

ALCOHOL, CREATIVITY, AND STATE DEPENDENT SENSORIMOTOR LEARNING

by

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ABSTRACT

In light of theoretical approaches to alcohol use that emphasize the possible adaptive or functional consequences of drinking alcoholic beverages, the possible beneficial effects of alcohol on performance were tested on non-alcoholic male undergraduate students. It was hypothesized that a moderately intoxicating dose of alcohol (1.1 ml ethanol/kg body weight) would increase creative writing as measured by novel figurative language usage and performance on the Remote Associates Test (RAT; Mednick and Mednick, 1967). A comparison of the writing of 11 subjects under alcohol and placebo conditions showed that alcohol ingestion increased the production of novel figurative language and increased the total amount of words written. A between groups analysis (alcohol vs placebo) showed no effect of alcohol on RAT performance. A possible expectancy confound was identified. The second hypothesis predicted that alcohol can produce state dependent learning of sensorimotor acts. Dart throwing accuracy with the nonpreferred hand and mirror tracing skill were examined in four groups of six subjects. The groups were defined by state (alcohol intoxication or placebo-linked sobriety) on Day 1 of testing crossed with state on Day 2 of testing. No evidence of alcohol state dependent learning was found, nor were there any significant effects of alcohol on performance.

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I. The Problem

This chapter discusses the functional approach to alcohol drinking habits and the theoretical issues it raises. Chapter II focuses on the possibility that alcohol intoxication directly facilitates creative writing and indirectly facilitates sensorimotor performance via alcohol state dependent learning.

What psychological processes operate to perpetuate alcohol drinking habits? What functions might alcohol serve in the life of the drinker? And what experiences, associated with alcohol intoxication, reinforce drinking? These are the general questions that the following research attempts to address and they are crucial questions asked by a functional (or adaptive) approach to alcohol use.

The importance of these questions may appear to be so obvious that consideration of them seems superfluous. Yet the power exerted by the disease model of alcoholism (e.g. Alcoholics Anonymous, 1957; Jellinek, 1960) which emphasizes the compulsive and physiological aspects of alcoholism, has unfortunately drawn attention away from such questions. There are reasons for preferring the functional approach to the disease model.

The disease model is found lacking because, contrary to its

premises, alcoholism does not precipitate severe craving or the 'loss of control' phenomenon (Maisto & Scheft, 1977; Marlatt, Demming, and Reid, 1973). Neither must a patient show signs of tolerance, withdrawal, or any other signs of physiological distress to be diagnosed as alcoholic (Schuckit, 1979). Furthermore, despite the evidence from twin studies for a genetic component to alcoholism (e.g. Goodwin, 1979), no organic substrates of alcoholism have been identified.

The emphasis that the disease model places on pathological processes (physical or mental) has arguably limited inquiry into alcoholism by rejecting the possible adaptive or functional aspects of drinking habits. Non-alcoholics may be enjoying many of the reinforcing aspects of drunkenness shared by the alcoholic and not all drunken experiences need be deleterious. Rather than dichotomizing alcohol users into alcoholics and social drinkers, it may be more fruitful to consider alcohol consumption as a matter of degree.

Clinicians have observed adaptive consequences of intoxication. Davis, Berenson, Steinglass and Davis (1974) reported the case of an alcoholic whose alcohol related assertiveness was useful and in one case lifesaving (the alcoholic, contrary to her sober habits, made a loud call for medical intervention when her child displayed ambiguous signs of distress). These authors advise that when arranging contingency contracts with alcoholics, the behavior therapist should attempt

to discover what reinforcing aspects of alcohol may have been maintaining its use. Bateson's (1971) clinical analysis of alcoholism supports this type of strategy as he described alcoholism as being perpetuated by an intoxication linked logic, or view of the world, wherein the world makes more sense for the alcoholic when he or she is drunk than when sober.

Galanter (1976) argues for an intoxicated state of consciousness model of addiction, especially in the case of drugs (e.g. alcohol and marijuana) that can serve the user in social interaction. He encourages clinicians to consider this when treating addicts:

"The altered state the abuser achieves may be valuable in assisting him to sustain an equilibrium within his particular social context. It becomes of central importance to ascertain what adaptive traits the intoxication state provides a given patient and then assist him to develop the capacity to achieve such ends without recourse to the intoxicants" (p. 638).

There are many logically possible adaptive functions of alcohol intoxication. Adaptive in this context means individually functional, rather than beneficial to the group. Drinking may be seen as adaptive if the user finds that alcohol facilitates desired thoughts or behaviours. Such facilitation can be real or imagined. That is, the benefit may be caused by the pharmacological action of alcohol, or such benefits may be falsely attributed to the effects of alcohol. Furthermore, non-specific factors (e.g. expectancy) common in the consumption of almost any drug can produce facilitative effects (e.g. pain

relief arising from placebos; Beecher, 1955).

Two basic problems arise in discussing adaptive functions of alcohol. First, the adaptive argument may be self-validating and irrefutable, particularly when based on post hoc analysis. If one looks long enough one is almost bound to find an adaptive consequence of virtually any action. Second, while a drug may facilitate one behavior it may disrupt two others thus having a negative net adaptive value. The first problem is a methodological one shared by all functional or evolutionary approaches in scientific inquiry. Philosophical analysis of a functional approach to any subject matter yields a basic metaphysical assumption that everything serves a function. This need not obstruct inquiry as a functional approach can act as an organizing principle to further our investigations of alcohol use. The second problem is more direct. It presents the researcher with the need to develop some sort of scoring system so that one may say that one habit is more or less adaptive than another. This problem will be sidestepped as the purpose of this thesis is to consider the presence of certain adaptive consequences of alcohol intoxication.

Two possible functional values of intoxication are: 1) it may enhance creativity, and 2) thoughts or behaviors, learned while intoxicated, may be best recalled in the intoxicated state (state dependent learning).

The experiment described below was designed to examine possible effects of alcohol on creative writing and to test for the presence of alcohol state-dependent sensorimotor learning. If alcohol does show facilitating effects with casual drinkers we might further our understanding of what possible reinforcements might be operating in the transition from casual to habitual use of alcohol.

II. The Focus

Alcohol's relationship with creativity and state dependent learning is poetically addressed by the Chinese poet Li Po:

With three cups,
I understand the great way.
With one jar,
I am at one with nature.
Only the perceptions
that one has while drunk
cannot be transmitted
after one is sober, (in Birch, 1965, p. 231).

Li Po is famous for his celebrations of the intoxicated state of consciousness, but hardly typical of the Chinese attitude. China has prohibited alcohol and repealed such laws at least 40 times (Moore, 1948). Ambivalence toward alcohol can also be seen in Western civilization. When distilled spirits were introduced alcohol was held to be a miracle drug that opened the mind and healed the body; this was soon followed by condemnations of drunkenness as a "disease of the mind" (Roueché, 1960). From Biblical times to the present alcohol has been viewed by religious, political, and medical authorities as being either beneficial or dangerously disruptive to the physical or mental state of the user, (Szasz, 1974). However, whether the cognitive effects of alcohol were judged good or bad, they were most often seen as extraordinary.

Alcohol and Creativity

The possible facilitative effects of alcohol on creativity has been a persistent issue. The 15th century physician Brunschwig held that alcohol "causes the heavy tongue to become light and well speaking," (in Rouche, 1960, p. 24). Many of our most cherished writers were said to be alcoholics (Kazin, 1976), including Edgar Allen Poe, Jack London, F. Scott Fitzgerald, Dylan Thomas, and Jack Kerouac. It is unclear exactly how alcohol may have affected their creativity. Fitzgerald and Kerouac were often drunk while writing. Thomas, on the other hand, was characteristically sober during his work; his binges were more a part of the social events in his life. Although there has been no systematic research on the relationship between alcohol and professional writing, the conjecture that alcohol may facilitate creative writing is considered in both the popular (e.g. Conrad, 1980) and medical (e.g. Goodwin, 1973) literature.

The scientific literature reveals few attempts to investigate the possible link between alcohol and creativity. Roe (1946) surveyed over twenty artists in New York and found only one who attributed to alcohol any positive effect on his painting. One unpublished study found that subjects drinking an average of 240 ml of 80 proof whiskey produced more original solutions to a word association test (Kent-Rosanoff Test) than

sober subjects (Hajcak, 1976). Kastyl (1969) found that alcohol produced no differences in associative creativity. Nash (1962) found that low doses of alcohol increased the amount of verbal association. Although Nash (1962) has been cited as an example of alcohol influencing creativity (Arieti, 1976), only Hajcak (1976) applied a direct and explicit experimental test of the hypothesis that alcohol facilitates creativity.

Despite the meager research, there are reasons to consider alcohol as a possible facilitator of creative writing. There are anecdotal reports of alcohol being perceived as an effective tool in overcoming "writer's block", the frustration associated with initiating the act of writing (Goodwin, 1973). Further, alcohol consumption has been regarded in most cultures as having disinhibiting effects (Horton, 1943). Increases in talkativeness (Nash, 1962) and aggression (Graham, 1980) have been associated with and attributed to alcohol intoxication. Such disinhibiting effects have been explained by the physiological effects of alcohol on the nervous system (Greenberg, 1953) and by expectancies associated with sociocultural sanctions attached to drunkenness (MacAndrew and Edgerton, 1969). Regardless of what the underlying processes may be, alcohol linked disinhibition may loosen the drinker's constraints on style. He or she may entertain thoughts and syntax that would have been edited when sober. William James, well aware of the disinhibition idea, regarded alcohol intoxication as a route to mystic

consciousness:

"The sway of alcohol over mankind is unquestionably due to its power to stimulate the mystical faculties of human nature, usually crushed to earth by the cold facts and dry criticisms of the sober hour. Sobriety diminishes, discriminates and says no; drunkenness expands, unites and says yes. It is in fact the great exciter of the Yes function in man" (1977, p. 305).

However creativity is more than saying yes to inhibited images and ideas. Appropriateness marks off the creative response from the merely unusual one. Whether writing is generated while drunk or sober, appropriate writing will characterize some proportion of the total output. So if the total output is increased, then the amount of creative writing should increase too.

Similar to the disinhibition argument is Rees' suggestion that "alcohol might promote literary work in those for whom severe emotional distress prevents effective work," (1960, p. 6). He advises that amounts of alcohol high enough to relieve distress but low enough to avoid intellectual impairment may help such writers. Goodwin (1973) observed that professional writers sometimes suffer from a form of "stagefright" (tension arising from anticipated criticisms of their latest work) and he suggests that alcohol may "silence the critic" so that the flow of writing may proceed. Some concede that alcohol may relieve excess anxiety but that this does not imply an increase in creativity (e.g. Arieti, 1976). There is conflicting evidence surrounding the assertion that people drink to relieve stress or

that alcohol is tension reducing (Cappell and Herman, 1972).

Experimental data on the effects of alcohol on verbal performance with placebo controls is sparse, but in general suggest that low doses of alcohol tend to increase verbal fluency while also reducing the appropriateness of the response. Nash (1962) found this with the written performance of subjects with a .035% blood alcohol concentration (BAC). Kastyl's (1969) subjects produced more verbal associations with moderate doses (.33 and .67 ml ethanol/kg body weight) than with a placebo or a 1.0 ml/kg dose. In a study that lacked a placebo control, subjects with a BAC of .13% had increased verbosity and lowered critical ability (Reputen, Al'perovich, Mikheyev, & Shneider, 1960). On the other hand, Hartocollis and Johnson's (1956) subjects, with a BAC of approximately .10%, showed reduced verbal fluency in both the restricted and open-ended association tasks.

As with appropriateness, the style of verbal associations also seems affected by alcohol. Pollach (1966) found that normal subjects' output became more personal, less stereotypical, and more emotional when drunk. Alcoholics showed an opposite effect. Applying a logic that is unclear, Pollach discusses this interaction in terms of alcoholics having different coping behaviors. Unfortunately Pollach didn't apply placebos in the sober condition. Levy and Murphy (1966) showed that subjects given moderate amounts of alcohol (.7 ml/kg) tend to generalize

verbal associations to sound more than to meaning whereas placebo subjects showed a reverse relationship. This suggests that alcohol reduces the appropriateness of verbal response.

Indeed, evidence regarding the relationship between alcohol and creativity, as reflected by the literature, is somewhat muddled. There are several rival hypotheses explaining the anecdotal link between alcohol and creative writing. Li Po and Jack Kerouac may have been creative in spite of intoxication, and there may be a greater number of people who suffer a loss of creativity when drinking than who benefit from alcohol. Further experimental testing may delineate the elusive relationship between alcohol and creativity.

Alcohol and State Dependent Learning

Is it the case that a person learns some things when drunk which he can only perform, or performs best, when again drunk? This is the main question addressed in studies of alcohol state dependent learning (ASDL). The importance of ASDL research in developing a theory about the adaptive or reinforcing aspects of alcohol drinking habits is straightforward and the clinical implications of this research have been considered. Overton (1972) succinctly states that the relevance of state dependent learning to alcoholism "arises from the possibility of conditioned reactions to alcohol, as distinct from its

pharmacological effects," (p. 211-212). If such conditioned reactions to alcohol are reinforcing, then the process of alcohol addiction may also be reinforced. Clinicians have advised that if certain behaviors are state dependent, then the therapist must identify them and help the addict/client gain access to such a repertoire of behaviors without recourse to drugs (Galanter, 1976; Reus, Weingartner, & Post, 1979).

Such dissociative learning may also act to obstruct therapeutic intervention because alcoholics, treated while sober, may not generalize their therapeutic insights or contingency contracts into times of intoxication. Storm and Smart (1964) go so far as to suggest that the treatment of alcoholism might be furthered if the client is intoxicated during therapy.

There are several reports of ASDL in normals (Goodwin, Powell, Bremer, Hoine & Stern, 1969; Petersen, 1977; Tarter, 1970; Weingartner, Adefis, Eich & Murphy, 1976) and in alcoholics (Storm and Caird, 1967; Weingartner and Faillace, 1971). These studies have typically used a 2 X 2 design with state on Day 1 (alcohol ingestion or placebo) crossed with state on Day 2. The Weingartner studies (1971; 1976) examined these four drug state/order combinations in the same subjects, whereas the others used a more traditional method of testing four groups of subjects, one for each combination. The alcohol condition in these studies typically involves the consumption of

approximately 1.0 ml ethanol/kg body weight. This produces blood alcohol concentrations averaging approximately .10%. The subjects perform novel verbal learning tasks (e.g. memorizing lists of words, nonsense syllables, or word associations) and are tested on Day 1. On Day 2, usually 24 hours after Day 1 testing, the subjects are tested again. The dependent variable is performance on Day 2.

Two of the aforementioned studies (Goodwin et al., 1969; Tarter, 1970) found alcohol state dependent negative transfer. That is, groups experiencing different drug states across days performed better on Day 2 tasks that were slightly altered from the Day 1 tasks than the groups who were in the same drug state across days. Theoretically, the same state subjects had greater recall of the Day 1 task which served to interfere with learning a similar yet different task.

State dependent learning in man has also been found with marijuana (Darley, Tinklenberg & Roth, 1974), amphetamine (Bustamante, Rosello, Jordan, Pradere & Insus, 1968), and barbiturates (Bustamante, Jordan, Villa, Gonzolez & Irsua, 1969). Non-pharmacologically induced state dependent learning has also been reported. Recall of verbal associations shows state dependence with patients alternating between the states of mania and normalcy (Weingartner, Miller & Murphy, 1977).

Some experimenters have failed to show ASDL both in normals (Miller, Adesso, Fleming, Gino, & Lauerman, 1972; Parker,

Birnbaum & Noble, 1976; Wickelgren, 1975) and alcoholics (Goodwin, Powell, Hill, Leiberman & Viamontes, 1974; Nathan, Goldman, Lisman, & Taylor, 1972). The Wickelgren (1975) study is not a strong refutation of the ASDL hypothesis as he did not directly test it. Also, his dependent measure was word recognition, and recognition tasks have been repeatedly shown to be insensitive to ASDL (Goodwin et al., 1969; Goodwin et al., 1974; Parker et al., 1976).

These conflicting results might be explained by identifying differences in degree of intoxication (Goodwin, et. al., 1974). Most of the experimental studies on ASDL did not report if the subjects felt intoxicated. Other possible confounding variables could be group differences in Day 1 learning (Miller et al., 1972) or state related differences in motivation to recall accurately (Parker et al., 1976). Unfortunately no single experimental procedure has been replicated which confounds the task of accounting for these equivocal findings in ASDL.

The methods of data analysis also pose a problem. Using a 2 X 2 factorial analysis of variance (ANOVA), with state on Day 1 crossed with state on Day 2 and with Day 2 performance as the dependent variable (DV), the aforementioned research will acknowledge ASDL only if there is a significant interaction effect of state on Day 1 and state on Day 2. This method can be confusing as both sober state dependent learning and alcohol state dependent learning are part of the interaction. Goodwin et

al. (1974), cited above as refuting ASDL, actually show evidence for ASDL inasmuch as the Day 2 performance of the group that had alcohol on both days (AA) was better than the group that had alcohol on Day 1 and a placebo on Day 2 (AP). Also, by using Day 2 data as the dependent variable, one overlooks the possible changes from Day 1. If the AA and the AP groups had identical Day 2 scores, it is still conceivable that ASDL occurred if the AA group had improved or remained the same across days while the AP group declined in performance. Two studies (Storm & Caird, 1967; Tarter, 1970) had the subjects learn the task to a criterion on Day 1. This is an inadequate control of the influence of Day 1 performance as groups could still differ in terms of overlearning the task. The present experiment employed data analysis strategies in addition to the standard four group ANOVA; these are discussed in Chapter V.

Investigations of ASDL in man have been limited to verbal recall and recognition, with the exception of Goodwin et. al. (1969) who, via a negative transfer paradigm, found ASDL operating in avoidance task performance. Changes in verbal memory present a natural focus for research since those who experience alcoholic blackout have been known to recall the forgotten word or image when they return to an intoxicated state (Goodwin, 1974). There are also methodological advantages to using verbal learning in tests of ASDL. A state dependent learning paradigm relies on providing original tasks so that the

subject's performance is relatively uninfluenced by previous learning experiences. Original verbal learning tasks are easy to construct and so prior learning is avoided.

If ASDL is to be useful in understanding the possible reinforcing aspects of intoxication, it is important to consider different types of stimuli or behaviors that may be learned in a state dependent manner. Are movements state dependent? Are fine sensorimotor adjustments state dependent? Drug use has been commonly associated with professional musicians (Becker, 1963); could musical improvisation be, to some degree, state dependent?

Research on alcohol and sensorimotor coordination has focused on alcohol's main effect with the results showing that moderate doses of alcohol (1.1 - 2.0 ml/kg) can impair performance, e.g. pursuit rotor skill and reaction time (Sidell & Pless, 1971; Tarter, Jones, Simpson & Vega, 1971). However, this effect fails to show up in some easy sensorimotor tasks, e.g. card-sorting (Lewis, 1973). This main effect of alcohol should not discourage state dependent research since alcohol's overall impairment of memory (Parker, Alkana, Birnbaum, Hartley & Noble, 1974) has obviously not prevented the discovery of ASDL of verbal stimuli.

If alcohol state dependent sensorimotor learning can be demonstrated, not only would the understanding of the possible adaptive functions of alcohol be advanced, but one might gain more knowledge of what the phenomenological "hit", or sensual

pleasure, is for the drinker who is more interested in the pleasurable rather than the tension reducing aspects of alcohol use (Schwarz, Burkhart & Green, 1978). That is, alcohol linked competence in sensorimotor skill (via state dependence) might be reinforced by more than the outcome of improved performance. For example, in this type of ASDL, expectancies of self-efficacy could be enhanced by intoxication. Such expectancies have been shown to be important in producing and maintaining new habits (Bandura, 1977).

III. The Present Experiment: Hypotheses and Measures

Alcohol and Creativity: Hypotheses and Measures

It was hypothesized that intoxication would increase creative writing as measured by novel use of figurative language and performance on the Remote Associates Test (Mednick and Mednick, 1967). Novel use of figurative language has strong face validity as a measure of creativity. Creative writing is simply writing that is original, imaginative, yet appropriate. Figurative language use is common in the work of authors recognized as being creative (e.g. Conrad, Melville, Kesey, etc.).

Figurative language use was scored following a procedure adapted from Barlow, Kerlin, and Pollio (1970). Fourteen categories of language use qualify as being figurative: metaphor, simile, oxymoron, personification, apostrophe, metonymy, periphrasis, pun, anthimeria, onomatopoeia, hyperbole, litotes, irony, and rhetorical question. Note that there is some overlap in these categories. For example, personification is often a case of metaphor.

The frequency of tropes (cases of figurative language) was

organized into two main categories: frozen and novel. A trope is frozen if it is so common that it is unlikely that any original language construction occurred. Trudeau is not literally the head of Canada, but the term 'head' is so common an allusion to leadership that one would regard this metaphor as a frozen trope. An original or novel trope would be, "Trudeau pushes the buttons of Canada." Scoring tropes is discussed further in the next chapter.

The Remote Associates Test (RAT; Mednick and Mednick, 1967) is widely used and easy to score. It is based on a unifactorial approach to creativity which defines it as the act of producing unusual (non-logically connected) associations to the particular requirements of a problem (Mednick, 1962). The subject is presented with three words (e.g. rat, blue, cottage) and asked to produce a fourth word that is related to all three. The answer in this case is cheese. The RAT was designed so that only one (and in some cases two) answers are appropriate. By its restrictive demands, the criterion of appropriateness in measuring creativity is met, unlike many other creativity tests (e.g. the Torrance measures) that could accept the bizarre response as creative. Mednick and Mednick (1967) report that the RAT is highly correlated with outside criteria for creativity, e.g. ratings of subjects and ratings of the subjects' projects.

State Dependent Learning: Hypotheses and Measures

It was hypothesized that alcohol state dependent learning can occur with sensorimotor behaviors. The specific behaviors were dart throwing with the nonpreferred hand and mirror tracing with the preferred hand.

These particular measures were selected for the following reasons: 1) they require coordinated movements that improve with practice; 2) it is unlikely that performance on either test would fatigue the subject during the brief time in the lab; 3) both tasks involve immediate feedback necessary for rapid learning; and 4) both tasks have a game-like quality that can be expected to enhance attention and motivation to perform well.

Alcohol was also expected to impair performance on both measures (Sidell and Pless, 1971).

IV. Method

Subjects

Male Simon Fraser University students over 19 years of age, who regarded themselves as casual drinkers, were recruited through classroom announcements. Subjects were asked to participate in an experiment investigating "cognitive performance and sensorimotor coordination." They were told that the experiment would take three hours a day on two days and that they would receive five dollars for participating.

Respondents were screened to insure that they had no medical problems which would be irritated by alcohol, had experienced intoxication at some time, and would not be disturbed should they be asked to drink an alcoholic beverage that might contain an intoxicating dose of alcohol. Subjects were told that different doses were being tested so it would be impossible to say how much alcohol they would receive. The mean age of the subjects was 23 years. The average amount of alcohol that the subjects reported consuming per week was 8.7 drinks (with one beer, one glass of wine, or one ounce of 80 proof liquor counting as one drink). None of the subjects reported any

previous experience with the RAT, dart throwing with the nonpreferred hand, or tracing mirror image patterns.

Of the 27 subjects who made appointments with the experimenter, 24 subjects completed the experimental procedure. Two quit for reasons unrelated to the experiment, and one quit because of discomfort with drinking the alcohol beverage.

Apparatus

A Smith and Wesson Model 1000 breathalyzer was used to determine blood alcohol concentration. The dart board was 46 cm in diameter. Placed on the surface of the dart board, for every test, was a white sheet of paper with a black dot (bullseye), 2.5 cm in diameter, in the center. The mirror tracing task was arranged with an apparatus (Lafayette Model 31010) that had a mirror on one end and a metal shield on the other end (facing the subject) which prohibited any direct view of the tracing pattern. The pattern to be traced was a 6 point star outlined by parallel tracks 4 mm apart. The point to point diameter of the star was 15 cm.

Procedure

The subjects were scheduled to meet with the experimenter in the lab, in the morning or afternoon of Day 1, at a mutually convenient time. The Day 2 appointment was always 48 hours (+ one hour) after the Day 1 appointment.

Subjects were asked to refrain from eating for at least 4 hours before coming to the lab and to abstain from alcohol for at least the previous 18 hours. The subjects were randomly divided into four groups according to the beverage condition: alcohol on both days (AA), placebo on both days (PP), placebo on Day 1 and alcohol on Day 2 (PA), and alcohol on Day 1 and placebo on Day 2 (AP). There were 6 subjects in each group.

The lab was a small cinder block office with a cushioned chair for the subject and impressionistic prints on the wall.

The following schedule applies to all subjects except where noted. Each subject was tested individually.

Day 1

The subject was thanked for volunteering and was told the procedures that he was expected to perform. A written description of the procedure was also handed to him. All subjects signed a consent form indicating that they understood the procedure and their right to withdraw.

In an adjoining room, the experimenter prepared the beverage: an 8 oz. drink consisting of tonic water, ice, two drops of peppermint extract, and alcohol. In the alcohol condition the drink contained 1.1 ml 95% ethanol/kg body weight. For a 161 lb man (mean weight of the subjects) such a drink would have the equivalent alcohol content of approximately 6.5 oz of 80 proof vodka. In the placebo condition, 2 ml of ethanol (equivalent to 0.2 oz vodka) rested on the top of the drink to allow for at least an initial taste of alcohol.

All subjects drank the beverage within 20 minutes, as requested. Twenty minutes later the subject rinsed his mouth with a non alcoholic drink, to reduce the possibility of alcohol in the mouth (Spector, 1971), and breathed into the breathalyzer. The subject was asked how he felt and how much alcohol, in terms of ounces of 80 proof vodka, he guessed he had consumed. When needed, additional questions probing possible intoxication were asked.

A double blind procedure was not used as the contrast in alcohol content between the two drinks was so high that it appeared obvious to the experimenter when the alcohol drink was consumed. Most subjects given the alcohol drink commented on how remarkably strong it was.

The subjects then began 20 practice dart throws with the nonpreferred hand. Subjects were told to aim for the bullseye. Each impact point of the throw was numbered as it landed on the

paper covering the board, and each dart was removed from the board before the next one was thrown. The bullseye was 160 cm above the floor and the subject threw the darts from a distance of 2 m. No time constraint was placed on the dart throwing. When the practice was over, the subject threw a further 10 darts that provided the Day 1 test score. The dependent variable was the radial distance of the impact point of the dart from center of the bullseye.

For the mirror tracing task, the subject sat before a mirror which displayed a reverse image of the star pattern. A small metal shield prevented the subject from directly observing the star pattern. The subject was instructed to draw a line following the star pattern as quickly as possible while keeping the pen within the 4 mm width of the track outlining the star. They were also told to continue tracing another lap around the star pattern if they completed a circuit before the time limit. After a one minute practice trial, the star pattern was replaced and the subject was tested on a two minute trial. The dependent variable was the distance (cm) the pen line travelled within the star pattern.

The subject was then presented with a subtest of the Remote Associates Test (RAT). To provide two tests, Form 1 of the RAT was split into odd and even items. The order of these two tests was counterbalanced for all groups. The subject was given 20 minutes to complete this shortened RAT. The dependent variable

was the total number of correct responses as determined by the RAT scoring key (Mednick and Mednick, 1967).

For subjects in the AA or PP groups, the RAT marked the end of Day 1 testing. All subjects breathed again into the breathalyzer. To facilitate sobering up and comfort, free lunches (meal tickets for the nearby cafeteria) were provided for all the subjects after an alcohol condition. The free lunch was unannounced during the recruitment campaign. The distribution of meal tickets was limited because of financial constraints on the experiment. This differential treatment of subjects was expected to present an insignificant source of error because a reward of one \$2.50 meal ticket would probably be too weak to elicit significant motivational differences between subjects when they appear on Day 2. Following the commitment expressed on the consent form, all subjects in any alcohol condition reaffirmed their intention not to drive until they reached sobriety (2 to 3 hours after consumption). Total experimental time for subjects in the AA or PP condition ranged between one and one and a half hours.

Subjects in the AP and PA groups remained in the lab to carry out the creative writing task. The creative writing task was given only to these groups since a repeated measures testing of the effects of alcohol on figurative language use was regarded as a more sensitive procedure than a between groups design. Also, since the scoring of this measure required three

judges and a considerable amount of time, it seemed appropriate to restrict this measure to the groups subjected to repeated measures analysis.

On Day 1 each subject from the AP and PA groups sat before a table with writing paper, a pen, a cassette tape recorder, and a print of an impressionistic painting. The print was either Courbet's "Mill on the River Loue" or Pissaro's "Church and Castle at Ergany". Assignment of prints was counterbalanced across days and condition. A cassette tape recorder was provided in case the subject preferred to dictate some, or all, of his thoughts.

The subject was told the following instructions:

This is a creative writing task. I want you to write as much creative writing as you can in 10 minutes. This can be in the form of poetry, prose, stream of consciousness writing, or any style you prefer. I am interested only in creativity. This is not a personality test nor will your writing be scored for anything other than creativity. If you are interested, I will tell you how this is scored after you finish the experiment. If you prefer to dictate your thoughts, this tape recorder will record anything you say. The purpose of the picture (the print) is to provide a stimulus for writing. Study it for a few minutes and when you are ready to start writing let me know and I will turn on the tape recorder and then leave you alone with your writing. If your writing departs from the context of the picture, that is OK. You do not have to refer to the picture. The purpose of the picture is to allow all subjects at least some starting point should they need one. Do you understand?

When it was clear that the subject understood the task, the subject began studying the picture. All subjects attended to the picture. The 10 minute writing period began after the subject

declared he was ready to write. When this period ended, the experimenter returned to the lab and proofread the writing to insure that the handwriting was legible. Only one subject dictated into the recorder (and only on one of the days). His creative writing data were omitted in the final analysis because of dictation being confounded with condition.

This marked the end of testing for the AP and PA subjects. All subjects breathed again into the breathalyzer and subjects in the alcohol condition were provided with a meal ticket for a free lunch.

Day 2

Each subject went through the same experimental procedure as on Day 1, with the exception that the subjects in the AP and PA groups received the alternate drink and studied the alternate print, and all subjects had the alternate RAT subtest. Also all subjects had 5, instead of 20, practice throws before Day 2 testing of dart throwing accuracy.

When all testing was completed, the subjects were asked what they thought was the purpose of the experiment. Subjects were debriefed regarding the hypotheses and scoring procedures. They were paid five dollars each and were heartily thanked by the experimenter. Their addresses were recorded so they could receive a summary of the results of the experiment. Again, all

subjects in the alcohol condition received a meal ticket.

Data Analysis

The presence of alcohol state dependent sensorimotor learning was tested by comparing the percentage difference between the scores on the Day 1 and Day 2 tests of the AA and AP groups. This was regarded as a crucial test as it focuses on the alcohol, not sober, state dependent learning. Also, using percent difference between Day 1 and Day 2 scores reduces the possible confound of differences between groups in Day 1 performance. (see Chapter II).

A 2 X 2 analysis of covariance with state on Day 1 (alcohol intoxication or placebo-linked sobriety) crossed with state on Day 2 was planned with test performance on Day 2 as the dependent variable and Day 1 performance as a covariate. This allows a measure of the influence of performance on Day 1 and it allows for an analysis of the proportion of variance accounted for by the alcohol conditions.

Alcohol's effects on creative writing were tested by comparing frequency of both frozen and novel tropes in the alcohol and placebo conditions for the AP and PA groups. These scores were determined by three trained judges following a procedure suggested by Barlow et al., (1970). Each judge read a typed text of the subjects' writing and the judges were blind to

the experimental condition of each data sample. A trope could be one word (e.g. pun) or a whole sentence (e.g. rhetorical question). See Chapter III for a discussion of tropes. The three judges worked together to score the creative writing. Only tropes that were unanimously agreed upon were scored. To prepare for this group effort at scoring, the judges studied the Barlow et al. (1970) training manual for scoring tropes and then, blind to the experimental condition, they independently rated each sample of writing. Using Winer's (1962) procedure for determining reliability statistics, the judges showed a between rater reliability of .87 when analyzing total novel tropes per data sample. The reliability for scoring frozen tropes was .45. The judges discussed their differences in scoring and proposed resolutions. Discussion was most useful in the often difficult problem of identifying a trope as being either frozen or novel.

Both a between groups t-test (AA vs PP) and a repeated measures t-test (A vs P in the AP and PA groups) were planned to test the effect of alcohol ingestion on RAT performance.

V. Results

Estimates of Intoxication and Alcohol Content

All subjects in an alcohol condition (N=18) reported that they felt intoxicated and they registered a mean blood alcohol concentration (BAC) of 0.095 (SE=0.006) on the first breathalyzer reading and 0.088 (SE=0.004) on the second. The overall mean BAC of the two readings combined was 0.092 (SE=0.004). Of the 18 subjects who experienced the placebo condition, 12 said that they felt 'normal', 6 subjects reported slight effects of alcohol, and none of these subjects regarded themselves as intoxicated. The mean dose of alcohol (in terms of ounces of 80 proof vodka) that the subjects judged they had received was 4.2 oz in the alcohol condition and 1.1 oz for the placebo condition. 7 of the 18 subjects receiving the placebo guessed that the drink was virtually alcohol free, 0.5 oz or less (the placebo had the equivalent of 0.2 oz.), and 3 of these subjects labeled the drink placebo. Accordingly, for the remainder of this paper the alcohol condition may be regarded as synonymous with intoxication and the placebo condition may be regarded as synonymous with sober.

Credibility of the Experimental Instructions

The post-experimental interviews showed that none of the subjects doubted that the experiment was designed to study alcohol, sensorimotor coordination and creativity. One subject suggested that the effect of alcohol on inhibitions was also being studied.

Creativity Data

Figurative language use

Table 1 presents the means and standard errors (SE) of the figurative language scores of the subjects in the PA and AP groups (N=11, as one subject's data were omitted because he dictated his thoughts instead of writing them). Table I also shows the mean number of words, number of sentences, the proportion of words to sentences, and proportion of novel tropes to total tropes in the two conditions: alcohol and placebo. Note that all t-tests are two-tailed.

The subjects wrote significantly more novel tropes while intoxicated than when sober ($t = 2.27$, $df = 10$, $p < .05$). The alcohol condition also produced a significantly higher

TABLE I. Mean frequency of tropes and amount of writing by the subjects of the PA and AP groups in the Alcohol (A) and Placebo (P) conditions (N=11).

	A	P	t*	p**
Novel tropes	3.5 (1.1)***	1.7 (0.8)	2.27	.05
Frozen tropes	3.2 (0.9)	3.3 (0.8)	0.08	.90
Total tropes	6.3 (1.8)	5.0 (1.4)	1.03	.35
Novel/Total (%)	46.5 (11.5)	20.5 (7.2)	3.00	.02
Total words	166.0 (6.9)	123.0 (8.7)	11.30	.001
Sentences	10.8 (1.3)	7.8 (0.7)	2.85	.02
Words/Sentence	18.0 (2.3)	17.0 (1.9)	0.37	.80

* Repeated measures t-test of difference in mean performance in the A and P conditions.

** Two-tailed t-test; df=10.

*** Values in parentheses are standard errors of the mean.

proportion of novel tropes to total tropes than the placebo condition ($t = 3.0$, $df = 10$, $p < .02$). No significant difference in use of frozen tropes was found between the two conditions ($t = 0.08$, $df = 10$, $p < .90$).

Post hoc analyses of quantity of writing were performed to assess the possibility of creative writing being a function of amount of total writing. Subjects wrote more words when they were intoxicated ($t = 11.3$, $df = 10$, $p < .001$). The average length of sentences was almost the same across conditions.

Table II shows the number of tropes as a proportion of the total words written. Intoxication produced a somewhat higher proportion of novel tropes than the sober condition but this difference was not statistically significant ($t = 1.01$, $df = 10$, $p < .35$). No significant differences between conditions were found in the proportion of frozen tropes, nor in the proportion of total tropes.

Further analysis of creative writing

Table III presents the frequency of different types of novel and frozen tropes used by subjects in the alcohol and placebo conditions. These were determined by an analysis by one of the judges (the author). Only 10 of the 14 categories of tropes listed in scoring manual by Barlow et. al. (1970) were applicable. Metaphor was the most prominent type of trope in

TABLE II. Mean percentage of tropes per total words written by the subjects in the AP and PA groups in the Alcohol (A) and Placebo (P) conditions (N=11).

	A	P	t [*]	p ^{**}
Novel tropes	2.2 (0.7) ^{***}	1.6 (0.8)	1.01	.35
Frozen tropes	1.9 (0.6)	2.9 (0.7)	1.2	.30
Total tropes	4.1 (1.1)	4.5 (1.4)	.34	.80

* Repeated measures t-test of difference in mean performance in the A and P conditions.

** Two-tailed t-test; df=10.

*** Values in parentheses are standard errors of the mean.

TABLE III. The frequency of different types of novel and frozen tropes occurring in the Alcohol (A) and Placebo (P) conditions of the AP and PA groups (N=11).

	ALCOHOL		PLACEBO	
	Novel	Frozen	Novel	Frozen
Metaphor	22	23	10	29
Simile	1	2	0	0
Personification	4	3	4	0
Hyperbole	4	2	2	2
Onomatopoeia	0	2	0	2
Litote	3	0	1	0
Irony	3	0	1	0
Apostrophe	0	2	0	0
Anthimeria	1	0	0	0
Rhetorical Question	1	0	1	3

both conditions.

Further informal inspection of the writing revealed no apparent differences between the intoxicated and sober writing in the number of references to imaginary people, places, or things. Nor did these samples differ in terms of producing story lines, moral themes, or personal experiences. However, 10 of the 11 samples of intoxicated writing and only 4 of the 11 samples of sober writing referred to experiential elements outside the realm of strictly personal experiences. The following extracts are examples of such non-personal experiences: "one can feel at peace....," "we see a layering of mountains," and "he sensed a tinge of guilt."

Remote Associates Test

Contrary to the Mednicks' (1967) claim of high odd-even reliability ($r = .86$ to $.92$) with the RAT, the odd-even reliability of the RAT scores for the subjects in the same state on both tests (AA and PP) was low ($r = .24$). Examination of the RAT scores of all subjects shows that the odd numbered items produced far higher scores (mean = 7.3) than the even numbered items (mean = 5.4). Accordingly, the proposed repeated measures analysis of RAT scores across state conditions was not pursued as it relies on comparisons between odd and even item scores.

The between groups analysis of total RAT scores on both days shows the PP group (N = 6, mean = 13.2, SE = 1.9) having non-significantly higher scores than the AA group (N = 6, mean = 10.3, SE = 2.3; $t = 1.06$, $p < .35$).

Sensorimotor Performance

Dart throwing accuracy

Table IV shows the mean distance from the bullseye (cm) for the darts thrown on both experimental days in all groups. Note that the lower the score, the more accurate the throw.

Analysis of the percentage difference between Day 1 and Day 2 trial scores shows the AA group averaging a non-significantly greater decline of performance across days than the AP group ($t = 1.46$, $df = 10$, $p < .20$). The PP and PA groups also showed an overall non-significant decline of performance across days.

A 2 X 2 analysis of covariance (state on Day 1 X state on Day 2) was performed on the Day 2 scores with the Day 1 scores acting as a covariate. No interaction was found ($F = 0.31$, $df = 1/20$, $p < .58$). Neither were there any main effects of state on Day 1 ($F = 1.09$, $df = 1/20$, $p .36$) or Day 2 ($F = 1.88$, $df = 1/20$, $p < .19$). Day 1 performance was a significant covariate ($F = 6.55$, $p < .02$, $df = 1/20$). The proportion of variance accounted

TABLE IV. Mean dart throwing inaccuracy (distance of impact point from the center of the bullseye, cm) during the practice (Pr), Day 1, and Day 2. Mean difference between the Day 1 and Day 2 scores (d) and the mean percentage of the Day 1 score that this difference represents (%d) are also presented for the four experimental groups (N=6 in each group).

	Pr	Day 1	Day 2	d	%d*
AA	9.5 (1.3)	7.1 (0.8) **	8.9 (0.9)	-1.7 (0.4)	-29.0 (14.9)
AP	9.3 (0.6)	8.4 (0.7)	8.8 (1.4)	-0.4 (1.0)	-3.7 (11.7)
PP	7.7 (0.5)	6.6 (0.6)	6.8 (0.7)	-0.2 (0.8)	-4.5 (11.5)
PA	8.5 (1.5)	8.1 (1.5)	9.4 (1.8)	-1.3 (1.9)	-23.8 (22.9)

* (Day 1 - Day 2) / Day 1

** Values in parentheses are standard errors of the mean.

for by the combined Day 1 and Day 2 main effects was 12%. A between groups analysis of Day 1 performance (A vs P) also showed no effect of alcohol on dart throwing accuracy ($t = 0.5$, $p < .65$, $df = 22$).

Comparisons of the first ten practice dart throws on Day 1 vs the Day 1 trial (ten throws) shows significant signs of learning in the AA group ($t = 3.98$, $p < .05$, $df = 5$) and in the PA group ($t = 3.93$, $p < .05$, $df = 5$). The AP and the PP groups showed non-significant signs of learning on Day 1 according to this analysis (AP: $t = 2.1$, $p < .10$; PP: $t = 1.6$, $p < .20$).

Mirror tracing

The mean scores on the mirror tracing task are presented in Table V. An analysis of the percent change in performance from Day 1 to Day 2 shows that, contrary to prediction, the AP subjects improved their scores more than those in the AA group, although this difference was not significant ($t = .71$, $p < .50$, $df = 10$).

A 2 X 2 analysis of covariance (state on Day 1 X state on Day 2) was performed on the Day 2 scores with Day 1 trial scores acting as a covariate. No interaction was found ($F = .002$, $df = 1/20$, $p < .96$). Neither did the state on Day 1 ($F = .37$, $p < .54$, $df = 1/20$) or the state on Day 2 ($F = 1.03$, $p < .32$, $df = 1/20$) show any significant effects on Day 2 performance. Day 1

TABLE V. Mean length of mirror tracing (cm) during the practice (Pr), Day 1, and Day 2. Mean difference between Day 1 and Day 2 scores (d) and the mean percentage of the Day 1 score that this difference represents (%d) are also presented for the four experimental groups (N=6 in each group).

	Pr	Day 1	Day 2	d	%d*
AA	20.3 ^{**} (5.4) ^{***}	29.5 (8.0)	41.8 (9.0)	12.2 (4.3)	64 (24)
AP	24.0 (6.3)	42.1 (12.7)	65.9 (12.1)	23.8 (8.7)	112 (71)
PP	20.8 (2.1)	41.8 (6.3)	70.1 (8.5)	28.3 (5.5)	74 (17)
PA	32.0 (10.2)	38.3 (9.8)	56.9 (23.4)	18.6 (13.8)	31 (18)

* (Day 2 - Day 1) / Day 1

** The practice scores were multiplied by two as they were derived from a one-minute trial whereas the Day 1 and Day 2 trials took two minutes.

*** Values in parentheses are standard errors of the mean.

performance was a significant covariate ($F = 38.89$, $p < .001$, $df = 1/20$). The proportion of variance accounted for by Day 1 state and Day 2 state combined was 11%. A between groups analysis of Day 1 performance also showed no effect of alcohol on mirror tracing ($t = 0.47$, $p < .70$, $df = 22$).

To test if learning occurred with mirror tracing, the practice trial score (a one minute trial) was doubled and compared with the Day 1 test score (a two minute trial). All groups improved their performance on the Day 1 trial, but only the PP group showed significant improvement (AA: $t = 1.28$, $p < .40$; AP: $t = 2.06$, $p < .10$; PP: $t = 4.27$, $p < .01$; PA: $t = 1.33$, $p < .30$).

VI. Discussion

The experiment supports the hypothesis that the act of consuming an intoxicating dose of alcohol facilitates some expression of creativity. Also, the results agree with the conventional wisdom, and previous research (e.g. Nash, 1962), that holds alcohol to be a facilitator of verbal fluency. The experiment affords no evidence for the existence of alcohol state dependent sensorimotor learning. These issues will be discussed separately.

Alcohol and Creativity

Subjects produced significantly more novel tropes and wrote significantly more words when they were intoxicated than when they were sober. The degree to which the increased output of novel tropes is independent of greater verbal output must remain uncertain. Subjects produced significantly more novel tropes to total tropes in the alcohol condition, but the greater proportion of novel tropes to total words was not statistically significant.

The alcohol related increases in novel trope usage is especially interesting in light of the fact that frozen trope

usage was little affected by alcohol. That is, the propensity to use conventional metaphors and similes, unlike novel ones, did not appear to increase under the influence of alcohol.

It is possible that this alcohol-linked increase in novel figurative language use was mediated by increased emotion in the subjects. Non-alcoholics generally anticipate, and attain, elevated moods as a result of drinking alcohol (Freed, 1978) and being exposed to relevant cues of the drinking situation (Pliner & Cappell, 1974). Emotional experience, pleasant and unpleasant, has been shown to generate more imagery than non-emotional experience (Lyman, Bernardin, & Thomas, 1980). The effects of emotion and mood in the present study is a moot point since no measures of emotion were taken.

Contrary to the creativity hypothesis, alcohol had no significant effect on RAT performance. The RAT is much more restrictive than an open ended creative writing task and this may account for the lack of agreement between these two measures.

Hajcak (1976) found that alcohol produced more original verbal responses (as measured by the Kent-Rosanoff Word Association Test), however he also found that a high dose of alcohol (9 oz. of 80 proof whiskey or more) significantly impaired RAT performance. It is difficult to compare the RAT results of the present experiment with Hajcak's because his subjects drank more alcohol, were in an ad lib drinking

situation, and performed a RAT test twice the length of the ones used in the present study.

The appropriateness of the creative writing, especially in the alcohol condition, might be questioned. That is, how did the novel tropes stand in terms of good or bad writing? No such analyses were conducted since a measure of "good creativity" poses more methodological problems than the scope of this research could address. Future researchers may want to explore this possibility and develop a way to judge the aesthetic qualities in creative writing. The judges working on the trope measurement were certain that alcohol, in the present sample, failed to produce any signs of a Hemingway or a Wolfe.

Alcohol and Verbal Fluency

No prediction was made regarding the effect of alcohol on amount of total writing. Although Nash (1962) showed that alcohol increases talkativeness, there were suspicions during the planning of the present experiment that this alcohol effect may not generalize to writing. One reason why the tape recorder was provided during the creative writing task was to allow the subject to speak his thoughts in case the alcohol weakened his energy or skill to write. Yet alcohol showed a remarkably strong effect ($p < .001$) of increasing the amount of total writing. This effect might be a function of possible pharmacological

effects of alcohol (e.g. disinhibition) or it might be a function of the subject's expectancy. Future research might explore the mediating processes that operate in alcohol's positive effect on verbal fluency.

The Possible Effects of Expectancy

The alcoholic beverage was effective in producing both subjective and objective (blood alcohol level) signs of intoxication. The placebo condition failed to produce the belief that an alcoholic beverage, of 1.5 oz vodka or more, had been consumed. Accordingly, none of the subjects who experienced the placebo reported any signs of intoxication. The failure here of a tonic and ice placebo to produce an effective illusion of containing more than 1.5 oz of vodka is interesting in light of its success elsewhere (e.g. Marlatt et al., 1973).

Wilson and Lawson (1976) used a placebo recipe similar to the one used in the present study (their placebo did not include peppermint) and their subjects judged its alcohol content to be an average of 3.68 oz liquor. Differences in method of preparation may account for the effectiveness of their placebo. They prepared the drink in front of the subject with a credible display of bottles; the styrofoam cup, in which it was served, maintained a scent of alcohol; and they presented false BAC feedback. All these procedures produced a more sophisticated and

effective placebo deception. Also, the demand characteristics could have enhanced the placebo effect. The experimenter in the present study was introduced as a graduate student and the lab setting probably conveyed more of a "low rent" appearance than the more professional and medically staffed alcohol lab of the Wilson and Lawson experiment.

Since the placebo condition did not generate the same intoxication expectancies as the alcohol condition, it is conceivable that the alcohol related increases in creative writing were, at least in part, a function of expectancy.

Several studies employing a 2 X 2 design, with expectancy of receiving alcohol or tonic crossed with receiving alcohol or tonic, show that expectancy is a significant variable in determining the amount of alcohol consumed in an ad lib drinking situation (Marlatt et al., 1973), aggression (Lang, Goeckner, Adesso & Marlatt, 1975), and sexual arousal (Wilson & Lawson, 1976). In the last study, the expectancy related increases in sexual arousal, as measured physiologically, occurred whether the subject consumed alcohol or not. This is especially interesting since alcohol has been shown in some cases to decrease physical signs of sexual arousal in alcoholics (Wilson, Lawson & Abrams, 1978) and nonalcoholics (Briddell & Wilson, 1976).

The creative writing task was straightforward. The demand characteristics were explicit in all conditions: the

experimenter is interested in the relationship between alcohol and creativity. This was deliberate since any deception about the writing task might have produced various reactions that would bias the measure and/or inhibit creativity.

Although the demand characteristics of the creative writing task were constant and clear, there may be differences in expectancies developed in the alcohol and placebo conditions. If the subjects shared the conventional wisdom that alcohol facilitates creativity, it is conceivable that the subjects, when intoxicated, expected to be more creative and therefore became more creative. The placebo condition, having failed to generate feelings of intoxication, would have then stimulated no such expectancy and thus no such effect. Unfortunately the subjects were not asked what their beliefs were regarding the relationship between alcohol and creativity. This simple procedure would have allowed further analysis of the expectancy issue.

Alcohol State Dependent Learning

The present study provides no evidence of alcohol state dependent sensorimotor learning. Neither were there any trends in the data that even suggest such an effect. There are several reasons why ASDL did not occur in the present study: 1) little learning actually took place, 2) the possible influence of

previously learned behaviors similar to the skills being tested, and 3) there may have been an abundance on Day 2 of situational cues, associated on Day 1, that allowed easy retrieval of sensorimotor 'memory'. These problems will be discussed separately.

It is crucial for any test of ASDL to show that learning occurred on Day 1. The AP and AA groups, the most important groups for testing ASDL, failed to show significant learning on the mirror tracing task. Although the AA group showed significant learning of dart throwing accuracy on Day 1 and the AP group showed near significant learning on this task, the two day data pattern presents another picture. A comparison of the Day 1 and Day 2 scores shows an overall decline in dart throwing accuracy in the same state groups (AA and PP). Whatever learning occurred on Day 1 was not in evidence on Day 2.

Another problem with testing for ASDL is that one has to be certain that the initial learning of the specific behavior occurs during the Day 1 trial. Even though the two behaviors were novel activities, they could have been similar to other sensorimotor skills familiar to the subject. The subjects may also have experimented with the nonpreferred hand in other tasks. In particular, the skill of making movements guided by a mirror image are common in self-grooming and other mirror related activities (e.g. reversing a car using a rear view mirror). This underlines the advantage of testing for alcohol

state dependent learning with verbal learning since it is easy to generate nonsense syllables or unique word combinations that would avoid the problem of previous learning.

Also, the act of throwing a dart or tracing a mirror image of a pattern can be integrated into memory as a general gestalt of body movement. Once the subject adopts a particular habit of movement (e.g. the trick of following a pattern through a mirror image) this movement may become resilient to state changes.

It has been shown that alcohol state dependent verbal learning can be reduced if, on Day 2, the subject is presented with cues to recall the Day 1 stimuli (Petersen, 1977). If so, then this factor may have operated in the present study to reduce ASDL as every contextual event associated with Day 1 performance was repeated on Day 2. Future investigators of ASDL may consider employing a similar experimental procedure but with Day 2 performance involving a different task than the specific one used on Day 1 yet which calls for the same sensorimotor skill as that learned on Day 1.

Overton (1974) advises that high doses of drugs must be used to insure that learning becomes state dependent. Perhaps this accounts for the present study's failure to find ASDL. However the dose used (1.1 ml 95% ethanol/kg body weight) is common in human state dependent research (e.g. Goodwin et al., 1969) and higher doses pose obvious ethical problems. Also, it may be difficult to administer a dose strong enough to cause

state dependent learning yet weak enough to avoid gross impairment of the subject's abilities on which any such state dependent learning must rely.

It is interesting to note that alcohol had no significant effect on the performance of either sensorimotor measure on either day. This suggests that the tasks were quite easy (Lewis, 1973).

Implications for the Functional Approach

As discussed above, the sensorimotor data lend no support to the notion that alcohol facilitates sensorimotor performance, nor does it support the state dependent hypothesis. On the other hand, alcohol did not significantly interfere with performance. Accordingly, the data on sensorimotor performance become relatively unimportant in discussing the functional approach to alcohol use and alcoholism. The creative writing data are more applicable to such a discussion.

As discussed in Chapter I, an overriding interest behind the present study was the view that alcohol drinking habits may arise, or be perpetuated by, their adaptive consequences. Intimately entwined with this idea is the assertion that alcohol use can be considered on a continuum from harmless to deleterious, and that many of the reinforcing aspects of drinking can operate at any point on such a continuum. This

general theoretical outlook is gaining acceptance and it has been neatly summarized by Pattison, Sobell, and Sobell (1977).

If the act of consuming alcohol, either directly or through expectancy, causes increases in verbal creativity and fluency, then we have advanced our understanding of the reinforcing properties of alcohol. A drinker, whose behavior is being influenced by this reinforcement, might ignore the dysfunctional aspects of his drinking habit. This may have operated in the case of many of the famous alcoholic writers. That alcohol has been shown to increase creative writing lends more credence to this type of argument. However this may also be a rare course taken by alcoholics, and indeed none of the subjects in the present study (all were non-alcoholics) appeared to have passionately embraced the creative effects of alcohol.

Treatment of alcoholism that focuses on the particulars of the individual's drinking habits has been shown to be an effective strategy (Sobell & Sobell, 1978). Individualized behavior therapy for alcoholics (IBTA; Sobell & Sobell, 1978) entails the identification of specific circumstances that have resulted in increased or deleterious drinking. The therapeutic goal is to identify alternative responses to drinking. A drinker's desire for creativity and/or verbal fluency might be considered as therapeutic points of departure in such an approach.

The generalizability of the creative writing results is limited. Only one dose of alcohol was used. Future researchers may explore a broader range of alcohol doses. As with most research on the psychological effects of alcohol, the experimental setting is radically different from normal drinking environments thereby underlining the problem of external validity. However, in the present experiment such a criticism might be countered by the claim that if the act of consuming alcohol can increase someone's creative output in a windowless, cinderblock university laboratory then it should be able to do the same in a more natural and hospitable setting. A natural setting would be expected to provide more stimuli for creative thought and a more receptive environment for the expression of it.

Drug induced states of consciousness have been identified with qualitatively unique experiences, e.g. mysticism (Durr, 1970; James, 1977). Further research on alcohol effects might determine if the increase in novel figurative language use is trivial, or if it is indicative of a complex state of creative or poetic potential. Is alcohol linked creative writing a matter of disinhibition or is it original synthesis of thought?

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