the stringent screening criteria for participation in this study tended to achieve above Average range I.Q. scores. The complete Wechsler Adult Intelligence Scale (WAIS) was therefore administered to all subjects and it was anticipated that Full Scale I.Q. scores (FSIQ) would serve as a covariate in statistical analyses to reduce the between group variability. The Beck Depression Inventory (Beck, Ward, Mendelson and Mock, 1961), a widely used self-rating scale of depression, was administered as a means of assessing the current level of depression experienced by the subjects. The potential presence of significant between group differences on the Beck Depression Inventory (BDI) could also be adjusted for in an analysis of covariance.

Group 1: Alcoholic Korsakoff Patients (AK). The alcoholic Korsakoff group developed by Mattis and Kovner was examined in this study. All members of this group had participated to some extent in previous studies (Mattis, Kovner and Goldmeier, 1978; Mattis et al. 1981; and Kovner et al. 1981a, 1981b). Of the six men, five resided at the Franklin Delano Roosevelt Veteran's Administration Hospital in Montrose, New York and one lived in a nearby chronic care

facility. The seventh member, a woman, was supervised by relatives with whom she lived. Each of these individuals presented with a history of severe, chronic alcoholism predating the development of a Korsakoff syndrome of several years duration. They each demonstrated a profound, stable anterograde amnesia characterized by an inability to recall daily personal and important current events, variable disorientation to time and place, and some degree of retrograde amnesia, manifested by difficulty in recalling past personal and historic events. While members of this group acknowledged having severe memory difficulty, only one individual was actively distressed by this impairment. No member of this group confabulated spontaneously. Results of the MOMSSE revealed no deficits in any areas except memory for members of this group.

Group 2: Chronic Alcoholics (CA). From approximately 200 consecutive admissions to the in-patient alcoholic treatment unit of the Franklin Delano Roosevelt Veteran's Administration Hospital in Montrose, New York, 10 "intact" chronic alcoholics were selected to participate in this study. They were screened to match Group 1 as closely as possible with respect to age and chronicity of alcoholism. All had been detoxified and under staff supervision for a minimum of one month prior to testing (ranging from one to eight months). The diagnosis of Alcohol Dependence was made

by the hospital staff according to the criteria established in the Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM III) which include: "A) Either a pattern of pathological alcohol use or impairment in social or occupational functioning due to alcohol use; and B) Either tolerance or withdrawal" (American Psychiatric Association, 1980, p.170).

All members of this group demonstrated a loss of control over their drinking, decreased tolerance for ethanol and variable withdrawal symptoms. As a group, they reported a history of severe alcoholism for an average of 25 years (ranging from 10 to more than 30 years). All began drinking in their teens and exhibited a pattern of continuous alcohol abuse with at most intermittent and relatively short periods of abstinence. Half of this group reported experiencing some mild degree of memory difficulty (including blackouts) but all were able to function independently and had no trouble remembering their appointments.

A brief medical examination conducted by a staff physician revealed at most a mild degree of organic brain impairment, generally involving tremor or peripheral neuropathy. An attempt was made to select individuals who were able to pass all items on the MOMSSE. However, about half of the members of this group made an error on some MOMSSE item that did not involve memory.

Group 3: Nonalcoholic Controls (NC). Seven nonalcoholic control subjects served as paid subjects in Experiments 1, 2, and 3. The group was expanded to 15 nonalcoholic controls in Experiment 4. Some of these individuals had participated in previous studies (Mattis, Kovner and Goldmeier, 1978; Mattis et al. 1981; and Kovner et al. 1981a, 1981b). They were matched as closely as possible to the other two groups with respect to age. Members of this group described themselves as occasional social drinkers and denied having a history of alcoholism. They were recruited from the non-medical staff at Montefiore Hospital and from a nearby employment service for senior citizens. Members of this group demonstrated intact functioning in all areas on the MOMSSE.

General Procedure

Since all members of the alcoholic Korsakoff group and some members of the nonalcoholic control group participated in previous studies (during which they were tested with some of the measures employed in this study), only data necessary to complete the present battery were obtained for these subjects. All members of the chronic alcoholic group and new members of the nonalcoholic control group underwent the following procedure. After completing the initial screening battery, two individual sessions were scheduled not less than one day and not more than one week apart. During each session subjects received one measure from Experiment 1

(either the Animal or Nonsense Hexagram List) one measure from Experiment 4 (either the Recall or Recognition Questionnaire from the Albert Retrograde Memory Battery) and the measure from either Experiment 2 (the SIT) or Experiment 3 (the Category Exemplar paradigm). The remaining three measures were administered during the following session. A brief break of about 10 minutes occured between tests within each session.

Experiment 1: Analysis of Recall and Recognition in Anterograde Verbal Memory

Background

Mattis, Kovner and Goldmeier (1978) devised a recall with recognition probes paradigm for verbal list learning that enabled them to distinguish between the performance patterns of alcoholic Korsakoff patients and another group of amnesic patients (suffering from post-herpes encephalitis). While both amnesic groups demonstrated significant impairments in recall (as measured by the percentage of items recalled on a given trial) relative to a normal control group, the alcoholic Korsakoff group manifested a clear superiority to the post encephalitic group in terms of recognition memory (as measured by the signal detection statistic d'). The ability to encode and store new information (albeit at a less than normal capacity) set the alcoholic Korsakoffs apart from the post-encephalitic patients. Moreover, the discrepancy between alcoholic Korsakoffs and normals (in terms of d' values) increased as the degree of semantic organization of the to-be-remembered information became greater. For novel material (which included lists of Nonsense Hexagrams and Persian words) the alcoholic Korsakoffs achieved near normal level d' values, but their d' values were significantly below normal performance levels for meaningful material (which included lists of categorized words and mixed English

words). In a subsequent study (Kovner et al., 1981) further insight into the nature of the alcoholic Korsakoffs' semantic encoding deficit was gained. The alcoholic Korsakoffs exhibited a susceptibility to proactive interference in recognition memory (demonstrated by a pattern of decreasing d' values across recognition probes) only on lists where target and distractor items were denotatively categorized.

Rationale and Specific Hypotheses

Experiment 1 was devised to extend the work of Mattis, Kovner and their colleagues by examining the pattern of performance of chronic alcoholics on two measures from their verbal learning battery. The alcoholics' performance was compared to that of alcoholic Korsakoff and nonalcoholic control groups which were somewhat larger in number than the ones measured in the orginal studies. Using the recall with recognition probes paradigm, the semantically organized Animal List and the novel Nonsense Hexagram List were administered to groups of chronic alcoholics, alcoholic Korsakoffs and nonalcoholic controls. The Animal List was selected because the alcoholic Korsakoffs demonstrated the most rapid and clearest decrement in d' values on this list in the previous study. The Nonsense Hexagram List was

employed as a measure of novel material because, unlike the Persian Word List, it did not require mastery of Farsi for correct repetition across trials.

In keeping with the continuity hypothesis, the following hypotheses were advanced:

Hypothesis I. It was anticipated that the percentage of items recalled by chronic alcoholics would be at a level between those of the alcoholic Korsakoffs and the nonalcoholic controls for both the Animal and Nonsense Hexagram lists.

Hypothesis II. It was hypothesized that the chronic alcoholics, like the alcoholic Korsakoffs, would demonstrate a sensitivity to proactive interference (as manifested by a decline in d' values across recognition probes) for the Animal List which would not be found on the Nonsense Hexagram List.

Method

Subjects. Ten chronic alcoholics, seven alcoholic Korsakoffs and seven nonalcoholic controls (selected in accordance with the criteria described above) participated in this experiment.

Materials. Two lists from the Mattis-Kovner Verbal Learning Evaluation were employed (Mattis, Kovner and Goldmeier, 1978). The categorized Animal List (Appendix C) served as the measure of meaningful material. The 20-target and 20-distractor items (all drawn from the Animal category)

were derived from norms established by Battig and Montague (1969) and were matched for frequency of usage with equal proportions selected from high, medium and low frequency words. The Nonsense Hexagram List (Appendix D) served as a measure of nonsense material. This list contains 20-target and 20-distractor items each composed of two consonant-vowel-consonant (cvc) trigrams with known associative values to English words (Archer, 1960). The target and distractor nonsense hexagrams were matched for the associative values of the trigrams; however, the associative strengths of the resulting hexagrams are not known.

Procedure. A modified free recall procedure using the selective reminding technique (Buschke, 1973) was employed. Twelve recall trials with three recognition probes (occurring after recall trials 4, 8, and 12) were administered.

On trial 1 the list was read to the subject at the rate of one word every 2 seconds and the subject was asked to repeat the word to assure correct registration. The subject was then asked to spontaneously recall as many words as possible, in any order. The subject received feedback as to the correctness of each word after it was recalled. If a subject offered a response which was not on the list,he/she was told that the response was incorrect and the word was recorded as an intrusion for that trial. Once the subject

indicated that he/she could not recall any more items, the trial was terminated. The examiner then told the subject those words which he/she forgot to recall from the list. This procedure was continued for 12 trials. After spontaneous recall on trials 4, 8 and 12, but before selective reminding took place, a recognition probe was introduced. The probe contained 20-distractor items interspersed with the 20-target items. Each of the 40 words was read to the subject, who was asked to respond "yes" if he/she thought the item was on the list and "no" if it was not on the list. Immediate feedback was provided after each response as to its correctness. After the recognition probe, the selective reminding procedure was resumed.

Data Tabulation. The percentage of items spontaneously recalled at three points in time (on trials 4, 8 and 12) served as the measure of recall for both the Animal and Nonsense Hexagram lists. For the Animal List, the number of items recalled was first corrected for intrusions (non-target names of animals) by subtracting the number of intrusions from the number of items spontaneously recalled on the trial. This difference was then divided by 20 (the number of target items) to determine the percentage of items recalled.

For each of the three recognition probes, the signal detection theory statistic d' was calculated to serve as an unbiased measure of recognition memory (Banks, 1970). This

statistic measures the discrimination sensitivity independently from response criterion, i.e., the subject's propensity for responding "yes" or "no." The d' value was calculated using the proportion of "yes" responses to target items ("hits") and the proportion of "yes" responses to distractor items ("false alarms"). A d' value of 3.92 represents perfect recognition (100% hits and 0% false alarms), while a d' value of 0.00 represents perfect guessing (equal numbers of hits and false alarms). A d' value of 0.8 represents the point at which d' is significantly different from chance at the .05 level of confidence.

Determination of Covariates. Group means and standard deviations for age, Full Scale I.Q. (FSIQ) and Beck Depression Inventory (BDI) are presented in Table 1. A one-way analysis of variance (ANOVA) was performed on each of these three factors using group (NC, AK and CA) as the between subject variable. As can be seen in Table 2, the groups were matched for age. With respect to FSIQ (Table 3) and BDI (Table 4), there were significant differences among the groups. Neuman-Keuls post hoc pairwise comparisons (Kirk, 1968) were performed on the group means to determine the precise nature of the differences. As can be seen in Table 5, the alcoholic Korsakoffs attained a significantly lower mean FSIQ than the other two groups, which did not differ significantly from each other. In terms of their BDI

scores (Table 6), the chronic alcholics scored significantly higher than the other two groups, which did not differ significantly from each other. Because of the significant between group differences in FSIQ scores and BDI scores, these variables were entered into subsequent analyses as covariates in order to reduce the between group variability.

Data Analysis. For both the Animal and Nonsense Hexagram lists, the recall and recognition memory data were analyzed using the two-way split-plot analysis of covariance (ANOCOVA) technique. In analyzing the recall data, the percentage of items recalled served as the dependent variable, Group served as the between subject factor, Trial (4,8 and 12) served as the within subject factor and FSIQ and BDI score served as the covariates. For the recognition ANOCOVAs, d'values served as the dependent variable, Group served as the between subject variable, Probe (1,2 and 3) served as the within subject variable and FSIQ and BDI scores served as the covariates. Further analysis of significant ANOCOVA effects was performed using Neuman-Keuls post hoc pairwise comparisons (Kirk, 1968).

A separate two-way split-plot analysis of variance (ANOVA) was conducted to examine the number of intrusion errors committed on the Animal List, with Group serving as the between subject variable and Trial (4,8 and 12) serving as the within subject variable.

Results

Evaluation of Recall. The group means and standard deviations for the number of intrusion errors committed on the Animal List on trials 4, 8 and 12 appear in Table 8. As can be seen, there were no significant between group differences in the Animal Intrusion ANOVA. While there may have been a tendency for the alcoholic Korsakoffs to make intrusion errors on earlier trials of the Animal List, their error rate was not significantly different from those of the other two groups on trials 4, 8 and 12.

Results of the ANOCOVA for the percentage of words (corrected for intrusions) recalled on the Animal List appear in Table 9. The group main effect, trial main effect and group by trial interactions were significant. Graphic presentation of the actual means for the group by trial interaction appears in Figure 1. Results of the Neuman-Keuls analyses performed on the adjusted means for the group by trial interaction appear in Table 10. The chronic alcoholics recalled a significantly greater percentage of items than the alcoholic Korsakoffs and a significantly smaller percentage of items than the nonalcoholic controls at each point in time (on trials 4, 8 and 12). However, the groups differed significantly in their patterns of performance across trials.

For the alcoholic Korsakoffs, there was no evidence of learning since they remained at essentially the same low level across trials. In contrast, both the nonalcoholic controls and the chronic alcoholics improved significantly from trial 4 to trial 12. However, the nature of their learning patterns was different in that the nonalcoholic controls showed initial improvement and then remained at a plateau. The chronic alcoholics displayed a slower rate of learning, as they remained at about the same level from trials 4 to 8 and then improved (from trials 8 to 12).

Results for the two-way split plot ANOCOVA for the percentage of words recalled on the Nonsense Hexagram List appear in Table 11. The group main effect, trial main effect and group by trial interactions were significant. Figure 2 presents the actual means for the group by trial interaction and Table 12 presents the Neuman-Keuls analyses on the adjusted means for the group by trial interaction. Visual comparison of Figures 1 and 2 reveals that all three groups performed at a lower level on the Nonsense Hexagram list than they did on the Animal list, suggesting that recalling nonsense hexagrams is a more difficult task than recalling categorized words for all subjects.

As can be seen in Table 12, there were no differences among the groups on trial 4, but the nonalcoholic control group performed at a significantly higher level on trials 8 and 12 than did the other two groups. At no point in time

did the chronic alcoholic group differ significantly from the alcoholic Korsakoff group in the percentage of nonsense hexagrams recalled. Moreover, while the nonalcoholic controls demonstrated significant learning across trials, the chronic alcholics and the alcoholic Korsakoffs shared the same flat pattern of performance across trials.

Evaluation of Recognition Memory. Results of the Animal List recognition probe ANOCOVA appear in Table 13. The group main effect and group by probe interaction were significant. Graphic presentation of the actual means for the group by probe interaction appears in Figure 3 and the results of Neuman-Keuls analyses on the adjusted means appear in Table 14.

Of particular interest are the distinctly different patterns of performance among the groups. The nonalcholic control group showed an overall improvement in d' values from probes 1 to 3. The chronic alcoholics manifested no significant change in d' values across recognition probes. The performance pattern of the alcoholic Korsakoffs was markedly different in that they suffered a significant decline in d' values across recognition probes. Thus, the ability of the alcholic Korsakoffs to discriminate target from distractor items actually deteriorated over time. By the third recognition probe, the alcoholic Korsakoffs performed at a chance level. When the performance levels of the groups are compared across recognition probes, it

appears that the alcoholic Korsakoffs have significantly lower d' values than the other two groups on each recognition probe. At no point does the performance level of the chronic alcoholic group differ significantly from that of the nonalcoholic control group.

Results of the Nonsense Hexagram recognition probe ANOCOVA are presented in Table 15. Only the group main effect reached significance. Neuman-Keuls analyses performed on the adjusted means for the group main effect appear in Table 16. These results reveal that the nonalcoholic control group demonstrated a significantly better ability to distinguish target from distractor items than did the other two groups, which did not differ significantly from each other.

Even though the group by probe interaction did not reach significance, it is presented graphically in Figure 4. As can be seen, all three groups of subjects demonstrated the same flat pattern of performance across recognition probes for the Nonsense Hexagram List.

Discussion

The present findings regarding the recall of both meaningful and novel material in verbal memory support those reported by Mattis, Kovner and Goldmeier (1978). Namely, alcoholic Korsakoffs demonstrated a significantly poorer ability to recall items from the Animal and Nonsense Hexagram lists than did the nonalcoholic controls. With

respect to recognition memory, the alcoholic Korsakoffs demonstrated the characteristic susceptibility to proactive interference found by Kovner et al. (1981) when target and distractor items were drawn from the same denotative category (as they are on the Animal List).

The results in the present study concerning recognition memory for novel material are somewhat different than those reported by Mattis, Kovner and Goldmeier (1978). In the original study, nonalcoholic control subjects did not differ significantly from the alcoholic Korsakoffs in terms of d' values (they attained a significantly higher d' value than the alcoholic Korsakoff group only for the first recognition probe). The present findings reveal a significant superiority in d' values for the nonalcoholic controls over the alcoholic Korsakoffs on all three recognition probes. Even though this difference in d' values exists absolutely, both groups of subjects demonstrated flat patterns of performance across recognition probes. As reported by Mattis, Kovner and Goldmeier (1978), the nonalcoholic control group again demonstrated no evidence of learning, and the alcoholic Korsakoff group did not suffer the effects of proactive interference in recognition memory for novel material.

In analyzing the data for the chronic alcoholic group, some evidence to support Hypothesis I emerged. On the Animal List, the chronic alcoholics did perform at a level

between those of the other two groups with respect to the percentage of words recalled. However, in recalling Nonsense Hexagrams, the chronic alcoholics manifested the same degree of difficulty as did the alcoholic Korsakoffs.

There were significant differences in the patterns of performance of the three groups across recall trials. For the Animal List, the chronic alcoholics performed in a manner that was similar to that of the nonalcoholic controls, demonstrating the capacity to learn meaningful material over time. For the Nonsense Hexagram List, the chronic alcoholics failed to improve over time, demonstrating the same flat pattern as the alcoholic Korsakoffs. These findings indicate that the nature of the to-be-remembered material plays an important role in the recall pattern of chronic alcoholics for anterograde memory. For meaningful material, the chronic alcoholics' recall pattern is similar to that of the nonalcoholic controls but appears to be less efficient. In contrast, the chronic alcoholics' performance in recalling novel information is similar to that of the alcoholic Korsakoffs, both quantitatively and qualitatively. These findings lend only minimal support for Hypothesis I.

With respect to Hypothesis II, the chronic alcoholics did not exhibit a susceptibility to proactive interference in recognition memory on the Animal List. Quantitatively, their performance level was similar to that of the

nonalcoholic control group. Qualitatively, their flat performance pattern across recognition probes was neither similar to that of the nonalcoholic control group (whose d' values increased across recognition probes) nor similar to that of the alcoholic Korsakoffs (whose d' values decreased across recognition probes). For the recognition of Nonsense Hexagrams, the chronic alcoholics performed at a level that was quantitatively similar to that of the alcoholic Korsakoffs. However, qualitatively there were no significant differences among the performance patterns of the three groups. This finding was in agreement with Hypothesis II, which predicted no sensitivity to proactive interference among the alcoholic Korsakoffs across recognition probes on the Nonsense Hexagram List.

Experiment 2: Analysis of Verbal Semantic Information Processing

Background

It has been demonstrated by Kovner et al. (1981b) that alcoholic Korsakoffs manifest a deficit in semantic organization that is observable at a behavioral level. Using the Semantic Information Test (SIT), developed to measure specific knowledge about selected noun-concepts presumably held in long-term storage, they examined the performance patterns of alcoholic Korsakoff patients, post head trauma patients and normal control subjects. The alcoholic Korsakoffs committed significantly more errors on the SIT than the normal controls, but significantly fewer errors than the post head trauma patients. Analysis of their patterns of errors revealed that the alcoholic Korsakoffs made a significantly greater proportion of errors on "easy" items than the other two groups, which did not differ significantly from each other. The authors proposed a multi-factor deficit to account for the alcoholic Korsakoff patients' impairment in semantic organization.

Rationale and Specific Hypotheses

Experiment 2 was designed to perform a modified replication of the Kovner et al. (1981b) study by evaluating the performance pattern of chronic alcoholics on the SIT and

comparing it to that of alcoholic Korsakoffs and nonalcoholic controls. The following predictions were made in keeping with the continuity hypothesis:

Hypothesis I. It was hypothesized that chronic alcoholics would obtain a total score on the SIT between those of the alcoholic Korsakoffs and the nonalcoholic controls.

Hypothesis II. It was anticipated that chronic alcoholics would demonstrate a tendency to commit a higher proportion of "easy" errors than the normal controls and a lower proportion of "easy" errors than the alcoholic Korsakoffs on the SIT.

Method

Subjects. The same groups, comprised of ten chronic alcoholics, seven alcoholic Korsakoffs and seven nonalcoholic control subjects, that participated in Experiment 1 were included in this experiment.

Materials. The Semantic Information Test (SIT), developed by Kovner et al. (1981b), was utilized in this experiment. The SIT is a 400-item true-false questionnaire that taps knowledge about 25 noun-concepts (assumed to be in long-term semantic storage). The 25 noun-concepts were selected from seven categories presented by Battig and Montague (1969) to sample nouns of high, medium and low frequency of usage. Of the 400 items, 200 are designated as "true" and 200 are designated as "false". Half of the items

pertain to basic properties of the noun-concepts (and are considered to be "easy") while the remaining half refer to more obscure characteristics of the noun-concepts (and are considered to be "hard"). Of the 400 items, there are 100 from each of these four categories: "easy-true;" "easy-false;" "hard-true" and "hard-false".

Procedure. The SIT was presented as a 25 page booklet in which each page contained a single noun-concept followed by 16 true-false statements about it. Subjects were tested individually. On each page, the subject was asked to read the noun-concept heading and then respond "true" or "false" after reading each statement aloud. Responses were recorded by the examiner, who urged the subject to make a "true" or "false" response to each statement.

Data Tabulation. The total number of correct responses on the SIT was tabulated for each subject. The number of errors committed on "easy" items (collapsing over "true" and "false") was also tabulated. The proportions of "easy" and "hard" errors were also computed for each subject.

Determination of Covariates. As can be seen in Tables 2, 3 and 4, the groups of subjects who participated in Experiment 2 were matched with respect to age and differed in terms of FSIQ and BDI scores. FSIQ and BDI scores were entered into subsequent analyses as covariates in order to reduce the between group variability.

Data Analysis. Analysis of the number of correct responses on the SIT was accomplished using a one-way analysis of covariance (ANOCOVA) with Group serving as the between subject factor and FSIQ and BDI scores serving as the covariates. Analysis of the proportion of errors committed on "easy" items was performed using a one-way analysis of covariance (ANOCOVA) in which Group served as the between subject factor, FSIQ and BDI scores served as the covariates, and the dependent variable (proportion of "easy" errors) was adjusted using an arcsin transformation. Significant ANOCOVA effects were further analyzed using Neuman-Keuls post hoc pairwise comparisons (Kirk, 1968).

Results

Group means and standard deviations for the number of correct SIT responses appear in Table 17. The results of the SIT number of correct responses ANOCOVA appear in Table 18. As can be seen, the group effect was significant. Results of the Neuman-Keuls analyses for the group effect appear in Table 19. Interpretation of these findings reveals that the alcoholic Korsakoff group's performance was significantly poorer than those of the other two groups, which did not differ significantly from each other. Results of the ANOCOVA for the SIT proportion of "easy" errors are presented in Table 20 and reveal no significant between group differences.

Discussion

Results from the SIT number of correct responses ANOCOVA are comparable to the finding reported by Kovner et al. (1981b) that alcoholic Korsakoffs committed significantly more errors on the SIT than a nonalcoholic control group. However, results of the SIT proportion of "easy" error ANOCOVA fail to confirm the tendency reported by Kovner et al. (1981a) for alcoholic Korsakoffs to make a significantly greater proportion of "easy" errors than nonalcoholic controls.

The actual proportional distribution of "easy" and "hard" errors for all three groups appears in Table 21. While the actual proportions of "easy" and "hard" errors for both the alcoholic Korsakoff and the nonalcoholic control groups are almost identical to those reported by Kovner et al. (1981b), the differences between the groups failed to reach a significant level in the present study. The previously reported difference may be a spurious finding associated with the relatively small sample size in the original study (which included five alcoholic Korsakoffs, five nonalcoholic controls and three post head trauma patients) as compared to the larger overall sample size in the present experiment (comprised of ten chronic alcoholics, seven nonalcoholic controls and seven alcoholic Korsakoffs). In the present study there was a tendency for the alcoholic

Korsakoffs to commit a higher proportion of "easy" errors than the nonalcoholic control group, but the magnitude of the difference between the groups failed to reach significance. There was also a tendency for the chronic alcoholics to perform at a level between those of the other two groups in their proportion of "easy" errors, but the differences among the groups were not statistically significant.

With respect to Hypothesis I, the chronic alcoholics did not achieve a performance level on the SIT between those of the other two groups. In fact, the chronic alcoholics performed at essentially the same level as the nonalcoholic controls and at a significantly higher level than the alcoholic Korsakoffs. The results of this experiment also failed to support Hypothesis II. In fact, there were no significant differences among the groups in the proportion of "easy" errors committed. The chronic alcoholics tended to perform at a level between those of the other two groups (in terms of the proportion of "easy" errors committed), but these between group differences failed to reach a statistically significant level.

Experiment 3: Analysis of Production Patterns of Category Exemplars

Background

It has been reported (Mattis et al., 1981) that alcoholic Korsakoffs manifest a deficit in their ability to retrieve category exemplars. Alcoholic Korsakoffs were found to generate category exemplars at a slower rate and to end production sooner than nonalcoholic controls. Both groups utilized similar techniques in generating exemplars from more to less popular responses.

Rationale and Specific Hypotheses

The ability of chronic alcoholics to generate category exemplars was examined in Experiment 3. Using the paradigm developed by Mattis et al. (1981), the performance pattern of chronic alcoholics was compared to those of alcoholic Korsakoffs and nonalcoholic controls.

Hypothesis I. It was hypothesized that chronic alcoholics would generate category exemplars at a rate between those of alcoholic Korsakoffs and nonalcoholic controls.

Hypothesis II. It was hypothesized that the chronic alcoholics would share the same strategy for retrieving exemplars as the alcoholic Korsakoff and nonalcoholic control groups, first generating responses for which the frequency of response index was high and then generating responses with lower frequency of response indexes.

Method

Subjects. The subjects who participated in this experiment included seven nonalcoholic controls, six alcoholic Korsakoffs and ten chronic alcoholics selected in accordance with the criteria presented above.

Procedure. A slight modification of the procedure developed by Mattis et al. (1981) was employed. Subjects were given the names of only four of the six categories from the Battig and Montague (1969) compilation that were used in the original study. The categories ("occupations", "articles of clothing", "pieces of furniture" and "vegetables") were presented in a random order. After the category was identified, the subject was asked to name exemplars of that category as quickly as possible. The examiner recorded all responses given in each 30 second interval for a total of five minutes. This procedure was repeated until all four categories had been tested.

Data Tabulation. To determine the rate of production of category exemplars, individual responses were first checked against the list provided for each category in the Battig and Montague (1969) norms. Additional responses (which did not appear in the normative compilation) were included as exemplars of a category only if they were judged to be acceptable by the examiner and an independent rater who was familar with the norms. The number of exemplars was

tabulated for each subject for each of the ten consecutive 30 second intervals in the five minute response period, collapsing over the four categories.

The methods used by the groups to retrieve category exemplars was evaluated according to the technique developed by Mattis et al. (1981). An average frequency of response index was derived for each of the first three blocks (Block 1, 2 and 3) of five successive responses (collapsing over the four categories) for each subject. This was accomplished by grouping the first 15 responses offered by each subject for each category into three blocks of five successive responses. Individual responses were assigned a frequency of response index according to the norms compiled by Battig and Montague (1969). The index represented the number of times a given response was offered by subjects in the normative sample. For each subject in this experiment, the average frequency of response index for each of the three blocks (Block 1,2, and 3) was based on a total of 20 responses (five from each of the four categories).

Determination of Covariates. Group means and standard deviations for age, FSIQ and BDI scores are presented in Table 22. A one-way analysis of variance (ANOVA) was performed on each of these three factors using Group as the between subject variable. As can be seen in Tables 23, 24 and 25, the groups were matched with respect to age but differed in terms of FSIQ and BDI scores. Neuman-Keuls post

hoc pairwise comparisons (Kirk, 1968) were performed on the group means to determine the precise nature of the differences. With respect to FSIQ (Table 26), the alcoholic Korsakoffs attained a significantly lower mean IQ than the nonalcoholic control and chronic alcoholic groups, which did not differ significantly from each other. In terms of BDI scores (Table 27), the chronic alcoholics attained a significantly higher mean score than the alcoholic Korsakoff and nonalcoholic control groups, which did not differ significantly from each other. Because of the significant between group differences in FSIQ and BDI scores, these variables were entered into subsequent analyses as covariates in order to reduce the between group variability.

Data Analysis. The number of category exemplars generated in each of the ten 30 second periods was analyzed using a two-way split-plot analysis of covariance (ANOCOVA). Group served as the between subject factor, Period (1,2,3,4,5,6,7,8,9 and 10) served as the within subject variable, the number of acceptable exemplars produced served as the dependent variable, and FSIQ and BDI scores served as covariates. The average frequency of response indexes for category exemplars (generated by the three groups for each of the three blocks of responses) were analyzed using a two-way split-plot analysis of covariance (ANOCOVA). Group served as the within subject factor, Block (1,2 and 3) served as the between subject factor, the average frequency

of response index served as the dependent variable, and FSIQ and BDI scores served as the covariates. Further analysis of significant effects was accomplished using Neuman-Keuls post hoc pairwise comparisons (Kirk, 1968).

Results

Group means and standard deviations for the number of category exemplars generated by each group in each period are presented in Table 28. Results of the ANOCOVA for the number of exemplars produced by the groups for each period appear in Table 29. The group and period main effects were significant. Results of the Neuman-Keuls analyses performed on the adjusted means for the group effect are found in Table 30. As can be seeen, the alcoholic Korsakoff group generated significantly fewer category exemplars overall than the chronic alcoholic and nonalcoholic Korsakoff groups, which did not differ significantly from each other.

The period main effect was analyzed by examining the mean number of exemplars produced in each of the ten 30 second periods (collapsing over groups). These means appear in the row marginals in Table 28. As can be seen, the number of exemplars produced declines from periods one to ten. Since the group by period interaction was not significant, this pattern was essentially followed by all three groups. All groups tended to produce the greatest number of responses during the earlier periods, after which their production output became smaller. Moreover, the

groups did not appear to reach assymptote at different rates. The alcoholic Korsakoffs produced significantly fewer exemplars than the other two groups during each 30 second period.

The mean frequency of response indexes for all three groups for the first three blocks of five consecutive category exemplars appear in Table 31. Results of the ANOCOVA performed on this data are presented in Table 32. Only the block main effect reached significance. The outcome of the Neuman-Keuls analyses performed on the adjusted means for the block effect appears in Table 33. Collapsing over groups, the average frequency of response indexes declined significantly across blocks. Interpretation of these findings reveals that the production of exemplars followed a pattern in which earlier responses were of greater popularity than later responses. Since neither the group effect nor the group by block interaction were significant, all three groups followed essentially the same pattern in sampling exemplars.

Discussion

The present results support Mattis et al.'s (1981) finding that alcoholic Korsakoff patients generate fewer category exemplars during each 30 second period than do nonalcoholic controls. Both groups were again found to share the same technique for retrieving exemplars of

decreasing popularity. Contrary to the previous results (Mattis et al., 1981), the alcoholic Korsakoffs in this experiment neither produced exemplars at a different rate nor terminated production sooner than the nonalcoholic controls.

In evaluating the performance of chronic alcoholics, it was found that they retrieved significantly more category exemplars than the alcoholic Korsakoffs during each period. These findings fail to support Hypothesis I. Rather than performing at a level between those of the other two groups, the chronic alcoholics' production of category exemplars was similar to that of the nonalcoholic controls and significantly better than that of the alcoholic Korsakoffs. As predicted in Hypothesis II, all three groups retrieved exemplars of decreasing popularity.

Experiment 4: Analysis of Recall and Recognition in Retrograde Memory

Background

Albert, Butters and Levin (1979a) demonstrated that the retrograde memory impairment associated with the alcoholic Korsakoff syndrome is characterized by a temporal gradient, in which information from the remote past is better retained than information from the recent past. This pattern was established on the Albert Retrograde Memory Battery, which includes a test of famous faces and Recall and Recognition Questionnaires that cover the time period from 1920 to 1975. Moreover, the alcoholic Korsakoffs showed this distinctive pattern of performance when "easy" items (concerned with people and events with enduring fame) and "hard" items (pertaining to people and events with transient fame) were analyzed separately (Albert, Butters and Levin 1979a). In a subsequent study (Albert, Butters and Levin 1979b), the fact that post-encephalitic patients were found to perform at even lower levels than the alcoholic Korsakoffs on both the Famous Faces Test and the Recognition Questionnaire demonstrated the sensitivity of these measures to distinguish between amnesic disorders of different etiologies. When all three tests from the Albert Retrograde Memory Battery were administered to a chronic alcoholic group, there was no evidence of retrograde memory impairment (Albert, Butters and Levin, 1979b). This finding suggests

that the retrograde component to the amnesia associated with the alcoholic Korsakoff syndrome is not shared by chronic alcoholics. The tendency for alcoholic Korsakoffs to perform more poorly on items pertaining to recent decades was confirmed by Cohen and Squire (1981), using a revised version of the Albert Famous Faces Test. In addition, for the items dealing with the most recent time period on this test (1970 to 1975), chronic alcoholics performed at a significantly lower level than did nonalcoholic controls, offering some slight support for the continuity hypothesis with respect to retrograde memory.

Rationale and Specific Hypotheses

In Experiment 4, recall and recognition in retrograde memory of chronic alcoholics, alcoholic Korsakoffs and nonalcoholic controls were examined using the Recall and Recognition Questionnaires from the Albert Retrograde Memory Battery. The following hypotheses were advanced:

Hypothesis I. It was hypothesized that alcoholic Korsakoffs would perform at an overall level significantly below that of nonalcoholic controls on the Recall and Recognition Questionnaires, and that the discrepancy between the two groups would be greater for more recent decades (e.g., the 1960's and 1970's) than for earlier decades (e.g., 1920's and 1930's).

Hypothesis II. With respect to chronic alcoholics, it was hypothesized that their performance would not differ significantly from that of nonalcoholic controls across decades (from the 1920's through the 1970's) on both the Recall and Recognition Questionnaires.

Method

Subjects. Ten chronic alcoholics, seven alcoholic Korsakoffs and fifteen nonalcoholic controls (selected in accordance with the criteria described above) participated in this experiment.

Materials. The Recall and Recognition Questionnaires from the Albert Retrograde Memory Battery were employed (Albert, Butters and Levin, 1979a). Each of these tests contains 132 questions concerning famous people and events from the 1920's through 1975. For each decade from 1920 through 1960 there are 24 items, and there are 12 items that cover the period from 1970 to 1975. Half of the items for each decade are designated as "easy" while the remaining half are designated as "hard". "Easy" items refer to people and events whose fame extends over many years, and "hard" refers to people and events whose fame was short-lived. Both tests were designed so that when the items were pooled, normal subjects would achieve an overall performance of 80-85% (Albert, Butters and Levin 1979a).

Procedure. For the Recall Questionnaire, the examiner read each question to the subject and recorded the subject's spontaneous response. If the subject failed to respond or offered an incorrect response, either a semantic cue or a phonemic cue was alternately offered by the examiner. Semantic cues provide additional information about the person or event and phonemic cues provide the initials of the famous person. On the Recognition Questionnaire each question was followed by three possible answers. The subject read the question aloud and responded by selecting one of the three choices provided. The examiner recorded all responses.

Data Tabulation. For the Recall Questionnaire, the number of correct responses given either spontaneously or following cues was tabulated for each subject. The number of items correct was recorded for each level of difficulty ("easy" and "hard") at every decade (1920's, 1930's, 1940's, 1950's, 1960's and 1970's). These raw scores were converted to percentages in order to adjust for the fact that there were only half as many items on the questionnaire pertaining to the 1970's as there were for the other decades. The number of correct responses on the Recognition Questionnaire was recorded and converted to percentages in the same fashion.

Determination of Covariates. Group means and standard deviations for age, FSIQ and BDI scores are presented in Table 34. A one-way analysis of variance (ANOVA) was performed on each of these three factors using Group as the between subject variable. As can be seen in Tables 35, 36 and 37, the groups were matched with respect to age but differed in terms of FSIQ and BDI scores. Neuman-Keuls post hoc pairwise comparisons (Kirk, 1968) were performed on the group means to determine the precise nature of the differences. With respect to FSIQ (Table 38), the alcoholic Korsakoffs attained a significantly lower mean FSIQ than the nonalcoholic control and chronic alcoholic groups, which did not differ significantly from each other. In terms of BDI scores (Table 39), the chronic alcoholics attained a significantly higher mean score than the alcoholic Korsakoff and nonalcoholic control groups, which did not differ significantly from each other. Because of the significant between group differences in FSIQ and BDI scores, these variables were entered into subsequent analyses as covariates in order to reduce the between group variability.

Data Analysis. The percentage of items correct (with cueing) on the Recall Questionnaire was analyzed using a three-way split-plot analysis of covariance (ANOCOVA). Group served as the between subject variable, Decade (1920's, 1930's, 1940's, 1950's, 1960's, and 1970's) and Difficulty level ("easy" and "hard") served as the within subject

variables, and FSIQ and BDI scores served as the covariates. The percentage of items correct on the Recognition Questionnaire was analyzed in a similar manner using a three-way split plot analysis of covariance (ANOCOVA). Group served as the between subject factor, Decade and Difficulty level served as the within subject factors, and FSIQ and BDI scores served as covariates. Significant main effects and interactions were further analyzed using Newman-Keuls post hoc pairwise comparisons (Kirk, 1968).

Results

Recall in Retrograde Memory. Results pertaining to the Albert Recall Questionnaire ANOCOVA are presented in Table 40. The difficulty main effect, decade main effect, group by decade interaction, and difficulty by decade interaction were all significant. The group effect approached but did not reach a significant level. The actual means for the group by decade interaction are plotted in Figure 5, and graphic presentation of the adjusted means for the group by trial interaction appears in Figure 6. Interpretation of the absolute values of the adjusted means is inappropriate, because they represent statistical rather than actual values. Nevertheless, the adjusted means do accurately reflect the relationships between the groups when differences in FSIQ and BDI scores are taken into account.

In comparing Figures 5 and 6, the shift in position of the chronic alcoholics in relation to the other two groups is of major importance. When the actual means are employed (Figure 5), the chronic alcoholics' performance appears to be similar to that of the nonalcoholic controls, and both groups appear to be superior to the alcoholic Korsakoff group. However, when FSIQ and BDI scores served as covariates (Figure 6), the chronic alcoholics' performance appears to be indistinguishable from that of the alcoholic Korsakoffs, and both groups appear to be inferior to the nonalcoholic controls.

Results of the Neuman-Keuls analyses performed on the adjusted means for the group by decade interaction appear in Table 41. As can be seen in Figure 6, the nonalcoholic control group manifested a clear superiority to the other two groups in the percentage of items correct for almost every decade tested, while the alcoholic Korsakoff and chronic alcoholic groups did not differ significantly from each other for any decade tested.

There were similarities in the patterns of performance among the three groups across decades. The percentage of items correct tended to increase from the 1920's to the 1940's and to decline from the 1940's to the 1970's for all three groups, even though the groups tended to exhibit different rates of change. Table 41 also reveals that the differences between the nonalcoholic control group and each

of the other two groups tended to be greater for more recent decades (1950's, 1960's, and 1970's) than they were for the earlier decades (1920's, 1930's, and 1940's).

Data pertaining to the difficulty and decade main effects and the difficulty by decade interaction are presented in Table 42. Collapsing over groups and decades, a significantly greater percentage of "easy" items was answered correctly than was the case for "hard" items. While this relationship was maintained for every decade, the magnitude of the difference between the percentage of "easy" and "hard" items correct varied from decade to decade. Collapsing over groups and difficulty levels, the decade main effect indicates that there were significant differences in the percentage of items answered correctly for different decades.

Recognition in Retrograde Memory. Results pertaining to the Albert Recognition Questionnaire ANOCOVA are presented in Table 43. The group main effect, difficulty main effect, decade main effect and difficulty by decade interaction were significant. The actual and adjusted means for the group effect appear in Table 44. Results of the Neuman-Keuls analyses performed on the adjusted means for the group effect can be found in Table 45. Interpretation of these findings reveals that the alcoholic Korsakoff group

performed at a level significantly below those of the other two groups, which did not differ significantly from each other.

Data relevant to the difficulty and decade main effects and the difficulty by decade interaction can be found in Table 46. Collapsing over groups and decades, a significantly greater proportion of "easy" items was answered correctly than was the case for "hard" items. This relationship was maintained for almost every decade, but the discrepancy between the percentage of "easy" and "hard" items answered correctly was not uniform across decades.

Graphic presentation of the actual group means for the non-significant group by decade interaction appears in Figure 7. The adjusted group means for the group by decade interaction are presented in Figure 8. Inspection of both Figures reveals that the nonalcoholic control and the chronic alcoholic groups maintain relatively flat patterns of performance across decades while the alcoholic Korsakoffs tend to show an overall decline in performance across decades, with some evidence of a more rapid drop in performance for the most recent decades (1960's and 1970's). Visual inspection reveals that there was a tendency for the differences in performance levels between the groups to be greater for the most recent decades (1950's, 1960's and 1970's) than they were for the earlier decades (1920's, 1930's, and 1940's).

Discussion

The results of this experiment lend some support for Hypothesis I. The alcoholic Korsakoffs demonstrated impaired performance relative to the nonalcoholic controls on both the Recall and Recognition Questionnaires. However, on the Recall Questionnaire the alcoholic Korsakoffs manifested this deficit for almost every decade tested (collapsing over difficulty level), while analysis of the data for the Recognition Questionnaire revealed only an overall impairment (collapsing over decades and difficulty level). The tendency for the difference between the alcoholic Korsakoff and the nonalcoholic control groups to be greater for more recent than for more remote decades appeared on both questionnaires, lending further support for Hypothesis I.

With respect to the performance of the chronic alcoholics, the findings from the analysis of the Recognition Questionnaire support Hypothesis II. There were no significant differences between the chronic alcoholic and the nonalcoholic control groups on the Recognition Questionnaire. However, these findings contrast with those obtained from the Recall Questionnaire. For almost every decade tested, the chronic alcoholics were quantitatively inferior to the nonalcoholic control group in their ability to recall information from retrograde memory. These

differences emerged in the ANOCOVA, when FSIQ and BDI scores served as covariates. These results highlight the importance of considering (and attempting to adjust for) the possible effects of these variables when evaluating recall in retrograde memory. Recognition in retrograde memory is apparently not as susceptible to the effects of differences in FSIQ and BDI scores as is recall in retrograde memory.

Qualitatively, the chronic alcoholic and nonalcoholic control groups shared a similar pattern of increasing and decreasing performance across decades on the Recall Questionnaire, and a similar flat pattern of performance across decades on the Recognition Questionnaire.

There are certain similarities as well as some important discrepancies between the present findings and those reported by Albert, Butters and Levin (1979a, 1979b). Alcoholic Korsakoff patients were again found to present with significant deficits in performance on the Recall and Recognition Questionnaires. The chronic alcoholics' relatively normal performance on the Recognition Questionnaire was also in agreement with the findings of the earlier study (Albert, Butters and Levin, 1979b).

The present findings regarding the impaired performance of the chronic alcoholics on the Recall Questionnaire, however, were not consistent with those reported by Albert, Butters and Levin (1979b). There are several reasons why this discrepancy is noteworthy. First, the present deficit

in recall for the chronic alcoholics emerged in the analysis of covariance, when FSIQ and BDI scores were entered as the covariates. The possible failure of the previous investigators to consider and control for between group differences in intelligence and depression may have obscured their ability to determine subtle but significant between group differences on the Recall Questionnaire.

Second, since the relationships among the groups were not significantly altered when these covariates were entered into the analysis for the Recognition Questionnaire data, it appears that performance on the Recognition Questionnaire was less susceptible to the possible individual and interactive effects of these variables than was performance on the Recall Questionnaire in the present study.

Third, the present findings revealed that the performance pattern of the chronic alcoholic group was significantly different from that of the nonalcoholic controls on the Recall Questionnaire. A similar deficit among chronic alcoholics in identifying faces from recent decades was reported by Cohen and Squire (1981). Moreover, when Butters and Albert (1982) performed separate analyses on the percentage of items correct both with and without cues for the "easy" and "hard" items on the Recall Questionnaire, the performance of the chronic alcoholic group was significantly poorer than that of the nonalcoholic control group for the most difficult condition (when no cues

were provided for the "hard" items). Taken together, these findings reveal the presence of subtle but significant retrograde memory deficits in chronic alcoholics.

Data from this experiment also bear directly upon the issue of a temporal gradient associated with the retrograde memory deficit found in the alcoholic Korsakoff syndrome. Albert, Butters and Levin (1979a) maintain that the presence of a temporal gradient (characterizing the performance pattern of the alcoholic Korsakoffs on all three tests from the Albert Retrograde Memory Battery) was not simply an artifactual finding due to a lack of equivalence among items from different decades. They reportedly equated for item difficulty by constructing the tests so that the performance pattern of control subjects was roughly flat across decades, with actual achievement levels at approximately the 80 to 85% level (Albert, Butters and Levin, 1979a).

The present findings suggest that the question of item equivalence remains an active one. In this experiment, the nonalcoholic control subjects failed to demonstrate a relatively flat performance pattern on the Recall Questionnaire. In fact, all three subject groups demonstrated relatively steep gradients across recent decades. While a relatively flat pattern was observed for the nonalcoholic control group on the Recognition Questionnaire, the same flat pattern was also found for the alcoholic Korsakoff and the chronic alcoholic groups. For

each questionnaire, the shape of the performance curve was not a discriminating factor distinguishing differences among the three groups in this experiment.

A different approach to evaluating the temporal gradient issue was offered by Butters and Albert (1982). Assuming statistical equivalence among test items, they reanalyzed their data for the alcoholic Korsakoff and the nonalcoholic control groups for the Famous Faces Test using the following procedure. For each group, the percentage of items answered correctly for the "hard" items from the 1930's was compared to the percentage of "easy" items answered correctly from the 1970's. As they expected, the nonalcoholic controls had significantly more difficulty recalling remote "hard" than recent "easy" faces, while the reverse trend was found for the alcoholic Korsakoff group. Moreover, the difference between the groups was smaller for the remote "hard" items than it was for the recent "easy" items. They interpreted these findings as demonstrating a "relative preservation of very remote memories under conditions of planned statistical inequality" for the alcoholic Korsakoff group and suggested that it offered the "strongest" support favoring the presence of a temporal gradient in the retrograde memory of alcoholic Korsakoffs (Butters and Albert, 1982, p. 263).

The results of applying this technique to the present data appear in Table 47 for the Recall Questionnaire and in Table 48 for the Recognition Questionnaire. For both questionnaires, the nonalcoholic controls tended to attain a higher percentage of items correct for the "easy" items from the 1970's than for the "hard" items from the 1930's. In contrast, the alcoholic Korsakoffs tended to achieve a higher percentage of correct responses for the "hard" items from the 1930's than for the "easy" items from the 1970's. These findings are consistent with those reported by Butters and Albert (1982) for the Famous Faces Test. In this experiment, the performance pattern of the chronic alcoholics tended to be similar to that of the alcoholic Korsakoffs on the Recall Questionnaire, and similar to that of the nonalcoholic controls on the Recognition Questionnaire.

Several issues complicate the interpretation of these findings, however. Although the tendencies demonstrated in the present study are similar to those reported by Butters and Albert (1982), the actual percentages in each cell are considerably lower in the present analyses than they were in the original ones. In addition, since the group by decade by difficulty interactions for both the Recall and Recognition Questionnaire ANOCOVAs (presented in Tables 40 and 43) were not significant, it is difficult to assess the relevance of the comparisons presented in Tables 46 and 47.

A methodological issue concerning the test construction may also be unevenly weighting items from different decades. The questionnaires were designed with 12 "hard" items from the 1930's and only six "easy" items from the 1970's. Even though the present analyses utilize the percentage rather than the number of items correct, "easy" items from the 1970's were weighted more heavily in determining the percentages than were the "hard" items from the 1930's.

General Discussion

Summary of Findings

In Experiment 1, recall and recognition in short term verbal memory were evaluated using two lists from the Mattis-Kovner Verbal Learning Evaluation (Mattis, Kovner and Goldmeier, 1978). For recall on the semantically organized Animal List, both the chronic alcoholics and the alcoholic Korsakoffs were significantly impaired. While the chronic alcoholics performed at a level that was intermediate between those of the other two groups, their pattern of performance paralleled the learning curve of the nonalcoholic controls rather than mimicking the flat pattern of the alcoholic Korsakoffs.

In recalling items from the Nonsense Hexagram List, a more difficult task in which phonemic analysis is salient and associational processing is minimal, the chronic alcoholics and the alcoholic Korsakoffs shared the same degree and pattern of impaired performance. This finding could be taken as weak support in favor of the continuity hypothesis. However, the degree of difficulty demonstrated by the nonalcoholic controls on this task raises concern regarding this measure's ability to discern subtle differences in the performance patterns of impaired groups. Morever, the fact that the results of the original study

conducted by Mattis, Kovner and Goldmeier (1978) failed to detect a significant difference in performance patterns between the nonalcoholic control and the alcoholic Korsakoff groups on this task questions the reliability of the present finding.

Analysis of the recognition memory data for the Animal List revealed a major dissimilarity between the performance patterns of the chronic alcoholics and the alcoholic Korsakoffs. The chronic alcoholics failed to demonstrate the deficit in semantic encoding and the susceptibility to proactive interference (manifested by declining d' values across recognition probes) that are characteristic features of the alcoholic Korsakoffs' performance. Even though the chronic alcoholics were quantitatively similar to the nonalcoholic controls on this task, they failed to share the nonalcoholic controls' ability to learn across recognition probes. On the Nonsense Hexagram List, both the chronic alcoholics and the alcoholic Korsakoffs manifested defective recognition memory. However, qualitative analysis revealed that all three groups shared a flat pattern of performance. Apparently, this task was so difficult that even the nonalcoholic controls were unable to demonstrate learning.

The results of Experiments 2 and 3 provided neither quantitative nor qualitative support for the continuity hypothesis. There was confirmation of the alcoholic Korsakoffs' semantic information processing deficit

(manifested by impaired performance on the SIT) and generalized retrieval impairment (evidenced by a diminished capacity to produce category exemplars) reported in earlier studies (Kovner et al., 1981b; and Mattis et al., 1981). However, the chronic alcoholics failed to manifest either of these impairments.

In Experiment 4, evaluation of recall and recognition in retrograde verbal memory was undertaken using questionnaires from the Albert Retrograde Memory Battery (Albert, Butters and Levin, 1979a). Quantitatively, the alcoholic Korsakoffs manifested the anticipated deficits in both recall and recognition for retrograde verbal memory. However, they exhibited no evidence of a distinctive temporal gradient effect (in which events from the more remote past were better recalled or recognized than events from the recent past).

The results regarding the performance of the chronic alcoholics are of particular interest. Albert, Butters and Levin (1979b) found no significant impairment in either recall or recognition for their chronic alcoholic group. In the present study, when between group differences in depression and intelligence were statistically taken into account, the chronic alcoholic group manifested impaired recall in retrograde memory. Moreover, the degree of impairment was similar to that displayed by the alcoholic

Korsakoffs. This finding indicates that, at least under certain controlled conditions, chronic alcoholics present with a retrieval deficit in retrograde memory.

No distinctions could be made among the three groups on the basis of the shape of their performance curves across decades for either questionnaire. All groups manifested a tendency to decline across recent decades on the Recall Questionnaire and to produce a relatively flat pattern on the Recognition Questionnaire. These findings failed to confirm the temporal gradient effect reported by Albert, Butters and Levin (1979a). The presence of a temporal gradient in the original study may have been an artifact related to the construction of the questionnaires and/or their standardization.

Conclusions

A major focus of this dissertation was to examine aspects of verbal memory in chronic alcoholics, alcoholic Korsakoff patients and nonalcoholic controls, paying particular attention to the subprocesses that have been implicated as causal deficits in the amnesia associated with the alcoholic Korsakoff syndrome. A pattern of deficit approach was employed to evaluate the findings in relation to the continuity hypothesis. Assuming that the continuity hypothesis implies a homogeneous deterioration in memory, the chronic alcoholics were expected to manifest a more

subtle degree of impairment than the alcoholic Korsakoffs, while both groups were anticipated to share qualitative similarities in their performance patterns.

The findings revealed that detoxified chronic alcoholics, with no clinically observable signs of cognitive dysfunction, presented with a relatively pervasive deficit in verbal recall (encompassing both anterograde and retrograde memory) and a more subtle deficit in recognition memory (involving the encoding and storage of novel material). Quantitatively, the chronic alcoholics exhibited the same degree of deficit as the alcoholic Korsakoffs on several measures (assessing recall and recognition of novel material in short term memory, and recall in retrograde memory). Qualitatively, there was a unique similarity between the chronic alcoholics and the alcoholic Korsakoff group only in their failure to learn novel material.

The bulk of these findings fail to support the continuity hypothesis. It may be that the verbal memory deficits shared by the chronic alcoholic and the alcoholic Korsakoff groups reflect a generalized cortical involvement resulting from long-term exposure to the toxic effects of alcohol. For the alcoholic Korsakoffs, the sudden onset of thiamine deficiency may serve as a second factor which exacerbates existing difficulties and introduces the focalizing effects of hemorrhagic brain damage. The

interaction between these factors may be responsible for the impairments in specific subprocesses evidenced by the alcoholic Korsakoffs. This explanation incorporates aspects of both the "chronic" and "acute" alternatives suggested by Albert, Butters and Levin (1979a) and views the amnesia associated with the alcoholic Korsakoff syndrome as the result of two interrelated disease processes.

Implications for Future Research

The generalizability of the present findings are limited due to the stringent criteria applied to the selection of the chronic alcoholic group. In this study, only 10 out of approximately 200 consecutive admissions to an alcoholic treatment unit met the criteria for inclusion into the chronic alcoholic group. The most frequent reasons for exclusion were: failure to meet the age requirement; failure to meet the one month minimum period of detoxification; a positive history of polydrug abuse; and/or the presence of subtle signs of organicity on the MOMSSE.

Ruling out a positive history of even mild head trauma and covarying for the effect of depression were additional factors that have not been adequately controlled for in earlier studies. A failure to reduce the between-group variability produced by these variables may have obscured the possible presence of subtle memory deficits in other chronic alcoholic groups.

Although the mnemonic deficits associated with the alcoholic Korsakoff syndrome do not appear to present along a continuum of impairment with chronic alcoholism, the concept of continuity may still be of heuristic value in understanding the toxic effects of alcohol on the brain. It may be possible in future studies to identify a number of subgroups of chronic alcoholics who present with degrees of cognitive dysfunction that are intermediate between those exhibited by the "intact" chronic alcoholics examined in the present study and the "borderline" Korsakoff group reportedly identified by Ryan et al. (1979).

Recent advances in the use of evoked potential techniques to evaluate functional and behavioral effects of alcohol simultaneously (Porjesz and Begleiter, 1983) provide an exciting opportunity to gain a better understanding of the process of alcoholism. Comparison of impairments associated with alcoholism with those produced by mild head trauma and polydrug abuse may yield additional information regarding the specificity of impairment associated with each of these conditions. Improving the state of the art in behavioral assessment, particularly with respect to retrograde memory, remains a challenging area for future research.

Reports describing the recoverability of function in chronic alcoholics add an element of hope to the clinical picture (Brandt, Butters, Ryan and Bayog, 1983; Goldman,

1982, 1983; and Williams and Rundell, 1981). The need to both attend to and attempt to remediate verbal memory deficits and depression among chronic alcoholics cannot be overemphasized. There is also a basic need to coordinate the research and treatment efforts taking place at various alcoholism centers in order to increase the comparability of findings from one study to another.

Table 1

Screening Variable Statistics
for Experiments 1 and 2

Variable		Group NC	CA	AK
AGE	Mean	60.71	60.40	60.86
	sd	9.16	3.95	7.08
	Range	47-71	54-67	54-73
FSIQ	Mean	110.43	113.90	102.86
	sd	8.62	4.15	7.08
	Range	100-123	107-121	95-115
BDI	Mean	5.29	15.40	5.57
	sd	4.31	4.53	5.26
	Range	0-13	8-21	1-17
		n=7	n=10	n=7

Note. NC = nonalcoholic controls
CA = chronic alcoholics
AK = alcoholic Korsakoffs

Table 2

Age ANOVA for Experiments 1 and 2

Source	SS	df	MS	F	p
Group	0.939	2	0.470	0.010	0.990
s.w.g.	944.684	21	44.985		

Table 3

FSIQ ANOVA for Experiments 1 and 2

Source	SS	df	MS	F	p
Group	507.861	2	253.930	5.915	0.009
s.w.g.	901.472	21	42.927		

Table 4

BDI ANOVA for Experiments 1 and 2

Source	SS	df	MS	F	p
Group	580.288	2	290.144	13.201	<0.001
s.w.g.	461.542	21	21.978		

Table 5
Neuman-Keuls Analyses for FSIQ ANOVA

Critical W Values

p value	Range (r) 2	3
.05	6.93	8.41
.01	9.45	10.91

Inter-group Mean Differences

Pair	r	Difference	p
CA - AK	3	11.04	<.01
CA - NC	2	3.47	NS
NC - AK	2	7.57	<.05

Table 6

Neuman-Keuls Analyses for BDI ANOVA

Critical W Values
Range (r)

p value	2	3
.05	4.96	6.01
.01	6.75	7.80

Inter-group Mean Differences

Pair	r	Difference	p
CA - AK	2	9.83	<.01
CA - NC	3	10.11	<.01
AK - NC	2	0.29	NS

Table 7

Animal Recall Mean Number of Intrusions Produced on Trials 4,8 and 12

Trial		Group AK	CA	NC	
4	Mean	0.86	0.90	0.57	0.79
	sd	2.27	1.45	0.79	1.53
8	Mean	1.14	0.80	0.14	0.71
	sd	1.77	1.37	0.38	1.30
12	Mean	1.71	0.50	0.14	0.75
	sd	2.50	0.97	0.38	1.57
	Mean	1.24	0.73	0.29	0.75
	sd	2.15	1.03	0.41	1.34
		n=7	n=10	n=7	

Note. NC = nonalcoholic controls
CA = chronic alcoholics
AK = alcoholic Korsakoffs

Table 8

Animal Recall Intrusion ANOVA

Source	SS	df	MS	F	p
Group	10.595	2	5.297	0.970	0.396
s.w.g.	114.629	21	5.458		
Trial	0.115	2	0.058	0.116	>0.500
Group x Trial	4.474	4	1.119	2.243	0.081
Trial x s.w.g.	20.943	42	0.499		
Total	150.755	71	2.123		

Table 9
Animal Recall ANOCOVA

Source	SS	df	MS	F	p
Group	25221.926	2	12610.961	30.191	<0.001
Covariates	50.008	2	25.004	0.060	>0.500
s.w.g.	7936.543	19	417.713		
Trial	2368.790	2	1184.395	15.032	<0.001
Group x Trial	833.615	4	208.404	2.645	0.048
Covariates	0.000	2	0.000	<0.001	
Trial x s.w.g.	3151.659	40	78.791		

Table 10

Neuman-Keuls Analyses for
Animal Recall ANOCOVA
(Group by Trial Interaction)

Critical W Values
Range (r)

p value	2	3
.05	9.10	10.95
.01	12.16	13.91

Adjusted Mean Differences
Between Trials

	Trial Pairs		
Group	4-8	8-12	4-12
CA	7.60	11.50*	19.00**
AK	3.57	0.72	2.86
NC	13.57**	7.14	20.71**

Critical W Values
Range (r)

p value	2	3
.05	14.55	17.62
.01	19.81	22.79

Adjusted Mean Differences
Between Groups

	Group Pairs		
Trial	NC -AK	CA - AK	NC -CA
4	41.78**	19.54*	22.24**
8	51.78**	23.47**	28.32**
12	59.64**	35.68**	23.96**

* $p < .05$.
** $p < .01$.

Table 11

Nonsense Recall ANOCOVA

Source	SS	df	MS	F	p
Group	4885.340	2	2442.670	9.664	0.002
Covariates	374.277	2	187.139	0.740	0.491
s.w.g.	4802.262	19	252.751		
Trial	975.985	2	487.992	13.898	<0.001
Group by Trial	685.836	4	171.459	4.883	0.003
Covariates	0.000	2	0.000	<0.001	
Trial x s.w.g.	1404.522	40	35.113		

Table 12

Neuman-Keuls Analyses for
Nonsense Recall ANOCOVA
(Group by Trial Interaction)

Critical W Values
Range (r)

p value	2	3
.05	6.08	7.31
.01	8.12	9.28

Adjusted Mean Differences
Between Trials

	Trial Pairs		
Group	4-8	8-12	4-12
CA	4.50	2.00	6.50
AK	0.00	1.48	1.48
NC	12.14**	7.14*	19.29**

Critical W Values
Range (r)

p value	2	3
.05	10.94	13.24
.01	14.88	17.11

Adjusted Mean Differences
Between Groups

	Group Pairs		
Trial	NC - AK	CA - AK	NC - CA
4	10.27	0.68	9.59
8	22.41**	5.18	17.23**
12	28.13**	5.75	22.37**

* $p < .05$.
** $p < .01$.

Table 13

Animal Recognition ANOCOVA

Source	SS	df	MS	F	p
Group	31.375	2	15.687	23.527	<0.001
Covariates	2.006	2	1.003	1.504	0.248
s.w.g.	12.669	19	0.667		
Probe	0.008	2	0.004	0.026	>0.500
Group by Probe	5.450	4	1.362	8.565	<0.001
Covariates	0.000	2	0.000	<0.001	
Trial x s.w.g.	6.363	40	0.159		

Table 14

Neuman-Keuls Analyses for
Animal Recognition ANOCOVA
(Group by Probe Interaction)

Critical W Values
Range (r)

p value	2	3
.05	.40	.48
.01	.53	.61

Adjusted Mean Differences
Between Probes

	Probe Pairs		
Group	1-2	2-3	1-3
CA	.12	.35	.23
AK	.34	.53**	.87**
NC	.53**	.14	.68**

Critical W Values
Range (r)

p value	2	3
.05	.60	.72
.01	.81	.94

Adjusted Mean Differences
Between Groups

	Group Pairs		
Probe	NC - AK	CA - AK	NC -CA
1	1.16**	1.37**	.21
2	2.03**	1.59**	.44
3	2.70**	2.47**	.24

* $p < .05$.
** $p < .01$.

Table 15

Nonsense Recognition ANOCOVA

Source	SS	df	MS	F	p
Group	10.641	2	5.321	9.423	0.002
Covariates	0.343	2	0.172	0.304	>0.500
s.w.g.	10.728	19	0.565		
Probe	0.291	2	0.146	0.619	>0.500
Group by Probe	0.850	4	0.212	0.902	0.473
Covariates	0.000	2	0.000	<0.001	
Trial x s.w.g.	9.423	40	0.236		

Table 16

Neuman-Keuls Analyses for
Nonsense Recognition ANOCOVA
(Group Effect)

Critical W Values
Range (r)

p value	2	3
.05	.47	.57
.01	.65	.75

Inter-group Adjusted
Mean Differences

Pair	r	Difference	p
NC - CA	3	1.01	<.01
AK - CA	2	.12	NS
NC - AK	2	.89	<.01

Table 17

SIT Number Correct
Group Means and Standard Deviations

	Group		
	NC	CA	AK
Mean	378.00	377.40	354.43
sd	8.06	9.53	23.29
	n=7	n=10	n=7

Note. NC = nonalcoholic controls
CA = chronic alcoholics
AK = alcoholic Korsakoffs

Table 18

SIT Total Number Correct ANOCOVA

Source	SS	df	MS	F	p
Group	1588.699	2	794.350	3.518	0.051
Covariates	174.945	2	87.473	0.387	>0.500
s.w.g.	4289.805	19	225.779		

Table 19

Neuman-Keuls Analyses for
SIT Total Number Correct ANOCOVA

Critical W Values
Range (r)

p value	2	3
.05	9.21	11.16
.01	12.60	14.52

Inter-group Adjusted
Mean Differences

Pair	r	Difference	p
CA - NC	2	2.67	NS
NC - AK	2	20.97	<.01
CA - AK	3	23.64	<.01

Table 20

SIT "Easy" Error ANOCOVA

Source	SS	df	MS	F	p
Group	0.391	2	0.196	2.395	0.118
Covariates	0.243	2	0.122	1.491	0.250
s.w.g.	1.550	19	0.082		
Regression Coefficients	0.113	4	0.028	0.296	0.876
Error	1.437	15	0.096		

Table 21

SIT Proportional Distribution of Errors for All Groups (Total Errors = 1.00)

	Group		
	NC	AK	CA
Proportion "Easy" Semantic Errors	.15	.26	.20
Proportion "Hard" Semantic Errors	.85	.74	.80

Note. NC = nonalcoholic controls
CA = chronic alcoholics
AK = alcoholic Korsakoffs

Table 22

Screening Variable Statistics
for Experiment 3

Variable		Group NC	CA	AK
AGE	Mean	60.71	60.40	60.17
	sd	9.16	3.95	7.49
	Range	47-71	54-67	55-73
FSIQ	Mean	110.43	113.90	101.83
	sd	8.62	4.15	7.17
	Range	100-123	107-121	95-115
BDI	Mean	5.29	15.40	5.83
	sd	4.31	4.53	5.71
	Range	0-13	8-21	3-17
		n=7	n=10	n=6

Note. NC = nonalcoholic controls
CA = chronic alcholics
AK = alcoholic Korsakoffs

Table 23

Age ANOVA for Experiment 3

Source	SS	df	MS	F	p
Group	0.990	2	0.495	0.012	0.989
s.w.g.	924.661	20	46.233		

Table 24

FSIQ ANOVA for Experiment 3

Source	SS	df	MS	F	p
Group	551.420	2	275.710	6.431	0.007
s.w.g.	857.448	20	42.872		

Table 25

BDI ANOVA for Experiment 3

Source	SS	df	MS	F	p
Group	550.640	2	275.320	12.005	<0.001
s.w.g.	458.661	20	22.933		

Table 26

Neuman-Keuls Analyses
for FSIQ ANOVA

Critical W Value
Range (r)

p value	2	3
.05	7.14	8.66
.01	9.73	11.23

Inter-group Mean Differences

Pair	r	Difference	p
CA - NC	2	3.47	NS
CA - AK	3	12.07	<.01
NC - AK	2	8.60	<.05

Table 27

Neuman-Keuls Analyses
for BDI ANOVA

Critical W Value
Range (r)

p value	2	r
.05	5.22	6.34
.01	7.12	8.21

Inter-group Mean Differences

Pair	r	Difference	p
CA - AK	2	9.57	<.01
CA - NC	3	10.11	<.01
AK - NC	2	.54	NS

Table 28

Mean Number of Category Exemplars Produced in Each 30 Second Period

Period (30 sec. interval)		Group AK	CA	NC	
1	Mean	7.42	7.92	9.32	8.22
	sd	1.72	1.35	1.56	1.64
2	Mean	2.83	4.97	4.82	4.37
	sd	0.92	1.28	0.86	1.39
3	Mean	1.46	3.40	3.32	2.87
	sd	0.58	0.95	1.35	1.30
4	Mean	1.42	2.70	3.00	2.46
	sd	0.41	0.61	0.82	0.89
5	Mean	1.38	2.67	2.18	2.18
	sd	0.56	0.70	0.89	0.88
6	Mean	0.75	2.47	2.11	1.91
	sd	0.63	0.63	0.38	0.90
7	Mean	0.83	2.02	1.82	1.65
	sd	0.49	0.94	0.53	0.87
8	Mean	0.71	2.13	1.89	1.68
	sd	0.29	0.64	0.75	0.84
9	Mean	1.17	2.22	1.89	1.85
	sd	0.47	0.92	0.66	0.84
10	Mean	1.04	1.85	1.50	1.53
	sd	1.07	0.66	0.35	0.76
	Mean	1.90	3.24	3.19	2.87
	sd	0.32	0.48	0.22	0.69
		n=6	n=10	n=7	

Note. AK = alcoholic Korsakoffs
CA = chronic alcoholics
NC = nonalcoholic controls

Table 29

Category Exemplar Number Produced ANOCOVA

Source	SS	df	MS	F	p
Group	39.832	2	19.916	13.286	<0.001
Covariates	2.100	2	1.050	0.700	>0.500
s.w.g.	26.983	18	1.499		
Period	857.707	9	95.301	134.207	<0.001
Group by Period	18.618	18	1.034	1.457	0.111
Covariates	0.000	2	0.000	<0.001	
Period x s.w.g.	126.398	178	0.710		

Table 30

Neuman-Keuls Analyses for
Category Exemplar Number
Produced ANOCOVA
(Group Effect)

Critical W Value
Range (r)

p value	2	3
.05	.42	.52
.01	.58	.67

Inter-group Adjusted Mean Difference

Pair	r	Difference	p
NC - CA	2	.05	NS
AK - CA	3	1.34	<.01
NC - AK	2	1.29	<.01

Table 31

Category Exemplar Mean Frequency of Response Index for Blocks of Five Consecutive Exemplars

Block		Group AK	NC	CA	
1	Mean	166.75	122.16	160.78	168.84
	sd	50.44	22.42	19.05	30.84
2	Mean	76.34	97.95	79.50	84.29
	sd	34.16	18.96	31.78	29.39
3	Mean	36.48	53.01	44.40	44.96
	sd	20.96	21.05	20.47	20.80
	Mean	93.19	111.04	94.89	
	sd	18.47	5.84	15.54	
		n=6	n=7	n=10	

Note. AK = alcoholic Korsakoffs
NC = nonalcoholic controls
CA = chronic alcoholics

Table 32

Category Exemplar Frequency of Response Index ANOCOVA

Source	SS	df	MS	F	p
Group	1583.582	2	791.791	1.30	0.297
Covariates	1277.608	2	638.804	1.05	0.371
s.w.g.	10976.774	18	609.821		
Block	179940.606	2	89970.303	110.87	<0.001
Block by Group	572.179	4	143.045	0.18	0.949
Block x s.w.g.	32458.557	40	811.464		

Table 33

Neuman-Keuls Analyses for Category Exemplar Frequency of Response Index ANOCOVA (Block Effect)

Critical W Value Range (r)

p value	2	3
.05	17.36	20.88
.01	23.19	26.53

Inter-block Adjusted Mean Differences

Block Pair	r	Differences	p
1-2	2	84.55	<.01
2-3	2	39.34	<.01
1-3	3	123.89	<.01

Table 34

Screening Variable Statistics
for Experiment 4

Variable		Group NC	CA	AK
AGE	Mean	58.87	60.40	60.86
	sd	6.37	3.95	7.08
	Range	47-71	54-67	54-73
FSIQ	Mean	111.47	113.90	102.86
	sd	7.36	4.15	7.08
	Range	100-123	107-121	95-115
BDI	Mean	4.93	15.40	5.57
	sd	3.67	4.53	5.26
	Range	0-13	8-21	1-17
		n=15	n=10	n=7

Note. NC = nonalcoholic controls
CA = chronic alcoholics
AK = alcoholic Korsakoffs

Table 35

Age ANOVA for Experiment 4

Source	SS	df	MS	F	p
Group	24.479	2	12.240	0.352	0.706
s.w.g.	1008.987	29	34.793		

Table 36

FSIQ ANOVA for Experiment 4

Source	SS	df	MS	F	p
Group	537.726	2	268.863	6.425	0.005
s.w.g.	1213.490	29	41.844		

Table 37

BDI ANOVA for Experiment 4

Source	SS	df	MS	F	p
Group	726.168	2	363.084	19.533	<0.001
s.w.g.	539.047	29	18.588		

Table 38

Neuman-Keuls Analyses for
FSIQ ANOVA

Critical W Value
Range (r)

p value	2	3
.05	6.07	7.34
.01	8.24	9.46

Inter-group Mean Differences

Pair	r	Differences	p value
NC - AK	2	8.61	<.01
CA - NC	2	2.43	NS
CA - AK	3	11.04	<.01

Table 39

Neuman-Keuls Analyses for
BDI ANOVA

Critical W Values
Range (r)

p value	2	3
.05	4.06	4.91
.01	5.50	6.32

Inter-group Mean Differences

Pair	r	Difference	p value
NC - AK	2	.64	NS
CA - NC	3	10.47	<.01
CA - AK	2	9.83	<.01

Table 40

Albert Recall ANOCOVA

Source	SS	df	MS	F	p
Group	283.940	2	141.970	3.233	0.056
Covariates	234.462	2	117.231	2.670	0.088
s.w.g.	1185.601	27	43.911		
Difficulty	319.833	1	319.833	110.757	<0.001
G. x Diff.	2.989	2	1.495	0.518	>0.500
Covariates Diff. x	0.000	0			
s.w.g.	83.744	29	2.888		
Decade	456.168	5	91.234	28.310	<0.001
G. x Dec.	63.959	10	6.396	1.985	0.040
Covariates Dec. x	0.000	2	0.000	<0.001	
s.w.g.	460.840	143	3.223		
Diff. x Dec.	47.279	5	9.456	4.807	<0.001
G. x Diff. x Dec.	21.139	10	2.114	1.075	0.386
Covariates Diff. x Dec. x	0.000	1	0.000	<0.001	
s.w.g.	283.268	144	1.967		

Table 41

Neuman-Keuls Analyses for
Albert Recall ANOCOVA
(Group by Decade Interaction)

Critical W Values
Range (r)

p value	2	3
.05	2.08	2.39
.01	2.79	3.20

Adjusted Mean Differences Between Groups

	Group Pairs								
	AK - CA			AK - NC			NC - CA		
Decade	Difference	r	p	Difference	r	p	Difference	r	p
1920's	.370	2	NS	2.151	3	NS	1.781	2	NS
1930's	.788	2	NS	1.726	2	NS	2.514	3	<.05
1940's	.280	2	NS	2.317	2	<.05	2.597	3	<.05
1950's	.620	2	NS	3.684	3	<.01	3.064	2	<.01
1960's	.948	2	NS	4.412	3	<.01	3.464	2	<.01
1970's	.023	2	NS	3.574	2	<.01	3.597	3	<.01

Note. AK = alcoholic Korsakoffs
CA = chronic alcoholics
NC = nonalcoholic controls

Table 42

Albert Recall Mean Percentage of
"Easy" and "Hard" Items Correct (with cues)
for Each Decade

Difficulty Level		Decade						
		1920s	1930s	1940s	1950s	1960s	1970s	
Easy	Mean	69.79	73.96	70.83	71.35	61.98	50.52	66.41
	sd	24.30	21.25	20.85	22.79	28.16	26.94	20.59
Hard	Mean	45.31	54.43	67.19	57.03	41.67	34.37	50.00
	sd	26.18	21.17	19.62	26.36	25.22	28.06	21.39
	Mean	57.55	64.19	69.01	64.19	51.82	42.45	58.20
	sd	23.46	19.77	19.22	23.47	25.64	24.90	20.61

Table 43

Albert Recognition ANOCOVA

Source	SS	df	MS	F	p
Group	222.492	2	111.246	4.929	0.015
Covariates	65.538	2	32.769	1.452	0.252
s.w.g.	609.384	27	22.570		
Difficulty	108.721	1	108.721	49.069	<0.001
G. x Diff.	4.576	2	2.288	1.033	0.369
Covariates	0.000	0			
Diff. x s.w.g.	64.254	29	2.216		
Decade	93.325	5	18.665	4.621	0.001
G. x Dec.	61.627	10	6.163	1.526	0.136
Covariates	0.000	2	0.000	<0.001	
Dec. x s.w.g.	577.611	143	4.039		
Diff. x Dec.	118.242	5	23.648	9.108	<0.001
G. x Diff. x Decade	23.360	10	2.336	0.900	>0.500
Covariates	0.000	1	0.000	<0.001	
Diff. x Decade x s.w.g.	373.880	144	2.596		

Table 44

Albert Recognition ANOCOVA
Group Means and Standard Deviations

Percentage of Items Correct

	Group AK	NC	CA
Mean	47.12	65.37	71.11
sd	15.30	11.64	8.19
Adjusted Mean	48.82	62.68	72.09

Note. AK = alcoholic Korsakoffs
NC = nonalcoholic controls
CA = chronic alcoholics

Table 45

Neuman-Keuls Analyses for Albert Recognition
ANOCOVA (Group Effect)

Critical W Value
Range (r)

p value	2	3
.05	1.30	1.58
.01	1.78	2.05

Inter-group Adjusted
Mean Differences

Pair	r	Difference	p
AK - NC	2	1.66	<.05
AK - CA	3	2.79	<.01
NC - CA	2	1.13	NS

Table 46

Albert Recognition Mean Percentage of "Easy" and "Hard" Items Correct for Each Decade

Difficulty Level		Decade						
		1920s	1930s	1940s	1950s	1960s	1970s	
Easy	Mean	80.47	72.40	58.07	61.46	68.75	64.06	67.53
	sd	15.93	11.48	17.90	21.03	21.79	23.61	14.18
Hard	Mean	54.17	59.90	57.55	68.49	61.72	51.04	58.81
	sd	23.38	16.59	14.57	22.37	23.56	26.07	15.44
	Mean	67.32	66.15	57.81	64.97	65.23	57.55	63.17
	sd	16.84	11.04	13.99	19.88	20.89	22.73	14.38

Table 47
Albert Recall Questionnaire Mean Percentage of "Easy" Items Correct (with cues) from the 1970s and "Hard" Items Correct (with cues) from the 1930s

Group		Mean Percentage of Items Recalled	
		"Hard" 1930s	"Easy" 1970s
NC	Mean	54	57
	Adjusted Mean	58	60
AK	Mean	36	24
	Adjusted Mean	39	27
CA	Mean	68	60
	Adjusted Mean	62	53

Note. NC = nonalcoholic controls
AK = alcoholic Korsakoffs
CA = chronic alcoholics

Table 48

Albert Recognition Questionnaire
Mean Percentage of "Easy" Items Correct from the 1970s and "Hard" Items Correct from the 1930s

Mean Percentage of Items Correct

Group		"Hard" 1930s	"Easy" 1970s
NC	Mean	61	68
	Adjusted Mean	56	63
AK	Mean	49	41
	Adjusted Mean	45	36
CA	Mean	67	75
	Adjusted Mean	76	84

Note. NC = nonalcoholic controls
AK = alcoholic Korsakoffs
CA = chronic alcoholics

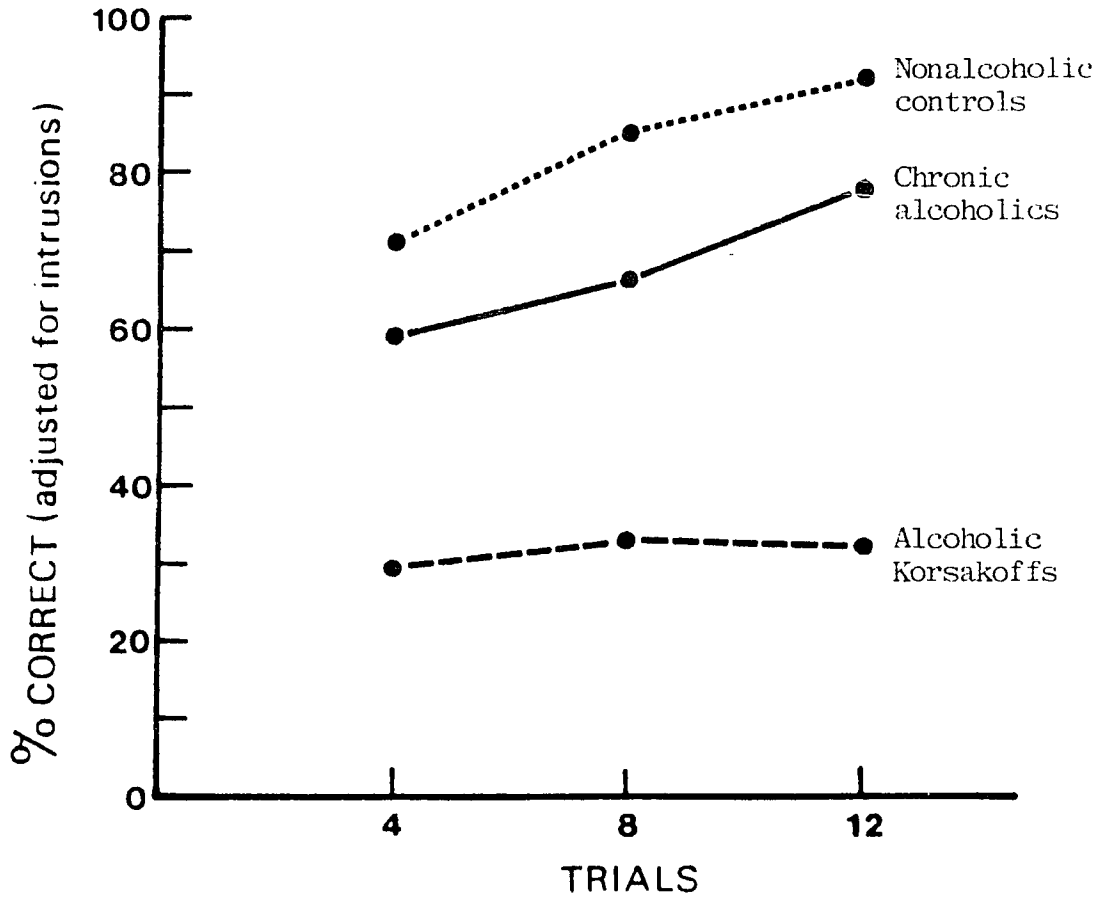


Figure 1. Animal List Group Mean Percentages of Items Correct.

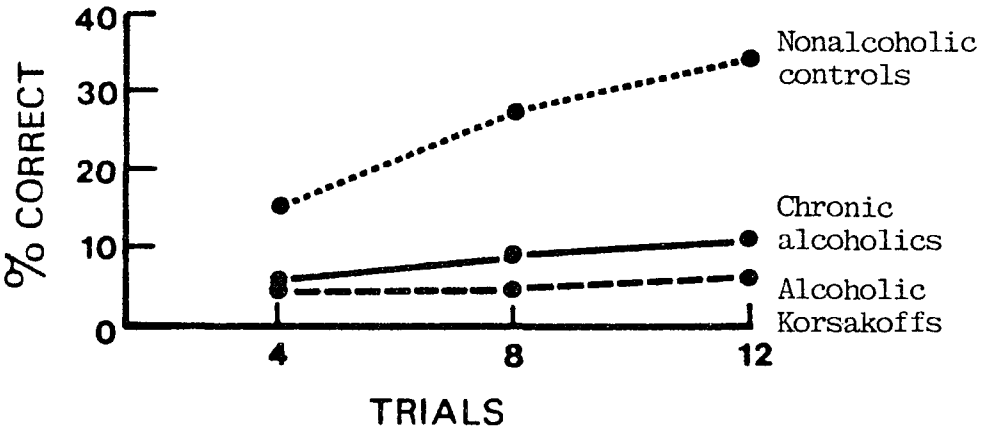


Figure 2. Nonsense Hexagram List Group Mean Percentages of Items Correct.

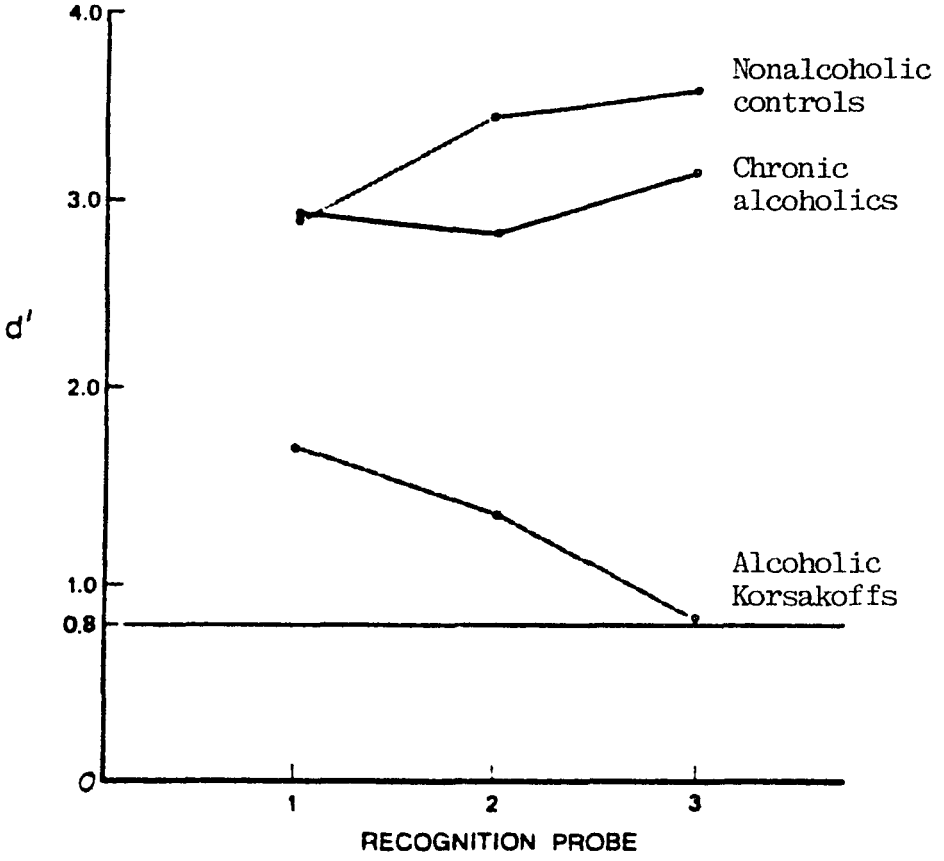


Figure 3. Animal List Group Mean d' Values.

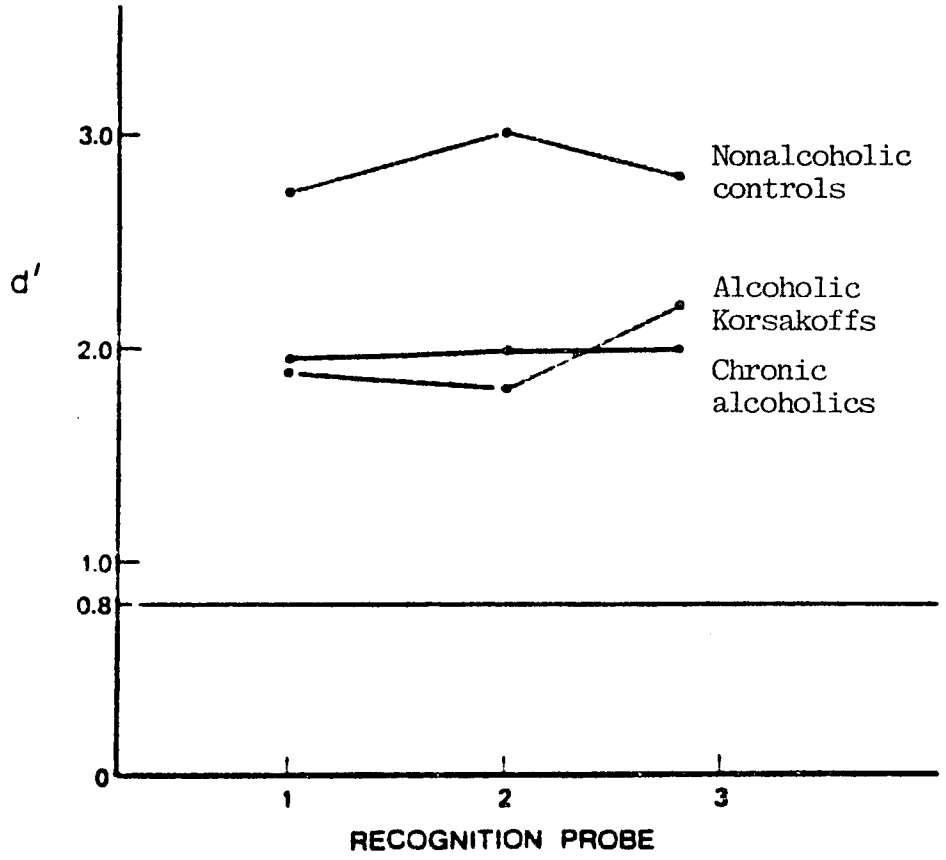


Figure 4. Nonsense Hexagram List Group Mean d' Values.

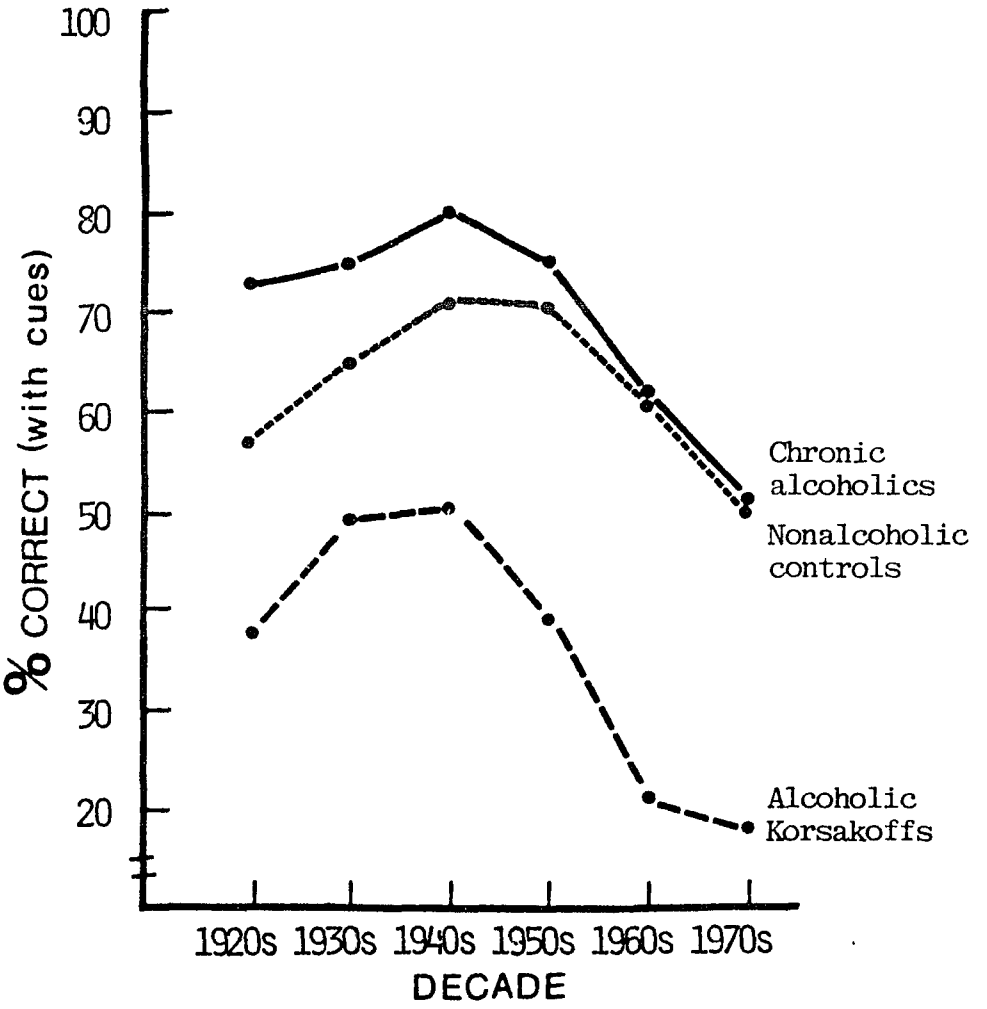


Figure 5. Albert Recall Questionnaire Group Mean Percentages of Items Correct (with cues).

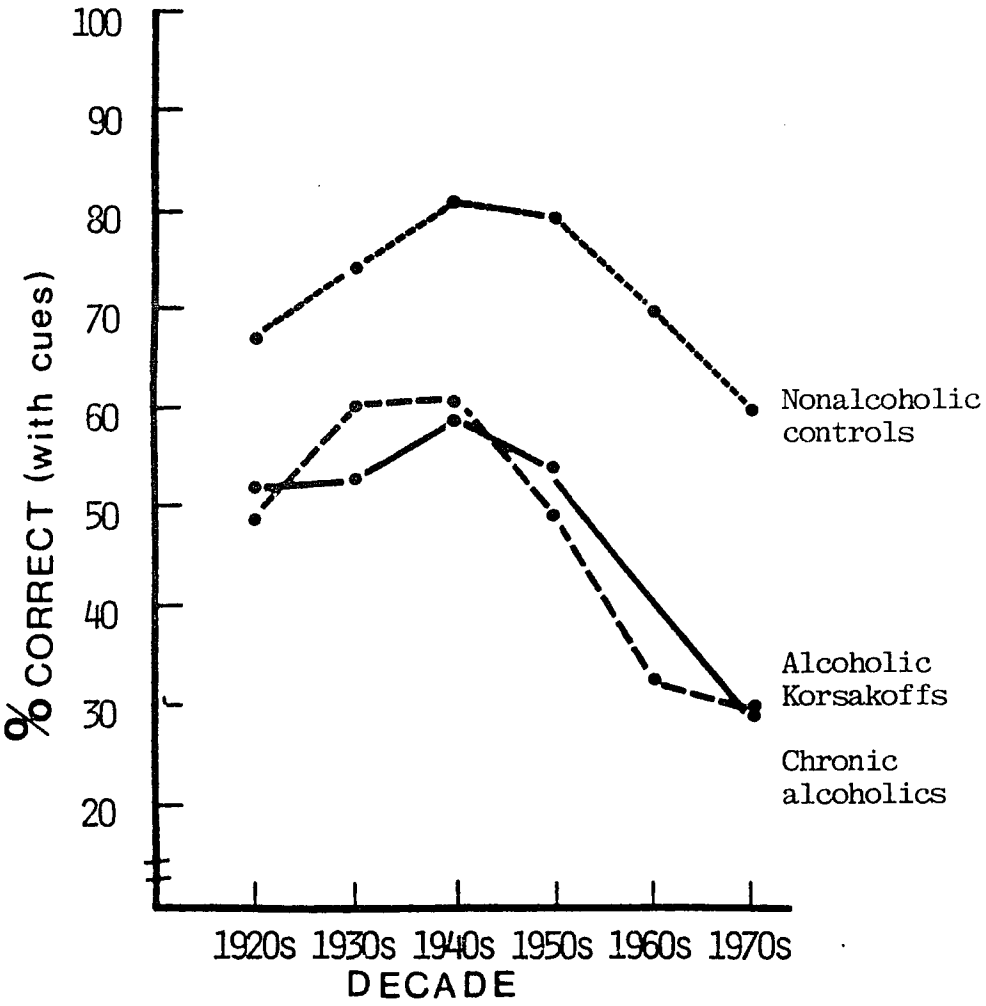


Figure 6. Albert Recall Questionnaire Group Adjusted Mean Percentages of Items Correct (with cues).

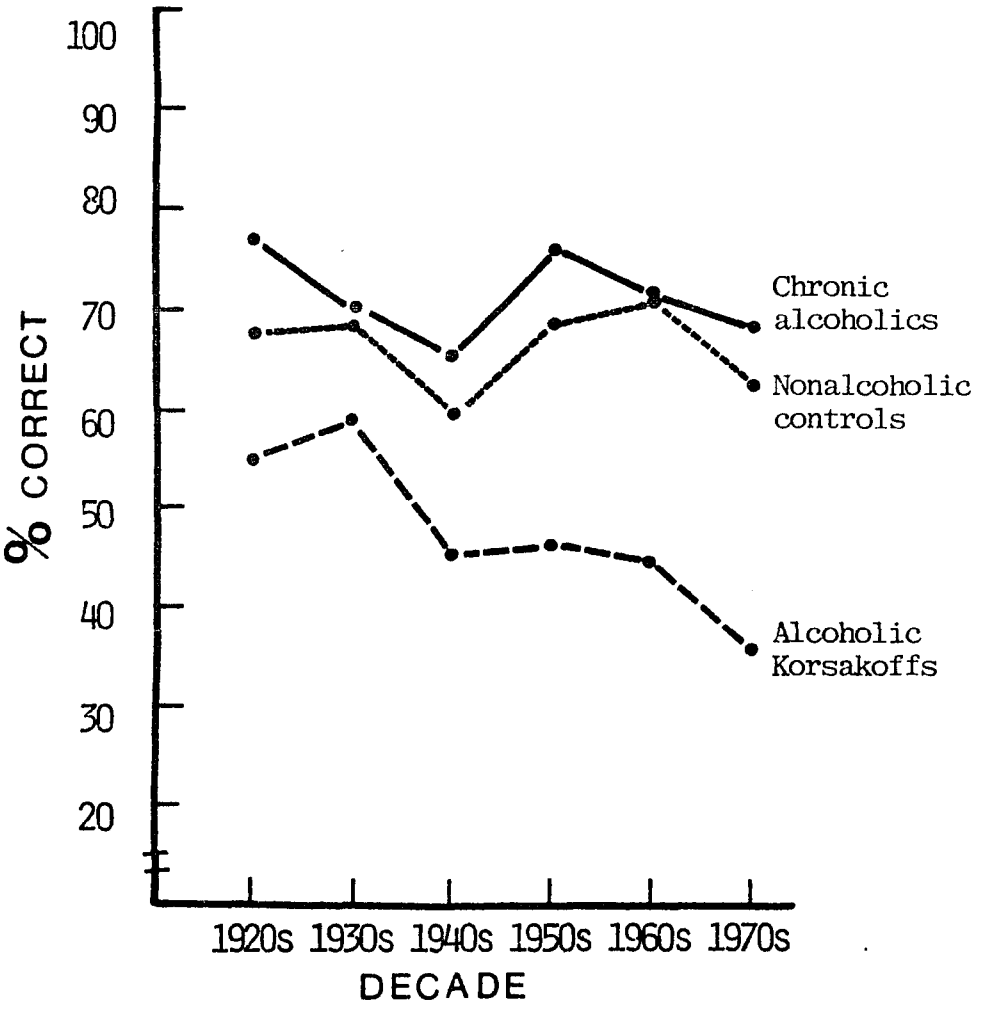


Figure 7. Albert Recognition Questionnaire Group Mean Percentages of Items Correct.

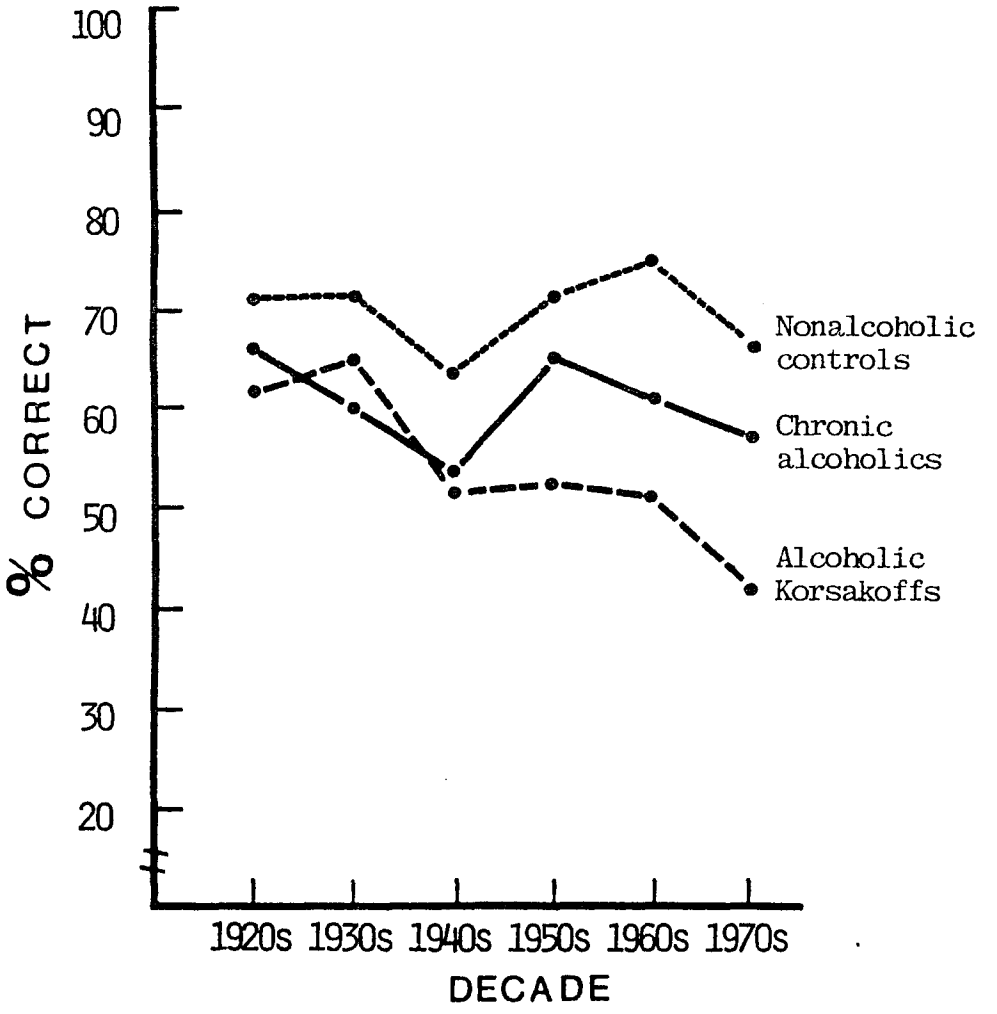


Figure 8. Albert Recognition Questionnaire Group Adjusted Mean Percentages of Items Correct.

Appendix A

Structured Clinical Interview

Personal History

Name: Age:

Education: Date of Birth:

Employment History:

Alcoholic History:

Age for first drink:

Amount and type of liquor per day, week, month:

Number of years of abuse:

Previous periods of abstinence:

Blackouts: Seizures: Withdrawal Symptoms:

Date of onset for present detoxification:

Medical History:

Previous hospitalizations:

General medical condition:

Condition of liver: Present medication:

Other prescribed and/or illicit drug abuse:

Seizures: Head Trauma: Loss of consciousness:

Learning difficulty: Psychiatric difficulty:

Chart Review:

EEG Results: Results of psychological testing:

Primary diagnosis: Secondary diagnosis:

Appendix B

Mattis Organic Mental Status Screening Evaluation (MOMSSE)

Department of Neurology

MATTIS ORGANIC MENTAL SYNDROME SCREENING EXAMINATION
(MOMSSE)

Name _____ D. B.:

Age : Date of Testing:

Hospital # Tested Previously: yes____ no ____

Married - Single - Divorced - Widowed Dates of Previous Examination:

Handedness _____ _____

I. State of Consciousness - Check 1 or more

A. alert _____ lethargic _____ stuperous _____

comatose _____ inattentive _____

B. stable _____ fluctuating _____

C. Since last examination:

stable _____ improved _____ deteriorating _____

II. Insight into illness.

A. Full awareness of symptoms and possible implications _____

B. Awareness of symptoms with denial or partial awareness of possible implications

_____

C. Denial of illness _____

III. Affect. A. depressed _____ hostile _____ flat _____

euphoric _____ labile _____

B. appropriate _____ inappropriate _____

IV. Estimate of Premorbid Intellectual Abilities.

A. Background Data

Educational level _____ Educational level of spouse ____ _____

Where educated _____ Where educated _____

Occupation _____ Occupation of spouse _____

Note. Reprinted by permission of the author.

Examiner's estimate of premorbid intellectual ability:

superior _____ above average _____ average_____

below _____ mentally retarded _____

unknown _____

On remainder of Mental Status Examination begin with items at estimated level of premorbid intelligence. If item is correctly solved give credit for all easier items. If item failed present easier items until correct response is made.

V. General Fund of Information: (Score 1 pt./item - add 1 to Raw Score if age 70+).

A.A. How many senators in United States Senate
90 or 100 acceptable

A. Who wrote Hamlet? (Shakespeare)

A. Capital of Italy? (Rome)

B.A. In what continent is Brazil? (S.A.)

B.A. How many weeks in a year? (52)

Def. Name 4 Presidents of United States since 1900? (any order)

Score	Classification
6	A.A.
4-5	A.
2-3	B.A.
0-1	Def.

VI. Verbal Abstraction: How are a _____ and _____ alike (the same)

		Patient Response	Scoring	
			Abstract (2 points)	Concrete (1 point)
A.A.	poem - statue		works of art, artistic creation	man made, tell stories, make you remember
A.	table - chair		furniture	4 legs, found in house, kitchen
A.	eye - ear		senses, sense organs, receptors	organs, parts of body, you get knowledge from them
B.A.	dog - lion		animals, mammals	4 legs, tail, fur
B.A.	coat - dress		clothing, wearing apparel	made of cloth, keep you warm, to wear
Def.	orange - banana		fruit	you eat, food, same color, have peel

Classification	Score Age 16 - 65	Age 65+
A.A.	11 - 12	9 - 12
A.	7 - 10	5 - 8
B.A.	3 - 6	3 - 4
Def.	0 - 2	0 - 2

VII. Attention: Digit Span - Present 1 digit per 1 second
Discontinue after failure on both trials of a given series.

DIGITS FORWARD

Series	Trial I	Trial II	
(3)	5-8-2	6-9-4	Defective
(4)	6-4-3-9	7-2-8-6	B.A.
(5)	4-2-7-3-1	7-5-8-3-6	A.
(6)	6-1-9-4-7-3	3-9-2-4-8-7	A.
(7)	5-9-1-7-4-2-8	4-1-7-9-3-8-6	A.A.

DIGITS BACKWARD

Series	Trial I	Trial II	
(2)	2-4	5-8	Defective
(3)	6-2-9	4-1-5	B.A.
(4)	3-2-7-9	4-9-6-8	A.
(5)	1-5-2-8-6	6-1-8-4-3	A.
(6)	5-3-9-4-1-8	7-2-4-8-5-6	A.A.

Digits Forward _____ Digits Backward _____

Forward and Backward _____

Add 1 point if age 65+ to sum of Forward and Backward

Classification	Score
A.A.	13+
A.	10 - 12
B.A.	8 - 9
Def.	less than 7

VIII. Memory I.

A. Orientation: year _____ month _____ day _____

date within 5 days _____

Hospital _____ City _____ President _____

Governor _____ Mayor _____

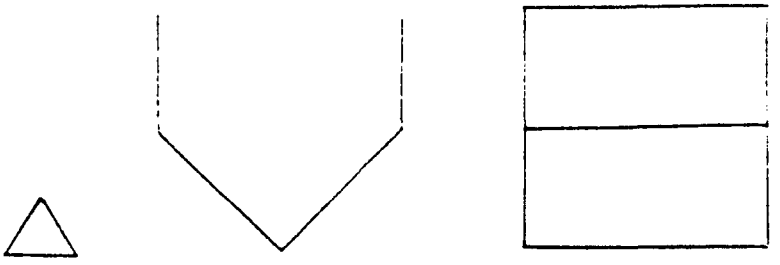
B. Verbal Memory -

I'm going to say a sentence and I want you to repeat it after me. "The purple fox runs". O.K. I want you to remember it because I'm going to ask you to repeat it later.

Now I want you to make up a sentence using the words "boy" and "dog" (Write down sentence). I want you to remember that sentence also because I'm going to ask you to repeat it later.

C. Visual Nonverbal Memory -

Reproduction of design from memory: Expose for 10 seconds - turn page - immediate reproduction



IX. Language:

Anomia - test for objects, body parts, and colors.

Sentence Repetition - "The lady followed the path down the hill toward home".

Triple Commands - close eyes, open mouth, and raise right hand.

Two Commands - put right hand on left ear.

Write - "Most girls like to sew".

Speech - fluent _____ not fluent _____ dysarthric _____

Silent Reading - "Read this silently and do what it says".

CLOSE YOUR EYES AND OPEN YOUR MOUTH

Patient reads aloud -

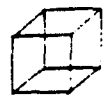
Hundreds of years ago, America was covered with green forests.

Memory II.

Recall of Sentences.

X. Construction:

A. Draw a clock

B. Copy: 

B. Block Design (Necessary materials - WAIS Blocks & Designs)

Demonstrate solution to WAIS Design #2. After scrambling the blocks have patient solve problem. If successful present without demonstration WAIS Designs #4 and #6.

Time limit for solution is 60 seconds.

Score:	Design #2	Design #4	Design #6
	_____ correct (1 pt.)	_____correct (1 pt.)	_____ correct (1 pt.)
	_____incorrect (0)	_____incorrect (0)	_____incorrect (0)
	(Draw Response)	(Draw Response)	(Draw Response)

Total Score: 3 points = Average

Add 1 point over 70+ years: 2 points = Below Average

0 - 1 point = Defective

SUMMARY - MOMSSE

NAME _____ Date of Examination _____

Age: _____ Examiner _____

D.B.: _____ Previous Examination yes _____ no _____

Dates: _____

I. State of Consciousness

II. Affect
Patient testable _____ Untestable _____

III. Insight
A _____ B _____ C _____

IV. *Estimate of Premorbid* Intellectual Abilities
AA _____ A _____ BA _____ Borderline to Retarded _____

V. General Fund of Information
AA _____ A _____ BA _____ Defective _____

VI. Verbal Abstraction
AA _____ A _____ BA _____ Defective _____

VII. Attention
AA _____ A _____ BA _____ Defective _____

VIII. Memory: Orientation Intact _____ Mildly impaired _____ Defective _____
Verbal Memory _____ _____ _____
Visual Memory _____ _____ _____

IX. Language:
Speech Fluent _____ Nonfluent _____
Naming Intact _____ Mildly impaired _____ Severe _____
Comprehension _____ _____ _____
Sentence Repetition _____ _____ _____
Writing _____ _____ _____

X. Construction Skills:
Drawing _____ _____ _____
Block Design _____ _____ _____

XI. Compared with Previous Examination:

Appendix C

Mattis-Kovner Animal List
(Target and Distractor Items)

Target Words	Distractor Words
LION	SKUNK
BEAVER	TIGER
SQUIRREL	MOUSE
RHINOCEROS	JAGUAR
BEAR	HIPPOPOTAMUS
ELEPHANT	RABBIT
HORSE	BULL
CHEETAH	PIG
DONKEY	MONKEY
RACCOON	GAZELLE
ANTELOPE	DEER
RAT	COW
LAMB	ZEBRA
FOX	MULE
SHEEP	CAMEL
BUFFALO	CAT
GOAT	WOLF
LEOPARD	GIRAFFE
DOG	PANTHER
LLAMA	MOOSE

Note. Adapted by permission of the authors.

Appendix D

Mattis-Kovner Nonsense Hexagram List (Target and Distractor Items)

Target Words	Distractor Hexagrams
GOPWAX	JIFRIG
PAKHEP	RAKGUY
LIKRED	HUMROW
HAPNOW	DORPAR
ROGSOD	PULSOW
HUBTUG	PUFMAX
FEMBAN	SURPIT
MOCHID	COMPEG
RIKPUT	NIKMUP
RINMAR	TIKBAY
LOBMUG	SIGMAT
PAKSET	NUMHIK
NORMOB	LINJAP
BORPEN	LEWNAG
DELRUB	SELRUT
DIXPAT	PIKRAN
HUFRIM	HAKWAD
YAMPIG	BOMPIK
NELRAP	CUSLAY
FILKEY	WENSEW

Note. Adapted by permission of the authors.

BIBLIOGRAPHY

Albert, M.S., Butters, N., and Levin, J. Temporal gradients in the retrograde amnesia of patients with alcoholic Korsakoff's disease. Archives of Neurology, 1979a, 36, 211-216.

-----. Memory for remote events in chronic alcoholics and alcoholic Korsakoff patients. In: H. Begleiter and B. Kissin (Eds.), Alcohol Intoxication and Withdrawal. New York: Plenum Press, 1979b.

Altura, B.M., Altura, B.T., and Gebrewold, A. Alcohol-induced spasms of cerebral blood vessels: relation to cerebrovascular accidents and sudden death. Science, 1983, 220, 331-333.

American Psychiatric Association. Task Force on Nomenclature and Statistics. Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III). Washington, D.C.: American Psychiatric Association, 1980.

Archer, E.J. Reevaluations of the meaningfulness of all possible cvc trigrams. Psychological Monographs, 1960, 74, 1-23.

Banks, W.P. Signal detection theory and human memory. Psychological Bulletin, 1970, 74, 81-99.

Barbizet, J. Human Memory and its Pathology. Trans. D.K. Jardine. San Francisco: W.H. Freeman, 1970.

Battig, W.F., and Montague, W.W. Category norms for verbal items in fifty-six categories. Journal of Experimental Psychology Monographs, 1969, 80, 1-46.

Beck, A.T., Ward, C.H., Mendelson, M., Mock, J., and Erbaugh, J. An inventory for measuring depression. Archives of General Psychiatry, 1961, 4, 561-571.

Berglund, M., and Risberg, J. Reversibility in alcohol dementia. In: H. Begleiter and B. Kissin (Eds.), Biological Effects of Alcohol. New York: Plenum Press, 1979.

Blass, J.P., and Gibson, G.E. Abnormality of a thiamine-requiring enzyme in patients with Wernicke-Korsakoff's syndrome. New England Journal of Medicine, 1977, 297, 1367-1370.

Brandt, J., Butters, N., Ryan, C., and Bayog, R. Cognitive loss and recovery in long-term alcohol abusers. Archives of General Psychiatry, 1983, 40, 435-442.

Buschke, H. Selective reminding for analysis of memory and learning. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 543-550.

Butters, N. and Albert M.S. Processes underlying failures to recall remote events. In: L.S. Cermak,(Ed.), Human Memory and Amnesia. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1982.

Butters, N. and Cermak, L.S. The role of cognitive factors in the memory disorders of alcoholic patients with the Korsakoff syndrome. Annals of the New York Academy of Science, 1974, 233, 61-75.

-----. Some analyses of amnesic syndromes in brain-damaged patients. In: R.L. Isaacson and K.H. Pribram (Eds.), The Hippocampus. New York: Plenum Press, 1975.

-----. Neuropsychological studies of alcoholic Korsakoff patients. In: G. Goldstein and C. Neuringer (Eds.), Empirical Studies of Alcoholism. Cambridge, Massachusetts: Ballinger Publishing Company, 1976.

-----. Alcoholic Korsakoff's Syndrome: An Information Processing Approach to Amnesia. New York: Academic Press, Inc., 1980.

Butters, N., Cermak, L.S., Montgomery, K., and Adinolfi, A. Some comparisons of the memory and visuoperceptive deficits of chronic alcoholics and patients with Korsakoff's disease. Alcoholism: Clinical and Experimental Research, 1977, 1, 73-80.

Carlen, P.L., Wortzman, G., Holgate, R.C., Wilkinson, D.A., and Rankin, J.G. Reversible cerebral atrophy in recently abstinent chronic alcoholics measured by computed tomography scans. Science, 1978, 200, 1076-1078.

Cermak, L.S. The encoding capacity of a patient with amnesia due to encephalitis. Neuropsychologia, 1976, 14, 311-326.

-----. Amnesic patients' level of processing. In: L.S. Cermak and F.I.M. Craik (Eds.), Levels of Processing in Human Memory. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1979.

-----. Human Memory and Amnesia. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1982.

Cermak, L.S., Butters, N., and Moreines, J. Some analyses of the verbal encoding deficit of alcoholic Korsakoff patients. Brain and Language, 1974, 1, 141-150.

Cermak, L.S., and Ryback, R.S. Recovery of verbal short-term memory in alcoholics. Journal of Studies on Alcohol, 1976, 37, 46-52.

Cohen, N.J. and Squire, L.R. Retrograde amnesia and remote memory impairment. Neuropsychologia, 1981, 19, 337-356.

Courville, C.B. Effects of Alcohol on the Nervous System of Man. (2nd ed.) Los Angeles: San Lucas Press, 1966.

Ellenberg, L., Rosenbaum, G., Goldman, M.S., and Whitman, R.D. Recoverability of psychological functioning following alcohol abuse: Lateralization effects. Journal of Consulting and Clinical Psychology, 1980, 48, 503-510.

Fabian, M.S., and Parsons, O.A. Differential improvement of cognitive functions in recovering alcoholic women. Journal of Abnormal Psychology, 1983, 92, 87-95.

Fedio, P. and Van Buren, J. Memory deficits during electrical stimulation of the speech cortex in conscious man. Brain And Language, 1974, 1, 29-42.

Feuerlein, W. and Heyse, H. Die weite der 3. Hirnkammer bei alcoholikern. Archive fur Psychiatrie und Nervekrankheiten, 1970, 213, 78-85.

Fitzhugh, L.C., Fitzhugh, K.B. and Reitan, R.M. Adaptive abilities and intellectual functioning in hospitalized alcoholics: Further considerations. Quarterly Journal of Studies in Alcoholism, 1965, 26,402-411.

Freund, G. The interaction of chronic alcohol consumption and aging on brain structure and function. Alcoholism: Clinical and Experimental Research, 1982,6, 13-21.

Glosser, G., Butters, N., and Kaplan, E. Visuoperceptual processes in brain-damaged patients on the digit symbol substitution test. International Journal of Neuroscience, 1977, 7, 59-66.

Goldman, M.S. Reversibility of psychological deficits in alcoholics: The interaction of aging with alcohol. In: D.A. Wilkinson (Ed.), Cerebral Deficits in Alcoholism. Toronto, Canada: Addiction Research Foundation, 1982.

-----. Cognitive impairment in chronic alcoholics: Some cause for optimism. American Psychologist, 1983, 38, 1045-1054.

Goldman, M.S.,Williams, D.L., and Klisz, D.K. Recoverability of psychological functioning following alcohol abuse: Prolonged visual-spatial dysfunction in older alcoholics. Journal of Consulting and Clinical Psychology, 1983, 51, 370-378.

Grant, I., Reed, R. and Adams, K.M. Natural history of alcohol and drug-related brain disorder: Implications for neuropsychological research. Journal of Clinical Neuropsychology, 1980,2, 321-331.

Hansen, L. Treatment of reduced intellectual functioning in alcoholics. Journal of Studies on Alcohol, 1980, 41, 156-158.

Horvath, T.B. Clinical Spectrum and epidemiological features of alcoholic dementia. In: J.D. Rankin, (Ed.), Alcohol, Drugs and Brain Damagge. Toronto, Canada: House of Lind., 1975.

Jenkins, R.L., and Parsons, O.A. Recovery of cognitive abilities in male alcoholics. In: M. Galanter (Ed.), Currents in Alcoholism , (Volume 7). New York: Grune & Straton, 1980.

Jonsson, C.O., Cronholm, B. and Izikowitz, S. Intellectual changes in alcoholics: Psychometric studies on mental sequels of prolonged intensive abuse of alcohol. Quarterly Journal of Studies in Alcohol, 1962,23, 221-242.

Jones, B.P., Butters, N., Moskowitz, H.R., and Montgomery, K. Olfactory and gustatory capacities of alcoholic Korsakoff patients. Neuropsychologia, 1978, 16, 323-337.

Kapur, N. and Butters, N. Visuoperceptive deficits in long-term alcoholics and alcoholics with Korsakoff's psychosis. Journal of Studies on Alcohol, 1977, 38, 2025-2035.

Kirk, R.E. Experimental Designs: Procedure for the Behavioral Sciences. Belmont, California: Brooks Cole, 1968.

Kish, G.B., Hagen, J.M. Woody, M.M., and Harvey, H.L. Alcoholics' recovery from cerebral impairment as a function of duration of abstinence. Journal of Clinical Psychology, 1980,36, 584-589.

Klisz, D.K. and Parsons, O.A. Hypothesis testing in younger and older alcoholics. Journal of Studies on Alcohol, 1977,38, 1718-1729.

Kleinknecht, R.A. and Goldstein, S.G. Neuropsychological deficits associated with alcoholism. Quarterly Journal of Studies on Alcohol, 1972,33, 999-1019.

Kovner, R., Mattis, S., Goldmeier, E., and Davis, L. Korsakoff amnesic syndrome: The result of simultaneous deficits in several independent processes? Brain and Language, 1981a, 12, 23-32.

Kovner, R., Mattis, S., Gartner, J., and Goldmeier, E. A verbal semantic deficit in the alcoholic Korsakoff Syndrome. Cortex, 1981b, 17, 419-426.

Laine, M. & Butters, N. A preliminary study of the problem solving strategies of detoxified long-term alcoholics. Drug and Alcohol Dependence, 1982, 10, 235-242.

Lhermitte, F. and Signoret, J.L. Analyse neuropsychologique et differenciation des syndromes amnesiques. Revue Neurologique, 1972, 126, 161-178.

Lishman, W.A. Cerebral disorder in alcoholism: Syndromes of impairment. Brain, 1981, 104, 1-20.

MacVane, J., Butters, N., Montgomery, K., and Farber, J. Cognitive functioning in men social drinkers: A replication study. Journal of Studies on Alcohol, 1982, 43, 81-95.

Marslen-Wilson, W.D., Teuber, H.L. Memory for remote events in anterograde amnesia: Recognition of public figures from newsphotographs. Neuropsychologia, 1975, 13, 353-364.

Mattis, S., Kovner, R. and Goldmeier, E. Different patterns of mnemonic deficits in two organic amnestic syndromes. Brain and Language, 1978, 6, 179-191.

Mattis, S., Kovner, R., Gartner, J., and Goldmeier, E. Deficits in retrieval of category exemplars in alcoholic Korsakoff patients. Neuropsychologia, 1981, 19, 357-363.

Milner, B. Amnesia following operation on the temporal lobes. In: C.W.M. Whitty and O.L. Zangwill (Eds.), Amnesia. London: Butterworths , 1966.

Milner, B., Corkin, S., and Teuber, H.L. Further analysis of the hippocampal amnesia syndrome: 14-year follow-up of H.M. Neuropsychologia, 1968,6, 215-234.

Oscar-Berman, M. Hypothesis testing and focusing behavior during concept formation by amnesic Korsakoff patients. Neuropsychologia, 1973,11, 191-198.

-----. Neuropsychological consequences of long-term chronic alcoholism. American Scientist, 1980, 68, 410-419.

Oscar-Berman, M., and Samuels, I. Stimulus-preference and memory factors in Korsakoff's syndrome. Neuropsychologia, 1977, 15, 99-106.

Parker, E.S., Birnbaum, I.M., Boyd, R.A., and Noble, E.P. Neuropsychologic decrements as a function of alcohol intake in male students. Alcoholism: Clinical and Experimental Research, 1980, 4, 330-334.

Parker, E.S. and Noble E.P. Alcohol consumption and cognitive functioning in social drinkers. Journal of Studies on Alcohol, 1977, 38, 1224-1232.

Parsons, O.A. and Farr, S.P. The neuropsychology of alcohol and drug use. In: S. Filskov and T. Boll (Eds.), Handbook of Clinical Neuropsychology. New York: Wiley, 1981.

Parsons, O.A., and Leber, W.R. The relationship between cognitive dysfunction and brain damage in alcoholics: Causal, interactive, or epiphenomenal? Alcoholism: Clinical and Experimental Research, 1981,5, 326-343.

-----. Premature aging, alcoholism, and recovery. In: W.G. Wood and M.F. Elias (Eds.), Alcohol and Aging: Advances in Research. Boca Raton, Florida: CRC Press, 1982.

Parsons, O.A., and Prigatano, G.P. Memory functioning in alcoholics. In: I.M. Birnbaum and E.S. Parker (Eds.) Alcohol and Human Memory. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1977.

Parsons, O. Tarter, R., and Jones, B. Cognitive deficits in chronic alcoholics. Il Lavoro Neuro-Psichiatrico, 1971, 49,5-14.

Porjesz, B. and Begleiter, H. Brain dysfunction and alcohol. In: Kissin and H. Begleiter (Eds.), The Pathogenesis of Alcoholism, (Volume 7). New York: Plenum Press, 1983.

Ryan, C. Learning and memory deficits in alcoholics. Journal of Studies on Alcohol, 1980, 41, 437-447.

Ryan, C. Learning and Memory deficits in alcoholics. Journal of Studies on Alcohol, 1980, 41, 437-447.

Ryan, C. and Butters, N. Further evidence for a continuum-of-impairment encompassing male alcoholic Korsakoff patients and chronic alcoholics. Alcoholism: Clinical and Experimental Research, 1980, 4,190-194.

-----. Learning and memory impairments in young and old alcoholics: Evidence for the premature-aging hypothesis. Alcoholism, 1980, 4,. 288-293.

-----. Cognitive deficits in alcoholics. In: B. Kissin and H. Begleiter (Eds.), The Pathogenesis of Alcoholism, (Volume 7). New York: Plenum Press, 1983.

Ryan, C., Butters, N., Montgomery, K., Adinolfi, A., and Didario, B. Memory deficits in chronic alcoholics: Continuities between the "intact" alcoholic and the alcoholic Korsakoff patient. In: H. Begleiter and B. Kissin (Eds.), Alcohol Intoxication and Withdrawal. New York: Plenum Press, 1979.

Ryback, R.S. The continuum and specificity of the effects of alcohol on memory: A review. Quarterly Journal of Studies on Alcohol, 1971, 32, 995-1016.

Sanders, H. The problems of measuring very long-term memory. International Journal of Mental Health, 1972, 1, 98-102.

Sanders, H.I., and Warrington, E.K. Memory for remote events in amnesic patients. Brain, 1971, 94, 661-668.

-----. Retrograde amnesia in organic amnesic patients. Cortex, 1975, 11, 397-400.

Schau, E.J., O'Leary, M.R., and Chaney, E.F. Reversibility of cognitive deficit in alcoholics. Journal of Studies on Alcohol, 1980, 41, 733-740.

Seltzer, B., and Benson D.F. The temporal pattern of retrograde amnesia in Korsakoff's disease. Neurology, 1974, 24, 527-530.

Squire, L.R. A stable impairment in remote memory following electroconvulsive therapy. Neuropsychologia, 1975, 13, 51-58.

Squire, L.R. and Cohen, N.J. Remote memory, retrograde amnesia, and the neuropsychology of memory. In: L. Cermak (Ed.), Human Memory and Amnesia. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1982.

Squire, L.R., Slater, P.C. and Chace, P.M. Retrograde amnesia: Temporal gradient in very long term memory following electroconvulsive therapy. Science, 1975, 187, 77-79.

Talland, G.A. Deranged Memory: A Psychonomic Study of the Amnesia Syndrome. New York: Academic Press, 1965.

Tarter, R.E. An analysis of cognitive deficits in chronic alcoholics. Journal of Nervous and Mental Disease, 1973, 157,138-147.

-----. Psychological deficit in chronic alcoholics: A review. The International Journal of the Addictions, 1975, 10, 327-368.

-----. Brain damage in chronic alcoholics: A review of the psychological evidence. In: D. Richter (Ed.), Addiction and Brain Damage. London: Croom Helm, 1980.

Tarter, R.E. and Alterman, A. I. Neuropsychological deficits in alcoholics: Etiological considerations. Journal of Studies on Alcohol, 1984, 42, 1-9.

Tarter, R.E. and Parsons, O.A. Conceptual shifting in chronic alcoholics. Journal of Abnormal Psychology, 1971, 77, 71-75.

Victor, M. Neurologic disorders due to alcoholism and malnutrition. In: A.B. Baker and L.H. Baker (Eds.), Handbook of Clinical Neurology. New York: Harper & Row, 1979.

Victor, M., Adams, R.D., and Collins, G.H. The Wernicke Korsakoff Syndrome. Philadelphia: F.A. Davis, 1971.

Walker, D.W., Barnes, D.E., Zornetzer, S.F., Hunter, B.E., and Kubanis, P. Neuronal loss in hippocampus induced by prolonged ethanol consumption in rats. Science, 1980, 209, 711-713.

Warrington, E.K. and Silberstein, M. A questionnaire technique for investigating very long term memory. Quarterly Journal of Experimental Psychology, 1970, 22, 508-512.

Warrington, E.K. and Weiskrantz, L. Amnestic syndrome: Consolidation or retrieval? Nature, 1970, 228, 628-630.

Wechsler, D. The effect of alcohol on mental activity. Quarterly Journal of Studies on Alcohol, 1941, 2, 479-485.

-----. The Measurement of Adult Intelligence. Baltimore: Williams and Wilkins, 1944.

Wechsler, D. Manual for the Wechsler Adult Intelligence Scale. New York: Psychological Corporation, 1955.

Weingartner, H., Faillace, L.A., and Markley, H.G. Verbal information retention in alcoholics. Quarterly Journal of Studies in Alcohol, 1971, 32, 293-303.

Wilkinson, D.A. Accelerated mental aging in alcoholism: Working hypothesis or uncontrolled variable? In: D.A. Wilkinson (Ed.), Cerebral Deficits in Alcoholism. Toronto, Canada: Addiction Research Foundation, 1982.

Wilkinson, D.A., and Carlen, P.L. Chronic organic brain syndromes associated with alcoholism: Neuropsychological and other aspects. In: Y. Israel et al. (Eds.), Research Advances in Alcohol and Drug Problems, (Volume 6). New York: Plenum Press, 1981.

Williams, H.L., and Rundell, O.H., Jr. Altered sleep physiology in chronic alcoholics: Reversal with abstinence. Alcoholism: Clinical and Experimental Research, 1981, 5, 318-325.