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State Dependent Learning: The Effects of Alcohol on Learning and Recall of Information About Alcohol Abuse and Its Consequences Among Light and Heavy Social Drinkers

By

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STATE DEPENDENT LEARNING: THE EFFECTS OF ALCOHOL ON LEARNING AND RECALL OF INFORMATION ABOUT ALCOHOL ABUSE AND ITS CONSEQUENCES AMONG LIGHT AND HEAVY SOCIAL DRINKERS

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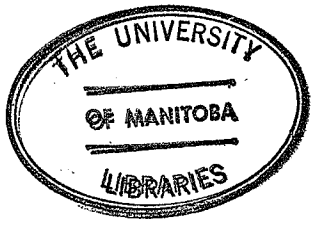

DEDICATION

To my parents who taught me the importance of hard work and compassion for my fellow man.

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I would like to express my sincere appreciation to my committee members who allowed me the freedom to develop and conduct this research in my own way and particularly to Ross Hartsough, my advisor, whose confidence, prodding and support played a deciding role in bringing this project to completion. Also, Dan Harper, my internal-external examiner, was responsible for making available the equipment and supplies needed for the breathalyzer measurements. I also wish to thank Lorne Sexton, a fellow student, for his many useful comments and sound advice during the initial planning stages, the two registered nurses, Ora Zablowski and Linda McCray, who played indispensable roles in conducting the drinking experiment, and to my impeccable typist, Vickki Wood, who tolerated my many unreasonable demands. And last, but not least, this project would not have been possible without the financial support and encouragement given me by my parents, Gladys and Medard, whose confidence sustained me through several, rather difficult years in graduate school.

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Abstract

Several researchers have pointed out the possible ecological and thereapeutic significance of state dependent learning for problems of alcohol abuse and its treatment. These speculations have been based on findings from both animal and human experiments in which relatively simple kinds of learning tasks, which lend themselves to easy and accurate quantification and experimental control, have been employed. However, since there is abundant evidence from this research that the presence or absence of state dependent effects often depends on the specific kind of learning task used, the external validity of these findings for practical concerns about failures of therapeutic gains acquired while sober to transfer effectively to later occasions involving alcohol consumption can be seriously questioned. It seemed reasonable that, in order to more validly determine the practical significance of state dependent learning for therapeutic efforts, a first step would be to examine kinds of learning experiences which more closely approximate those characteristics of existing forms of treatment.

The present study was conducted to determine if state dependent learning could be demonstrated for information acquired through exposure to realistic, filmed material of the variety used by programs designed to prevent alcohol abuse and its consequences. Nonalcoholic, social drinkers were shown two educational films, an alcoholism film and a control film unrelated to alcohol abuse while intoxicated or sober and were tested for recall of sampled information from the films both immediately after and again twenty-four hours later under either similar

or alternate state conditions. Immediate and delayed recall of factual information from the films was assessed by questionnaires using a fill-in-the-blank format with delayed recall being measured by both an alternate form and a test-retest method. Later recall of judgment ratings made by the Ss immediately after the films about their subjective reactions to the material presented was also evaluated. Self-report data on the drinking habits and various alcohol-related experiences of the Ss were also collected and an attempt was made to determine possible relationships between these measures and recall performance under alternate state conditions.

The results pertaining to learning and recall of factual information from the films indicated that (1) mild to moderate degrees of alcohol intoxication had no significant effect on the amount of sampled information acquired through exposure to either of the films, (2) evidence of state dependent learning was found on the test-retest method of delayed recall assessment but not on the alternate form method for the alcoholism film, and on the alternate form measure but not on the test-retest measure for the control film, and (3) no significant differences were found between the light and heavy drinkers on measures of original learning or later recall under alternate state conditions. Evidence of state dependent learning was also found for later recall of judgments made about subjective reactions to the films. However, in this case, state dependent effects were found to be similar for both films and also a function of previous drinking experience whereby the light drinkers were significantly more impaired in their recall attempts than the heavy drinkers by changes in state. And lastly, self-report data about the frequency of experienced state dependent-like memory phenomena associated with previous occasions of

alcohol intoxication were not found to be good predictors of recall performance under alternate state conditions in the drinking experiment.

The implications of these findings for therapeutic concerns about problems of effective transfer arising from state specificity were discussed and it was concluded that future research employing learning experiences more akin to those for which predictions are being attempted is needed to provide definitive answers to some of these practical questions about the ecological significance of human state dependent learning.

The terms 'state dependent' and 'dissociated' learning have been used to describe an intriguing phenomenon reported in numerous animal and human studies investigating the effects of various pharmacological agents on learning and memory. In addition to expected deficits arising from specific drug effects on the performance of a learned response, a change in 'state' has often been reported to have produced a substantial performance decrement as well. Behaviors acquired under drugged conditions seem to be best elicited at later times while similarly drugged, and often either partially or totally fail to transfer to the nondrugged state. Conversely, behaviors acquired under nondrugged conditions often fail to transfer to the drugged state. In short, these observations suggest that the performance of a learned response is dependent, at least in part, on the presence of a similar state, defined either in behavioral, pharmacological or biochemical terms, to that which was present during the acquisition of that response.

During its forty year history of experimental investigation, the phenomenon of state dependent learning has attracted an ever-increasing number of investigators from many diverse fields for many different reasons. For instance, psychopharmacologists, who initially considered dissociated learning to be a nuisance variable which needed to be controlled for in investigating behavioral effects of drugs, currently employ the phenomenon as a criterion for drug classification. Physiological psychologists have viewed state dependent learning as a possible means of uncovering neurochemical mechanisms of memory. Classical and operant conditioning researchers have been attracted to the possibility of its use to investigate conditioning based on internal stimuli. Cognitive theorists have attempted to use the phenomenon to investigate human memory

processes and develop information processing models of memory. And applied psychologists have been concerned by the practical implications of dissociation for drug abuse and therapies. As a consequence, there is at present not one but several rather distinct lines of research interest which have evolved in this rapidly growing field of investigation.

The scope of the present review will necessarily be restricted with a primary focus on published investigations of alcohol state dependent learning in man. However, because of the similarity and repetitive nature of many of the current issues and themes prevalent in this body of research to those present in the field as a whole, this review will be preceded by (1) a survey of the historical highlights of current interest in dissociated learning, and (2) an overview of some of the major trends, issues and findings apparent in comtemporary research.

Historical Background of Research on State Dependent Learning

The formal beginning of research on drug-induced, state dependent learning is usually ascribed to Girden and Culler's (1937) investigations of the effects of curare on conditioned leg flexion in dogs. Basically, they found that (1) curare did not impede the rate of development of the conditioned response to the sound of a bell, (2) the conditioned response established under curare vanished on return to the normal state and reappeared only after re-curarization, (3) a conditioned response established in the normal state disappeared while under curare and reappeared only after return to normal, and (4) two, distinct conditioned responses could be established to the same stimulus, one under curare and the other in the normal state, in the same animal, and that their subsequent elicitation depended upon reinstating the drug conditions present at time of their acquisition. They coined the term 'dissociation

of learning' to describe this absence of transfer of training between the curare and normal states. These initial findings were subsequently replicated and extended by other studies in which dissociation was observed with curare and other drugs, which also produce muscular paralysis, using other animal species and other classically conditioned responses (e.g., Girden, 1942a; Girden, 1942b; Girden, 1942c).

The next independent report of state dependent learning was published by Conger (1951). In an attempt to further investigate the observations of Masserman and Yum (1946) on the effects of alcohol on neurotic behavior in cats, he successfully demonstrated the 'disinhibiting' properties of alcohol on an approach-avoidance conflict in rats. In a second experiment, Conger found that alcohol selectively reduced the avoidance tendency, but not the approach tendency of rats in which a simple approach-avoidance conflict had been established under sober conditions. Once having established that the disinhibiting effects of alcohol on conflict behavior resulted from the production of a decrease in the avoidance response motivated by fear, he attempted to determine the basis of this effect. He reasoned that in addition to the obvious interpretation that alcohol was having a specific effect on some underlying fear mechanism, his results might simply have been produced by a change in the animal's stimulus situation resulting from inebriation by introducing a variety of novel sensations (tingling, staggering, etc.). His colleagues, Miller and Kraeling (1952) had demonstrated that an approach-avoidance conflict, established in a narrow, black alley, could be effectively eliminated by a shift in locale to a wide, white alley (stimulus generalization decrement). And a second study by Murray and Miller (1952) had shown that this stimulus change

effect was much greater in reducing avoidance responses motivated by fear than approach responses motivated by hunger. To investigate this possibility, Conger ran a final experiment to determine if animals could establish a reliable discrimination based solely on the presence or absence of intoxication. One group of animals was trained to run down an alley to a goal box for food after an injection of alcohol, but to avoid electric shock in the same goal box after an injection of water. A second group was trained in the reverse order to avoid after alcohol and approach after water. He found that both groups were able to learn the discrimination task, and that the first group acquired it more rapidly than the second group. Conger interpreted these findings as support for both hypotheses. He concluded that since both groups learned the discrimination, alcohol must have changed the stimulus situation for the rat, but that in addition the group which was favored by any fear-reducing effects of alcohol did in fact learn the discrimination more rapidly.

Neal Miller, in a series of review articles on psychopharmacological studies of the motivational effects of drugs (Miller, 1957; Miller and Barry, 1960; Miller, 1961) emphasized the need to control for drug-induced stimulus change in future investigations as highlighted by Conger's findings. As a method of control, he recommended the use of a 2 x 2 factorial design as diagrammed below.

		Testing State: Drug	Testing State: No Drug
Training State	Drug	D-D	D-N
	No Drug	N-D	N-N

Procedurally, half the subjects receive initial training when drugged and the other half when not drugged. Then each of these two groups is split into two halves, one of which is tested for the learned response when drugged and the other when not drugged. In this design, four treatment groups are required. Computationally, comparison of the row sums (D-D + D-N to N-D + N-N) indicates the effects on test performance of having had the drug during previous training, comparison of the column sums (D-D + N-D to D-N + N-N) indicates the effects on test performance of having the drug during testing, and comparison of the diagonal sums (D-D + N-N to D-N + N-D) indicates the effects on test performance of having changed the drug state from training to testing (i.e., the training state by testing state interaction).

Most of the studies investigating drug effects on learned behavior, at that time, typically had employed a design where animals were first trained under no drug conditions and drug effects were then evaluated by comparing subsequent performance of half the animals under drug conditons to the remainder under no drug conditions (i.e., comparison on test performance of groups N-D to N-N). Miller pointed out that any existing differences in test performance might be the result of either the action of specific drug effects on performance, or the more indirect effects of drug-induced, stimulus change, or both. Miller argued that by including the remaining two groups (D-D and D-N) to balance the design, these two possible sources of performance differences could be independently evaluated.

Grossman and Miller (1961) reported the first study to use this completely balanced design in evaluating the fear-reducing effects of alcohol and chlorpromazine on an approach-avoidance conflict in rats. All

the animals received preliminary approach training under no drug conditions. Then half of them received avoidance training under drug conditions, while the other half received similar training under no drug conditions. These two groups were then halved again, with each half receiving test trials under either drug or no drug conditions. Their analysis of the test performance data, which was a measure of approach tendency, indicated (1) no effect of having had the drugs during avoidance training (D-D + D-N = N-D + N-N), (2) a significant effect of having had the drugs during testing (D-D + N-D > D-N + N-N), and (3) no effect of having changed the drug state from training to testing (D-D + N-N = D-N + N-D). They concluded that the fear-reducing effects of alcohol and chlorpromazine on conflict behavior were the result of the specific drug actions on the avoidance response rather than the effects of stimulus change, as inferred from their finding that the changes in drug conditions from training to testing did not affect test performance.

In contrast to Grossman and Miller's (1961) findings, however, two subsequent studies were reported in which convincing demonstrations of state dependent learning were obtained. Otis (1964) in a study investigating the effects of chlorpromazine on the performance of an active avoidance, pole jumping response in rats reported that in addition to a retarding effect of the drug on response acquisition, a significant state change effect was observed. Rats which were trained under the influence of chlorpromazine and tested under saline and those which were trained under saline and tested under chlorpromazine showed less recovery of the avoidance response than animals which received only saline, or only chlorpromazine during training and testing. In other words, the state change groups (N-D and D-N) showed less recovery of original learning than did the same state groups

(D-D and N-N) which is indicative of state dependent learning (state change effects) as defined by Miller's design.

The second convincing demonstration of state dependent learning was reported by Overton (1964) in a series of experiments designed to extend some of Girden and Culler's (1937) observations. Overton sought to determine (1) if a centrally acting drug (pentobarbital) in contrast to those previously investigated which had strong peripheral actions (curare, etc.) might also produce dissociated learning, and (2) if operant responses were also subject to state dependent effects as classically conditioned ones had been shown to be. In the first experiment, he found that rats trained to escape to one side of a T-maze while in one state, as induced by pentabarbital or saline injections, responded randomly when tested in the alternative state. Other animals given discrimination training based on drug state (pentobarbital, turn left; saline, turn right) when tested alternatively in either state gave responses appropriate to their existing state. In a second study, rats were trained to one side while in one state, then retrained to the same side while in the alternate state. Retraining took as long as original training which indicated that no transfer of training had occurred between the two states. A third experiment showed that opposite response tendencies could be established in the same animal concurrently by alternating training trials in the two states. Rate of acquisition for learning opposite responses in alternate states was identical to that of animals learning a single response in either state indicating that there was no interference generated by learning antagonistic responses simultaneously in different states. A fourth experiment demonstrated that the amount of dissociation observed was a function of dosage size. And a fifth experiment compared the effectiveness of the

presence and absence of drug state in controlling differential responses to that of various exteroceptive stimuli (multiple stimuli-visual, auditory and tactile; single stimulus-visual), interoceptive stimuli (peripherally acting drugs--gallamine and tetiaethylammonium), and drive states (food and water deprivation). Pentobarbital was found to establish respond control significantly faster than any other condition which implied that dissociation could not be accounted for by peripherally induced, stimulus change, and seemed to be more likely the result of drug-induced alterations of the central nervous system itself.

In sum, Overton's experiments clearly demonstrated that (1) centrally acting drugs can produce dissociated learning of operant responses, (2) centrally acting drugs can acquire discriminative control over operant responses, (3) drug-induced performance decrements can result from state change rather than specific drug actions on performance variables, and (4) dissociation may not be the product of peripheral stimulus change as suggested by others (Conger, 1951; Miller, 1960; Otis, 1964) but may reflect some unknown action of the drug in temporarily altering the function of the central nervous system. By and large, Overton's convincing demonstrations of state dependent learning, along with that of Otis (1964), have been responsible for renewed interest in dissociation and have resulted in its general acceptance as a bone fide phenomenon of unknown origin.

Overview of Contemporary Research on State Dependent Learning

During the last fifteen years, a host of studies investigating drug-induced state dependent learning both in a variety of animal species and in man have been reported. An exhaustive review of the literature will not be attempted. The last attempt was made by Overton (1968). More recent

reviews have been selective, reflecting the sheer number of published reports as well as a growing tendency toward specialization of interest apparent in current research. Accordingly, an attempt will be made to describe broadly some of the major trends, issues and findings which have emerged to date. For convenience, animal and human research will be considered separately. This general overview of contemporary research will then be followed by a more detailed discussion of existing studies on alcohol state dependent learning in man which is the area of immediate interest for the present investigation.

Animal Research

Basically, two rather distinct lines of research with animals have evolved since Overton's (1964) demonstrations of state dependent learning. Overton (1972) has classified these two research strategies as 'drug discrimination' procedures and 'transfer' procedures.

In the drug discrimination approach, animals typically are trained to perform a discriminative response based on the presence or absence of a particular drug. Acquisition trials are alternated in which the animal is reinforced for making one response while drugged and an opposite response while not drugged. Dissociation is indirectly reflected by the rate of acquisition of the antagonistic response. Rapid acquisition implies greater dissociation of learning than slower acquisition because the antagonistic response required in one state produces less interference with the acquisition of the other response in the alternate state than is the case for animals trained to perform both responses in the same state (e.g., Overton, 1964; Overton, 1966).

These drug discrimination studies have focused mostly on evaluating the effects of various drug parameters on speed of acquiring discriminative response control with a variety of infra-human species, and have yielded rather consistent findings. Some of these are: (1) animals can learn a discriminative response based on the presence or absence of various drugs, (2) these discriminations are acquired more rapidly with high drug dosages than with low dosages, (3) discriminations can be also established using two dosages of the same drug, (4) animals can also learn to discriminate between different drug types, (5) drug discriminations can be established more rapidly than most sensory discriminations,(6) only centrally active drugs produce reliable discriminative control while drugs which act outside the central nervous system only do not, and (7) although most of the drugs commonly abused by humans are also capable of producing discriminative control in animals, there seems to be no significant relationship between addiction risk of a particular drug and the ease with which it develops discriminative control. Detailed reviews of these and other research findings can be found in Barry (1974), Ho and Chute (1978), Overton (1968) and Overton (1972).

Transfer procedures, on the other hand, attempt to evaluate state dependent learning more directly by assessing the degree to which conditioned responses fail to transfer from a drug-induced state to the normal state, and vice versa. In other words, dissociated learning is reflected by observed performance decrements of a learned response in the alternate state, rather than by a lack of interference of previous learning with acquisition of an antagonistic response in the other state. The experimental paradigm most commonly used to determine this lack of transfer or dissociated learning is the 2 x 2 factorial design as advocated by Miller (1957).

Generally, transfer studies have been much less reliable in their findings than those employing the drug discrimination strategy. As a consequence, they have been subjected to considerable conceptual and methodological scrutiny in recent years. Basically, the transfer studies indicate that state dependent learning can usually but not always be found using a variety of drugs similar to those found effective in the drug discrimination studies for some but not all learning tasks, in a variety of animal species (see Overton, 1968; Overton, 1972). Several of the earlier investigations using the transfer paradigm and the same drugs yielded contradictory findings when different learning tasks were employed (e.g., Grossman and Miller, 1961 versus Otis, 1964 and Crow, 1966). Subsequent studies attempted to clarify the source of these inconsistencies by examining various task demanding response parameters to determine just which behaviors dissociate and why (Bindra, Nyman and Wise, 1965; Bindra and Reichert, 1966; Bindra and Reichert, 1967; Holloway, 1972; Holloway and Wansley, 1974). Unfortunately, several independent studies have reported findings which conflict with their results and interpretations (see Bliss, 1974). Consequently, it is apparent that task differences play an important role in the production of state dependent learning but the reasons for this effect remain elusive.

In addition to this difficulty in consistently obtaining state dependent effects, several studies have also reported conflicting findings about the nature of the dissociative effects observed. A number of investigators have reported that training had failed to effectively transfer, and was dissociated in the direction of drugged to normal conditions, but not from normal to drugged states (e.g., Berger and Stein, 1969; Crow, 1966). Other studies have reported substantial and similar amounts of transfer failure

in both directions (e.g., Bindra et al., 1965; Overton, 1964). Overton (1968) suggested that the former group of findings exhibit 'asymmetrical' dissociation (i.e., D-S < D-D and S-D = S-S) and the latter results indicate 'symmetrical' dissociation (i.e., D-S < D-D and S-D < S-S). Again, the mechamisms by which these two types of dissociation occur remain unknown. However, Overton (1974) has suggested that 'asymmetrical' dissociation may in fact be an artifact of experimental design resulting from the confounding of state change effects with other drug effects, by illustrating that this pattern of results might also be produced by the combination of three different drug effects, namely memory consolidation deficits, state dependent learning, and performance facilitation.

Concerns about this and other problems of interpretation resulting from design limitations inherent in the 2 x 2 transfer paradigm have recently been raised and presently remain unsolved. Overton (1974) has argued that, if a particular drug produces significant, cognitive and behavioral effects other than state dependent learning, then the observation that the change state groups were inferior on test performance to the same state groups is not necessarily a valid indicator of state dependent learning. In support of his argument, he illustrated how a variety of possible drug effects (performance impairment or facilitation during training and/or testing; nonspecific retrieval impairment during testing; memory consolidation deficits during training; reduction of novelty responses during training and/or testing; behavioral tolerance to the drug during training and/or testing; pharmacological tolerance to the drug during training and/or testing) can be combined to mimic the patterns of test performance which have typically been interpreted as reflecting either symmetrical or asymmetrical state dependent learning.

Since the 2 x 2 design does not provide sufficient data to allow an evaluation of these other possible drug effects and their interactions, Overton concluded that the 2 x 2 design is incapable of definitively demonstrating state dependent learning.

Although Overton acknowledged that there is no ideal remedy to this problem, he has provided some practical advice for improving the basic design. First, he recommended that all available information on original training should be reported in addition to testing data in order to evaluate possible drug effects on learning and to establish if there are acquisition differences among the groups which might affect demonstrated performance during testing over and above any state change or other drug effects during testing (i.e., a subject might perform poorly because he had learned less rather than because of the state change condition). Secondly, he referred to the fact that an analysis of variance of test performance data is often superior to simple effect comparisons, which compare various pairs of group means, since it controls for several possible drug effects (memory consolidation deficits, performance deficits, performance facilitation, and nonspecific retrieval deficits) but not others (reduction of novelty responses, behavioral tolerance, pharmacological tolerance) by separately evaluating the effects of drugs during training, during testing and the effects of state change on test performance. And finally he advised that a logical pattern analysis of both acquisition and testing data acknowledging the possibility of other drug effects and attempting to determine their significance is superior to blindly applied, statistical tests.

It is difficult to evaluate the gravity of Overton's concerns and their implications for assessing the validity of the existing research

which has employed the transfer strategy, although it must be conceded that his conceptual arguments are quite compelling. What seems to be needed are convincing demonstrations that some of these combinations of drug effects which would result in such interpretive pitfalls actually do occur. Only one such study has been reported. Deutsch and Roll (1973) in an investigation of the effects of alcohol on the performance of a discriminative escape response in rats, found that animals which had received training while intoxicated and then tested for performance while sober performed more poorly than any of the other groups comprising the transfer design. This pattern of results is typically interpreted as indicating asymmetrical dissociation. However, further analysis of their findings indicated that their results could be more simply accounted for by the effects of alcohol in interfering with original learning and facilitating performance during testing. They concluded that the combined action of these effects had mimicked asymmetrical dissociation. However, it is interesting to note that the application of an analysis of variance in which the interaction term is used as the index of dissociation, rather than the simple effect comparisons employed by Deutsch and Roll (1973) and others to ascertain directionality of state change effects, would not have warranted an interpretation of state dependent learning in this case. Their findings do seem to suggest that attempts to determine the directionality of state change effects by simple effect comparisons of data generated by the transfer paradigm can be thwarted by other drug effects as Overton's (1974) analysis suggests. They also highlight the need to report acquisition data as well as performance data.

In addition to this need for further supporting evidence to confirm these concerns it seems likely that the various drug effects which might combine to mimic state dependent learning may or may not be particularly important factors for different learning tasks and their required response patterns. Overton (1974) pointed out that choice tasks requiring a discriminative response appear to be less susceptible to some of these possible drug effects than are the 'go/no-go' variety of tasks. Also, speeded tasks or tasks where performance speed is used as the dependent variable are probably more vulnerable to drug effects such as performance impairment or facilitation (Zenick and Greene, 1978). Consequently, Overton's (1974) advice about considering which drug effects may be operative in the particular task to be used and, if possible, attempting to appraise their relative effects seems to have merit. This type of logical analysis seems particularly salient for human investigations in which some of these possible drug effects, such as performance impairment, performance facilitation, reduction of novelty responses, and drug tolerance in frequently used agents, likely play minor roles in the types of tasks usually employed.

It is difficult to evaluate and compare the utility of the two research strategies which have developed to investigate state dependent learning because of their differences in areas of interest. The drug discrimination strategy has been employed mostly to investigate the effects of drug parameters on the establishment of discriminative response control to provide an empirical basis for drug classification while the transfer strategy has been used chiefly to study task variables

to determine which kinds of learned responses are susceptible to dissociation with an implicit goal of prediction to human circumstances. Obviously both have been productive. The drug discrimination strategy has provided very consistent findings and the transfer strategy has produced a wealth of unexpected findings and questions as well as inventive studies which unfortunately have been unable to provide many conclusive answers at present. Certain advocates of the drug discrimination paradigm have suggested that since both procedures presumably reflect the same underlying mechanisms which govern state dependent learning, only the more reliable methodology should be retained (e.g., Overton, 1974; Schuster and Balster, 1977). Others, however, remain unconvinced and consider the two strategies as investigating separate processes (e.g., Barry, 1974; Chute, 1978).

A major problem in resolving this issue stems from the lack of a generally accepted theoretical model from which to decide. This is not to say that theories have not been constructed to account for state dependent learning. On the contrary, a host of models, hypotheses and speculations have been proposed during its history of experimental investigation (see Overton, 1978). Probably the foremost explanation which is based on and appears largely consistent with the drug discrimination findings, is the drug-stimulus hypothesis which proposes that drugs induce dissociated behaviors because they produce internal cues which are used by the animal as conditional stimuli and are necessary for the production of the learned response with which they have become associated. Unfortunately, attempts to specify and confirm which internal stimuli are drug-produced have been unsuccessful (Bliss, 1974; Overton, 1968).

Other explanations have proposed a variety of possible neurological, perceptual and cognitive mechanisms which are temporarily altered by drugs to account for the performance decrements produced by state change. Many of these models have been proposed and subsequently modified or abandoned in attempts to accommodate novel findings. Unfortunately, most of these 'alteration' models have been too vague to allow empirical evaluation. It is generally acknowledged that none of the existing theories of state dependent learning are able to consistently and convincingly account for all of the reported findings to date (Bliss, 1974; Chute, 1978; Overton, 1968; Overton, 1978). In concluding his exhaustive review of existing theories, Overton (1978) pointed out that the vast majority of studies on state dependent learning have been non-theoretical in nature and as a result considerable advances have been made in understanding the phenomenology of dissociation with appallingly little progress in determining its cause.

Human Research

Investigations of human state dependent learning produced by drugs have been less numerous than animal studies probably because of the ethical and procedural restrictions inherent in administering drugs to human subjects. Almost all of the studies reported to date have employed the transfer strategy. In spite of encouragements to utilize alternative methodologies and the recent concerns about the validity of this approach (Overton, 1972; Overton, 1974), human researchers have been reluctant to employ the drug discrimination strategy as an alternative. There appears to be at least three major reasons for this attitude. First, drug discrimination procedures necessitate multiple trials of repeated drug administration which is impractical with human

subjects. Secondly, drug discriminations are typically established gradually over consecutive trials and there is evidence that multiple training trials can eliminate state dependent learning in humans, which suggests that the underlying processes may be different (Weingartner, 1978). Thirdly, the transfer design seems to be more analogous to practical situations in which state dependent learning might be of importance (drug-related amnesias, etc.).

Typically, subjects are asked to learn a variety of different kinds of material, usually verbal in nature, while either intoxicated or sober, and are later tested on some type of retention task in either an intoxicated or sober state. As in the animal transfer studies, state dependent learning is usually determined by comparing the change of state groups to the same state controls on measures of retention either by means of an analysis of variance (interaction term) or simple effect comparisons (D-D to D-S, and S-S to S-D) to determine the directionality of dissociative effects, or both. Implicit in this research is the assumption that since confounding performance variables can be greatly reduced in comparison to animal studies, the effects of drugs on learning and memory can be more directly examined.

Human state dependent learning has been demonstrated with six drug types, namely amphetamines (Bustamante, Rosello, Jordan, Pradere and Insua, 1968), barbituates (Bustamante, Jordan, Vila, Gonzalez and Insua, 1970), physastigmine (Weingartner and Murphy, 1977), sodium amytal (Ley, Jain, Swenson, Eaves, Bradshaw, Kincey, Crowder and Abbiss, 1972), marijuana (Darley, Tinklenberg, Roth and Atkinson, 1974; Eich, Weingartner, Stillman and Gillin, 1975; Hill, Schwin, Powell and Goodwin, 1973; Rickles, Cohen, Whitaker and McIntyre, 1974; Stillman, Weingartner,

Wyatt, Gillin and Eich, 1974), and alcohol (to be reviewed later). The basic manipulation has been the sequential administration of one of these drugs and some placebo. Parametric investigations of different drugs or different dosages of the same drug have not been reported.

Most of the human studies have yielded observations of partial, state change retention deficits with moderate drug dosages. However, different tasks have produced different results, sometimes yielding symmetrical, asymmetrical and nonsignificant findings. Like the animal studies which employ the transfer strategy, failures to demonstrate state dependent effects and replicate previous findings have also been encountered, particularly with alcohol which has been the drug most intensively studied. Only those investigations of human state dependent learning which have used alcohol to produce state change conditions will be considered in detail in the present review. Detailed reviews of studies employing other drugs can be found in Eich (1977) and Weingartner (1978).

Historically, investigations of state dependent learning in man began in the mid-1960's mostly as the result of speculations made on the basis of recent findings of animal studies. Several investigators suggested the possible significance of state dependent learning for drug-related therapies and phenomena of drug abuse in humans. For instance, both Otis (1964) and Miller (1966) warned of possible difficulties for psychotherapautic undertakings, conducted simultaneously with the administration of psychoactive drugs, which might result from a lack of effective transfer of therapeutic gains to the normal state when drugs are discontinued. However, an article by Storm and Smart (1965) in which they

proposed a possible explanation, based on observations of dissociation in animal studies, for various features of alcoholism and an alternative strategy for treatment, seems in retrospect to have been the most influential in initiating and giving direction to human investigation.

In accordance with Miller's formulations (e.g., Miller, 1961), Storm and Smart (1965) suggested that alcohol, by producing a variety of organic or internal stimuli, might result in decrements in response generalization between intoxicated and sober states as observed in dissociation studies and as a consequence behaviors learned in one state may not effectively transfer to the other. By applying this model to various features of alcohol abuse, they convincingly demonstrated that blackouts, loss of control and behavioral disparity between intoxicated and sober states might be accounted for by the dissociative effects of alcohol. In addition to these primary dissociative effects (generalization decrements), however, they suggested that a secondary, learned discrimination between alcohol and sober conditions, resulting gradually from the application of different social reinforcement contingencies available in drinking and nondrinking situations might develop as well. Such an occurrence would enhance generalization decrements and result in greater dissociative effects as a function of the length of drinking history, which could account for the increasing frequency of these phenomena at lower dosages in the more advanced stages of alcoholism. By applying this deductive analysis to implications for treatment, they suggested that if alcohol does produce dissociated learning in man and if alcoholics are particularly prone to these effects as a result of their reinforcement histories, then treatment might be more effective if conducted under intoxicated conditions rather than while the alcoholic is sober.

The majority of the earlier studies on human state dependent learning were attempts to answer the following questions derived from Storm and Smart's (1965) formulations: (1) does alcohol produce state dependent learning in man, (2) if so, is the alcoholic more susceptible to dissociative effects than nonalcoholics, and (3) are blackouts reversible as should be the case if they are in fact state dependent? These studies, which were conducted largely to provide answers to these practical questions, are presented below.

Investigations of Alcohol State Dependent Learning in Normal Populations

To date, eleven studies employing the transfer strategy to investigate alcohol state dependent learning in man have been reported (see Table I). Eight of these have focused on the effects of alcohol induced, state change upon the performance of a variety of learning tasks with normal or nonalcoholic populations, while three have examined state dependent effects in alcoholic subjects. This latter group will be presented separately in the next section of this review.

The first demonstration of alcohol induced dissociation in man was reported by Storm, Caird and Korbin (1965) as a preliminary investigation of their dissociation hypothesis. They studied the effects of alcohol induced, state change on the retention of a serial verbal learning task in normal subjects. The experiment employed four groups. One group received alcohol during both learning and relearning sessions. A second received alcohol during learning but not relearning. A third received no alcohol during learning but alcohol during relearning. And a fourth received no alcohol during learning or relearning. Experimental intoxication was produced by the ingestion of alcohol in a dosage of 1/60 oz.

Table 1.0

Investigations of Alcohol State Dependent Learning in Man

Study	Subjects	Dosage*	Interval	Task	Dissociation
Storm et al. (1965)	Normals	.81 gm/kg; BAL's: none	48 hrs.	serial learning	symmetrical
Goodwin et al. (1969)	Normals	1.2 gm/kg; BAL's: .08-.14gm/100 ml.	24 hrs.	avoidance rote learning word association picture recognition	symmetrical asymmetrical asymmetrical none
Tarter (1970)	Normals	.57 gm/kg; BAL's: none	24 hrs.	paired associate learning paired associate, negative transfer	none symmetrical
Hinrichen et al. (1974)	Normals	1.4gm/kg; BAL's: .15gm/100 ml	48 hrs.	paired associate learning mirror drawing heart rate control	asymmetrical none - - -
Powell et al. (1971)	Normals	1.2gm/kg; BAL's: .08-.14gm/100 ml.	24 hrs.	autonomic reactivity autonomic habituation	symmetrical none
Crow & Ball (1975)	Normals	1.0gm/kg; BAL's: none	24 hrs.	word association picture identification finger maze autonomic habituation	symmetrical symmetrical none symmetrical
Weingartner et al. (1976)	Normals	.81 gm/kg; BAL's: .06-.095gm/100ml.	4 hrs.	free recall	symmetrical
Petersen (1977)	Normals	.78 gm/kg; BAL's: .09gm/100 ml.	24 hrs.	free recall category recall cued free recall cued category recall	symmetrical asymmetrical none none
Storm & Caird (1967)	Alcoholics	.81gm/kg; BAL's: none	48 hrs.	serial learning	asymmetrical
Weingartner & Faillace (1971)	Alcoholics & Normals	1.2gm/kg; BAL's: none	48 hrs.	free association (alcoholics) free recall (alcoholics) free association (normals) free recall (normals)	symmetrical asymmetrical none symmetrical
Goodwin et al. (1974)	Alcoholics	1.2gm/kg; BAL's: .08-.14gm/100 ml.	24 hrs.	word association word recognition-recall	none none

Note: all dosages have been converted to standard units of gms. absolute alcohol per kg. body weight.

alcohol per lb. body weight. Learning and relearning sessions occurred 48 hrs. apart. The learning task consisted of the serial memorization of a list of twelve nonsense syllables to a criterion of one perfect repetition, with number of trials taken to reach criterion used as an index of learning rate on the first day and of transfer of training, or retention, on the second. Their results indicated an effect of alcohol in retarding original learning and an effect of state change on relearning. In short, they demonstrated that subjects, relearning under the same drug state as was present during acquisition, reached criterion more rapidly than those who relearned under different drug conditions.

Essentially, subsequent research has confirmed this preliminary demonstration of alcohol state dependent learning in man. However, attempts to extend these findings to a variety of learning tasks have produced some unexpected results. Goodwin, Powell, Bremer Hoine and Stern (1969), in a more elaborate study, investigated alcohol induced state change effects on the retention of a wide range of learning tasks. Their experimental design similarly employed a 2 x 2 transfer of training paradigm. Intoxication was induced by the ingestion of eight to ten ounces of vodka, depending on body weight, mixed with a soft drink, over a one hour period prior to training and retention sessions. In addition, blood alcohol levels were measured by a breathalyzer test immediately prior to sessions and were reported to vary from 80 to 140 mg/100ml. Equivalent amounts of soft drink were given as placebo control. Learning and retention sessions occurred 24 hrs. apart. State change effects were evaluated on the retention of four learning situations,

namely an avoidance task, a rote learning task, a word association task and a picture recognition task, which were administered to all groups in this order.

The avoidance task consisted of the random presentation of four patterns of lights with each pattern being extinguishable by one of a number of available switches. Incorrect responses or failure to respond resulted in the presentation of a noxious tone. A criterion of twenty consecutive correct responses was used with number of errors committed indicating acquisition rate. During the retention session, pattern-switch relationships were changed. Thus, performance during the second session provided a measure of interference from original learning on new learning, as in the drug discrimination studies with animals.

The rote learning task employed four, five-word sentences of varying meaningfulness. The criterion employed was not reported. On the second day, subjects were required to recall the material previously learned with errors of sequence and omission used to measure retention.

The word association test involved the presentation of words of low associative value. Subjects were instructed to respond to these stimulus words with the first word that came to mind. During retention testing, they were asked to respond to these stimulus words with their previous, self-generated responses.

The picture recognition task consisted of presenting subjects with twenty pictures on the first day. Ten of these were considered 'neutral' (catalog models) and ten were 'emotional' (nudes). On the following day, subjects were asked to select the original series from forty possibilities.

Their results indicated a significant, state change effect on retention of the avoidance, rote learning and word association tasks but not on the picture recognition task, although a dissociative trend on retention of the 'emotional' pictures was noted. Of the three tasks reported to have been impaired by state change, the avoidance task was symmetrically disrupted, while both the rote learning and word association tasks yielded an asymmetrical trend in which the change from alcohol during original learning to sober conditions during the retention session interfered with recall, but the change from sober to intoxicated conditions did not. This asymmetry is similar in direction to that reported in some of the animal studies mentioned previously. In addition, the word association task was reported to be apparently more susceptible to state change in term of magnitude of effect than the others. Moreover, they noted that on the rote learning task, although state change produced difficulty in spontaneous recall on the following day, after one relearning trial, subjects performed as well as those in the same state conditions.

Goodwin et al. (1969) concluded from these data that certain types of memories appear more sensitive to dissociative effects than others. They suggested that recall of single experiences in which overlearning does not occur appear to be particularly vulnerable to the dissociative properties of alcohol.

Tarter (1970) reported a further investigation of the dissociative properties of alcohol on paired associate learning, relearning and negative transfer in normal subjects. His design similarly consisted of a transfer of training paradigm in which alcohol and sober conditions

were fully crossed with learning and relearning sessions separated by a 24 hr. period. Intoxication was induced by ingestion of 1/30 ounce vodka (35% solution) per lb. body weight. No blood alcohol levels were reported. During training, subjects memorized a nine item, paired associate list of nonsense syllables to a criterion of one correct trial. On the second day, the material to be learned was constructed from three paired associates from the original list (relearning), three novel pairs (new learning) and three pairs of rearrangements from the first list (negative transfer).

His results indicated a detrimental effect of alcohol upon new learning during both sessions, and a state change effect in decreasing negative transfer but not on relearning. In other words, this study failed to demonstrate alcohol state dependent effects on relearning previously learned material, but did show a symmetrical, dissociative effect on the degree of negative transfer from previous learning. Tarter (1970) concluded that his results lend further support to Goodwin et al. (1969)'s suggestion that well learned material may be less susceptible to dissociation. It is also interesting to note that interference with new but similar learning may be more susceptible to state change effects than direct reproduction of original training, as demonstrated by both Tarter (1970) and Goodwin's (1969) avoidance task where considerable overlearning did not eliminate dissociation as it did in other tasks. Perhaps this observation might account for the consistency of reported dissociation from the drug discrimination studies and the lack of it in the transfer studies with animals.

Hinrichen, Katahn and Lenenson (1974), in an attempt to extend the generality of alcohol induced dissociation, reported a study

employing three types of learning tasks not previously investigated. In addition, this study used the highest dosage of alcohol with normal subjects as has yet been reported. Intoxication was produced by a dosage of 1.4 gm alcohol per kg. body weight. Subjects were allowed one hour to ingest this amount, with learning trials beginning ten min. later. Blood alcohol levels were measured about 50 min. after ingestion and following acquisition of the first task. These levels were reported as having a mean of .15%. Subjects receiving alcohol were described as visibly intoxicated. The learning tasks consisted of (1) paired associate learning in which subjects were required to learn ten, number-word pairs to a criterion of one successful trial, (2) motor skill learning where all subjects were given five trials on a mirrow drawing task, and (3) heart rate control learned from visual, biofeedback. Subjects relearned each task during a second session conducted 48 hrs. later.

Their results indicated (1) an asymmetrical, state change effect on retention of paired associate learning, (2) a retarding effect of alcohol on the acquisition of the mirror drawing task, but no state change effect on this motor task, and (3) the lack of initial acquisition of the heart rate control task, which disallowed an evaluation of possible dissociative effects. Hinrichen, et al. (1974) concluded that their finding of a lack of state change effects on the mirror drawing task along with the relatively weak, asymmetrical dissociative effect observed on the paired associate task, especially given the very high dosage of alcohol used, support Goodwin et al. (1969)'s assumption that learning tasks requiring considerable overlearning

are more resistant to the dissociative effects of alcohol. Their findings also suggest that task variables may be more important in obtaining dissociative effects than the amount of alcohol consumed.

Two studies have provided evidence for the dissociative effects of alcohol on autonomic reactivity with normal subjects. Powell, Goodwin, Jones and Hoine (1971) reported an investigation of the effects of alcohol and state change on the autonomic orienting responses of skin potential, finger pulse volume and heart rate. Their experimental design and procedure followed that of Goodwin et al. (1969) in all respects except for the required task. Subjects were seated in a sound-proof room and were presented with a loud tone of 15 sec. duration repetitively at 30 sec. intervals for a total of twenty presentations per session. Subjects were instructed to focus their eyes on a target during each presentation. Twenty-four hours later all subjects underwent a second, identical session during which either similar or changed drug conditions were introduced. Physiological measures were recorded before, during and after tone presentations.

The results were analyzed in terms of both responsivity and subsequent habituation of the physiological measures to tonal stimulation. Both response-depressing and state change effects of alcohol on autonomic responsivity were found. However, measures of autonomic habituation showed only a slight, dissociative trend. Powell et al. (1971) speculated that their failure to obtain dissociation of autonomic habituation might have resulted from the observed, response-depressing effect of alcohol masking the state dependent phenomenon.

Crow and Ball (1975) extended these findings in a study designed to gather correlational data of autonomic responsivity to various learning tasks used to demonstrate alcohol state dependent learning with normal subjects. A typical 2 x 2 transfer of training paradigm was used to examine the effects of state change, produced by dosages of 1 gm alcohol per kg. body weight ingested during a one hour period on the retention of a word association, picture identification and finger maze task, measured twenty-four hours later. Both the word association and picture identification procedures were similar to those of Goodwin et al. (1969). The finger maze task involved blindfolded practice to a criterion of two consecutive, errorless trials, with performance being measured in terms of time and errors. In addition, physiological measures of electroencephologram, heart rate, finger pulse volume, skin resistance and respiration rate were recorded throughout the training and retention sessions.

Their behavioral results indicated a main effect of alcohol in retarding original learning on the picture identification task and to a much greater extent, on the finger maze. No analysis of the effect of alcohol on original learning on the word association task was possible since immediate recall (acquisition) was not measured. In addition, symmetrical, state change effects were observed on both the word association and picture identification tasks, but not on the finger maze. They suggested that this lack of dissociation on the finger maze task may have resulted from an overlearning component.

Their physiological measures indicated a depressing effect of alcohol during training for only finger pulse volume and skin resistance.

State dependent effects on habituation measures were obtained for heart rate, finger pulse volume and skin resistance. The overall relationship between behavioral and physiological measures was low. However, greater association of the two types of data was found for the state change conditions than for the same state groups. Crow and Ball (1975) concluded that, although state change effects were obtained for some of the behavioral and physiological measures, direct comparison of cognitive and autonomic dissociation is made difficult by the relatively greater, suppressive properties of alcohol on autonomic functioning as was observed both in their study and in that of Powell et al. (1971). Consequently, it seems that, although dissociative effects on autonomic reactivity can sometimes be demonstrated, their relationship to behavioral indices is apparently not straightforward.

Clearly, the studies presented above which have investigated the effects of alcohol state dependent learning in man on a variety of verbal learning, discriminative operant and autonomic responses, indicate that dissociative effects vary widely across different learning tasks. Several task properties which may be responsible for these observed differences have also been suggested. Some of these are: (1) verbal learning tasks which are not well learned, such as the word association task, seem more susceptible than those which are well learned, (2) verbal tasks are apparently more vulnerable than tasks requiring discriminative motor responses learned over several trials, (3) recall tasks seem to be more adversely affected by state change than recognition tasks, and (4) interference with new learning (negative transfer) may be

a more sensitive indicator of dissociative effects than direct retention measures of original learning. Unfortunately, most of these inferences are not conclusive, since appropriate experimental controls were not included to evaluate alternative explanations and provide quantitative assessment of the effects of these various dimensions on observed dissociated learning. Recently, however, two investigations of the dissociative effects of alcohol on verbal learning material have systematically evaluated several parameters of possible importance.

Weingartner, Adefris, Eich and Murphy (1976) investigated the susceptibility of common, concrete, high-imagery words as compared to less concrete, low-imagery words using a free recall procedure to the dissociative properties of alcohol. Their transfer of training paradigm was somewhat dissimilar to those typically employed. A within-subject, repeated measures design was used in which all subjects learned and later recalled equivalent lists of twenty nouns, half of low imagery and half of high imagery value. Each subject participated in all four, congruent and disparate, learning-recall conditions, which were counterbalanced to control for order effects. Subjects were required to listen to a single presentation of a word list and immediately to reproduce in writing what they could recall. Four hours later, under either congruent or disparate state conditions, they were asked to recall the words again under free recall instructions. Intoxication was induced by ingestion of one ounce vodka per 30 lb. body weight over a period of 10 min. which produced blood alcohol levels of .060-.095%. Learning-recall procedures began one half hour after consumption. Their data allowed an analysis of both the effects of alcohol on acquisition (immediate recall) and subsequent retention (four hour recall) and the effect of state change on later recall.

Their results indicated poorer immediate and delayed recall as a function alcohol. Both high and low imagery words were equally affected. In addition to this, a symmetrical state dependent effect of alcohol on later recall was also found. Moreover, a much greater number of low imagery words than high imagery nouns were lost under state change conditions. Weingartner et al. (1976) concluded that the magnitude of dissociation observed was a function of the imagery properties of the verbal learning material. Since low imagery words are usually more poorly encoded than high imagery words, they suggested that memories which are more poorly encoded may be particularly susceptible to dissociative effects.

Peterson (1977) provided a confirmation and extension of these findings. He investigated the importance of this concrete-abstract dimension as well as the influence of providing recall cues upon the magnitude of alcohol induced dissociation on a vareity of verbal learning tasks. Unlike the Weingartner et al. (1976) study, he employed the more traditional, between-subject, 2 x 2 transfer of training design. Intoxication was induced by ingestion of 1.0 ml alcohol per kg body weight given 30 min. prior to learning-recall sessions. Mean blood alcohol levels of 88.5 mg/100 ml, taken immediately prior to training and recall sessions were reported. Each group was trained on four consecutive, verbal learning tasks and recall was tested 24 hrs. later. The learning tasks included (1) context-cued recall where subjects were required to form mental images for noun triplets using provided context words, (2) context-cued category recall using two words from each of 24 categories, (3) multiple trial, free recall involving eight abstract and eight concrete nouns, and (4) category recall without cues.

His results indicated no effect of alcohol on original learning in any of the four tasks studied. On the multiple trial, free recall task, a symmetrical, state change effect was found in which a greater proportion of abstract as compared to concrete words were lost, a finding that lends support to the findings of Weingartner et al. (1976). On the category recall task without cues, an asymmetrical, state change effect was observed. Neither of the remaining two tasks which provided contextual cues for recall yielded state dependent effects. Petersen (1977) suggested that dissociation might result from changes in the cognitive cues used for retrieval of information, since the provision of recall cues to a subject effectively eliminated state dependent recall deficits.

Recently, Weingartner and his colleagues (Eich, 1977; Weingartner, 1978; Weingartner & Murphy, 1977a; Weingartner & Murphy, 1977b) have proposed an information processing theory of human state dependent learning, based on the theoretical formulations of Tulving (Tulving, 1977; Tulving and Madigan, 1970; Tulving and Thomson, 1973). On the basis of recent findings that the provision of powerful retrieval cues to subjects during state change recall attempts can effectively erase state dependent effects of marijuana (Eich et al., 1975) and alcohol (Petersen, 1977), Weingartner has suggested that memories which are irretrievable in the alternate state may be merely inaccessible rather than unavailable. This inaccessibility is thought to result from an inability on the part of the subject to generate by himself appropriate retrieval strategies to gain access to available memory stores. Normal recall is assumed to result from the production of appropriate retrieval

strategies (scanning processes) which are capable of reproducing those cognitive circumstances or encoding strategies (organizational processes used to transform input into storable memory units or clusters) which were employed to store information about the original learning task. State dependent learning presumably occurs because these encoding and retrieval strategies are state specific or unique to the state in which they are employed rather than the stored information itself.

Although many of the theoretical postulates still need to be clarified, this cognitive theory of state dependent learning does appear to be compatible with several findings from the earlier investigations. For instance, this model would predict that the magnitude of dissociated learning should be a function of the strength of encoded information, since retrieval of weakly stored input would presumably be more dependent upon accurate retireval strategies, and the extent to which the retention testing format provides retrieval cues to the subject. In accordance with these predictions, earlier studies have indicated that (1) overlearning apparently diminishes state dependent effects, (2) high imagery words, which are more easily encoded are more resistant to dissociation than low imagery words, (3) state dependent effects have been less consistently reported for recognition or identification tasks, which provide retrieval cues or reminders to the subject, than for free recall, free association, and serial learning tasks, which don't provide comparable cues, and (4) paired associate learning tasks, which provide retrieval cues by the presentation of the stimulus word of the individual pairs, has been less reliable in producing state dependent learning as well.

It is probably premature to critically evaluate this cognitive theory of human state dependent learning since the findings on which it is based are very recent and attempts at replication and extension by independent investigators with the exception of Petersen's study, have not as yet been reported. However, its ability to accommodate many of the findings from the human research as well as its apparent suitability as a theoretical framework from which to investigate a variety of clinical phenomena in which dissociation may be important (e.g., studies on mood-related state dependent learning in manic-depressive psychosis by Henry, Weingartner and Murphy, 1973, and Weingartner, Miller and Murphy, 1977) stand in its favour.

Comparisons of Alcohol State Dependent Learning in Normal and Alcoholic Populations

Storm and Caird (1967) provided the first demonstration of alcohol state dependent learning in alcoholics. The subjects used were hospitalized patients with long histories of excessive drinking, but with no physical complications due to alcoholism. None of the subjects had been drinking for at least a period of three weeks prior to the experiment. The procedure and design employed was identical to that of Storm, Caird and Korbin (1965), which was described above, with one exception. The present study used a list of twelve, two syllable common nouns rather than nonsense syllables because of the considerable difficulty their alcoholic sample had in learning the latter material. Their results indicated an effect of alcohol in retarding original, serial learning, but not upon relearning. Moreover, an asymmetrical, state dependent effect was found. They concluded that both this study as well as that of Storm, Caird and Korbin (1965) lend support to their dissociation hypothesis.

Although this pioneering study provided a convincing demonstration of alcohol state dependent learning in alcoholics, the design used did not allow a direct comparison of the magnitude of dissociation effects produced in the alcoholics with normal subjects. Thus, the possibility of alcoholics being more susceptible to dissociative phenomena than nonalcoholics as hypothesized by Storm and Smart (1965) could not be evaluated. An adequate, comparative study would at least necessitate careful matching of the two groups on such variables as age, education, socioeconomic status, etc. as well as employing a wide range of learning tasks and dosage levels to allow the evaluation of possible differences in learning ability and alcohol tolerance.

Weingartner and Faillace (1971) reported a comparative study of the effects of alcohol and state change on a variety of verbal learning tasks in alcoholics and nonalcoholics, which attempted to control and evaluate some of these factors. A small group of alcoholic volunteers with at least a ten year history of problem drinking and having been hospitalized for at least one week, were matched with a nonalcoholic control group on the variables of age, sex, race, education and body weight. The study was conducted in two separate stages.

The first experiment was designed to determine changes in the nature of verbal learning as a function of alcohol dosage in the alcoholic and nonalcoholic groups. During the first week, alcoholic and nonalcoholic subjects were presented daily with a series of verbal learning tasks consisting of (1) a free association task using ten words with the resulting self-generated responses to be recalled at the end of the session, (2) a free recall task of twenty words presented twice in random order and recalled immediately after each presentation,

and (3) a serial learning task of eight words which was repeated until either a criterion of one perfect reproduction or a maximum of six trials had been reached, with a test trial occuring after each presentation. Each daily session was 30 min. in length and equivalent lists for each of the verbal learning tasks were used on consecutive days. During the next five days, intoxication was introduced in a graduated manner, 30 min. prior to continuation of the training sessions. Subjects were administered 95% alcohol diluted in juice in amounts starting with two ounces on the first day and increased in one ounce steps on each successive day until a maximum of six ounces for the alcoholics and three ounces for the nonalcoholics was reached. This difference in maximum dosage reached by the two groups was due to the fact that the nonalcoholics became physically ill with the larger amounts which the alcoholics easily tolerated. During the final two days of training sessions, no alcohol was administered.

Interpretation of their data was made somewhat difficult by the differences in maximum dosage reached and in the learning rates on the free recall and serial learning tasks for the two groups. Nonetheless, the results indicated that on the free recall task, the nonalcoholics recalled a greater number of words than did the alcoholics both when sober and drinking. In addition, the alcoholics showed a greater recall deficit while drinking on the second recall trials than did the nonalcoholics. On the serial learning task, the alcoholics had much greater difficulty in learning than the nonalcoholics. However, introduction of alcohol even at the highest dosage level had no effect on recall performance in the alcoholic in

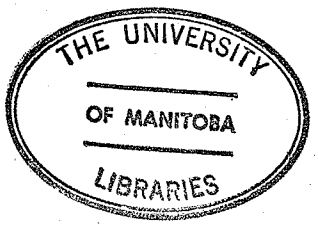
contrast to the nonalcoholic whose recall performance was greatly disrupted by the lowest amounts administered. On the free association task, alcohol, even at the lowest dosages, profoundly affected the kinds of associations produced by the alcoholics in which idiosyncratic associations greatly increased while common responses decreased. Moreover, the drinking alcoholic had considerable difficulty in recalling these associations a short time later. In contrast, while sober, the alcoholic's associations were common and easily reproduced on request like those of the nonalcoholic group. However, while drinking the common associations of the nonalcoholic during sobriety remained and displayed little deficit in recall.

Their second experiment was an attempt to evaluate the extent to which these differential effects of alcohol on recall of the free association and free recall tasks for the two groups might also be state dependent. The transfer of training design used was similar to that of Weingartner et al. (1976) in that each subject of both groups participated in all four of the congruent and disparate state conditions. Intoxication was induced by ingestion of 1.2 gm. alcohol per kg. body weight half an hour prior to training-recall sessions. Recall sessions were conducted 48 hrs. after original learning. The free association and free recall procedures were identical to those used in the first experiment.

Their results indicated that on the free association task, the alcoholics, regardless of experimental condition, recalled fewer responses. In addition, the alcoholic group displayed a symmetrical, state change effect on the reproduction of associations while dis-

sociation was not observed in the nonalcoholic group. On the free recall task, the alcoholics again across all conditions recalled less than did their nonalcoholic counterparts. Both groups demonstrated state change effects of alcohol on retention with the magnitude of this effect being much greater in the alcoholic group. The nature of dissociation observed in the nonalcoholics was symmetrical, while in the alcoholic group, the state dependent effect was asymmetrical, but in a direction opposite to that typically reported (i.e., D - S = D - D and S - D < S - S). They concluded that the dissociative properties of alcohol are significantly greater for alcoholics than for nonalcoholics.

However, this conclusion must be considered doubtful in light of a more recent failure to demonstrate dissociation with hospitalized alcoholics reported by Goodwin, Powell, Hill, Lieberman and Viamontes (1974). Their experimental design used the more traditional, between subject 2 x 2 transfer of training paradigm. Intoxication was induced by ingestion of 1.2 gm alcohol per kg. body weight over a one hour period. They noted that the alcoholics showed no behavioral signs of intoxication. Training procedures were conducted immediately after the drinking period and recall testing occurred 24 hrs. later. Verbal learning consisted of (1) the word association task designed by Goodwin et al. (1969), and (2) a word recognition-recall task in which subjects were first given a list of forty words from the vocabulary subtest of the WAIS to briefly define, and then were presented with ten of the simpler words to memorize and later were asked to recall and then pick them out of a list of forty possibilities.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Their results indicated neither a main effect nor a state dependent effect of alcohol on retention of these tasks. They suggested that overt intoxication may be a prerequisite for dissociation. Furthermore, they concluded that their study provided no support for the assumption that alcoholics are more susceptible to dissociation and, if anything, alcoholics may be more resistant to the state dependent effects of alcohol than nonalcoholics.

Investigations of the Role of Dissociation in the Production of Alcoholic Blackouts

The term 'blackout' is typically defined as reported memory loss for events experienced during prolonged periods of alcohol intoxication. Jellinek (1952) popularized the notion that blackouts are an important predictor of alcoholism. This claim was based on questionnaire data suggesting that blackouts occur early in the course of alcoholism, prior to the appearance of other symptoms of alcoholism and that alcoholics often had blackouts after ingestion of modest, subintoxicating dosages of alcohol. In contrast to this widely accepted conclusion, Goodwin, Crane and Guze (1969a), in a study based on interview data with a large sample of hospitalized alcoholics, reported that blackouts are a late rather than early manifestation of alcoholism, that they never occur in association with mild or moderate drinking, and that more than a third of the alcoholics studied had never experienced a blackout.

In a follow up report, Goodwin, Crane and Guze (1969b) presented their findings from a survey of anecdotal descriptions of memory loss

associated with drinking, obtained from their sample of alcoholics through structured interviews. Their analysis of this interview data suggested that two forms of memory loss were evident. The first type, which they designated as 'en bloc' memory loss, was characterized by having a definite onset, terminating with a feeling of lost time and was seldom followed by return of memory. The second kind, termed 'fragmentary' memory loss, lacked a definite onset and the individual was unaware of having forgotten an event until later reminded, or after spontaneous recall had occurred. In the latter type, eventual recall, although sometimes only partial, was typical. They suggested that the fragmentary memory loss might reflect state dependent effects of alcohol, while the en block variety may represent a physiologically based, permanent memory deficit.

Ryback (1970a) reported a summary of detailed observations of alcoholic blackouts during a prolonged drinking period in a controlled setting with seven, hospitalized alcoholic patients. Within the first 36 hrs. of heavy drinking, four of the seven subjects experienced periods of blackout. These blackout periods occurred after rapid rises in blood alcohol levels. Subjects' descriptions of these periods suggested that a block of time rather than a specific event was involved. Reported blackout periods varied in length from 9 hrs. to 3 days. Observations during these periods suggested specific difficulty with short term memory, while both immediate and remote memory functioning appeared intact. Moreover, subjects could not recall what had occurred during these blackout periods even when similarly intoxicated on the following day. Because of this, Ryback (1970a) concluded

that these periods of memory loss could not be due to the state dependent effects of alcohol and suggested that these blackouts appeared to be more the product of the temporary inhibition of short term memeory functioning resulting in permanent, long term memory deficits.

Subsequent, controlled research, investigating the effects of prolonged, heavy intoxication with alcoholics on memory functioning, as measured by a variety of tests evaluating immediate, short term and long term recall of single, memorable experiences during the course of controlled drinking periods, has consistently supported these conclusions (Goodwin, Othmer, Halikas and Freeman, 1970; Goodwin, Hill, Powell and Viamontes, 1973; Lisman, 1974; Tamerin, Weiner, Poppen, Steinglass and Mendelson, 1971). Because of their similarity in methodology and results, the findings of these studies will be summarized together.

1. alcohol amnesia during prolonged periods of heavy drinking in alcoholics with histories of blackouts seems to be a function of rapidly rising, blood alcohol levels.
2. these periods of amnesia appear to be the product of specific, short term memory deficits (inability to recall events occurring 5 - 30 min. previously), rather than failures of immediate recall, or registration (inability to recall events occurring less than one min. previously), or failures in long term memory, or retrieval (inability to recall events occurring 24 hrs. previously where both immediate and short term memory for these events have been shown to be intact).
3. these short term memory deficits appear to have the following properties:

a) they seem nonselective as to types of memories lost, and are definable more in terms of specific, temporal periods rather than kinds or number of events lost.

b) they appear to be a threshold, or all-or-none phenomenon rather than graded.

c) they appear to be reliable predictors of subsequently reported, blackout periods in that events reported as forgotten following a prolonged drinking period are those which had been lost shortly following the experiences during the drinking period itself. This finding casts serious doubt upon psychodynamic (e.g., Washburne, 1958) and malingering, or secondary gain interpretations of alcoholic blackouts and gives rise to some interesting implications regarding the alcoholic's legal responsibility for acts committed during blackout periods (Ryback, 1970b).

d) during these episodes of short term memory loss, remote memory for sampled events experienced in the past appears to remain relatively intact.

e) the memories lost during these short term memory lapses seem to be permanent in that recall deficits appear at later times either while sober or during similar, intoxicated conditions. This property suggests interference with memory consolidation from short to long term storage rather than retrieval difficulties. This last finding has been replicated in three of the studies reported and rather convincly demonstrates the insufficiency of a state dependent interpretation of alcoholic blackouts.

The Role of Dissociation in Social Drinking Phenomena, Alcohol Abuse and Treatment

As mentioned previously, the majority of studies on alcohol state dependent learning in man were conducted to evaluate speculations, based on animal demonstrations, about the possible role of dissociation in phenomena of alcohol abuse and consequent implications for treatment. However, before attempting to extrapolate from the findings of the human research reviewed above, a few observations and comments about the nature of these phenomena in natural settings and their possible significance for prevention of alcohol abuse and its consequences will first be made. Comment on these features of alcohol abuse will be restricted to memory phenomena since they have been the focus of research interest.

A. Some observations on the frequency and nature of alcohol-related memory phenomena in natural settings

Surprisingly, very few attempts have been made to systematically document information based on anecdotal reports and naturalistic observations about the nature and frequency of memory phenomena among alcohol consumers. Most of what is known comes from reports by and observations on hospitalized alcoholics, while similar information on nonalcoholic, social drinkers has not been reported to this writer's knowledge. Certainly, such descriptive and normative data would aid enormously in determining the ecological importance of these phenomena. Unfortunately, many of our beliefs about the significance of these phenomena, particularly in regard to the social drinker, probably have resulted from either personal experiences, informal observations

made at parties, or verbal reports by acquaintances. Although these observations attest to the occurrence of such phenomena in natural settings, they do not allow the determination of their frequency of occurrence among the drinking public or the practical importance of their consequences. It is interesting to note that most of the normative data available concerns the frequency and nature of blackouts among alcoholics. This bias has probably been the result of their highly dramatic characteristics and assumed diagnostic significance. However, other types of memory impairments, some of which may be only partial and/or temporary, although not as dramatic and perhaps often occurring unnoticed by the individual himself, also may have important consequences.

Most of our information about the varieties of memory phenomena reported by hospitalized alcoholics comes from the work of Goodwin (Goodwin et al., 1969b) and Ryback (Ryback, 1970a; Ryback, 1971). These investigators found that memory losses reported by sober alcoholics could be classified into two major varieties, namely blackouts or 'en bloc' memory losses and greyouts or 'fragmentary' memory losses. Blackouts refer to permanent memory losses for entire blocks of time during periods of heavy, prolonged intoxication. Research has indicated that blackouts, or permanent, long-term memory deficits are not state dependent (i.e., not recoverable) and apparently result from temporary impairments of short term memory functioning. In short, events during these periods of time seem to be registered but not effectively retained or stored in permanent memory traces (i.e., disruption of memory consolidation). Greyouts, on the other hand, refer to memory lapses for specific events experienced while drunk when recall is later attempted when sober. Eventual recall, although sometimes only partial, occurring either

spontaneously or with help, is often the case. Consequently, it has been suggested that greyouts reflect retrieval difficulties, since memory storage seems relatively intact, rather than consolidation failures. There is some evidence that greyouts can be selective in terms of lost experiences unlike blackouts which seem to be an all-or-none phenomenon. Tamerin, Weiner and Mendelson (1970), in a controlled drinking experiment, found that alcoholics selectively failed to recall only the dysphoric or noxious experiences of their drinking episodes on the following day while sober.

In addition to these varieities of memory impairments, alcoholics have often been noted to claim that their recall of drunken experience is better while similarly drunk than when sober, and also that they often drink to improve their memories of significant events such as the location of a bottle they previously had hidden while intoxicated. Diethelm and Barr (1962) have provided some supporting evidence for these claims in a study in which diagnostic interviews were conducted with hospitalized alcoholics while intoxicated. They found that while drunk their patients talked of drinking-related conflicts and feelings which had not been expressed previously in sober interviews, and that, on the following day while sober, their patients reported amnesia for much of this affect-laden material in spite of efforts made by the interviewers to elicit recall.

B. <u>The role of controlled investigation in determining the causes of memory phenomena</u>.

Several investigators (.e.g, Goodwin et al., 1969b; Overton, 1972; Ryback, 1971) have suggested that these cases of greyout and memory

improvement might be the product of dissociation. Unfortunately, other plausible explanations can be proposed to account for these observations as well. For instance, anecdotal reports of selective greyout might be accounted for by a 'secondary gain' hypothesis. Reports of better recall of drunken experience while similarly drunk might reflect situation specificity rather than state specificity since the social and physical surroundings typical of drinking occasions probably differ considerably in most cases from sober contexts. And alcoholics' reports about memory improvement from drinking might simply reflect cognitive impairments resulting from 'hangover' or withdrawal while sober which would likely dissipate once drinking had been resumed. In each of these cases, a dissociation interpretation is not the only possible explanation.

Collectively, these anecdotal reports and naturalistic observations suggest the existence of certain types of memory phenomena among alcoholics which do not seem to be of the blackout variety, and which have certain features in common with laboratory demonstrations of state dependent learning. However, alcohol often produces a variety of cognitive-behavioral effects in addition to dissociated learning (Overton, 1974) and changes in environmental context can also result in performance impairments (Miller, 1960). Consequently, these anecdotal reports and unobtrusive observations typically do not provide sufficient information about or control over these other possible factors to conclusively determine the role of dissociation in natural settings. Because dissociation is essentially a phenomenon defined through the exclusion of other possible factors, it seems likely that the determination of its

contributions to phenomena of social drinking and alcohol abuse inevitably must come from controlled experimentation in which some of these confounding variables can be isolated and evaluated.

C. The possible significance of determining causation of memory problems for treatment planning and prevention of alcohol abuse.

It has been suggested in the above discussion that human memory phenomena associated with alcohol consumption may arise from a variety of sources and their combinations, one of which is state dependent learning. With respect to preventing possible memory problems which might undermine rehabilitative efforts with alcoholics or result in unfortunate consequences for the social drinker, an understanding of the underlying causes might be vital. For example, in the case of the rehabilitated alcoholic, periods of relapse might result from either failure of therapeutic gains to transfer from the hospital to the outside world, or cognitive deficits, either temporary or permanent, leading to poor retention and utilization of recent learning, or dissociated learning resulting from the consumption of those first few drinks. Preventive measures incorporated into treatment planning would likely need to be quite different depending on the predominant source of the problem. Consequently, knowledge of these underlying causes and the parameters governing their occurrence might be very helpful in designing appropriate interventions.

D. Some aspects of preventive and rehabilitative programs in which dissociation may be a problem.

Traditional approaches to the treatment of the alcoholic basically attempt to establish by various means a psychological or physical

barrier against subsequent drinking (Storm and Smart, 1965). If successful, the alcoholic remains totally abstinent and concerns about therapeutic gains being unavailable during subsequent drinking periods have no practical significance since he never again finds himself in situations where this possibility might occur. Dissociation can be a problem only if changes in state occur after treatment has been completed. However, given the rather high rate of subsequent remission, periods of relapse occur all too frequently. Although it is unlikely that dissociation problems are directly responsible for initiating these relapses, once they have occurred, a 'snowballing' effect, which is often the case, might result from a combination of altered state conditions and state specificity of therapeutic gains. Consequently, preventive measures such as those suggested by Storm and Smart (1965) might be useful in reducing the extent and consequences of relapse among treated alcoholics.

More recently, however, a variety of behavior therapy techniques have been employed to return the alcoholic to controlled social drinking as an alternative to enforced abstinence (see Lloyd and Salzberg, 1975). The advantages of this alternative strategy are straightforward when one considers the adverse impact of contingencies existing in the social environment of the alcoholic which do not support abstinent patterns of behavior and to which the treated individual must return. However, dissociation problems arising during attempts at controlled social drinking might pose a hindrance to successful treatment outcome. Contrary to this pessimistic prediction though, preliminary investigations of the effectiveness of these techniques have indicated a relative superiority to conventional modes of treatment. It is interesting to

note however that many of these behavioral approaches have used aversive control to shape controlled social drinking habits during actual drinking periods in simulated, bar room situations. Although the rationale for these procedures was to provide the actual stimulus properties of alcoholic beverages to which unacceptable responses could be suppressed by shock and acceptable drinking behaviors selectively strengthened by aversion relief, mild to moderate levels of intoxication probably resulted as well. Consequently, their successes may in part have been achieved by inadvertently bypassing dissociative problems by training acceptable drinking patterns during altered state conditions.

Although most of the therapeutic concerns about dissociation have focused on the alcoholic, a similar problem may also exist for mass media campaigns in which attempts are made to prevent alcohol abuse and its consequences and promote controlled consumption of alcoholic beverages by the drinking public. Since most of these educational messages are typically received on sober occasions (e.g., in the classroom, after the news report on television, etc.) it seems equally possible that their effectiveness might be hampered by a lack of transfer to social drinking circumstances. Should this be found to be the case and this lack of effective transfer the product of dissociation, the effectiveness of such programs might be improved by either presenting the material while the audience is intoxicated, or in ways found to be resistent to dissociative effects. This is not to say that all occasions during which an individual does not or choses not to recall and act upon

knowledge about the negative consequences of alcohol abuse and methods to prevent such occurrences, are always the product of state dependent learning. However, dissociation might be a factor of importance in determining availability of such information and one which could likely be corrected by appropriate, program modifications.

E. Some practical implications of research findings on alcohol state dependent learning in man.

In light of the above considerations, the existing research on alcohol state dependent learning in man (see Table 1) seems to provide some tentative answers to some of these practical concerns. Taken together, these studies indicate that dissociation of learning can result from alcohol intoxication but not always. Of the twenty-seven learning tasks employed in the eleven transfer studies reviewed, seventeen were found to be state dependent, while ten were not. In all of the successful demonstrations, a partial rather than complete recall deficit was observed. Eleven of the seventeen successful demonstrations yielded symmetrical findings while six produced asymmetrical patterns.

Certain learning task parameters have been found to be important in the production of dissociation in man such as the strength of original learning or encoding and the extent to which retrieval cues are present during alternate state recall attempts. Generally, verbal learning tasks have yielded state dependent effects more consistently than those requiring discriminant motor responses, and concrete kinds of verbal material have been found to be more durable during state change conditions than abstract material. Although dosage parameters have not

been systematically examined, dissociation has been demonstrated with quantities of alcohol as small as .57 gm. alcohol per kg. body weight which suggests that heavy intoxication may not be a prerequisite. In addition, the blackout studies suggest that heavy intoxication may at times preclude dissociative learning because little is originally learned or consolidated which might later be dissociated or made unavailable by changes in state. Investigations of subject parameters, or individual differences among people in susceptibility to dissociation, have focused solely on the alcoholic-nonalcoholic dimension. This paucity of comparative studies is understandable since the addition of each subject dimension doubles the required number of treatment groups for the transfer paradigm. Unfortunately, the few studies that do exist have found contradictory findings and consequently it remains unknown if alcoholics are more or less susceptible to dissociation than non-alcoholic social drinkers.

Collectively, these findings indicate that recall of memories for weakly encoded experience, particularly of a verbal nature, can be greatly impoverished by changes in state if unprompted, which seems compatible with reports of greyout described above. However, from a therapeutic standpoint, these findings, which imply a certain lack of robustness and reliability of dissociative phenomena in man, do not seem to provide sufficient cause for major modifications in all treatment approaches. Although dissociation may be significant in producing alternate state recall deficits for memories of poorly encoded experience, there seems to be little reason to suspect that

well-learned material such as that typically reinforced over several sessions during treatment would dissociate to any significant degree during subsequent drinking periods. This observation seems particularly salient for behavioral techniques which employ rather concrete, non-verbal tasks requiring discriminative motor responses over multiple trials, although much less relevant for strategies of the mass media variety which often amount to one trial learning experiences. Moreover, since research has been unable to determine conclusively if individual differences in susceptibility exist, and, if so, how to identify high risk individuals, the practising clinician has little predictive power to decide the likelihood of significant dissociative problems occurring for the individual case.

F. Some reservations in extrapolating from research findings to therapeutic efforts.

As pointed out in the opening statement of the previous section, these conclusions about the practical significance of dissociation for therapeutic efforts are tentative. Their acceptance partly depends upon the assumption that the research findings of the laboratory studies are equally valid for material learned in therapeutic contexts. Unfortunately, there appear to be some good reasons for questioning the generalizability of these findings to therapeutic concerns. Probably the most reliable finding to date, which has come from this research, is that dissociative effects widely vary, in terms of magnitude and consistency, across different kinds of learning tasks. Because of this heterogeneity of findings across learning tasks, the

validity of generalizations to therapeutic types of material can be seriously questioned. When comparing the kinds of learning tasks investigated to date with those typically employed in therapeutic efforts, several differences of probable importance become apparent. For example, the more traditional treatment approaches often employ material which is multimodal and of high personal significance presenting real-life documentaries about the personal and social consequences of alcohol abuse for the individual via representative examples (e.g., Alcoholics' Anonymous) in an attempt to change attitudes and subsequent drinking behavior. In contrast, laboratory tasks have been relatively simplistic, unrelated to drinking problems and alcohol abuse, and relatively impersonal. It seems possible that any of these differences might profoundly affect the degree to which learning can be dissociated by alcohol. As a consequence, it seems likely that, in order to more validly determine the practical significance of dissociation for therapeutic efforts, the kinds of learning experiences examined should approximate more closely those characteristics of existing forms of treatment.

G. The purpose of the present investigation.

The present study was conducted to determine if state dependent learning could be demonstrated for information acquired through exposure to filmed material which approximates that typically employed by a variety of preventive and rehabilitative programs. More specifically, nonalcoholic social drinkers were shown two educational films, an alcoholism film and a control film which was unrelated to alcohol

abuse, while intoxicated or sober and were tested for recall of sampled information from the films both immediately after and again twenty-four hours later under either similar or alternate state conditions. Alcohol intoxication was induced in a small group atmosphere in an attempt to approximate social drinking circumstances and was assessed both biochemically (blood alcohol levels) and through self-report (rating scales). Subjects were divided into light and heavy social drinkers from self-report data to determine if differences in observed dissociation might be a function of drinking experience. Delayed recall of two kinds of memories from the films was assessed, namely (1) recall of objective or factual information presented, and (2) recall of personal or subjective reactions to the films (judgments of film attributes) on selected dimensions. Delayed recall of factual information was measured by both an alternate form and test-retest method employing fill-in-the-blank statements about the films. Self-report data on the drinking habits and experiences of the subjects were also collected.

Because of the exploratory nature of the present investigation, specific predictions or hypotheses were not proposed. Alternatively, an attempt was made to answer the following series of research questions.

A. Learning and recall of objective information from the films:

1. What is the effect of alcohol on the amount of information retained through exposure to filmed, real-life events?
2. Is this effect of alcohol on learning similar or different for material related to alcohol abuse in comparison to unrelated types of material?

3. Is later recall of information from the films state dependent?
4. Is there any difference in the production of state dependent learning between the two types of films?
5. Do these findings differ as a function of method of recall assessment?
6. Do the answers to the above questions differ for light and heavy social drinkers?

B. Subjective reactions to the films and their subsequent recall:

1. What is the effect of alcohol on judgments made about certain film attributes (interest value, emotional impact, comprehension difficulty, attention holding value)?
2. Are these effects different for alcohol-related, film material in contrast to unrelated material?
3. Is later recall of these original judgments state dependent?
4. Is state dependency of judgment recall a function of the type of film involved?
5. Do the answers to this series of questions differ for light and heavy social drinkers?

C. Self-report information on drinking habits and phenomenology of alcohol intoxication:

1. What percentage of the sample of nonalcoholic, social drinkers report state dependent types of memory phenomena resulting from alcohol intoxication and what is the average frequency of occurrence among these individuals?

2. Is there any significant relationship between the frequency of occurrence of these reported memory phenomena and (a) average frequency and quantity of consumption, (b) other phenomenological aspects of alcohol consumption (frequency of intoxication, blackouts, notable behavior change, and comparative tolerance to alcohol intoxication), (c) degree of immaturity of reported drinking motives, and (d) frequency of significant problems resulting from alcohol as measured by an alcoholism test.
3. Are these self-report measures of frequency of occurrence of these state dependent-like memory phenomena adequate predictors of actual recall performance under state change conditions as observed in the drinking experiment?

METHOD

Subjects. Thirty-eight, male volunteers were recruited from the undergraduate students enrolled in the Introduction to Psychology course at the University of Manitoba. They ranged in age from 18 to 35 years, with the median age being 20 years. All Ss were required to complete a sign-up booklet prior to the drinking experiment which contained a Drinking Experience Inventory, and a physician consent form, which was to be signed by their family doctors (see Appendix A). In addition, the Ss were instructed to abstain from all alcohol comsumption and other drugs outside the experiment 24 hours prior to the first day until the conclusion on the second day, and to eat a light meal no less than 2 hours prior to each session. A registered nurse was present during all experimental procedures as a medical precaution. Intoxicated Ss were given transportation home after each session.

The Ss were divided into 2 groups on the basis of their quantity by frequency indices (Q-F scores) which were calculated for each S from his self-report data on Section A of the Drinking Experience Inventory. This index is the sum of the products of an S's typical quantity and his typical frequency of consumption of liquor, beer and wine (Straus & Bacon, 1953). Individual Q-F scores ranged from 4 to 66 with a median score of 24. The two groups were constructed on the basis of a median split procedure whereby Ss who obtained Q-F scores above the median were designated heavy drinkers and Ss with scores below the median were termed light drinkers. A breakdown of these scores into typical quantity and frequency separately is reported in Appendix B along with additional summary data for the other dimensions measured by the Drinking Experience Inventory (see Material section for a description of these dimensions).

Apparatus. 1. A Breathalyzer, Model 900A, manufactured by Smith & Wessan Co. was used to determine blood alcohol levels (courtesy of the Royal Canadian Mounted Police, Winnipeg Branch).

2. Film equipment consisted of a 16 mm. projector, screen, a volume control panel and 6 sets of stereo headphones (courtesy of Audio-Visual Services, University of Manitoba).

Materials. 1. An 'alcoholism' film and a 'control' film were selected as the learning material for the experiment according to the following procedure. Initially, an 'alcoholism' film was chosen from the film library of the Alcoholism Foundation of Manitoba from several available alternatives which were screened by the experimenter. This selection was made on the basis of several characteristics demanded by the purpose of the study such as: (a) the film needed to present its plot and pertinent information on alcoholism in a highly realistic, plausible and not unduly moralistic manner (i.e., something that the viewer might seriously consider as possibly happening to him), (b) the main characters of the film needed to be easy to identify with (similarity in age, socio-economic status, attitudes, interests, etc.), (c) the film needed to be interesting, attention holding, and not unduly complicated in order to maximize learning. In other words, the film was chosen as the best of several alternatives for producing attitude change among individuals similar to the subject population used in the drinking experiment. The 'alcoholism' film selected was entitled "The Conspiracy of Silence" produced by Durham Production, Inc., Omaha, Nebraska. It presented a portrait of a young, middle-class, married couple and the breakdown of their marriage

because of the husband's drinking problem. Essentially, the film presented the developmental phases of acute alcoholism from their teenage, dating days to eventual divorce highlighting the social and behavioral consequences of alcohol abuse, and the futility of attempted concealment and denial of the problem.

The 'control' film was also selected from several possibilities, which were screened by the experimenter, on the basis of the following considerations: (a) the film needed to be completely unrelated to alcoholism, but also concerned with a major social problem with a goal of attitude change, and (b) it needed to be highly similar to the alcoholism film in terms of the characteristics listed above (i.e., realism, interest value, attention holding, etc.). Although it was virtually impossible to equate the 'alcoholism' and 'control' films, which of necessity were multimodal, on all possible dimensions which might affect learning and recall of the material presented, an attempt was made to determine the similarity of the films on the following dimensions which were considered of greatest importance: realism, interest value, attention holding, emotional impact and recallability of specifics (complexity). From the initial screening, 2 candidates for the 'control' film were selected. Five independent judges were recruited, viewed the 'alcoholism' film and the 2 'control' films, and rated them on the 5 dimensions mentioned above (see Appendix C for these rating scales). Appendix D contains the mean rating scores for each dimension for the 3 films, and the statistical comparisons used to determine equivalence (correlated t-tests, two-tailed, $p = .05$). As can be seen from the Film Comparison table, 'control' film #2 was chosen over 'control' film #1 on the basis of its greater equivalence to the 'alcoholism' film on 4 of the 5 dimensions. The only dimension on which 'control' film #2

differed marginally from the 'alcoholism' film was that of emotional impact. However, because this dimension was the only bipolar scale used, which tends to augment existing differences and because the mean scores for each film were not at either extreme (pleasant vs. unpleasant), this statistical difference was considered unimportant in comparison to the similarity found on the other dimensions.

The 'control' film which was selected was entitled "He's Not the Walking Kind" produced by the National Film Board of Canada. It presented a portrait of a physically handicapped, young, man confined to a wheelchair, and his personal struggle to achieve a normal and satisfying life. Basically, it presented the social, career and developmental problems encountered by the handicapped person, highlighting his similarity in attitudes, interests and goals in life to physically normal, middle-class, young people.

Both films were in colour and approximately 25 minutes in length.

2. Recall of factual material related to specific events and information presented in each of the two films was measured by separate questionnaires using a fill-in-the-blank format. This method of assessment was chosen rather than a multiple choice or true-false procedure because it appeared to approximate more closely a recall-type task than do the other two which evaluate recognition. The fill-in-the-blank format does provide a certain degree of answer cuing since general scenes and events must be first described in many instances before specific information can be requested. However, it seemed apparent that any procedure attempting to assess specific recall of information about complex, real-life occurrences can at best be considered a form of aided, or structured recall measurement since the question asked inevitably contains information which aids in the production of an appropriate answer. Consequently, the fill-in-the-blank format seemed to be a good approximation of a direct questioning method such as

that employed in a structured interview. In addition, however, a fill-in-the-blank format is likely more susceptible than direct questioning to accurate guessing based on the narrowing of plausible responses by the structure of the rest of the statement (but less so than multiple choice or true-false approaches). To control for this possible artifact, the pilot work, by which the recall questionnaires were designed, included a 'blind' control group which attempted to answer the questions without having seen the films beforehand. An individual, oral examination was considered unsuitable because of standardization problems and timing constraints arising from Ss being run in groups. Also, any methods requiring complicated, responding skills (writing sentences, etc.) were eliminated because of possible confounding of recall deficits with performance impairments.

Two equivalent questionnaires of 10 items for each of the films were constructed so that delayed recall could be assessed both independently of immediate recall (alternate form method) and by the same method used to assess immediate recall (test-retest method). This was done in order to obtain two methods of recall assessment. The process by which these questionnaires were constructed is described below.

Initially, a list of 34 possible items was compiled for each film. These items were constructed randomly from the various sequences presented in each film. An attempt was made to make the items as heterogeneous in content as possible reflecting diverse aspects of the films. The temporal sequence of the items was retained both in the unrefined lists and the final questionnaires in order to provide a logical progression for the responder.

A pilot study was conducted to determine the degree of item difficulty under immediate recall, sober conditions for the two lists. A group of 10 Ss were recruited from the Introduction to Psychology course at the University of Manitoba. These Ss viewed both films and answered the corresponding list of items after each film presentation. A second group of 8 Ss were given the same lists of items without having seen the films and were asked to guess what the correct answers might be, based on the wording of the questions. The average percent of correct responses by the film group was 85% for all the items on the 'alcoholism' film list and 75% for the items on the 'control' film list. In contrast, the average percent of correct responses by the blind group was 31% for the 'alcoholism' film and 36% for the 'control' film. Consequently, it was concluded that the majority of items could not be accurately answered without having viewed the films and that they provided a valid measure of immediate recall.

An item analysis of this data was then performed to further refine the lists. Individual items were rejected on the basis of the following criteria: (a) any item with a frequency of correct response by the film group under 50%, and (b) any item with a frequency of correct response by the blind group over 50%. The first criterion was employed to ensure that the average S under sober conditions would likely respond with at least 50% accuracy when tested immediately after a film presentation. Since it was expected that alcohol might produce a deficit both in immediate recall and delayed recall, and since normal forgetting might also lower recall scores when later measured, it seemed necessary to guard against the possibility of a bottoming effect (too low a ceiling under optimal conditions) in the drinking experiment. The second criteria was adopted

to further reduce the possibility that correct answers might result from accurate guesswork rather than accurate recall. This procedure resulted in the rejection of 14 items from each list and produced a total residue of 20 items per film. These remaining items for each film were then ranked according to frequency of correct responses made by the film group, and an odd-even split was conducted on each of the lists to produce two, alternate forms of 10 items for each film (see Appendix E).

Statistical analyses were then performed on the immediate recall scores of the film group to determine (a) mean scores and standard deviations for each of the 4 questionnaires, (b) the degree of equivalence of the alternate forms for each of the 2 films, and (c) the similarity of average difficulty of the 'alcoholism' film questionnaires and the 'control' film questionnaires. These analyses indicated that (a) for the 'alcoholism' film, the alternate form questionnaires had mean recall scores of 8.6 and 8.7, and standard deviations of 0.55 and 0.50 respectively for Form A1 and Form A2, and for the 'control' film, the alternate form questionnaires had mean scores of 8.2 and 8.2, and standard deviations of 0.54 and 0.49 respectively for Form C1 and Form C2, (b) correlations of equivalence of the alternate form questionnaires for the alcoholism film and the control film were .70 and .61 respectively, and (c) a comparison of the mean recall score pooled over the 2 alternate forms for the 'alcoholism' film to that of the 'control' film indicated no significant difference between the average difficulty of the film questionnaires ($t = .978$, $p > .30$, two tailed test of significance). In short, these analyses substantiated the equivalence of the alternate forms as recall measures for both films, and indicated that the recall questionnaires for the alcoholism film and for the control film were of comparable difficulty.

3. A Drinking Experience Inventory was compiled to collect descriptive, self-report information about the drinking habits and experiences of the Ss. The entire inventory takes approximately 20-30 minutes to complete and is divided into 4 general sections (see Appendix A). Section A contains (1) items measuring average amount and frequency of alcohol consumption (#1a, b, & c and #2a, b, & c) from which a quantity-frequency index for each S was computed, as described previously, and (2) items concerning the typical social circumstance of the S's drinking (#3 = where, and #4 = with whom). Section B contains a series of questions about phenomenological reactions to drinking (frequency of intoxication, tolerance to alcohol, frequency of behavior change while intoxicated, state dependent recall, frequency of blackouts, typical mood induced by drinking). These 5 dimensions, rated by Ss on 5-point scales correspond to items #1-6 respectively. Section C is an Immaturity Scale of Drinking Motives designed by Jung (1977). Ss were asked to rate the appropriateness of 16 possible motives for their drinking on 5-point scales (never to always). Of the 16 motives, 13 are considered immature, while 3 are deemed mature. An individual's score reflects the number of immature items marked 3 or more. The test has been shown to have good concurrent validity in predicting current amount and frequency of average alcohol consumption, and potential to predict degree of increase in amount and frequency of consumption over a one-year period (Jung, 1977). Section D is the Self-Administering Alcoholism Screening Test (SAAST) designed by Swenson and Morse (1975) and is a self-administering form of the Michigan Alcohol Screening Test (MAST) by Selzer (1971). Each item, with the exception of the first question is scored if answered with an 'alcoholic' response. A total score reflects the number of such

responses. For items #2, 5, 7 and 8, a 'no' is the 'alcoholic' response, while, for all other items, a 'yes' is the indicative answer. A cut off score of 10 is used to differentiate alcoholic from nonalcoholic individuals while scores of 7-9 are considered 'highly suspect.' Swenson and Morse (1975) reported that the SAAST had excellent discriminative validity in differentiating alcoholic patients from psychiatric and medical patients and in addition identified a small number of 'hidden' alcoholics in the control groups. The MAST, and other modified versions has consistently been proven to have high discriminative validity with diverse populations suspected or known to have drinking problems (Favazza & Pires, 1974; Moore, 1972; Moore, 1971, Morse & Swenson, 1975; Pokorny, Miller & Kaplan, 1972; Selzer, 1971; Selzer, Vanosdall, & Chapman, 1971; Selzer, Vinokur & van Rooijen, 1975). The SAAST was included in the inventory, in addition to the reasons mentioned below as a precaution against including individuals in the drinking experiment with significant, drinking problems (i.e., ethical considerations).

The Drinking Experience Inventory was administered to all Ss, prior to the drinking experiment, in order (1) to provide detailed, descriptive information about the drinking experiences and habits of the Ss used in this experiment, (2) to allow the evaluation of the effects of drinking history (typical amount and frequency of consumption) on the extent of observed, state dependent recall, and (3) to be used in a post-hoc fashion for generating hypotheses about possible relationships between the various dimensions and susceptibility to state dependent recall.

4. Appendix F contains a series of 5-point scales which all Ss were asked to complete for each of the two films on both days of the

experiment. The first 2 items correspond to perceived degree of intoxication (a relative and comparative measure, respectively), while the last four items refer to their judgments of the film's effects on them on the dimensions of attention holding, interest value, comprehension difficulty, and emotional impact. On the first day, these scales were administered to determine the effects of alcohol on film judgment dimensions and to provide a subjective measure of degree of intoxication. On the second day, in addition to collecting subjective measures of intoxication, Ss were asked to recall their previous day film judgments to assess recall of subjective experience for the films.

Procedure. Nineteen heavy drinkers and 19 light drinkers, as designated by their Q-F scores from Section A of the drinking experience inventory were randomly assigned to 4 treatment conditions. Group D-D, consisting of 5 heavy and 5 light drinkers, viewed the films and were tested for immediate recall (acquisition) while drunk, and 24 hours later were tested for delayed recall again while drunk. Group S-S, consisting of 4 heavy and 5 light drinkers, viewed the films and were tested for immediate recall while sober, and later were tested for delayed recall again while sober. Group D-S, containing 5 heavy and 5 light drinkers, viewed the films and were tested for immediate recall while drunk, and later were tested for delayed recall while sober. And Group S-D, containing 5 heavy and 4 light drinkers, viewed the films and were tested for immediate recall while sober, and later were tested for delayed recall while drunk. In other words, Groups D-D and S-S were tested for delayed recall under similar state conditions as those enforced during the presentation of the films (congruent, or same state conditions), while

groups D-S and S-D were tested for delayed recall under dissimilar state conditions (disparate, or changed state conditions).

Ss were run in groups of 4 or 5, which contained roughly the same number of heavy and light drinkers from the same treatment conditions, on 2 consecutive, weekday evenings (i.e., 2 subgroups/treatment condition). The order of film presentations was counterbalanced within each treatment condition to control for possible order effects and changing blood alcohol levels (BAL's) among intoxicated Ss. One of the 2 subgroups for each of the treatment conditions viewed the 'alcoholism' film first and then the 'control' film, while the other subgroups were presented the films in reverse order. The recall questionnaires for each of the films were also counterbalanced within each treatment condition to control for possible dissimilarity in difficulty. Although the pilot work had indicated that the alternate forms were roughly similar measures of immediate recall, this additional control was included because their equivalence as delayed measures of recall had not been evaluated. Consequently, half of the Ss in each treatment condition were administered one of the two questionnaires for each film to assess immediate recall, while the remaining Ss were given the other questionnaires. The counterbalancing of immediate recall questionnaires also produced a similar, counterbalancing control in the delayed recall measures in both the alternate form and test-retest methods which were used for all treatment conditions.

On Day 1, each group of 4 or 5 Ss were seated in the 'drinking' room which contained a large table surrounded by 6 chairs, a radio and packs of playing cards. Initially, the Ss were informed about the procedures to be completed during the first session and were told in

advance if they would be given alcohol to consume. None of the Ss were informed at this time about the procedure or treatment assignments for Day 2. Day 1 sessions began with a one hour drinking period for all Ss. During this hour, a research assistant remained with the Ss to promote an informal, group atmosphere. Ss were encouraged to interact freely during this time (playing cards, talking, joking, etc.) with the only restriction being to remain in the 'drinking' room. Ss requiring bathroom facilities were accompanied by the research assistant. During the hour, each S received 4 beverages to be consumed. These drinks were served at 15 min. intervals by the registered nurse who functioned during this part of the experiment as barmaid and unobtrusively as a medical check on the reactions of the Ss who were receiving alcohol. The Ss in the drunk conditions received beverages containing orange juice and 80-proof vodka mixed in proportions of 2 to 1, and an ice cube. The total amount of alcohol consumed by these Ss was .7 gm. of absolute alcohol per kg. of body weight (.9 ml. alcohol/kg. body weight). In other words, an S weighing 160 lb. received 5.7 oz. of vodka in the hour, while an S weighing 175 lb. received a total of 6.3 oz. Ss in the sober conditions received similar amounts of orange juice, equated for fluid volume according to body weight, on the same schedule of administration.

Approximately 20 minutes after the consumption of the final drinks (Spector, 1971) the Ss were escorted one at a time to an adjoining room where breathalyzer measures were taken by the registered nurse. These measurements were taken for both drunk and sober Ss as a procedural control. Each measurement took approximately 4 to 5 minutes, and all Ss were informed of their readings. The breathalyzer procedures took about 20 minutes for each group.

Following these state induction and measurement procedures, the Ss were escorted to the 'projection' room where they were seated in chairs, equipped with writing arms, facing the projection screen and fitted with individual sets of headphones. They were reminded that a short, paper-and-pencil test based on the material presented in the films would follow each of the films they were about to see. Immediately after the first film, the Ss were given a pencil and a questionnaire form containing (1) an immediate recall questionnaire (Appendix E) based on the appropriate film, and (2) a film judgment rating form (Appendix F), respectively. They were instructed not to leave any of the items blank, and if uncertain to guess. Ss were asked to indicate on the first page if they had ever seen the film beforehand (none of the Ss indicated affirmatively). A ten minute period was allotted for completion of each questionnaire. All Ss completed these questionnaires comfortably within this time limit. The questionnaires were then collected and the second film was presented. Immediately after the second film, the questionnaire based on the second film were distributed with the same verbal instructions and time limit. The entire film procedures took approximately 60 minutes (30 minutes for each film and accompanying questionnaire).

After the completion of the film procedure, Ss were escorted back to the 'drinking' room where they were taken to the adjoining room one at a time for a second breathalyzer reading which concluded Day 1 procedures. Intoxicated Ss were detained until transportation had been arranged.

On Day 2, Ss were informed about the procedures to be completed during the final session and about treatment assignment. Again this was followed by a drinking hour, during which intoxicated or sober conditions, depending on group assignment, were induced and individual

breathalyzer readings were recorded as on Day 1. Following these procedures Ss were returned to the 'drinking' room for an additional 10 to 15 minute period in order to roughly equate the temporal sequences of Day 1. Ss were then escorted to the projection room where they were seated as on Day 1. They were reminded that they would be given and asked to complete 2 questionnaire forms based on the films they had viewed on the previous day. Again they were told not to leave any of the items blank, and to guess if uncertain of an answer. The first questionnaire form was then distributed along with pencils, and contained (1) a delayed recall alternate form (alternate to that used for immediate recall) questionnaire, (2) a film judgment rating form (same as that used on Day 1), and (3) a second delayed recall test-retest form (same as that used for immediate recall) questionnaire, respectively. Ss were told that the first of two questionnaire forms they would receive was based on the first of the two films they had viewed the previous day, and, for the film judgment rating form (page 2) that they were to rate questions #3 to 6 exactly as they had on the previous day. A twenty minute period was allotted for the completion of the first questionnaire form. Approximately 5 minutes after the first questionnaire was completed (all Ss finished well within the time limits) and collected, the second questionnaire was distributed. The second questionnaire form was similarly constructed to the first, except for the fact that the fill-in-the-blank items were based on the second film. The Ss were told that the final questionnaire was based on the second of the two films they had viewed the previous day, and again the instructions for the film judgment rating form were repeated. Again they were allowed 20 minutes to complete the second questionnaire form.

Following the completion of the second questionnaire, Ss were escorted back to the 'drinking' room where they were taken one at a time to the adjoining room for a second breathalyzer reading which concluded Day 2 procedures. Intoxicated Ss were again detained until transportation had been arranged.

RESULTS

Intoxication Indicators

Three measures of intoxication were recorded twice for each S who consumed alcohol during learning and/or recall sessions. Breathalyzer measures (gms. alcohol per 100 ml blood) were recorded 20 minutes after consumption of the final drinks (pre-film measure) and again about 60 minutes later (post-film measure). Self-report measures (5 point rating scales) of degree of perceived intoxication (1 = not at all; 3 = moderately; 5 = extremely) and of their comparisons to typical degree of experienced intoxication (1 = much less; 3 = about the same; 5 = much more) were collected about 45 minutes after the last drink (post-film #1) and again about 30 minutes later (post-film #2). The mean scores and standard deviations of these measures are presented in Table 2.0.

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insert Table 2.0 about here

For the breathalyzer measures, the mean scores for the pre-film and the post-film recordings were .065 and .057 gms/100 ml. respectively, which indicate that mild to moderate degrees of intoxication were induced in those Ss who received alcoholic beverages during the drinking hour and were roughly sustained throughout the film sequences. The self-report measures essentially corroborate these biochemical data. Ss' mean rating scores on the degree of perceived intoxication scales were 2.79 and 2.44 respectively (a rating of 3 on the 5 point scale was defined as 'moderately intoxicated'). On the comparative scale mean scores were 2.72 and 2.49 respectively, which indicate that on the average the degree of intoxication experienced by the Ss during the drinking experiment was roughly

Table 2.0

Means and Standard Deviations of Intoxication Indicators for Ss who Received Alcoholic Beverages (n = 39)

Intoxication Indicator	Mean ($\bar{X}$)	Standard Deviation (sd)
Breathalyzer Measures		
Pre-films	.065	.018
Post-films	.057	.018
Perceived Degrees of Intoxication		
Post-film #1	2.79	.72
Post film #2	2.44	.74
Comparison to Typical Intoxication		
Post-film #1	2.72	.93
Post-film #2	2.49	.96

equivalent and if anything somewhat less than that typically experienced by them on previous drinking occasions (a rating of 3 was defined as 'about the same').

These intoxication indicators were then further analyzed for possible differences between the light and heavy social drinkers in terms of degree of intoxication experienced. These analyses are presented in Table 2.1. Comparison of the mean scores from the breathalyzer measures indicated

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insert Table 2.1 about here

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no significant difference between the light and heavy drinkers on the biochemical measures of intoxication. On the experiential scales, the light drinkers on the average rated both their perceived degree of intoxication and comparisons to previous intoxicated experiences slightly higher than did the heavy drinkers. However, none of these differences approached statistical significance.

Lastly, in an attempt to assess possible adaptation effects to alcohol consumption, the mean scores of the intoxication indicators taken on the first day were compared to those recorded on the second day for those Ss who received alcohol during both learning and recall sessions. These analyses are presented in Table 2.2. As can be seen, there were no significant differences between any of the intoxication measures taken during the first intoxication session and those recorded on the second occasion which indicates that adaptation effects arising from repeated intoxication, measured both biochemically and by self-report, did not occur.

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insert Table 2.2 about here

Table 2.1

Comparisons of Mean Intoxication Scores Averaged over Pre- and Post Measures for Light (N = 14) and Heavy (N = 15) Social Drinkers

Intoxication Indicators	Means (Standard Deviation) for Light Drinkers	Means (Standard Deviation) for Heavy Drinkers	t score	probability
Breathalyzer Measures	.060 (.009)	.065 (.017)	.667	$p > .20$
Perceived Degree of Intoxication	2.65 (.64)	2.47 (.74)	.667	$p > .20$
Comparison to Typical Intoxication	2.79 (.82)	2.30 (.73)	.521	$p > .20$

[Note: In these and all later comparisons, $p < .05$, two tailed test, is used as the criterion for statistical significance unless otherwise stated.]

Table 2.2

Comparisons of Mean Intoxication Scores Averaged over Pre- and Post-Measures from Day 1 to Those of Day 2 for Ss who Received Alcohol on Both Days (n = 10)

Intoxication Indicators	Means (Standard Deviations) for Day 1	Means (Standard Deviations) for Day 2	t score	probability
Breathalyzer Measures	.062 (.016)	.059 (.012)	.429	$p > .20$
Perceived Degree of Intoxication	2.5 (.25)	2.8 (.63)	1.26	$p > .20$
Comparison to Typical Intoxication	2.7 (.43)	2.8 (.58)	.314	$p > .20$

Learning and Recall of Factual Information from the Films

Three measures of recall of factual information selected from the films were collected for each S, namely an immediate recall measure, as an index of amount learned or acquired through exposure to the films, and two delayed recall measures, as measures of amount retained over a twenty-four hour period. One of the delayed recall measures was an alternate form to that used for assessing immediate recall in which individual test items were different than those used originally, while the second measure of delayed recall was a test-retest form whereby individual test items were the same as those used previously to determine immediate recall. For each of these measures, Ss received a composite recall score out of a possible 10 which represented the number of items answered correctly. Item correctness was determined by matching Ss' responses to a pre-set list of criterion answers. Each item was scored as being either correct or incorrect (1 or 0).

All of these recall measures were subjected to higher order, repeated measures analyses of variance. For the immediate recall data, acquisition state (drunk or sober) and drinking experience (light or heavy) were the between group factors, while film type (alcoholism or control) was the repeated measure. For both forms of delayed recall data, acquisition state (drunk or sober), recall state (drunk or sober) and drinking experience (light or heavy) were the between group factors and film type (alcoholism or control) was again the repeated measure. In the analyses of both types of delayed recall data, state dependent learning was assessed by the acquisition state by recall state interaction (state change groups vs same state groups). Simple effects

analyses to determine the directionality of state change effects were not conducted because of inherent interpretive problems discussed earlier. All analyses indicated that the drinking experience between group factor was not significant either as a main effect or in interaction with any of the other variables. Consequently, it has been omitted from the following presentation. Individual cell means have been pooled over this factor.

A. Immediate Recall (Acquisition)

Table 3.0 contains the mean scores on immediate recall for the intoxicated and sober groups (between group variable) for each of the two films (repeated measure). Analysis of variance yielded no significant effect of either acquisition state ($p = .427$) or the acquisition state by film type interaction ($p = .458$), which indicates that alcohol consumption had no significant effect on amount of information acquired from either of the two films. However, the film type factor was marginally

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insert Table 3.0 about here

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significant ($p = .094$) indicating that the Ss in both acquisition groups were somewhat more accurate in their responses to the control film questionnaire than to the alcoholism film measures. This finding is in contrast to the pilot research which indicated film equivalence on immediate recall measures. Possibly the fact that the present group of Ss were recruited specifically for participation in a drinking experiment while those in the pilot study were not might account for this discrepancy (i.e., reactivity toward the alcoholism film shown in the context of a drinking experiment).

Table 3.0

Mean Scores and (Standard Deviations) of Immediate Recall of Information From the Alcoholism and Control Films for Intoxicated and Sober Subjects (M = 19)

		Acquisition State	
		Drunk	Sober
Film Type	Alcoholism	7.35 (1.75)	7.39 (1.50)
	Control	7.70 (1.89)	8.28 (1.18)

In order to assess the effects of intoxication on immediate recall, the four basic treatment groups were combined according to acquisition state (i.e., Groups D-D and D-S; Groups S-D and S-S). These groups were treated identically on the first day and became distinct only on the second day during which recall state was manipulated. However, further examination of the immediate recall data indicated that this assumed similarity, resulting from identical treatment on the first day, was not warranted. Table 3.1 contains a further breakdown of the data presented in Table 3.0. Analyses of variance conducted on the immediate

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insert Table 3.1 about here

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recall scores for each of the two films indicated that in both cases acquisition state was not responsible for these group differences in agreement with the original analysis. However, the treatment groups do differ significantly as a function of which treatment condition they were to be assigned to on the second day. In other words, the two treatment groups which were to be assigned to intoxicated conditions on the second day did significantly better on immediate recall than did those Ss assigned to sober conditions on the second day. This phenomenon was evident in both films ($p < .02$ and $p < .04$ respectively) for reasons unknown. Since the treatment manipulations on the second day had not yet taken place when these differences occurred and since Ss had no prior knowledge of second day treatment assignments these group differences do not seem to be the product of experimental manipulations. In addition, since the Ss were randomly assigned to treatment groups, group differences independent of treatment manipulations should not

Table 3.1

Mean Scores and (Standard Deviations) of Immediate Recall of Information From the Alcoholism and Control Films for Subjects Grouped According to Treatment Assignment on the Second Day

Acquisition State:		Drunk		Sober	
Recall State:		Drunk	Sober	Drunk	Sober
		(n = 10)	(n = 10)	(n = 9)	(n = 9)
Film Type:	Alcoholism	8.00 (1.56)	6.70 (1.77)	8.00 (1.32)	6.78 (1.48)
	Control	8.50 (1.08)	6.90 (2.23)	8.56 (1.33)	8.00 (1.00)

have occurred. Although these group differences, presumably the chance result of random assignment, do not negate the validity of the previous analyses of the immediate recall data in terms of the effects of intoxication on amount of information acquired through exposure to the two types of films, analyses of the delayed recall data and their interpretation was complicated by the presence of these differences on the measures of original learning.

B. Delayed Recall

Because of the group differences on immediate recall, or acquisition measures mentioned above, each of the two measures of delayed recall (alternate form and test-retest) was analyzed in two ways. First, the delayed recall data was examined in the conventional manner by analyses of variance (unadjusted scores). However, because of possible confounding of delayed recall measures by the differences reflected in the immediate recall data, a second analysis was also performed. An analysis of covariance was conducted on the same data in which immediate recall scores were employed as a covariate. This additional analysis was performed in an attempt to statistically remove the amount of variance from the delayed recall data resulting from differences in immediate recall. Because of the marginal difference in immediate recall on the two films, the delayed recall data were analyzed separately for the alcoholism and control films.

Alternate Form Measures of Delayed Recall

1. Unadjusted for Differences in Immediate Recall: Table 3.2 contains the unadjusted mean scores of the alternate form delayed recall data grouped according to acquisition state, recall state, and film type for the four treatment groups. Analysis of variance on the delayed recall data

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insert Table 3.2 about here

Table 3.2

Unadjusted Mean Scores and (Standard Deviations)

of Alternate Form Delayed Recall of Information

From the Alcoholism and Control Films

Acquisition State:		Drunk		Sober	
Recall State:		Drunk	Sober	Drunk	Sober
		(n = 10)	(n = 10)	(n = 9)	(n = 9)
Film Type:	Alcoholism	6.70 (1.94)	6.30 (1.42)	6.00 (1.12)	6.89 (1.05)
	Control	6.90 (1.60)	5.60 (1.96)	6.56 (1.67)	8.56 (1.24)

from the alcoholism film indicated no significant effects of either acquisition state ($p = .91$), recall state ($p = .61$) or their interaction ($p = .18$). Consequently, no significant effect of state change, as reflected by the interaction term, was found although a slight trend in the data can be seen (the state change groups D-S and S-D had slightly lower scores than did the same state groups D-D and S-S).

For the control film, analysis of variance indicated a significant effect on delayed recall of acquisition state ($p = .02$), no effect of recall state ($p = .52$), and a highly significant interaction ($p = .004$) whereby the state change groups recalled significantly less than did their same state counterparts.

2. Adjusted for Differences in Immediate Recall: Table 3.3 contains the mean scores of the alternate form recall data after being adjusted for differences in immediate recall. Analysis of covariance on

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insert Table 3.3 about here

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the alternate form recall data from the alcoholism film questionnaires indicated that neither acquisition state, ($p = .93$), recall state ($p = .54$), nor their interaction ($p = .13$) were significant. On the other hand, the covariate (immediate recall scores) was found to be highly significant ($p = .007$) reflecting expected relationships between immediate and delayed recall scores.

The analysis of covariance on the delayed recall data from the control film questionnaires yielded a significant effect of acquisition state ($p = .04$), no effect of recall state ($p = .18$), and a significant acquisition state by recall state interaction ($p = .008$). As for the

Table 3.3

Adjusted Mean Scores of Alternate Form Delayed Recall of Information From the Alcoholism and Control Films

Acquisition State:		Drunk (n = 10)	Sober (n = 10)	Drunk (n = 9)	Sober (n = 9)
Recall State:					
Film Type:	Alcoholism	6.97	6.02	6.27	6.64
	Control	6.71	5.99	6.34	8.55

alcoholism film, the covariate was also significant (p = .05).

Test-Retest Measures of Delayed Recall

1. Unadjusted for Differences in Immediate Recall: Table 3.4 contains the mean scores of the test-retest, unadjusted, delayed recall data for the four treatment groups on each of the two films. Analysis of variance indicated no significant effect of acquisition state (p = .39), a significant effect of recall state (p = .01), and no significant effect of the acquisition state by recall state interaction (p = .20) for the alcoholism film. As can be seen from Table 3.4, the Ss who

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insert Table 3.4 about here

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were drunk at time of recall on the second day did significantly better than those who were sober.

For the control film, analysis of variance yielded a very similar pattern. Again, the effects of both acquisition state and the acquisition state by recall state interaction were not significant (p = .19 and p = .35 respectively). Recall state was found to have a significant effect (p = .01) indicating that the intoxicated Ss performed significantly better than the sober Ss on the second day.

2. Adjusted for Differences in Immediate Recall: Table 3.5 contains the mean scores of the test-retest delayed recall data after being adjusted for differences in immediate recall. Analysis of covariance

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insert Table 3.5 about here

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of the test-retest delayed recall data from the alcoholism film yielded a marginal effect of acquisition state (p = .08), no effect of recall state (p = .51) and a significant effect of the acquisition state by recall state interaction, on the effect of state change (p = .008).

Table 3.4

Unadjusted Mean Scores and (Standard Deviations) of Test-Retest Delayed Recall of Information From the Alcoholism and Control Films

Acquisition State:		Drunk		Sober	
Recall State:		Drunk	Sober	Drunk	Sober
		(n = 10)	(n = 10)	(n = 9)	(n = 9)
Film Type:	Alcoholism	8.30 (1.25)	6.60 (1.65)	8.11 (1.05)	7.56 (1.33)
	Control	8.60 (0.97)	6.90 (2.18)	8.78 (1.20)	8.00 (1.22)

Table 3.5

Adjusted Mean Scores of Test-Retest Delayed Recall of Information From the Alcoholism and Control Films

		Drunk		Sober	
Acquisition State:					
Recall State:		Drunk (n = 10)	Sober (n = 10)	Drunk (n = 9)	Sober (n = 9)
Film Type:	Alcoholism	7.81	7.12	7.62	8.02
	Control	8.16	7.80	8.29	7.98

This pattern of findings is in sharp contrast to that yielded by the analysis of variance of unadjusted scores reported above. In addition, a highly significant effect of the covariate was also indicated ($p = .000$). For the control film, analysis of covariance indicated no significant effects of either acquisition state ($p = .56$), recall state ($p = .23$) or the acquisition state by recall state interaction ($p = .93$). Again, the covariate (immediate recall) was highly significant ($p = .000$). Table 3.6 contains a summary of the findings of the analyses of variance and covariance described above for the alternate form and test-retest delayed recall data from the alcoholism and control films.

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insert Table 3.6 about here

Subjective Reactions to the Films and their Subsequent Recall

Each S was asked to respond to four questions regarding his evaluations of certain film attributes immediately after each film presentation on the first day and were asked to recall their responses to these questions on the second day. The four judgment dimensions were attention holding (the degree to which his attention wandered during the film), interest value (how interesting he found the film), comprehension difficulty (the amount of difficulty experienced in understanding the plot), and emotional impact (whether he found the film pleasant or unpleasant). Answer choices were provided in the form of 5 point rating scales. For the first three of these dimensions, a rating of 1 was defined as 'not at all', while a rating of 5 referred to 'highly.' The emotional impact dimension was a bipolar scale whereby a rating of 1 referred to 'highly unpleasant', a 3 to 'neither pleasant nor

Table 3.6

Summary of Findings from the Analyses of Variance and Covariance of the Alternate Form and Test-Retest Delayed Recall of Information from the Alcoholism and Control Films

Alcoholism Film

Source of Variation:	Acquisition State		Recall state		State Change	
Delayed Recall Measures:	Alternate Form	Test-Retest	Alternate Form	Test-Retest	Alternate Form	Test-Retest
ANOVA	no	no	no	yes	no	no
Statistical Analysis:						
ANCOVA	no	yes (marginal)	no	no	no	yes

Control Film

Source of Variation:	Acquisition State		Recall State		State Change	
Delayed Recall Measures:	Alternate Form	Test-Retest	Alternate Form	Test-Retest	Alternate Form	Test-Retest
ANOVA	yes	no	no	yes	yes	no
Statistical Analysis:						
ANCOVA	yes	no	no	no	yes	no

unpleasant,' and a 5 to 'highly pleasant.' These ratings were analyzed and are presented separately for the immediate film judgments on the first day and for their delayed recall on the second day. In both cases, the data were subjected to higher order, repeated measures analyses of variance in which acquisition state, recall state, and drinking experience were the between group factors and film type was the repeated measure. The immediate judgment ratings were analyzed separately for each of the judgment dimensions. Recall state, although not in effect at the time when the initial ratings were collected, was included as a factor in the analyses to evaluate possible group differences independent of treatment effects on the first day such as those found in the previous analyses of recall of factual information. Accuracy of delayed recall for these film judgments was determined by comparing the ratings collected on the second day to those given on the first day. Each S received a composite score of recall accuracy, or one point for each accurate or same-as-the-first-day rating for a possible total of 4.

A. Immediate Judgment Ratings

Tables 4.0, 4.1, 4.2, and 4.3 contain the various mean rating scores and standard deviations grouped according to the factors of acquisition state, recall state, drinking experience and film type for the 4 judgment dimensions. Recall state was found to be a significant factor in none

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insert Tables 4.0, 4.1, 4.2 & 4.3 here

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of the analyses of variance which were performed which indicates that no systematic differences among the treatment groups independent of experimental manipulations were present. Analyses of variance performed

Table 4.0

Mean Rating Scores and (Standard Deviations) of the Attention Holding Judgments Grouped According to Acquisition State, Recall State, Drinking Experience and Film Type

Acquisition State:	Drunk				Sober			
	Drunk		Sober		Drunk		Sober	
Drinking Experience:	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Alcoholism	2.40 (1.14)	1.80 (0.84)	1.20 (0.45)	2.00 (1.73)	1.60 (0.55)	1.50 (1.00)	1.50 (1.00)	2.20 (1.30)
Film Type: Control	2.00 (0.71)	2.00 (0.71)	1.20 (0.45)	2.20 (1.10)	1.60 (0.55)	1.75 (0.50)	1.50 (0.58)	1.60 (0.89)

Table 4.1

Mean Rating Scores and (Standard Deviations) of the Interest Value Judgments Grouped According to Acquisition State, Recall State, Drinking Experience and Film Type

Acquisition State:	Drunk				Sober			
	Drunk		Sober		Drunk		Sober	
Drinking Experience:	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Alcoholism	3.40 (1.52)	3.00 (1.00)	3.80 (0.84)	4.00 (1.00)	3.40 (0.55)	3.75 (0.50)	3.25 (0.96)	3.80 (1.10)
Film Type: Control	3.60 (1.14)	3.40 (0.89)	3.20 (1.30)	4.00 (1.00)	3.60 (0.89)	3.00 (1.15)	4.00 (1.15)	3.40 (0.55)

Table 4.2

Mean Rating Scores and (Standard Deviations) of the Comprehension Difficulty Judgments Grouped According to Acquisition State, Recall State, Drinking Experience and Film Type

Acquisition State:	Drunk				Sober			
	Drunk		Sober		Drunk		Sober	
Drinking Experience:	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Alcoholism	1.40 (0.89)	1.20 (0.45)	1.20 (0.45)	1.00 (0.00)	1.20 (0.45)	1.50 (0.58)	1.00 (0.00)	1.20 (0.45)
Film Type: Control	1.00 (0.00)	1.40 (0.55)	1.40 (0.55)	1.80 (1.30)	1.20 (0.45)	1.50 (0.58)	1.00 (0.00)	1.00 (0.00)

Table 4.3

Mean Rating Scores and (Standard Deviations) of the Emotional Impact Judgments Grouped According to Acquisition State, Recall State, Drinking Experience and Film Type

Acquisition State:	Drunk				Sober			
	Drunk		Sober		Drunk		Sober	
Drinking Experience:	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Alcoholism	2.80 (0.45)	2.40 (0.55)	3.20 (0.45)	2.00 (1.73)	2.20 (0.84)	3.00 (0.82)	2.25 (0.96)	2.00 (0.71)
Film Type: Control	3.20 (1.10)	3.60 (0.89)	3.40 (0.55)	4.00 (1.22)	3.40 (1.52)	2.75 (0.96)	3.50 (0.58)	3.40 (1.14)

on the judgment ratings of the attention holding and comprehension difficulty dimensions indicated no significant effects of the three between group factors, the repeated measure or any of their interactions.

Analysis of variance of the interest ratings indicated no significant main effects of the acquisition state, recall state, drinking experience or film type factors, and of the various interactions only the acquisition state by drinking experience by film type interaction was found to be significant ($p = .05$). This significant interaction is diagrammed in Table 4.4 separately for the light and heavy drinkers. Apparently the heavy drinkers who were drunk found the alcoholism film more interesting than the control film, while for those who were sober the reverse was true. In contrast, for the light drinkers, those who were drunk found the control film more interesting than the alcoholism film, while those who were sober rated the alcoholism film as being the more interesting.

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insert Table 4.4 about here

Analysis of variance of the emotional impact ratings indicated a significant main effect of the repeated measure, film type ($p = .0001$). The mean rating scores for the alcoholism film and the control film, pooled over all other factors, were 2.47 and 3.42 respectively. The significant main effect of film type indicates that, on the average, the Ss in the drinking experiment rated the alcoholism film as being somewhat unpleasant and the control film as somewhat pleasant in terms of the emotional impact experienced. This finding basically substantiates the marginal difference in emotional impact of the two films which was

Table 4.4

Mean Rating Scores of the Interest Value Judgments Grouped According to Acquisition State and Film Type for Heavy and Light Drinkers

	Heavy Drinkers	
	Acquisition State	
	Drunk	Sober
Film Type: Alcoholism	3.60	3.33
Film Type: Control	3.40	3.80

	Light Drinkers	
	Acquisition State	
	Drunk	Sober
Film Type: Alcoholism	3.50	3.78
Film Type: Control	3.70	3.20

determined by the pilot work described previously. All other main effects and the interactions were not significant with the exception of the acquisition state by drinking experience by film type interaction ($p = .025$), which is diagrammed in Table 4.5 separately for the two films.

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insert Table 4.5 about here

This significant interaction indicates that the heavy drinkers who were sober and the light drinkers who were drunk rated the alcoholism film as having a more unpleasant emotional impact on them than did the heavy drinkers who were drunk and the light drinkers who were sober. In contrast, the heavy drinkers who were sober and the light drinkers who were drunk rated the control film as having a more pleasant effect on them than did the heavy drinkers who were drunk and the light drinkers who were sober.

B. Delayed Recall of Judgment Ratings

Table 4.6 contains the mean recall scores and standard deviations of the previous day judgment ratings grouped according to the factors of acquisition state, recall state, drinking experience and film type. The summary table for the higher order, repeated measures analysis of variance which was performed is presented in Table 4.7 as well. As

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insert Tables 4.6 and 4.7 about here

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can be seen, the main effects of acquisition state, recall state, drinking experience (the between group factors) and film type (the repeated measure) on recall of judgment ratings were not significant. Of the

Table 4.5

Mean Rating Scores of the Emotional Impact Judgments Grouped According to Drinking Experience and Acquisition State for the Alcoholism and Control Films

Alcoholism Film

Acquisition State	Drinking Experience: Heavy	Drinking Experience: Light
Drunk	3.00	2.20
Sober	2.23	2.50

Control Film

Acquisition State	Drinking Experience: Heavy	Drinking Experience: Light
Drunk	3.30	3.80
Sober	3.45	3.10

Table 4.6

Mean Recall Scores and (Standard Deviations) of Previous Day Judgment Ratings Grouped According to Acquisition State, Recall State, Drinking Experience and Film Type

Acquisition State:	Drunk				Sober			
Recall State:	Drunk		Sober		Drunk		Sober	
Drinking Experience:	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Film Type: Alcoholism	2.80 (0.84)	3.40 (0.55)	3.40 (0.55)	1.80 (1.30)	2.60 (0.89)	1.50 (1.00)	3.25 (1.50)	2.40 (1.52)
Control	2.80 (1.30)	3.60 (0.55)	3.60 (0.55)	2.40 (0.55)	2.40 (1.52)	2.75 (1.26)	3.25 (0.50)	3.40 (0.89)

Table 4.7

Analysis of Variance Summary Table of Delayed Recall Scores for Previous Day Film Judgments

Source	Sum of Squares	df	Mean Squares	F	Probability
MEAN	604.889	1	604.889	580.23	0.000
A (acquisition state)	1.489	1	1.489	1.43	0.241
R (recall state)	0.801	1	0.801	0.77	0.388
D (drinking experience)	2.389	1	2.389	2.29	0.141
AR	5.823	1	5.823	5.59	0.025*
AD	0.001	1	0.001	0.00	0.979
RD	5.065	1	5.065	4.86	0.035*
ARD	5.313	1	5.313	5.10	0.031*
ERROR	31.275	30	1.043		
F (film type)	2.736	1	2.736	2.63	0.115
FA	0.324	1	0.324	0.31	0.581
FR	0.089	1	0.089	0.09	0.772
FD	2.736	1	2.736	2.63	0.115
FAR	0.124	1	0.124	0.12	0.732
FAD	1.007	1	1.007	0.97	0.333
FRD	0.018	1	0.018	0.02	0.895
FARD	0.124	1	0.124	0.12	0.732
ERROR	31.175	30	1.039		

* [$p < .05$, two tailed test of significance]

various interactions of these factors, only the recall state by drinking experience interaction ($p = .035$), the acquisition state by recall state interaction ($p = .025$) and the acquisition state by recall state by drinking experience interaction ($p = .031$) were found to be significant.

The recall state by drinking experience interaction is diagrammed in Table 4.8. Cell means have been pooled across the factors of

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insert Table 4.8 about here

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acquisition state and film type. This significant interaction indicates that, for the heavy drinkers, those Ss who were sober at time of recall recalled more accurately their previous day judgments than did those who were drunk. However, for the light drinkers, the opposite pattern was evident in which the Ss who were drunk recalled more accurately their judgments than did those who were sober.

The acquisition state by recall state interaction is presented in Table 4.9. Cell means have been pooled across the film type and

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insert Table 4.9 about here

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drinking experience factors. This interaction indicates that those Ss who were drunk on the first day (acquisition) and sober on the second (recall) and those who were sober on the first day and drunk on the second were less accurate in recalling their previous day judgments than Ss who were either drunk or sober on both days. In other words, the same-state groups were superior in recall than the changed-state groups.

Table 4.8

Mean Recall Scores of Previous Day Judgments Grouped According to Recall State and Drinking Experience

Drinking Experience	Recall State: Drunk	Recall State: Sober
Heavy	2.65	3.38
Light	2.82	2.50

Table 4.9

Mean Recall Scores of Previous Day Judgments Grouped According to Acquisition State and Recall State

		Acquisition State: Drunk	Acquisition State: Sober
Recall State	Drunk	3.15	2.32
	Sober	2.80	3.08

However, the significant acquisition state by recall state by drinking experience interaction indicates that this effect of state change on recall of judgments varied as a function of the drinking experience factor. This three way interaction is presented in Table 4.10. Cell means have been pooled across the film type factor

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insert Table 4.10 about here

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and groups S-S and D-D, and groups D-S and S-D have been combined to form same state and changed state groupings. As can be seen, only for the light drinkers a significant state change effect is evident. In contrast, the heavy drinkers in the state change conditions performed as well as those in the same state groups.

Self-report Information About the Drinking Habits and Experiences of the Subjects

Prior to the drinking experiment, all Ss were asked to complete a questionnaire about their typical drinking habits and various aspects of their experiences both during and after drinking occasions (see Appendix A). Of the 15 variables investigated, 12 were continuous while 3 were categorical. Appendix B contains the mean scores and standard deviations for the continuous variables as well as frequency data on the categorical ones. Only the continuous variables were subjected to quantitative analyses. The continuous variables or dimensions were of two kinds. The first type was concerned with reports of dissociation-like memory phenomena associated with alcohol consumption. Ss were asked three questions about frequency of noticed

Table 4.10

Mean Recall Scores of Previous Day Judgments Grouped According to Drinking Experience and Combined Acquisition and Recall State Treatment Conditions

	Drinking Experience	
	Heavy	Light
Same State Groups	3.03	3.20
Changed State Groups	3.00	2.12

occurrence of fragmentary memory losses and phenomena of memory improvement namely, the frequency of experienced difficulty in recalling, when sober, specific events which had occurred during drinking episodes (SDI), the frequency of recalling these forgotten events during subsequent drinking occasions (SD2), and the frequency of either spontaneous or aided recall of these memory losses at later times while sober (SD3). Ss rated their answers to these state dependent questions on 5 point scales where a response of 1 indicated "never' and a 5 referred to 'always.' The second category of variables involved other aspects of their drinking habits and experiences. These additional dimensions were 1) typical frequency of consumption (FR), 2) typical quantity consumed per occasion (QT), 3) a frequency by quantity index (Q-F), 4) an immaturity scale of drinking motives (IMM), 5) an alcoholism screening test (SAAST), 6) frequency of intoxication on drinking occasions (TOX), 7) tolerance to alcohol intoxication in comparison to acquaintances (TOL), 8) frequency of behavior change while intoxicated (BCH), and 9) frequency of blackouts (BLO). Descriptions of these variables were presented previously. The Q-F index was omitted from the following analyses because of its redundancy with the FR and QT variables.

A. Self-report Data on the Frequency of Occurrence of Dissociation-like Memory Phenomena in Natural Settings

The state dependent questions (SD1, SD2, and SD3) were included in the inventory to determine if nonalcoholic, social drinkers report dissociation-like memory phenomena related to alcohol consumption similar to those commonly claimed by alcoholics and also the frequency of occurrence of these phenomena. The mean rating scores for SD1,

SD2, and SD3 were 2.08, 1.37, and 2.37 respectively (a rating of 1 referred to 'never' and a 2 indicated 'seldom'). Of the 38 Ss in the study, 74% reported having experienced difficulty recalling when sober specific events from previous drinking occasions as indicated by a score of 2 or more on SD1. However, the average frequency of such occurrences was quite modest as reflected by the mean score of 2.08 (seldomly occurring after drinking occasions). Of those Ss responding affirmatively to SD1 (scores of 2 or more), only 32% (or 26% of the total sample) reported ever having recalled these forgotten events during subsequent drinking occasions as indicated by a score of 2 or more on SD2. The average frequency of reported occurrence of memory improvement (SD2) by those Ss who claimed to have had experienced such phenomena was 2.4 (2 = seldom; 3 = sometimes). And lastly, of those Ss responding affirmatively to SD1, 96% (or 73% of the total sample) reported having recalled these forgotten events at later times when sober either spontaneously or when reminded by someone else as indicated by a score of 2 or more on SD3. The average frequency of reported occurrence of subsequent, sober recall (SD3) by those Ss who claimed to have had such experiences was 2.75.

B. Relationships Between Self-report Measures of Dissociation-like Memory Phenomena and Those of Drinking Habits and Other Experiences

In order to determine the degree of relationship between the 3 measures of dissociation-like memory phenomena reported by the Ss and the 8 measures of the other aspects of drinking habits and experiences listed above, individual correlation coefficients were computed and are presented in Table 5.0. As can be seen, SD1 was significantly correlated ($p < .01$, two tailed test) with QT (typical quantity), IMM (immaturity of drinking motives), SAAST (alcoholism test), and TOL

(alcohol tolerance), while for both SD2 and SD3, only their relationship to the IMM variable was significant. To determine the predictability of the frequency of occurrence of dissociation-like memory phenomena from knowledge of an individual's scores on the other dimensions, stepwise multiple regression analyses were conducted for each of the self-report state dependent measures (dependent variables). For the SD1 variable, a significant, multiple R of .700 with 2 and 35 degrees of freedom ($p < .01$) resulted. Only two of the 8 independent variables were found to be good predictors of SD1 scores, namely TOL (alcohol tolerance) and SAAST (alcoholism test), and together accounted for 49% of their variance. The other independent variables

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insert Table 5.0 about here

(QT and IMM) which had yielded significant, individual correlations were found to be largely redundant with these two predictors. For the SD2 variable, again a significant, multiple R of .475 with 1 and 36 degrees of freedom ($p < .01$) resulted. The IMM (immaturity of drinking motives) variable alone was found to be a good predictor of the SD2 ratings, which accounted for 23% of their variance. And, for the SD3 scale, a significant multiple R of .505 with 1 and 36 degrees of freedom was determined ($p < .01$). As for the SD2 variable, only the IMM dimension was found to be a good predictor of the SD3 ratings and accounted for 26% of their variance. Individual correlations among the 8 dimensions which served as independent variables or predictors of the self-report state dependent measures in the multiple regression analyses are contained in Table 5.1.

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insert Table 5.1 about here

Table 5.0

Correlations Between Types of Reported State-Dependent-Like Memory Phenomena and Other Experiential and Phenomenological Measures for all Ss (n = 38)

Other Experiental Measures	Reported SD-like Memory Phenomena		
	SDI	SD1	SD3
FR	.316	.080	.258
QT	.463 (*)	.171	.236
IMM	.496 (*)	.433 (*)	.505 (*)
SAAST	.492 (*)	-.020	.200
TOX	.214	-.002	.077
TOL	.606 (*)	.339 (+)	.340 (+)
BCH	.249	.349 (+)	.372 (+)
BLO	.383 (+)	.014	.179

Note: (*) indicates $p < .01$ and (+) indicates $p < .05$, two tailed test

Table 5.1

Correlations Among Experiential and Phenomenological Measures Other than Reported State-Dependent-like Memory Phenomena for all Ss (n = 38)

	FR	QT	IMM	SAAST	TOX	TOL	BCH	BLO
FR	1.00							
QT	.523 (*)	1.00						
IMM	.343 (+)	.375 (+)	1.00					
SAAST	.262	.556 (*)	.450 (*)	1.00				
TOX	.357 (+)	.617 (*)	.345 (+)	.497 (*)	1.00			
TOL	.482 (*)	.440 (*)	.517 (*)	.253	.071	1.00		
BCH	-.026	-.009	.323	.217	.214	.021	1.00	
BLO	.320	.109	.166	.341 (+)	-.140	.435 (*)	.109	1.00

Note: (*) indicates $p < .01$ and (+) indicates $p < .05$, two tailed test.

C. Relationships Between Subjects' Reports of Frequency of Occurrence of Dissociation-like Memory Phenomena and Their Recall Performance under State Change Conditions during the Drinking Experiment

Because Ss' reports about the frequency of experienced state dependent-like memory phenomena related to social drinking were not systematically included as a between group factor in the experimental design employed in the drinking experiment, as was the case with the quantity by frequency indices of alcohol consumption, no direct test of the possible significance of this variable in the production of actual state dependent recall deficits could be made. Simple correlations between Ss' ratings on these state dependent questions and their actual recall performance are complicated by the fact that none of the individual recall scores reflect the effects of state change alone. As was mentioned previously, state change effects can only be evaluated by contrasting combinations of group means from the transfer design to isolate various factors which might be affecting recall scores.

As a more indirect method of determining if Ss who claimed to have had experienced dissociation-like phenomena were in fact more susceptible to changes in state in terms of recall deficits produced, correlations between actual recall scores of their judgment ratings and for information from the control film, both of which yielded evidence of state dependent learning, and their responses to the state dependent questions from the drinking experience inventory were determined for both the same state and changed state groups. Correlations were performed on the same state recall data in addition to the changed

state conditions as a control, since if the state dependent questions do reflect susceptibility to state change effects, no relationship between the recall scores of the same state groups and Ss' responses to these questions should be present.

Table 5.2 contains the correlations between the alternate form delayed recall scores from the control film and Ss' rating scores from SD1, SD2, and SD3 for the same state and changed state groups.

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insert Table 5.2 about here

As can be seen, none of the correlation coefficients were statistically significant for either the same state or changed state groups. In order to determine if by combining the state dependent questions together they might more accurately predict recall scores, multiple linear regression analyses were performed for the same state and the changed state groups separately. In both cases, the resulting multiple R's were not significant, indicating that Ss' responses to all 3 of the state dependent questions were inadequate predictors of actual recall performance under state change conditions. Table 5.3 contains corresponding correlations between Ss' recall of their judgment ratings from the alcoholism and control films combined and their responses to SD1, SD2, and SD3. Again, all correlation coefficients were not significant, nor were the multiple R's which were also determined for the same state or changed state groups. Taken together these findings indicate that there was no meaningful relationship or correspondence between the Ss' reports of dissociation-like memory phenomena experienced previously during drinking occasions

Table 5.2

Correlations Between Alternate Form Delayed Recall Scores from the Control Film and Reports of State-Dependent-Like Memory Phenomena (SD1, SD2, SD3) for the Same State (n = 19) and Changed State Groups (n = 19)

		Alternate Form Recall Scores for the Control Film	
		Same State Groups	Changed State Groups
Reports of State	SD1	.094	.067
Dependent Like	SD2	-.415	-.197
Memory Phenomana	SD3	-.177	-.037

Note: for $p < .05$, two tailed test, $r > .456$, and for $p < .01$, two tailed test, $r > .575$.

and their recall performance under state change conditions during the drinking experiment.

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insert Table 5.3 about here

Table 5.3

Correlations Between Delayed Recall of Judgment Ratings for the Alcoholism and Control Films Combined and Reports of State-Dependent-Like Memory Phenomena (SD1, SD2, SD3) for the Same State (n = 19) and Changed State Groups (n = 19)

		Recall of Judgment Ratings	
		Same State Groups	Changed State Groups
Reports of State Dependent Like Memory Phenomena	SD1	.052	.208
	SDS	.065	.059
	SD3	.176	.250

Note: for $p < .05$, two tailed test, $r > .456$, and for $p < .01$, two tailed test, $r > .575$.

DISCUSSION

In regard to the research questions originally proposed, the findings of the immediate recall (acquisition) analyses indicated that mild to moderate alcohol intoxication had no significant effect on the amount of sampled information acquired through exposure to the filmed material. This lack of effect of alcohol intoxication on acquisition of objective or factual information was found for both types of films and for both the heavy and light drinkers which indicates that neither the thematic content of the material presented nor differences in previous drinking experience among the Ss were important factors in determining the amount of information immediately recalled. These findings suggest that information related to alcohol abuse and its consequences can be acquired under intoxicated conditions as efficiently as under sober circumstances and that concerns about possible acquisition problems resulting from moderate degrees of inebriation may be unwarranted.

While the above findings were quite straightforward, interpretation of the delayed recall data was somewhat complicated by the existence of group differences in immediate recall, independent of treatment effects. Because of these differences in initial acquisition among the Ss, an analysis of covariance was performed on the delayed recall data in an attempt to statistically remove that portion of score variance determined by these existing differences in immediate recall.[1] The analyses of covariance used to determine the effects of changes in state on delayed recall performance (i.e.,

the acquisition state by recall state interaction effects on delayed recall scores adjusted for differences in immediate recall) yielded evidence of a partial state dependent effect on recall of information presented in the films. However, this state change effect was found to be a function of both the method used to assess delayed recall and the kind of filmed material presented (see Table 3.6). Basically, the alternate form method of delayed recall assessment yielded evidence of significant state change effects for the control film but not the alcoholism film, while the reverse pattern was found with the delayed recall data from the test-retest format.[2]

The major distinction between these two measures of delayed recall was that the test-retest format contained the same items which had been used to evaluate immediate recall on the previous day and thus was essentially a second trial, while in contrast the items employed in the alternate form measure were novel. Generally, the test-retest scores were higher for both films than the alternate form scores (see Tables 3.2 and 3.4) which suggests that a learning effect had resulted from the immediate recall assessment procedures yielding higher delayed recall scores on the familiar items than on the novel ones in spite of the fact that no feedback about the accuracy of Ss' initial responses had been given. Apparently, the Ss on the average not only retained much of the information presented in the films on the previous day, but also the specific questions they had been asked and their responses to them. Consequently, it seems that the information tapped by the test-retest measure of delayed recall, because of the testing procedures used on the previous day to assess immediate recall, had been more strongly

learned or encoded than information requested by the alternate form method which had not been elicited beforehand. In addition, most of the Ss were observed to complete the test-retest measure much more quickly than the alternate form items which is suggestive of a relative ease of processing and responding to the more familiar items.

This probable difference in strength of original learning, resulting from the immediate recall assessment procedures of the previous day, between the information tapped by the familiar, test-retest items and that of the novel, alternate form items may have been responsible for the discrepancies obtained between the two measures of delayed recall. If this was in fact the case, then the findings of state dependent effects for the control film on the alternate form method of delayed recall assessment but not on the test-retest measure suggest that recall of the more strongly encoded information (test-retest items) was not significantly affected by changes in state while recall of the more weakly encoded information (alternate form items) was considerably impaired. This interpretation is consistent with previous studies in which strength of original learning has been found to be an important determinant of state dependent recall (e.g., Goodwin et al., 1969). However, for the alcoholism film, the reverse was true. Evidence of state dependent effects was found on only the test-retest measure which suggests that recall of information which had been more strongly encoded was significantly impaired by changes in state but that recall of the more weakly encoded information was not affected. This reversal of state dependent findings between the two films essentially substantiates the original proposal that differences in thematic content of the materials employed in the

learning tasks may be important in determining the production of state dependent learning, and more specifically that recall of information about alcohol abuse and its consequences may be affected by changes in state differently than information which is unrelated to alcohol abuse. The mechanisms by which this factor of thematic content was instrumental in producing this reversal of state dependent findings, however, remain open to question.

In relation to therapeutic application, these preliminary findings suggest that overlearning of information about alcohol abuse and its consequences may not necessarily reduce the extent of subsequent recall deficits resulting from changes in state and might even increase the probability of problems arising from state specificity of therapeutic gains. However, because this factor of strength of original learning was not systematically investigated in the present study but was only indirectly observed by the methods of recall assessment employed, further research would seem to be necessary to more systematically investigate this parameter of possible importance in recall of therapeutic information under altered state conditions. Like the previous findings about the effects of alcohol on acquisition, the individual differences in previous drinking experience among the Ss were also found to be unimportant in the production of state dependent recall deficits for information presented in either of the films.

In addition to evaluating the degree to which later recall of objective information acquired was affected by changes in state, recall of evaluations made by the Ss' about their subjective reactions to certain film characteristics were also assessed. These recall items

were included to determine if recall of memories about personal reactions to specific events experienced might also be subject to state specificity. It seemed logical that these memories of self (subjective reactions) as opposed to memories of environmental specifics (objective information acquired through exposure to external events) might be of clinical importance. Several studies (e.g., Tamerin et al., 1970; Vannicelli, 1972) have been reported in which sober alcoholics' predictions about the effects of alcohol on such dimensions as mood state, motor performance and personal preferences were found to be discrepant with subsequent intoxicated behavior. Tamerin et al. (1970) found that later recall while sober of several kinds of feeling states and behavior experienced while intoxicated was also inaccurate. If these observations of inaccurate prediction and recall of memories of self were found to be the product of state dependent learning, it might provide a partial explanation of several interesting phenomena of alcohol abuse. For instance, if memories of self were in fact state dependent, this finding could explain why certain persons drink to excess to 'forget their sober problems' and why they often fail to avoid certain circumstances experienced as quite unpleasant while sober during intoxicated periods. In the present study, the sample of personal reactions to the films presented was quite small and were not specifically chosen as representative of those which might be of consequential importance. However, they do represent a first attempt to evaluate recall of these types of memories within a state dependent framework.

The outcome of this modest attempt was quite surprising and straightforward in light of the small number of recall items employed and the manner in which recall, or more correctly, recognition[3] was measured.

Basically, the results indicated that later recall of these evaluations of subjective reactions to the films was unaffected by either the state in which they were made or the state in which recall was attempted but was significantly impaired if the state in which recall was attempted differed from that in which they were originally generated. This state dependent effect[4] was similar for both films indicating that dissociation was not a function of thematic content as was the case for recall of objective film information. It was also found that this effect of state change varied as a function of the drinking experience dimension whereby the light drinkers were more impaired than the heavy drinkers. In other words, the greater an S's previous experience with alcohol (higher quantity and frequency of drinking) the greater was his accuracy in recalling his previous evaluations about his subjective reactions to the films under alternate state conditions. This last finding seems inconsistent with both a motivational hypothesis of increased frequency of alcohol excesses to 'forget those sober problems' as well as earlier predictions made about susceptibility to the dissociative properties of alcohol increasing with extent of drinking history. However, given the narrowness of the present sample of alcohol consumers employed, it cannot be concluded that alcoholics are more resistant to dissociative effects for memories of self than nonalcoholics. Obviously, further research employing a broader range of Ss and items of more practical significance is needed. The present findings do suggest however that a drinking history dimension and its relevance to state dependency may not be a simple, positive linear relationship as had been previously suggested.

Taken together, the above findings suggest that the parameters, which were found to affect the production of state dependent recall in the drinking experiment, differed as a function of the kinds of memories involved. Recall of objective film information under state change conditions was affected by differences in thematic content of the material but not by differences in previous drinking experience. In contrast, for recall of evaluations made about the personal impact of the films (subjective reactions), differences in previous drinking experience were found to be highly important in the production of dissociative effects while differences in thematic content had no significant effect. From a therapeutic standpoint, the present findings suggest certain complications in determining if therapeutic material acquired might fail to be recalled during altered state conditions and who might be most susceptible to such problems. First, since the present findings in addition to those of several previous studies indicate that different kinds of memories seem to be differentially affected by changes in state, it becomes necessary to determine which kinds of specific memories acquired from therapeutic experiences are of most importance. In the present study, evidence of state dependent learning was found for recall of both memories of self and those of objective information presented in the films. However, since these state change effects were found to be differentially affected by the parameters investigated, predictions about state specificity of recall would likely need to consider the kinds of memories involved and other parameters of possible importance. Secondly, since the two kinds of memories investigated in the present study were obtained from the same Ss, the differential effectiveness of the parameters examined indicates that the Ss were not consistent in their recall performance on the different

tasks. This lack of correspondence between Ss' recall performance under state change conditions on the two kinds of memories investigated would seem to suggest that individuals who are susceptible to dissociative effects on one type of memory may not be equally vulnerable to state change deficits for memories of another type. This possibility would seriously question the validity of a unitary trait approach to susceptibility to dissociative effects as well as complicate attempts to determine accurate predictors to identify high risk individuals. This is not to say that individual differences in susceptibility to state change effects do not exist. However, attempts to determine these differences would need to take into account this variability across memories of different kinds in order to achieve an adequate degree of prediction for specific situations.

The self-report data from the Drinking Experience Inventory indicated that the majority of the nonalcoholic, social drinkers who participated in this study claimed to have had experienced fragmentary types of memory loss following drinking occasions on which they considered themselves to have been intoxicated. In contrast, only 4 of the 38 Ss reported having had experienced a blackout. These findings suggest that fragmentary types of memory problems may be more frequent and of more practical significance for nonalcoholic social drinkers than are classical blackouts. Almost all of those Ss claiming to have experienced fragmentary memory losses reported that these lost memories sometimes returned either spontaneously or with help at later times while sober. Only a few of these same Ss however reported to have experienced regaining these lost memories while similarly intoxicated

at later times. In addition, certain measures of other experiential dimensions were found to be good predictors of these reports about frequency of occurrence of these memory losses and their subsequent recall under either sober or intoxicated circumstances. Unfortunately, no evidence of correspondence between these reports of dissociation-like memory phenomena and actual performance observed under state change conditions was found. In short, these self-report measures were not found to be adequate predictors of recall performance under controlled, state change conditions.

It was hoped that these self-report measures might reflect an S's degree of susceptibility to dissociative problems which could be indirectly verified by his actual recall performance. In light of the previous recall findings however it appears that this expectation was somewhat naive. First, it was found that the Ss were not consistent in recall performance under state change conditions across the kinds of memories investigated. Since the questions asked about the incidence of dissociation-like memory phenomena were nonspecific in terms of the kinds of memories involved, it seems possible that the types of memory referred to by the Ss from their previous experiences may have been quite different in kind from those investigated in the drinking experiment. Secondly, the memory losses reported by the Ss may not have been the product of changes in state but rather the results of other factors such as situational changes which also have been found to impair recall performance. It seems likely that considerably greater detail about the circumstances involved in these memory losses would have been required to determine roughly the influence of these possible sources. However, the present findings concerning the susceptibility of recall

of memories of self to state change effects raise further questions about the validity of some of the self-report measures employed. Since the questions were responded to while the Ss were sober, their recall of phenomenological experiences while intoxicated may not have been very accurate. Consequently, the validity of personal information provided about experiences while intoxicated such as mood and behavioral changes, and recall of memories which had previously been experienced as lost while sober can be seriously questioned. These possible inaccuracies in recall of memories of self resulting from state specificity would seem to pose great difficulty for attempts to collect valid information about the phenomenology of intoxication by any method based solely on sober report.

Like many of the transfer studies of alcohol state dependent learning in man, the present investigation in retrospect seems to have raised more questions than it has answered. Certainly, the present findings imply that applied concerns about problems arising from state specificity of therapeutic gains in efforts to prevent alcohol abuse and its consequences cannot be answered by a simple yes or no and that many of these questions would seem to require rephrasing. Basically, the present study has demonstrated that recall of information, acquired through exposure to real life, multidimensional filmed material, can be significantly impaired by changes in state. However, these state dependent effects were found to differ according to the kinds of specific memories involved. Different types of memories (memories of self vs. memories of objective information) were found to be differentially

affected by the parameters of previous drinking experience of the Ss and thematic content of the material (related or unrealted to problems of alcohol abuse and its consequences). Also, findings of dissociative effects for objective information were dependent upon the method of recall assessment employed. And finally, no evidence was found to support a simple trait approach to individual differences in susceptibility to dissociative phenomena and the present attempt to measure such differences via sober report and assess its validity through direct observation of recall performance under state change conditions was unsuccessful.

In sum, the findings of the present investigation support the contention that generalizations made on the basis of laboratory research to therapeutic kinds of learning experiences are not necessarily valid and indicate the possible importance of certain parameters in determining the extent of resulting dissociative effects which have not previously been investigated. It is tempting at this point to try to extend the present findings to answer some of the crucial questions about the importance of state dependent learning for therapeutic undertakings. However, given some rather obvious differences between the sample of Ss employed in the present study and those typically involved in rehabilitative programs and our lack of information concerning the relationship between recall of therapeutic material and durable behavior change, which is the ultimate goal of treatment, such an attempt would be premature. It is hoped, however, that the present study has reopened some very practical issues about the ecological and therapeutic significance of state dependent learning and has roughly sketched a methodology by which they may be successfully resolved through future research.

Footnotes to the Discussion

[1]Winer (1962) and others have warned that, if large intact group differences are present on some pre-existing variable prior to treatment manipulations, an analysis of covariance used to statistically remove its effects on the dependent variable from those of the independent variable of interest, should be interpreted with caution. In the present case, however, the basis treatment groups were combined into same state groups (D-D and S-S) and state change groups (D-S and S-D) to determine presence or absence of significant state change effects (i.e., the aquisition state by recall state interaction). In regard to these composite groups no significant, intact group differences on measures of immediate recall were present for either film ($p = .94$ and $p = .29$ respectively). This lack of intact group differences between the state change and same state groups resulted from the combining procedure used for purposes of statistical analysis whereby the serendipitous group differences found among the Day 1 subject groupings on immediate recall performance (i.e., groups D-D and S-D were found to be superior to groups S-S and D-S) were balanced out. As a consequence, both the state change and the same state groups contained one subgroup with higher immediate recall scores and one with lower scores which resulted in the mean scores on immediate recall measures for the two groups being roughly equivalent. In short, these combining procedures resulted in an increase in the within group variability of immediate recall scores for the composite groups and a decrease in between group differences to an insignificant level. Because of this, the more traditional analysis of variance procedure would provide a rather

conservative estimate of the effects of changes in state since any effects on delayed recall resulting from prior differences among individual immediate recall performance would augment the error term (within group variation) rather than mimic treatment effects (between group variation). The analysis of covariance procedure was used to provide a more sensitive test for state dependent effects by statistically removing that portion of within group variation resulting from differences in immediate recall from the delayed recall data. Similarly, the use of the analysis of variance and covariance to determine the effects of acquisition state on delayed recall performance seems equally valid since the composite groups used to determine the influence of this variable (i.e., groups D-D and D-S, and groups S-S and S-D) were found not to be significantly different on measures of immediate recall. Unfortunately, this was not found to be the case for the between group factor of recall state because the composite groups used to evaluate its effect on delayed recall performance were significantly different on the immediate recall measures (i.e., groups D-D and S-D, and groups D-S and S-S).

[2]For the alternate form method of delayed recall assessment, these patterns of state change effects were found by both the analyses of variance and covariance. For the test-retest method, however, only the analysis of covariance yielded evidence of state change effects on recall of information from the alcoholism, while both methods of analysis agreed on a lack of such effects for the control film. Apparently, the adjustments made by the analysis of covariance for differences in

immediate recall on the delayed recall data from the alcoholism film, as measured by the test-retest procedure, resulted in findings of a state change effect which had been masked by these existing differences as demonstrated by a lack of significant state change effects yielded by the analysis of variance of the unadjusted scores (see Table 3.6).

[3]The Ss were required to reproduce their original evaluations by selecting the rating which they had given on the previous day. Since the questions to be rated and the response choices provided (1 to 5) were identical to those employed on the previous day, the Ss' task was essentially to choose the appropriate response out of 5 possibilities, which amounts to a recognition rather than a recall type of memory task. Given previous findings about the resiliency of recognition tasks to state change effects (e.g., Goodwin et al., 1969), the present findings are particularly interesting since retrieval aids in the form of the questionnaires provided on the second day were plentiful.

[4]Immediate recall (or recognition) of these evaluations was not assessed. Like Goodwin et al.'s (1969) word association test, the superiority of the same state groups over the changed state groups on the later measures of recall possibly might have resulted from a combination of other drug effects during their generation or recall attempts rather than state dependent learning as proposed by Overton (1974). However, since differences in either acquisition state or recall state were found to have had no significant effect on recall performance, this possibility seems remote.

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Appendix A

PERSONAL DATA SHEET

(please print)

Name: _____

(last name) (usual first name)

Address of Present Residence: _____

Phone: _____

Faculty Enrollment: _____, Year Level: _____

Age: _____ years. Marital Status: _____

Weight: _____ lbs. Height: _____ ft. _____ in.

---

1. Do you have any physical disabilities or medical problems which might be adverseley affected by the ingestion of the amounts of alcohol to be used in this study?

Yes _____ No _____

If yes, please specify _____

_____

_____

2. Do you presently use any perscription or other drugs?

Yes _____ No _____

If yes, please specify the type of drug(s), and the amount and frequency of consumption. _____

_____

_____

(Please note: your answers to questions 1 and 2 will be considered strictly confidential).

3. In the unlikelihood of an emergency arising from the intoxication procedures to be used, who should we contact?

Name: _____

Address: _____

Phone: _____

APPENDIX A (cont'd)

DRINKING EXPERIENCE INVENTORY

The following questionnaire is to gather information about your drinking habits and experiences. Several of the questions require rather specific answers which you may find difficult to provide in a precise way. Although you are to be accurate in your responses, please provide approximate answers to those questions which you are uncertain rather than leaving them blank. On completing the questionnaire, please check to see that you have answered each question.

Please Note: all information given by you in this questionnaire will be treated as strictly confidential and will be available to no one other than research staff.

APPENDIX A (cont'd)

Section A

1. The following question asks you to estimate the average amount of alcohol which you usually consume on any one occasion. Please remember that you are being asked about how much you actually drink, and not how much you can drink. (please check ✓ only one answer per question).

   a) On the average, how many ounces of distilled spirits (rye, vodka, gin, scotch, etc.) do you generally drink on any one occasion? (a full bottle contains 26 oz., a half bottle contains 13 oz., and a mixed drink from a bar contains 1 oz.).

		Score
1. I don't drink distilled spirits	_____	0
2. one to three ounces	_____	1
3. four to six ounces	_____	2
4. seven to nine ounces	_____	3
5. ten to twelve ounces	_____	4
6. thirteen to fifteen ounces	_____	5
7. sixteen to eighteen ounces	_____	6
8. more than eighteen ounces (specify #)	_____	7

   b) On the average, how many bottles of beer do you generally drink on any one occasion?

1. I don't drink beer	_____	0
2. one to two bottles	_____	1
3. three to four bottles	_____	2
4. five to six bottles	_____	3
5. seven to eight bottles	_____	4
6. nine to ten bottles	_____	5
7. eleven to twelve bottles	_____	6
8. more than twelve bottles (specify #)	_____	7

   c) On the average, how many ounces of wine do you generally drink on any one occasion? (full bottle contains about 25 ounces, a half bottle contains about 12 ounces, and an average size wine glass contains about 4 ounces).

1. I don't drink wine	_____	0
2. one to ten ounces	_____	1
3. eleven to twenty ounces	_____	2
4. twenty-one to thirty ounces	_____	3
5. thirty-one to forty ounces	_____	4
6. forty-one to fifty ounces	_____	5
7. fifty-one to sixty ounces	_____	6
8. more than sixty ounces (specify #)	_____	7

2. How often do you drink:

   a) Distilled Spirits?

1. never	_____	0
2. only once or twice a year	_____	1
3. less than once a month	_____	2
4. about once a month	_____	3
5. more than once a month but not weekly	_____	4
6. about once a week	_____	5
7. more than once a week but not daily	_____	6
8. every day	_____	7

b) Bottled Beer?

		Score
1. never	_____	0
2. only once or twice a year	_____	1
3. less than once a month	_____	2
4. about once a month	_____	3
5. more than once a month but not weekly	_____	4
6. about once a week	_____	5
7. more than once a week but not daily	_____	6
8. every day	_____	7

c) Wine?

1. never	_____	0
2. only once or twice a year	_____	1
3. less than once a month	_____	2
4. about once a month	_____	3
5. more than once a month but not weekly	_____	4
6. about once a week	_____	5
7. more than once a week but not daily	_____	6
8. every day	_____	7

3. Where do you drink most often? (please check only one)

a. your own home?	_____
b. friend's home?	_____
c. private party?	_____
d. licensed restaurant?	_____
e. night club?	_____
f. bar?	_____

4. When you drink, are you usually: (please check only one)

a. with spouse or family members?	_____
b. with friends from work, school, etc.?	_____
c. with barroom clientel that you've met and know solely through association with drinking?	_____
d. alone?	_____

APPENDIX A (cont'd)

Section B

1. Have you ever considered yourself to have been intoxicated or "under the influence" of alcohol? (if no, go on to Section c)

   Yes _____ No _____

   How often do you become intoxicated when drinking?

   never _____, seldom _____, sometimes _____, usually _____, always _____.

2. In comparison to most of your drinking friends, how much alcohol is required for you to become similarly intoxicated?

   much less _____, a bit less ____, about the same amount _____, a bit more _____, much more _____.

3. During these periods of intoxication, have you ever noticed or been informed by others of a marked change in your behaviour from that which you consider typically normal for you?

   never ____, seldom ____, sometimes ____, usually ____, always ____.

4. a) Have you ever had difficulty recalling certain events, experienced during these periods of intoxication, at later times when sober?

   never ____, seldom ____, sometimes ____, usually ____, always ____.

   b) Have you ever experienced recalling these forgotten events during subsequent drinking occasions?

   never ____, seldom ____, sometimes ____, usually ____, always ____.

   c) Have you ever experienced recalling these forgotten events at later times when sober either spontaneously or when reminded by someone else?

   never ____, seldom ____, sometimes ____, usually ____, always ____.

5. In contrast to these difficulties in recalling specific events (4 a b & c), have you ever experienced blackouts. (complete loss of memory for substantial periods during a drinking episode without having physically passed out)? If so, how often?

   never ____, seldom ____, sometimes ____, usually ____, always ____.

6. During drinking occasions, many people report changes in their mood. If, in your drinking experiences, you have observed this effect, please complete the following statement.

   Drinking usually tends to make me feel: (please check only one).

   a. tense, nervous, on edge ____
   b. angry, furious, ready to fight ____
   c. worthless, helpless, unhappy ____
   d. lively, vigorous, full of pep ____
   e. tired, fatigued, worn out ____

APPENDIX A (cont'd)

Section C

People generally drink for many different reasons. The following series of questions asks you to rate the relevance or appropriateness of several reasons, (which people typically give) for your drinking.

1. Just to be friendly. never ____, seldom ____, somtimes ____, usually ____, always ____.

2. feeling pressure, tension. never ____, seldom ____, somtimes ____, usually ____, always ____.

3. relief from pain. never ____, seldom ____, sometimes ____, usually ____, always ____.

4. just to experience the feeling. never ____, seldom ____, sometimes ____, usually ____, always ____.

5. having problems. never ____, seldom ____, sometimes ____, usually ____, always ____.

6. feeling lonely. never ____, seldom ____, sometimes ____, usually ____, always ____.

7. nothing else better to do. never ____, seldom ____, sometimes ____, usually ____, always ____.

8. feeling angry. never ____, seldom ____, sometimes ____, usually ____, always ____.

9. special occasions, celebrations. never ____, seldom ____, sometimes ____, usually ____, always ____.

10. not getting ahead. never ____, seldom ____, sometimes ____, usually ____, always ____.

11. to be 'in' and part of the crowd. never ____, seldom ____, sometimes ____, usually ____, always ____.

12. to reduce inhibitions. never ____, seldom ____, sometimes ____, usually ____, always ____.

13. to get high or smashed. never ____, seldom ____, sometimes ____, usually ____, always ____.

14. to increase self-confidence. never ____, seldom ____, sometimes ____, usually ____, always ____.

15. to forget I'm not the person I'd like to be. never ____, seldom ____, sometimes ____, usually ____, always ____.

16. to be polite in not refusing. never ____, seldom ____, sometimes ____, usually ____, always ____.

APPENDIX A (cont'd)

Section D

		Yes	No
1.	Do you enjoy a drink now and then?	____	____
2.	Do you feel you are a normal drinker? (that is, drink no more than average).	____	____
3.	Have you ever awakened the morning after some drinking the night before and found that you could not remember a part of the evening?	____	____
4.	Do close relatives ever worry or complain about your drinking?	____	____
5.	Can you stop drinking without a struggle after one or two drinks?	____	____
6.	Do you ever feel guilty about your drinking?	____	____
7.	Do friends or relatives think you are a normal drinker?	____	____
8.	Are you always able to stop drinking when you want to?	____	____
9.	Have you ever attended a meeting of Alcoholics Anonymous (AA) because of your drinking?	____	____
10.	Have you gotten into physical fights when drinking?	____	____
11.	Has drinking ever created problems between you and your wife, husband, parent, or near relative?	____	____
12.	Has your wife, husband, or other family members ever gone to anyone for help about your drinking?	____	____
13.	Have you ever lost friendships because of your drinking?	____	____
14.	Have you ever gotten into trouble at work because of drinking?	____	____
15.	Have you ever lost a job because of drinking?	____	____
16.	Have you ever neglected your obligations, your family, or your work for 2 or more days in a row because you were drinking?	____	____
17.	Do you ever drink in the morning?	____	____
18.	Have you ever felt the need to cut down on your drinking?	____	____
19.	Have there been times in your adult life when you have found it necessary to completely avoid alcohol?	____	____
20.	Have you ever been told you have liver trouble? Cirrhosis?	____	____
21.	Have you ever had delirium tremens (DT's)?	____	____
22.	Have you ever had severe shaking, heard voices, or seen things that weren't there after heavy drinking?	____	____
23.	Have you ever gone to anyone for help about your drinking?	____	____
24.	Have you ever been in a hospital because of drinking?	____	____
25.	Have you ever been told by a doctor to stop drinking?	____	____

	Yes	No
26. Have you ever been a patient in a psychiatric hospital or on a psychiatric ward of a general hospital?	____	____
27. Was drinking part of the problem that resulted in that hospitalization?	____	____
28. Have you ever been a patient at a psychiatric or mental health clinic or gone to any doctor, social worker, or clergyman for help with any emotional problem?	____	____
29. Have you ever been arrested, even for a few hours, because of drunken behavior (not driving)? How many times? _____	____	____
30. Have you ever been arrested, even for a few hours, because of driving while intoxicated? How many times? _____	____	____
31. - 34. Have any of the following relatives ever had problems with alcohol?		
31. A. Parents	____	____
32. B. Brothers or sisters	____	____
33. C. Husband or wife	____	____
34. D. Children	____	____

APPENDIX A (cont'd)

Physician Consent Form

TO: Dr. _____

FROM: Robert Goulet,
Department of Psychology,
University of Manitoba.

This memo is to inform you that your patient, _____, has volunteered to participate in a research project which will involve his consumption of moderate quantities of alcohol (from 5 to 8 ounces of vodka, depending on body weight, spaced over a one hour period) on two, consecutive days. This investigation will be conducted at the Duff Roblin Building, University of Manitoba, by myself and a registered nurse with the Victoria General Hospital, Emergency Unit, to be utilized should any medical emergency arise during the course of this study. Because of our concern for the safety of our subjects, we are requiring written permission from the family physician of all volunteers.

If you have no reservations, based on his medical history and current state of health, please complete the following consent form.

I, _____, declare that my patient, _____, is in good physical health, and has no medical problems or is currently undergoing any medical treatment which might be adversely affected by the consumption of the quantities of alcohol to be used in this experiment.

Signature _____

Date _____

Thank you for your cooperation.

APPENDIX A (cont'd)

SUBJECT CONSENT FORM

(please read carefully)

Name _____

Date _____

I, _____, understand that the research for which I am volunteering requires a time commitment of two to three hours per day for two consecutive days and may involve the consumption of moderate amounts of alcohol (approximately five to eight ounces of vodka mixed with equivalent amounts of orange juice over a one hour period) during the course of this experiment.

As a subject in this study, I agree to fulfill the following requirements:

1. to obtain written permission from my family physician to participate in this experiment as verification that I do not have any medical problems and am not undergoing any medical treatment which may be adversely affected by consuming moderate quantities of alcohol. (This consent form is to be completed by your physician).

2. to abstain from all alcohol consumption and other drug use (tobacco and coffee are permissible), except that administered during the experiment, for a period beginning twenty-four hours prior to the first day and ending with the completion of procedures on the second day.

3. to eat a light meal no less than two hours prior to each of the two sessions.

4. to remain after each day's session, if alcohol has been consumed, and to accept escorted transportation to place of residence. (Subjects residing on campus will be escorted back by research staff. Subjects residing off campus are to arrange to be picked up following each session if possible; if not, transportation will be provided for them).

5. to carry out all instructions given to me during the course of this experiment.

I understand that I may withdraw from the study at any time. All of my questions concerning the procedures and purposes of this experiment have been answered to my satisfaction.

Signature _____

Witness _____

APPENDIX B

Drinking Experience Inventory (n = 38)

A. Summary Table of Means & Standard Deviations for all Continuous Variables (12 scales).

Code	Variable	Possible Total	Mean Score	Standard Deviation
FR	Frequency of Consumption	21	10.97	3.50
QT	Quantity/Consumption	21	5.82	2.35
Q-F	Quantity-Frequency Index	147	25.63	14.19
IMM	Immature Drinking Motives	13	3.24	1.90
SAAST	Alcoholism Test	33	3.03	2.66
TOX	Frequency of Intoxication	5	2.79	0.91
TOL	Tolerance to Alcohol	5	2.95	1.08
BCH	Behavior Change Frequency	5	2.45	1.06
SD1	State Dependent #1	5	2.08	0.78
SD2	State Dependent #2	5	1.37	0.71
SD3	State Dependent #3	5	2.37	1.15
BLO	Blackout Frequency	5	1.13	0.41

APPENDIX B (cont'd)

B. Frequency of Responding for all Categorical Variables (3 scales)

1. With Whom do you typically drink?

	Frequency (%)
a) spounse or family members	3%
b) friends from work, school, etc.	97%
c) barroom clientel known solely through drinking	0%
d) alone	0%

2. Where do you typically drink?

	Frequency (%)
a) own home	16%
b) friend's home	13%
c) private party	33%
d) licensed restaurant	3%
e) night club	5%
f) bar	30%

3. Drinking usually tends to make me feel:

	Frequency (%)
a) tense, nervous, on edge	3%
b) angry, furious, ready to fight	0%
c) worthless, helpless, unhappy	0%
d) lively, vigorous, full of pep	86%
e) tired, fatigued, worn out	11%

APPENDIX C

Film Rating Sheet

On the basis of the film you have just seen, please answer the following questions. Circle only one of the five possible answers to each of the questions.

1. How difficult was it for you to keep your attention from wandering during the film?

1	2	3	4	5
not at all difficult		moderately difficult		highly difficult

2. How interesting did you find the subject matter of the film?

1	2	3	4	5
not at all interesting		moderately interesting		highly interesting

3. How realistic did you find the plot, its characters and the way they were presented?

1	2	3	4	5
not at all realistic		moderately realistic		highly realistic

4. Overall, did the film have a pleasant or unpleasant emotional impact on you?

1	2	3	4	5
highly unpleasant		neither unpleasant nor pleasant		highly pleasant

5. If tested at this moment, how many of the specific events and situations depicted in the film do you suppose you could recall?

1	2	3	4	5
one of them		about half of them		all of them

APPENDIX D

Mean Rating Scores on Film Dimensions for the Alcoholism Film, Control Film #1, and Control Film #2

Film Dimensions	Alcoholism Film	Control Film #1	Control Film #2
1. Realism	4.6	4.0	4.4
2. Interest Value	3.6	3.2	3.8
3. Attention Holding	1.4	2.0	1.2
4. Emotional Impact	2.8	3.2	3.8
5. Recall	3.4	3.6	3.4

Comparisons of Mean Rating Scores on Film Dimensions Between the Alcoholism Film and Control Film #1, and Between the Alcoholism Film and Control Film #2 (correlated t-tests)

	Alcoholism Film vs. Control Film #1		Alcoholism Film vs. Control Film #2	
Film Dimensions	t score	probability	t score	probability
1. Realism	3.21	$.02 < p < .05$	0.34	$p > .20$
2. Interest Value	1.64	$.10 < p < .20$	-0.34	$p > .20$
3. Attention Holding	-1.18	$p > .20$	0.53	$p > .20$
4. Emotional Impact	-1.00	$p > .20$	-2.23	$.05 < p < .10$
5. Recall	-0.41	$p > .20$	0.00	$p > .20$

APPENDIX E

Alcoholism Film Questionnaire, Form A1

1. The title of the film is "_____ of Silence."

2. The main characters in the film are a young, married couple whose names are Joe and _____.

3. The name of the theme song which is sung at various times during the film is "Here's _____ _____ _____."

4. When the young couple is shown at a party before their marriage, the narrator states that approximately _____ percent of all alcoholics are under 30 years old.

5. At a later time, after their marraige, the narrator tells us that soon they never went anywhere without taking along something to drink. Joe asks his wife where the _____ is.

6. Joe and his wife are at a nightclub. Joe goes over to the bar and asks the _____ if that drink is for them, drinks it and orders another to be brought to their table.

7. When Joe is flirting with another woman at the nightclub, the narrator tells us that he now suffers from _____.

8. At the nightclub, Joe meets an attractive readhead, who is an old acquaintance. After chatting a bit at her table, they start to _____.

9. During the scene where Joe's wife tells him to pack and get out, at first she tells him that she went to see a _____.

10. When his wife tells him her plan to divorce him, Joe thinks at first that it was because he lost his _____.

Alcoholism Film Questionnaire, Form A2

1. The film begins with a school teacher talking to a _____ in an office.

2. After the first few scenes, the narrator of the film begins by asking us "What are these people trying to _____."

3. After Joe and his wife have returned home from a party, the narrator tells us that it is estimated that for every alcoholic, _____ other lives are also affected.

4. In talking about the period before they were married, Joe's wife tells us that it never occurred to her that _____ people could be alcoholics.

5. Just after their marriage, Joe and his wife are seen standing on a _____ drinking martinis. Joe's wife mentions that they got into the habit of having a drink before dinner.

6. One Saturday morning after a party, Joe, who is very hung over, is seen in the kitchen having _____ for breakfast.

7. When Joe is causing a scene at the nightclub, his wife intervenes and demands to go home. Joe slaps her and throws his _____ _____ on the floor in front of her.

8. After the incident at the nightclub, Joe's wife picks him up at the _____ _____.

9. After telling Joe to get out, his wife tells us that she finally realized that, by _____ Joe, she had also become part of the problem.

10. This film was produced by Durham Productions, Inc., in the state of _____, U.S.A.

Control Film Questionnaire, Form C1

1. The title of film is "He's Not the _____ Kind."

2. At the beginning of the film, we see a young man sitting in a wheelchair in the middle of a _____, waving and shouting to the jet as it leaves the ground.

3. As Brian goes to work in the morning, after leaving his apartment block, he travels along the sidewalk, crosses a busy street at a crosswalk and then crosses some _____ _____ before reaching his destination.

4. During lunch time at work, Brian is in the cafeteria talking to a young man about his _____.

5. Brian concludes his story about his childhood by telling us that his greatest wish is that his _____ realize that he is happy and on his own.

6. Brian and his father are shown on the dock of a lake near the family home. After lifting Brian into their motorboat, his father positions him at the _____ of the boat.

7. Between events at the rodeo, two clowns in a _____ _____ entertain the crowd.

8. After the rodeo, Brian is sitting in his wheelchair in the front yard of the family home. His father walks into the yard wearing a _____.

9. Toward the end of the film, Brian and his father are shown approaching a tractor which is parked at the side of a _____.

10. After Brian is comfortably seated on the tractor, his father places the _____ on a wagon attached to the back of the tractor.

Control Film Questionnaire, Form C2

1. Brian is shown in his apartment sitting in his wheelchair, near the beginning of the film. He turns on the _____ with an extension rod, which allows him to reach the switches.

2. Inside the building where he works, Brian is shown at an office desk talking into a _____ telephone, making arrangements to pick up some articles.

3. Brian works at Good _____ Enterprises, which employs the handicapped.

4. After he leaves work, the next scene shows Brian dressed in a blue suit and wearing a cowboy hat, being helped on to a_____.

5. Just after Brian arrives at the family home, he is shown together with his parents, brothers and sisters outside the house. His father is shown cutting up a _____.

6. As Brian describes his childhood, and we are shown a scene from the past where two kids are building a snowman, he tells us that he has been in a wheelchair since he was _____ years old.

7. After the scene at the lake, Brian travels by car into a nearby town. Once there, he is shown enjoying himself at a _____, as he watches two men playing a game.

8. Brian and his father are having breakfast together out in the yard. Brian tells his father than he can't get excited anymore. His father interrupts him and reminds him about his experience with the _____.

9. When his father helps Brian get on the seat of the tractor, they have difficulty lifting his legs over the _____.

10. At the end of the film, the _____ gets smaller and smaller in the distance.

APPENDIX F

Judgment Rating Scales

The following series of questions asks you to rate your answers on a 5 point scale. Points 1, 3 & 5 have been defined for you. Points 2 & 4 have been supplied in case your answers fall between the defined points. Please circle only one point for each question. If you have not been given alcohol, start with Question #3.

1. How intoxicated do you feel at this moment?

1	2	3	4	5
not at all intoxicated		moderately intoxicated		highly intoxicated

2. In comparison to your past drinking experiences, are you presently more intoxicated or less intoxicated than you usually get on an average drinking occasion?

1	2	3	4	5
much less intoxicated		about the same		much more intoxicated

3. How difficult was it for you to keep your attention from wandering during this film?

1	2	3	4	5
not at all difficult		moderately difficult		highly difficult

4. How interesting did you find the story of the film?

1	2	3	4	5
not at all interesting		moderately interesting		highly interesting

5. How difficult was it for you to follow and understand the plot of the film?

1	2	3	4	5
not at all difficult		moderately difficult		highly difficult

6. Did the film have a pleasant or unpleasant emotional impact on you?

1	2	3	4	5
highly unpleasant		neither pleasant nor unpleasant		highly pleasant