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Temporal gradient of reinforcement and temporal gradient of punishment differences between alcoholics and non-alcoholics.

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INTRODUCTION

Psychological Predisposition and Alcoholism

Psychological research on alcoholism has largely consisted of two types of studies. Until the last decade, the majority of work carried out was concerned with the problem of studying the personality characteristics of alcoholics in an attempt to differentiate alcoholics from non-alcoholics. This work reflected a common assumption that the alcoholic population was relatively homogeneous in nature. From a psychological standpoint such an assumption implied that alcoholism was probably the manifestation of a more or less unique constellation of personality characteristics which could be designated the "alcoholic personality", with the additional implication that this personality could be discovered through psychological testing. Research on alcoholism using psychological tests consisted of a question and a method. The question has been "What is the alcoholic personality" or What types of persons are most likely to become alcoholics"? The method has been one of administering, scoring, and analyzing test responses to find variables that significantly differentiate alcoholic from non-alcoholic groups.

Lisansky (1967) reports that this type of research dominated the literature in the decade following World War II. Between 1945 and 1956 more than 30 studies using the

Rorschach alone were reported. However, since 1956, the number of these studies has been reduced considerably.

Sutherland, Schroeder, and Tordella (1950) reviewed the test literature related to, "...the hypothesis that alcoholism is caused by personality traits", and concluded from their critique that, "...no satisfactory evidence has been discovered that justifies the conclusion that persons of one type are more likely to become alcoholics than persons of another type". Syme (1957) reviewed another seven years of psychological test studies and once again concluded that, "...There is no warrant for concluding that persons of one type are more likely to become alcoholics than persons of another type." A third review of the literature, by Franks (1960), stated that: 1) There is no general agreement as to the etiology and dynamics of alcoholism; and 2) the majority of experiments are such that the findings are often difficult to interpret and highly limited in their value.

In recent years, a large number of studies on alcoholism have appeared using the MMPI. While a consistent finding has emerged from these studies, namely, that alcoholics have consistently shown more or less significant elevation of Scale 4, a scale of "psychopathic deviation", as Lisansky (1967) states, there is little agreement about the significance or meaning of this finding. Also, despite

the fact that three different alcoholism scales have been derived from the test items, MacAndrew and Geertsma (1964), in evaluating the claimed effectiveness of these scales in differentiating alcoholic from non-alcoholic patients, found that none of the scales can differentiate diagnosed alcoholic and non-alcoholic psychiatric patients to any appreciable degree. Further, they concluded that the alcoholism scales may not be a measure of alcoholism itself, but of general maladjustment.

Thus, while it is true that the test literature has not yet yielded evidence for the "alcoholic personality", it is equally true that many investigators have not yet given up the search, believing that the idea cannot be rejected that personality factors play a dominant role in determining who will become an alcoholic and who will not. The most recent and most extensive study done in an attempt to determine personality correlates and antecedents of adult alcohol-related behavior has been done by Jones (1968). In an attempt to answer the question that has plagued this type of alcoholism research, namely, are there discernible personality correlates of drinking behavior, and do these antedate patterns of drinking or abstaining, a follow-up longitudinal study was carried out. In analyzing interview and test data for subjects before and after they became alcoholics, Jones concluded: "A core of the present characteristics

of the various drinking groups seem to have its roots in the past, before a drinking problem has been established. The data of this study indicate that this acting out and assertive behavior predated, at least to some degree, an inappropriate drinking pattern, and may be considered a predisposing factor." She describes the pre-alcoholic boy as being over dependent, but experiencing intense independence - dependence conflicts, and as being unable to maintain adequate interpersonal relationships.

As Gomber (1968) has stated, part of the importance attributed to Jones' study lies in the fact that there appears to be occurring in alcohol studies a return back to the position which puts psychological predisposition into a primary place in the etiology of alcoholism. The research question of defining the pre-alcoholic personality which received diminished attention for some years, may now be reopened. For researchers in this area, the importance of work on the antecedents of adult problem drinking lies in its implication for prevention. They feel that it may become possible to identify in high school, or even earlier, boys who are in danger of becoming alcoholic. Preventive work with them could be both nonspecific and specific. Nonspecific prevention would be directed to improving their personality functioning, i.e., helping them become aware of their dependency, or helping them find constructive

channels for their aggression. Specific prevention, as Jones herself suggests, might take such forms as seeing to it that boys who demonstrate the particular personality characteristics later associated with problem drinking are introduced to drinking in a setting such as the home that prevents its being defined as masculine or rebellious behavior.

Nevitt (1968) stresses a note of caution regarding Jones' study and all others that search for predisposition. The demonstration of a predisposing factor is not the whole story about the etiology of alcoholism. Clearly, there are many boys or young men who have problems in coping with unacceptable dependence, but who do not become alcoholics. The question of what makes the difference between those who become drinkers and those who do not remains unanswered. Despite the enthusiasm of some over Jones' paper as being a real contribution to the understanding of the psychological etiology of alcoholism and as a step further toward being able to predict with better than chance accuracy those adolescents who are likely to develop into problem drinkers as adults, perhaps a better, more conservative, conclusion from her study is that it raises questions that are worthy of further study. Her sample consisted of six adolescents who later became problem drinkers and only two adolescents who were later categorized as abstainers. The ideal longitudinal study needs to begin with a group so large that

those who become problem drinkers years later will constitute a sample larger than six subjects.

Gomberg (1968) sees the current status of this type of research in terms of its contribution to an understanding of alcoholism as consisting of some unacceptable psychoanalytic concepts, several case studies, and a fair amount of psychological test literature. In a problem area where ideas are scarce and methodology weak, the least one can say is that the conclusions of Sutherland, Schroeder, and Tordella (1950); Syme (1957); and Franks (1960), that there is little of value in this literature and that there is no definition of the alcoholic personality, still hold. It seems clear that whatever contribution this area of research is to make lies in longitudinal studies. The mere knowledge that certain personality or psychological test characteristics distinguish samples of adult alcoholic patients from other groups of people does not by itself reveal a good deal about the etiology of alcoholism. The question of what is cause and what is effect still remains a moot one in such studies. It seems almost trivial to state that distinguishing characteristics may just as well have resulted from prolonged excessive drinking as have been the cause of it. Carpenter (1967) refers to the alcoholic personality search paragon as a "no-alcohol condition" experiment. If subjects in the two groups are matched on relevant criteria, the experimenter must infer that differences between the two groups are due

either to the prolonged immoderate use of alcohol in the one group or characteristics in that group which are related to the origin of alcoholism.

Learning Theory and Alcoholism.

As a result of the general failure of studies to identify personality traits, psychiatric syndromes, or background characteristics that are common to and typify the alcoholic, more recent research on alcoholism has begun to be concerned with the study of the alcoholic's general behavior insofar as that behavior may resemble the response of drinking excessively. Vogel (1961) has stressed that what is essential in accounting for some of the behaviors of alcoholics is a theory of general behavior rather than a theory of alcoholic personality. In this framework, no psychological assumptions or generalizations about alcoholics are made other than the behavioral observation that alcoholics are typified only by the persistence of the excessive drinking response. Consequently, the most appropriate means of studying alcoholism is to analyze the excessive drinking response itself.

Clancy (1964) states that a high alcoholic intake becomes excessive when either poor health results or the pursuit and consequences of drinking interfere with important aspects of life such as work, family, and finances.

Excessive drinking literally means excessive intake -- a quantitative judgment; but in common usage it means considerably more. Among other things it includes the adverse effect of the alcoholic's drinking behavior on others, the manner and extent to which it interferes with his life, and the frequency of the drinking episodes. Many of the judgments with respect to these factors are qualitative in addition to being quantitative. Ultimately, the judgment whether a person's drinking is excessive is based on combined quantitative and qualitative observations. Neglect of the full meaning of the term gives rise to arguments about definition. Definitions based on intake alone are inadequate, so also are definitions which regard alcoholism as merely one of many symptoms of a personality disorder.

Examination of the response of excessive drinking leads to two questions concerning the alcoholic's behavior: 1) What serves to maintain the response? and, 2) Why does the response persist despite the fact that repeated excessive drinking ruins the person's life? Answers to the first question are numerous. Reinert (1968) presents many of the traditional explanations; namely that the alcoholic drinks to celebrate, to get courage, to be sociable, to overcome boredom, to drown sorrows, or to satisfy the existential need for transcendence, meaning, and purpose. Other examples

of widely-accepted views are that the alcoholic is basically self-destructive as a result of inward displacement of aggression (Menninger, 1938), and the classical psychoanalytic position that describes alcoholics as fixated at the oral level of psychosexual development because of childhood frustrations (Fenichel, 1945).

Learning theory provides an explanation to this question, an explanation that has had relatively little acceptance in a field so dominated by the traditional search for the "alcoholic personality". The learning theory point of view states simply that alcoholism is fundamentally a bad habit. As Kepner (1964) points out, in analyzing the actual behavior of drinking excessively, a basic assumption that is followed is that alcoholism is primarily functional and can best be described within the context of reinforcement learning principles. One such principle is that individuals learn to repeat acts that have been accompanied by drive reduction and to avoid acts that have been accompanied by punishment. The use of alcohol is seen as a source of two important rewards. First, the physiological changes produced by alcohol are pleasurable and are thus positive reinforcers. Secondly, alcohol provides temporary relief from such noxious stimuli as anxiety and tension. Each time these are reduced the drinking response is reinforced and the tendency to repeat

the act is strengthened. Through the process of stimulus generalization, the cues associated with drinking become stimuli which further trigger the drinking response.

Clancy (1964) emphasizes that the use of learning principles provides an explanation for the alcoholic's inability to remain sober for any great length of time. His heavy drinking customarily ends in pain or displeasure composed of both physical and psychological elements. At this time drinking takes on an aversive quality since it is associated with pain, and abstinence ensues when the pain is stronger than the pleasure. Because abstinence is initiated by pain, the pain must be maintained if the abstinence is to be continued. That is, drinking is associated with pain, and this pairing between alcohol and displeasure must be reinforced in order to sustain the need for abstinence. However, by its very nature, abstinence in itself tends to prevent such a reinforcement and is generally dissociated from the pain which prompted it. Failure to reinforce the association results in partial extinction, and, since there is no longer pain, there is no need for abstinence. Drinking is then resumed because the contemplated pleasure again outweighs the pain, at least for a time.

The learning theory approach in alcoholism has enormous potential benefit, for if there is validity to the idea of alcoholism as a bad habit, possibilities for research

and changing of the faulty habit are opened which are otherwise closed. Teaching moderation, for example, as a preventive measure makes little sense if alcoholism is thought of as being due to invariable predisposing factors. Despite the apparent merit of this approach, it has not held a prominent place among the etiologies of alcoholism. Reinert (1968) presents several possible reasons for this. First, for many theorists, terms such as anxiety and tension reduction, drive reduction, or the removal of fear motivated restraints are important concepts but, nevertheless, are ways of phrasing the explanation which seem too mechanistic to explain the complexity of the behavior. Secondly, it appears possible that the part learning plays in the process of becoming an alcoholic is so self-evident that many researchers and therapists see no point in dwelling on the matter in their writings. Jellinek (1960) approaches this position when he grants that a learning theory view is "essential" to alcoholism, and that it is a "prerequisite" to bringing about the conditions which are necessary for the development of addiction. However, his primary conclusion about etiology is that "the main structure around which research should center is the pharmacological process of addiction."

The second question raised by analyzing the excessive drinking response, namely, why does the alcoholic continue to drink excessively despite the consequences he pays

for continuing, can be answered satisfactorily only through learning theory principles. Despite the rewards that are provided through prolonged drinking (anxiety reduction, etc.) the punishments that the alcoholic incurs considerably outweigh the rewards. These punishments often take the form of poor health, lack of money, loss of family, loss of job, etc. In this paradigm, the behavior of the alcoholic is described as "non-integrative" (Mowrer and Ullman, 1945), that is, its consequences are ultimately more punishing than rewarding.

Keller and Seeley's (1958) widely used definition of alcoholism clearly illustrates this last point: ".... a chronic behavior disorder manifested by repeated drinking of alcoholic beverages in excess of the dietary and social uses of the community and to an extent that interferes with the drinker's health or his social or economic functioning." The last half of this definition is the crucial part. Clearly, neither the traditional explanations nor common sense provide an answer for the persistence of drinking in the face of such dire consequences. The learning theory approach presented by Dollard and Miller (1950), however, does provide a more satisfactory explanation. According to this, the tendency for a given action to be perpetuated or inhibited is influenced not only by the nature of the rewards and punishments ("effects") of that action, but also by the

temporal order of these consequences. Thus, if an immediate consequence is slightly rewarding, it may outweigh a greater but more remote punishment. This principle that states that immediate reinforcements are more effective than delayed ones is called the temporal gradient of reinforcement. It means that the immediate effects of a moderate reduction in drive can be stronger than those of a much greater increase in pain that occurs long afterwards. In terms of alcoholism, the strengthening effect of an immediate reinforcement on a symptom that is provided by drinking may be much greater than the deterring effects of much stronger but delayed punishments.

Consequently, analysis of excessive drinking behavior indicates that it may be seen as an instance of the more general paradigm in which a response regularly receives immediate reward and subsequent or delayed punishment. Similarly, the persistence of the response in alcoholics guarantees their receiving immediate rewards, but it frequently precludes their obtaining many of the larger, but delayed, rewards of life, rewards such as "socio or economic functioning" as stated in Keller and Seeley's definition.

From this examination of the response of excessive drinking, the alcoholic can be described as a person who, at least in a major area of his life, does not sacrifice an immediate, easily foreseeable reward, for the possibility of

rewards which can only be imagined as occurring some unknown time in the future. That is, he appears to be unable to delay gratification and wait for future rewards, choosing rather the guaranteed certainty of the immediate rewards that drinking provides.

Delay of Gratification Research

The idea that the alcoholic is unable to delay gratification is not a new one, although it is only recently that actual experiments have been based on it. Moreover, while the concept of delay of gratification is also not a new one, until the last ten years little scientific work was done to explore its implications and to deduce testable hypotheses. The concept was originally a Freudian one, and in psychoanalytic theory it is seen as a crucial process in the transition from diffuse associative thinking to goal-directed, reality-oriented cognition. As Roberts and Erikson (1968) have pointed out, it is perhaps because of Freud's vague dynamic formulation of the concept that little formal empirical research has been done in this area until recently

Singer (1955), in reviewing the are of delayed gratification, states: "Some people do manifest a persistent style of coming to terms with their environment which involves relative delay of immediate reactions to needs or provocative stimulation and employment of planfulness or

fantasy in their mode of relating." Thus it is theorized that many people exhibit a characteristic life style of forfeiting small immediate rewards for rewards that are perceived to be larger, even though the attainment of these larger rewards is uncertain and in the future.

Mischel, who has done considerable work defining the variables underlying preference for delayed reinforcement, found that willingness to give up a small immediate reward in favor of a larger delayed one is positively related to: (1) differences in certain ethnic and racial backgrounds (1958); (2) need achievement (1961a); (3) presence of the father in the home (1961b); and (4) social responsibility and trust behavior (1961c). Mischel and Metzner (1962) found that preference for delayed reward is positively related to age and intelligence and negatively related to the length of the delay interval, i.e., that the expectation for receiving a reward decreases with its temporal distance. Klineberg (1968), also studying children, has shown that the capacity to choose a larger reward, delayed for a relatively short and specified period of time, over a smaller reward available immediately is related to the degree to which personal future events in general appear to be endowed with a sense of reality, as well as to the degree of everyday preoccupation with future rather than present events.

In gereral, the conclusions concerning the concept of temporal gradient of reward confirm the findings of Mahrer (1956), namely, 1) that immediate rewards are preferred over delayed rewards, and 2) that the effectiveness of a reward diminishes with increasing delay. However, as Mischel, Grusec, and Masters (1969) point out, the effects of temporal punishment on human behavior are not as well known. Kamin (1959) has demonstrated a delay of punishment gradient with rats, and Solomon (1964) has argued for the existence of a gradient effect of delayed punishment similar to that of delayed reward. The experimental manipulation of temporal punishments with humans has not been extensive. Cook and Barnes (1964) have shown that normal subjects tend to prefer an immediate punishment (shock) over one that is delayed, and Hare (1966) has demonstrated that the emotional effects and the aversive properties of future pain or punishment are relatively small for psychopaths. Whereas the normal person finds it distressing to wait for some unpleasant unavoidable event, the psychopath does not. The emotional significance of future punishment is of relatively little immediate concern to him.

Experiments manipulating temporal variables have been a recent development in research on alcoholism. These studies are based on the observation that the alcoholic's excessive drinking behavior is characterized by the per-

sistence of frequent, but delayed, punishments, and they are designed to study whether the alcoholic's non-drinking behavior resembles the response of drinking excessively. Banks and Vogel-Sprott (1965) , using adult male alcoholics and non-alcoholics, found that an immediately rewarded response is more difficult to suppress when it is punished on a delayed basis than when the punishment occurs closer in time to the reward. Vogel-Sprott and Banks (1965) compared the frequency of an immediately rewarded (IR) response in alcoholics and non-alcoholics under conditions of immediate punishment (IP) and delayed punishment (DP). The IR-IP paradigm presented a penny (IR) and shock (IP) simultaneously immediately after a particular response. The IR-DP condition presented a penny immediately after the response, and the shock occurred thirty seconds later. The hypothesis was that alcoholics cannot modify their behavior under delayed punishment as well as can non-alcoholics. The results were not conclusive. Contrary to expectations, the difference between alcoholics' and non-alcoholics' performance was not significantly greater under delayed than under immediate punishment. However, the differences were in the predicted direction, and the authors suggested changes in experimental procedure as a means of reassessing the hypothesis.

A similar experimental paradigm (Vogel-Sprott, 1967) suggested that alcoholics cannot suppress a rewarded response in spite of punishment. However, the results were open to the conclusion that a failure to curtail the response may characterize neurotics in general, regardless of whether they are alcoholics.

The essential questions with which these studies have attempted to deal, namely, what are the effects of delayed versus immediate punishment on alcoholics, and are these effects different for non-alcoholics, remain unanswered. However, the results lead to the speculation that when the excessive drinking response is acquired it may be difficult to suppress because the reward is relatively immediate but the punishment is delayed. Moreover, since alcoholics are typified by the response, it may be that its persistence in them is indicative of their more general inability to curtail any delayed punished response.

Smart (1968) speculates that one possible explanation for alcoholics' ability to tolerate delayed punishment may be that they have developed a different time orientation than non-alcoholics. Using a test requiring the description of future events, as well as a story completion test, he found a significant difference between alcoholics and social drinkers in terms of future time perspective. He theorizes that the alcoholic does not respond

to delayed punishments for drinking because they appear in a shortened and poorly perceived future.

A study by Finkel (1967) suggested that delayed reward was not as effective for alcoholics as it was for non-alcoholics. An experimental situation was used in which Ss had to suppress a response which produced an immediate reward but lost a larger delayed reward. In addition, to obtain a larger reward at a later time, Ss had to forfeit a present reward. The results indicated that alcoholics are deficient in the ability to suppress a response which obtained a small momentary reward but lost a larger delayed reward. No conclusion could be reached regarding the alcoholic's hypothesized inability to forfeit a present reward for a later one.

The results of all these studies suggest several important hypotheses for additional analyses of alcoholics' behavior. The failure of Vogel-Sprott and Banks (1965) to find that the differences between alcoholics and non-alcoholics were not significantly greater under delayed than under immediate punishment may be due in part to the nature of the experimental procedure. Both immediate and delayed punishment (shock) were inflicted only to responses that were immediately rewarded. The response was a sequence of three button presses to a tone from a signal generator, and the reward was a penny. The immediacy of the reinforcer

and the delayed nature of the punishment were designed to be similar in nature to the sequence of reward and punishment inherent in excessive drinking. However, the simplicity of the task was such that it required almost no effort for Ss to avoid receiving the shock. They merely had to suppress the response of pushing the buttons in order to receive the penny. The question then arises whether the alcoholic could be as successful as the non-alcoholic in avoiding the delayed punishment if he were called on to do more than simply suppressing an innocuous response. That is, could he actively persevere at working at a task in order to avoid receiving a delayed punishment.

The passive nature of the task used in the above study, i.e., the lack of activity in avoiding a delayed punishment or obtaining a reward is not really analagous to the situation the alcoholic faces in daily life. Nor is the procedure used by Finkel (1967) directly related to what must be done in reality. In that study, the alcoholic could earn delayed reward simply by enduring frustration for a long enough time. However, as Mischel (1966) has pointed out, in most life situations the attainment of larger rewards, or the avoidance of punishments, involves contingencies other than, or in addition to, simple waiting. He suggests experimental designs where the attainment of rewards or the avoidance of punishment is contingent upon the

successful performance of an instrumental task, both with and without additional waiting.

Purpose of Study.

This study proposed to assess the extent to which the alcoholic's non-drinking behavior resembles the response of excessive drinking. The principle question with which it was concerned was whether the alcoholic is less able than the non-alcoholic to modify his behavior when the consequences of that behavior are not immediate. It also attempted to determine which reward and punishment temporal schedules are most effective in changing the alcoholic's behavior. The effects of the following reinforcement schedules on the behavior of alcoholics and non-alcoholics were investigated: 1) The ability to work to obtain immediate reward; 2) The ability to work in order to obtain delayed reward; 3) The ability to work in order to avoid immediate punishment; and, 4) The ability to work in order to avoid delayed punishment. In addition, as a control variable, the effects of a no reinforcement schedule were also studied.

The essential hypothesis of the study was that alcoholics would perform significantly poorer than non-alcoholics on a task under the two conditions of delayed reinforcement. That is, alcoholics would be less able than non-alcoholics to work in order to avoid receiving delayed

punishment or to obtain delayed reward. However, while the prediction was made that delayed consequences would differentially effect the groups, it was predicted that under immediate reinforcement conditions, as well as the no reinforcement schedule, the two groups would perform essentially comparably. It was also predicted that the alcoholics' performance under the delay schedules would not be significantly higher than their performance under the no reinforcement condition. That is, delayed consequences would be no more effective in modifying the alcoholics' behavior than no consequences at all. However, a significant difference between the effect of no reinforcement and delayed reinforcement was predicted for the non-alcoholics, with performance under delayed conditions being greater than under no reinforcement. Furthermore, it was hypothesized that while the non-alcoholics' performance under immediate reinforcements would not be significantly higher than under delayed consequences, this difference would be a significant one for the alcoholics, with performance under immediate consequences exceeding that under delayed. Lastly, it seemed likely that within the two delay conditions the alcoholics' inability to perform under such consequences would result in a significant decrease in their behavior from the first half of the task to the second half. No such trend effect was predicted for the non-alcoholics.

METHOD

Subjects

Two groups of male subjects, matched according to age, educational, socio-economic, and ethnic differences were used in this study.

1) Alcoholics. These subjects were drawn from the alcoholic population at a hospital which has a special program and a separate ward for the care and treatment of problem drinkers. Acceptance into the problem drinkers' program means that the patient's primary diagnosis is chronic alcoholism. No patient in this group was included in the study who, in addition to his alcoholism, had medical evidence of organic damage or a diagnosis of any form of psychosis. In addition, no alcoholic was tested who had been in the hospital less than one week. A total of fifty patients who met these criteris participated in the experiment.

2) Non-alcoholics. This group consisted of fifty patients from the same hospital. They were obtained from three separate wards, and none of them had a history of alcoholism, had ever been diagnosed as psychotic, or had any medical evidence of organicity. Appendix A presents the age, educational, socio-economic, and ethnic characteristics of both groups.

Apparatus

The apparatus consisted of a two plate metal

tapping board, a metal tapping stylus, a digital counter, and a Tursky type shock apparatus designed for use with humans, similar to that presented in Tursky, Watson, and O'Connell (1965). The two plates were attached to a board so that their centers were twenty-four inches apart. Each time either plate was struck by the stylus the counter was activated. The shock apparatus was connected to the subject by an electrode placed on the inside of the wrist of the non-tapping arm. The experimental room was arranged in such a manner that S sat in front of the tapping plates and was shielded from E by a large board. To S's left was a chute through which money was dispensed into a glass dish. In front of E was the counter, the shock apparatus, and a tape-recorder to present the instructions.

Procedure.

The positive reinforcement used for both the immediate and delayed reward groups was money. This appeared to be the most appropriate reward, particularly for the delayed reward subjects, for the following reason. As Bandura and Walters (1964) have pointed out, one reaction to a task in which individuals have to tolerate delay of reward and to persist in the pursuit of a goal is to devalue the worth of the goal object that appears to be inaccessible or not readily attained. The likelihood of this occurring was reduced by making use of the generalized reinforcing properties of money. In addition, each subject in the

delayed reward group received a promisary note (Appendix B) before the experiment began, signed by the experimenter and the director of psychological research in the hospital, promising to pay him in one week the amount he earned in the study. As Klineberg (1968) has shown, the capacity to work for a delayed reward is related to the degree to which personal future events in general appear to be endowed with a sense of reality. The purpose of the official appearing promisary note was to increase the subjects' expectation that the money would be paid to him.

The punishment was electric shock. The shock was administered by the method of establishing individual pain thresholds discussed in Nichols and Tursky (1967). The shock was adjusted for each subject individually at the start of the experiment. Each subject first received a barely detectable level. The level was then increased in steps until the subject stated that it had become uncomfortable enough so that he did not want it raised any higher. That level was the one he received during the experiment. Parke and Walters (1963) have already shown that alcoholics and non-alcoholics do not differ in their selection of a noxious level of electric shock. The immediate and delayed intervals of punishment were 0 and 30 seconds. These intervals were employed because they have been used successfully to demonstrate a delay of punishment gradient. Banks and Vogel-Sprott (1965) found a significant difference between 0 seconds immediate

punishment (IP) and 30 seconds delayed punishment (DP) in terms of less suppression of a rewarded response under 30 seconds DP than under 0 seconds IP. However, they found no significant differences between 30 seconds DP and either 60 or 90 second DP intervals.

Depending on which reinforcement schedule S was on, the following instructions were presented to him by means of a tape recording.

Immediate Reward Schedule (IR): E informed S that the purpose of the study was to learn how fast people were able to tap from one board to another. E then demonstrated the tapping and allowed S to tap several times. The following instructions were then given:

> Your job is to tap as fast as you can until you are told to stop. If you have tapped fast enough by the time you are told to stop, you will be paid twenty cents. However, if you do not tap fast enough, you will not earn any money. Now, when you are told to begin, start to tap as fast as you can.

After S had tapped for thirty seconds, no matter what his total number of taps was, E gave him twenty cents in the form of four nickels which were dispensed through the chute. S was then told:

> That time you tapped fast enough to earn the money. However, from now on, each time that you tap you will have to tap faster than you just did in order to earn more money. Each time you do not tap faster than you just did, you will not receive any money. Now, when you are told to begin again, start to tap as fast as you can.

S then went through ten more 30 second tapping trials, with 30 seconds of rest between each trial. Each time he exceeded his iniital tapping rate, he received twenty cents immediately after the tapping trial.

Delayed Reward Schedule (DR): As in IR, E explained the nature of the task, demonstrated tapping and allowed S to tap several times. The following instructions were then presented:

> Your job is to tap as fast as you can until you are told to stop. If you have tapped fast enough by the time you are told to stop, you will be paid twenty cents, although you will not be able to receive the money until a week from today. Each time that you are able to tap fast enough by the time you are told to stop, you will earn twenty more cents, which you will be paid in one week. You will be given a copy of an IOU which both you and the experimenter will sign that promises to pay you the amount of money you are able to earn. We will fill in the amount at the end of the study. However, if you do not tap fast enough, you will not earn any money. Now, when you are told to begin, start to tap as fast as you can.

As in the IR schedule, S tapped for 30 seconds, and no matter what his total number of taps was, E recorded on the IOU that S had earned twenty cents, and he informed S of this. S was told the following:

> That time you tapped fast enough to earn the money. However, from now on, each time that you tap, you will have to tap faster than you just did in order to earn more money. Each time you do not tap faster than you just did, you will not earn any money. Now, when you are told to begin again, start to tap as fast as you can.

The identical procedure as for IR was repeated, the sole exception being that each time S exceeded his initial tapping rate he was informed that he had earned twenty cents, rather than receiving the money.

Immediate Punishment Schedule (IP): Tursky's (1965) method of establishing individual pain thresholds was used for all Ss. After S had been exposed to a graded series of electric shocks on his wrist and had told E when the level had become uncomfortable enough for him that he would not like it to be raised any higher, E explained the nature of the task, demonstrated tapping, and allowed S to tap several times. The following instructions were then presented:

> Your job is to tap as fast as you can until you are told to stop. If you have tapped fast enough by the time you are told to stop, you will not receive a shock. However, if you do not tap fast enough you will feel a shock on your arm just like the last one you received. Now, when you are told to begin, start to tap as fast as you can.

After S had tapped for thirty seconds, no matter what his total number of taps was, he received a shock immediately at the end of the thirty seconds of tapping. S was then told the following:

> You did not tap fast enough that time to avoid receiving the shock. However, from now on, each time that you are able to tap faster than you just did you will not receive the shock. Each time that you do not tap faster than you just did, you will feel the shock again. Now, when you are told to begin, start to tap as fast as you can.

The same procedure as in IR and DR schedules was repeated, the exception being that if S did not exceed his initial tapping level he received an immediate shock.

Delayed Punishment Schedule (DP): The procedure and instructions for the DP schedule were identical to that of IP except that the shock was administered 30 seconds after the completion of a tapping trial that did not exceed the initial trial total.

No Reward - No Punishment Schedule: As in the four reinforcement conditions, E explained the study, demonstrated tapping, and allowed S to tap several times. The following instructions were presented:

> Your job is to tap as fast as you can until you are told to stop. Now, when you are told to begin, start to tap as fast as you can.

After S had tapped for 30 seconds the following instructions were presented:

> From now on each time that you tap, you are to try to tap faster than you just did. When you are told to begin again, start to tap as fast as you can.

To review, the groups of subjects for this study consisted of fifty alcoholics and fifty non-alcoholics. Within each group ten Ss were tested under each of the four reinforcement conditions, i.e.,immediate and delayed reward, and immediate and delayed punishment. In addition, ten alcoholics and ten non-alcoholics were also tested under the no reinforcement control condition.

RESULTS

The results of this study were analyzed in terms of two dependent measures: 1) mean number of success scores; and 2) mean rate-of-tapping differences from the base-rate level. A success score was earned by a subject's exceeding his base-rate level of tapping on any given trial. Thus, a maximum of ten success scores was possible for all subjects. The second dependent measure, the average tapping rate differences from base-rate, was obtained by determining the difference between each subject's base level tapping rate and his performance on each trial. The mean of these ten trial differences was then calculated for each subject. These scores represent a more sensitive measure of the effect of the reinforcement conditions than do the success scores which are essentially binary data, for, unlike the success scores, they reflect the magnitude of change from the base-line performance. All data were analyzed by analysis of variance, and all *a posteriori* comparisons between means of significant interactions were carried out by the Tukey procedure of testing for a significant gap, a procedure discussed in Edwards (1954).

Success Scores

Table 1 summarizes the analysis of variance of the success scores for both groups under immediate and delayed reward and punishment. Examination of the table indicates that the main effect of groups (A) was not signifi-

Table 1

Analysis of Variance of Immediate and Delayed Reward and Punishment Tapping Behavior - Success Scores

Source of Variance	df	ms	F
Between Ss	79		
Groups (A)	1	2.756	2.123
Reinforcement Type (B)	1	3.906	3.010
Reinforcement Time (C)	1	16.256	12.525***
A x B	1	11.556	8.903**
A x C	1	23.256	17.918***
B x C	1	17.556	13.526***
A x B x C	1	9.506	7.324**
Ss/A x B x C	72	1.297	
Within Ss	80		
Trials (T)	1	2.756	4.200*
A x T	1	2.256	3.438
B x T	1	0.756	1.152
C x T	1	1.806	2.752
A x B x T	1	0.006	0.009
A x C x T	1	1.406	2.142
B x C x T	1	2.256	3.438
A x B x C x T	1	0.006	0.009
Ss x T/A x B x C	72	0.656	

* $p < .05$

** $p < .01$

*** $p < .001$

cant. Alcoholics obtained an average of 7.5 successes over all reinforcement conditions, compared to 8.0 for the non-alcoholics. Similarly, the main effect of reinforcement type (B) was not significant, the mean number of successes under immediate and delayed reward being 7.4, compared with 8.1 under immediate and delayed punishment.

The significant main effect of reinforcement time (C) is based on the average number of successes of both groups under immediate and delayed reinforcement. As was expected, immediate reinforcement was more effective in increasing performance than was delayed. Under immediate, the average number of successes was 8.4, compared with 7.1 under delayed.

The significant interaction of groups by reinforcement type is based on the average number of success scores for each group under reward and punishment. The alcoholics obtained an average of 8.3 successes under punishment compared with an average of 6.6 under reward, while the non-alcoholics' mean number of successes under reward and punishment were 7.8 and 8.2 respectively. The Tukey test revealed that for all interactions of between subjects' variables, a difference between the means of 0.97 is significant at $p < .05$, while a difference of 1.3 is significant at $p < .01$. Consequently, alcoholics achieved significantly ($p < .01$) more successes under punishment than under reward, while the non-alcoholics'average successes under both re-

inforcement types were essentially comparable. In addition, under reward the alcoholics achieved significantly ($p < .01$) fewer successes than did the non-alcoholics.

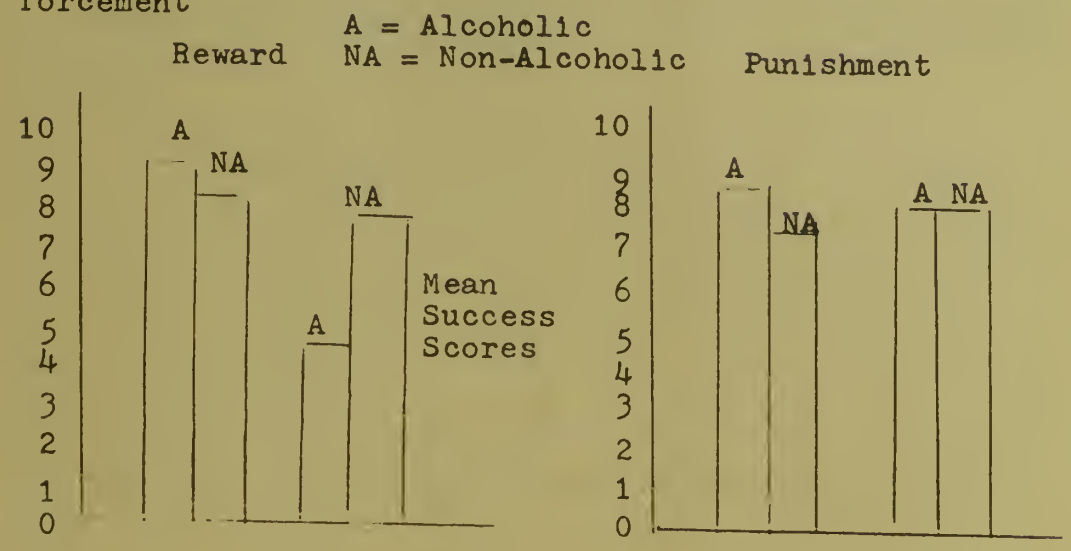
The significant interaction of groups by reinforcement time was in the predicted direction. That is, while alcoholics achieved significantly ($p < .01$) more successes under immediate than delayed (8.9 vs. 6.1), the performance of non-alcoholics was not differentially effected by these temporal conditions ($\bar{X}$ - immediate = 7.9; $\bar{X}$ - delayed = 8.1). Comparing groups, the alcoholics achieved significantly ($p < .05$) more successes under immediate reinforcement than did the non-alcoholics, while under delayed reinforcement there was a reversal of effect, with the non-alcoholics obtaining significantly ($p < .01$) more successes than the alcoholics.

Examination of the significant reinforcement type by reinforcement time interaction reveals that under reward there were significantly ($p < .01$) more successes in the immediate condition than the delayed (8.7 vs. 6.1), while under punishment immediate and delayed did not differentially effect performance ($\bar{X}$ - immediate = 8.0; $\bar{X}$ - delayed = 8.1).

The significant groups by reinforcement type by reinforcement time interaction is presented in Figure 1.

Figure 1

Mean Group Successes Under Immediate and Delayed Reinforcement



The alcoholics, as predicted, averaged significantly ($p < .01$) fewer successes under delayed reward (4.1) than did the non-alcoholics (8.2). Contrary to expectations, there was no significant difference in the mean number of successes obtained by alcoholics under the immediate and delayed punishment conditions ($\bar{X}$ - immediate = 8.6; $\bar{X}$ - delayed = 8.1). However, as predicted, the average number of success scores achieved by the non-alcoholics was not differentially effected by temporal conditions under either reinforcement type.

As Table 1 indicates, the only significant within Ss variable was the main effect of trials. The mean number of successes for the first five trials was 4.0, compared with 3.7 for the second five.

Difference Scores

Table 2 summarizes the analysis of variance computed on the average differences in tapping rate by alcoholics and non-alcoholics under the various reinforcement conditions.

Examination of Table 2 indicates that neither the groups nor reinforcement types significantly effected the extent of deviation from base-line performance. The significant effect of reinforcement time is reflected in the average increase in response rate under the immediate reinforcement conditions compared with delayed reinforcement. Tapping rate increased an average of 21.2 under immediate *vs.* an average of 12.7 under delayed.

The significant groups by reinforcement type interaction is presented in Figure 2.

Figure 2

Mean Group Tapping Rate Changes as a Function of Reinforcement Type

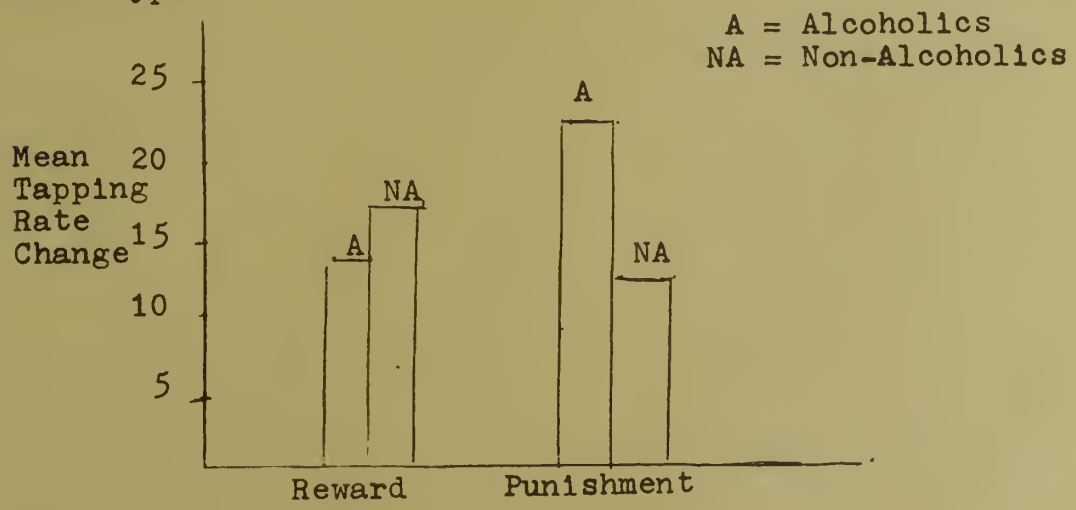


Table 2

Analysis of Variance of Immediate and Delayed Reward and Punishment Tapping Behavior - Difference Scores

Source of Variance	df	ms	F
Between Ss	79		
Groups (A)	1	87.912	1.062
Reinforcement Type (B)	1	60.762	0.734
Reinforcement Time (C)	1	749.090	9.050**
A x B	1	397.530	4.803*
A x C	1	636.006	7.684**
B x C	1	653.672	7.898**
A x B x C	1	395.012	4.372*
Ss/A x B x C	72	82.763	
Within Ss	80		
Trials (T)	1	66.822	3.658
A x T	1	7.140	0.390
B x T	1	55.932	3.062
C x T	1	56.406	3.088
A x B x T	1	7.482	0.409
A x C x T	11	69.432	3.801
B x C x T	1	201.152	11.012**
A x B x C x T	1	47.742	2.613
Ss x T/A x B x C	72	18.266	

* $p < .05$

** $p < .01$

The Tukey test revealed that for all between subjects' variables a difference of 7.8 between the means is significant at $p < .05$, and a difference of 10.7 is significant at $p < .01$. It is seen from Figure 2 that reward and punishment differentially effected the performance of alcoholics and non-alcoholics. More specifically, alcoholics increased their rate of tapping under punishment significantly ($p < .05$) greater than their increment under reward ($\bar{X}$ - punishment = 22.9; $\bar{X}$ - reward = 14.1), while the performance of non-alcoholics was not differentially effected by the type of reinforcement ($\bar{X}$ - punishment = 13.6; $\bar{X}$ - reward = 17.5).

The significant interaction of groups by reinforcement time is presented in Figure 3.

Figure 3

Mean Group Tapping Rate Changes as a Function of Reinforcement Time

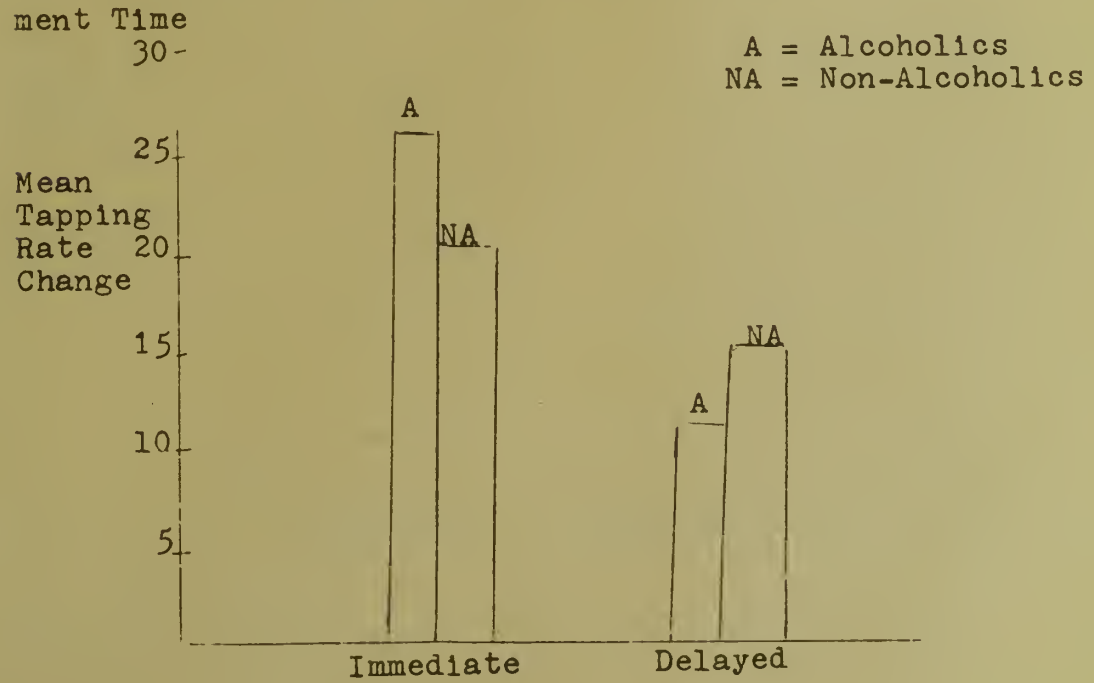
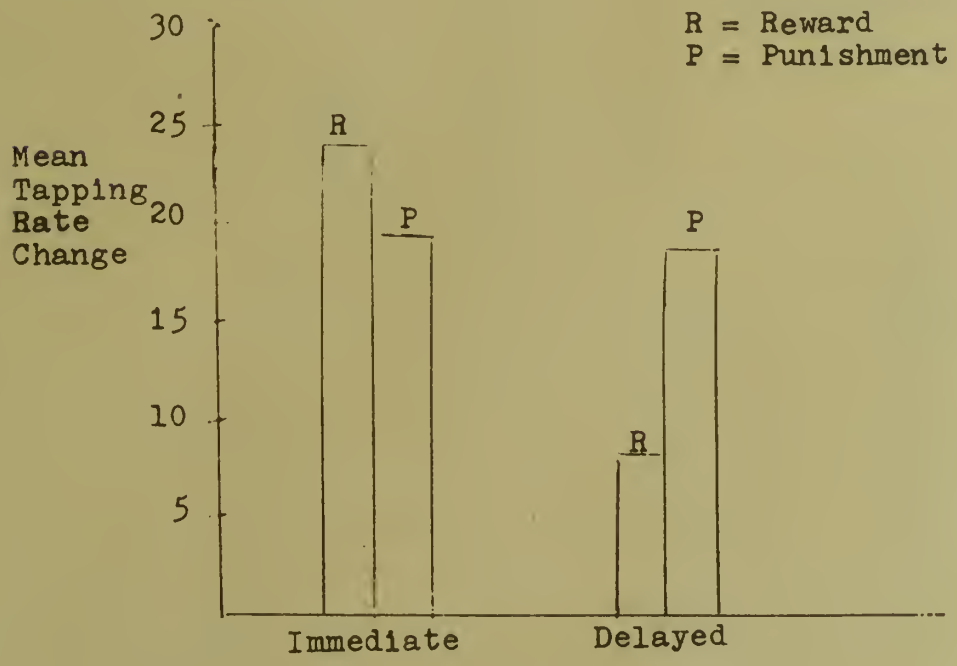


Figure 3 reveals that, as predicted, while the performance rate of alcoholics was significently ($p < .01$) reduced from immediate reinforcement ($\bar{X}$ = 26.8) to delayed ($\bar{X}$ = 10.2) there was no essential change in the performance of non-alcoholics across temporal conditions ($\bar{X}$ - immediate = 15.8; $\bar{X}$ delayed = 15.2). Moreover, the results indicate that alcoholics perform at a significantly ($p < .01$) higher rate than non-alcoholics when the consequences of their performance are immediate.

The significant reinforcement type by reinforcement time interaction is presented in Figure 4

Figure 4

Mean Reinforcement Type Tapping Rate Change as a Function of Reinforcement Time



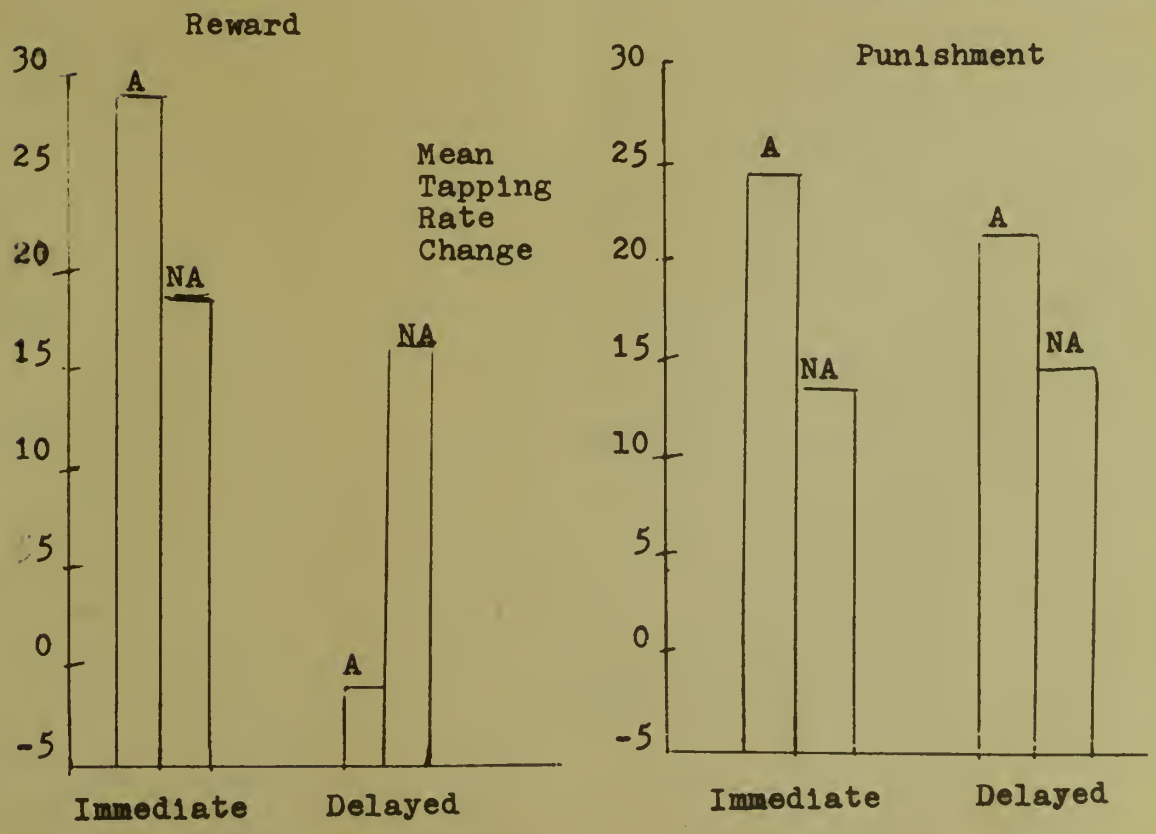
Examination of the figure indicates that there was a significantly ($p < .01$) greater increase in performance rate, relative to the base-line, under immediate reward ($\bar{X} = 24.2$) than under delayed reward ($\bar{X} = 7.4$). Under immediate and delayed punishment, however, the increment in performance rate remained stable ($\bar{X}$ - immediate = 18.6; $\bar{X}$ - delayed = 18.0).

The significant group by reinforcement type by reinforcement time interaction is presented in Figure 5.

Figure 5

Mean Group Tapping Rate Change as a Function of Reinforcement Type and Time

A = Alcoholics
NA = Non-Alcoholics



The figure reveals that under conditions of delayed reward the alcoholics' mean performance ($\bar{X}$ = -1.3) was significantly ($p < .01$) reduced when compared to their performance rate under either immediate reward ($\bar{X}$ = +29.6) or to the performance of non-alcoholics under both the immediate and delayed reward conditions ($\bar{X}$ - immediate = +18.7; $\bar{X}$ - delayed = +16.2). Furthermore, under both immediate conditions the alcoholics' rate of performance increase was significantly ($p < .01$) greater than that of the non-alcoholics under immediate consequences.

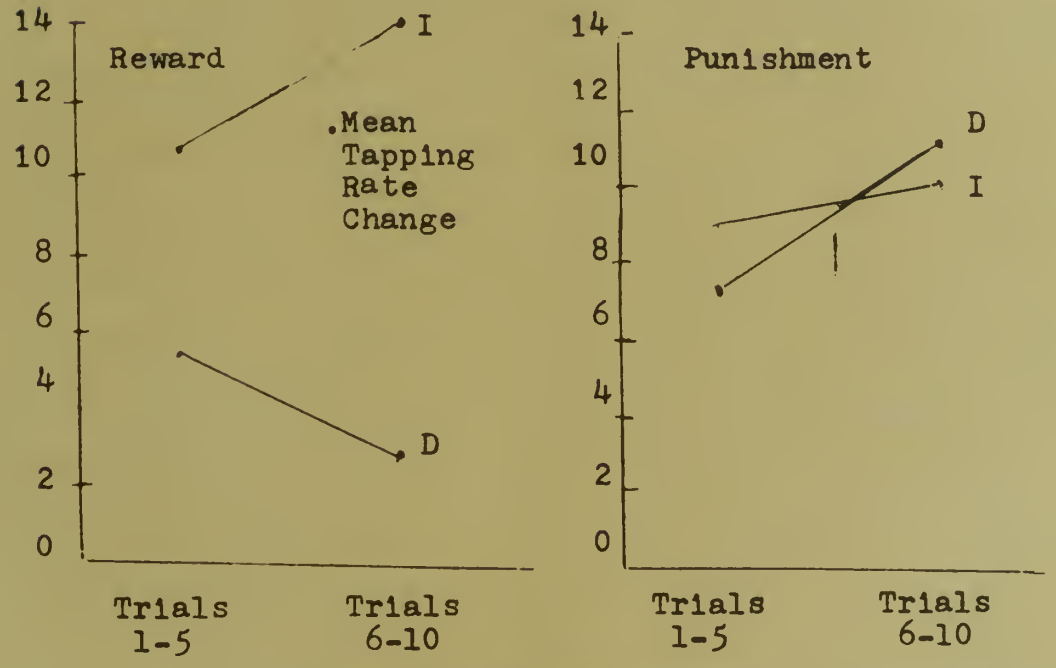
A crucial finding from the figure is that under the delayed reward condition, the performance rate of alcoholics was suppressed slightly below their base-rate level of responding. Thus, while alcoholics and non-alcoholics increased their performance rate under both immediate reward and immediate punishment, with the rate increment significantly ($p < .01$) greater for alcoholics, a delay in the presentation of reward to alcoholics produced a decrease in their performance rate to a level comparable to that of a condition of no reward. Delayed punishment, on the contrary, was functionally equivalent to conditions of immediate reward or immediate punishment for alcoholics. In contrast to the alcoholics, non-alcoholics maintained a comparable level of performance throughout all immediate and delayed reinforcement conditions.

Figure 6 presents the means on which the significant interaction of reinforcement type by reinforcement time by trials is based.

Figure 6

Mean trial Tapping Rate Changes as a Function of Reinforcement Type and Time

I = Immediate
D = Delayed



The Tukey test revealed that a difference of 3.7 between the means is required for significance a $p < .05$, and a difference of 4.8 is needed for significance at $p < .01$. As is seen in the figure, while tapping rate under immediate reward increased slightly but not significantly from the first five trials to the second ($\bar{X}$ - trials 1-5 = 10.3; $\bar{X}$ - trials 6-10 = 13.8), under delayed reward it decreased sightly, but, again, not significantly ($\bar{X}$ - trials 1-5 = 5.3;

$\bar{X}$ - trials 6-10 = 2.0). Under punishment, tapping rate increased slightly, although not significantly, for both immediate and delayed conditions on the second five trials compared to the first.

Comparison of No Reinforcement and Delayed Reward.

Tables 3 and 4 summarize the analyses of variance comparing the no reinforcement control condition with delayed reward. Table 3 summarizes the analysis on the success score measure. The significant main effect of groups is based on the alcoholics having achieved an average of 3.8 successes on both conditions, compared with a mean of 6.4 for non-alcoholics. The significant reinforcement type effect is due to delayed reward being more effective in increasing performance than no reinforcement ($\bar{X}$ - delayed = 6.1; $\bar{X}$ - no reinforcement = 4.1).

The significant interaction of groups by reinforcement type is based on the mean number of success scores for each group under each condition. The Tukey test indicated a difference of 1.1 is needed for the means to be significant at $p < .05$, and a difference of 1.5 is required for significance at $p < .01$. As predicted, the alcoholics' mean number of successes under both conditions were essentially comparable ($\bar{X}$ - delayed = 4.1; $\bar{X}$ - no reinforcement = 3.6). In contrast, as was also predicted, the non-alcoholics

Table 3

Analysis of Variance of No Reinforcement Schedule and Delayed Reward Tapping Behavior - Success Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	32.512	18.388***
Reinforcement Type (B)	1	21.012	11.884**
A x B	1	12.012	6.794*
Ss/A x B	36	1.768	
Within Ss	40		
Trials (T)	1	32.512	45.993***
A x T	1	0.112	0.159
B x T	1	3.612	5.110*
A x B x T	1	2.812	3.978
Ss x T/A x B	36	0.706	

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Analysis of Variance of No Reinforcement Schedule and Delayed Reward Tapping Behavior - Difference Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	628.320	11.232**
Reinforcement Type (B)	1	782.500	13.988***
A x B	1	205.440	3.672
Ss/A x B	36	55.939	
Within Ss	40		
Trials (T)	1	584.280	21.508***
A x T	1	30.012	1.104
B x T	1	86.112	3.170
A x B x T	1	29.040	1.069
Ss x T/A x B	36	27.164	

** $p < .01$

*** $p < .001$

obtained significantly ($p < .01$) more successes under delayed reward ($\bar{X} = 8.2$) than under no reinforcement ($\bar{X} = 4.6$). Furthermore, the groups did not differ from each other under no reinforcement.

The significant effect of trials is due to the differential effect on rate of performance of the first five trials compared with the second five. The mean number of successes achieved on trials 1-5 was 3.2, while an average of 1.9 was obtained on trials 6-10. The significant interaction of reward type by trials is based on the mean number of success scores on the two trial blocks under no reinforcement and delayed reward. The results of the Tukey test indicated a difference of 0.71 between means is needed for significance at $p < .05$, and a difference of 0.97 is needed at $p < .01$. Under no reinforcement, significantly ($p < .01$) more successes were achieved on trials 1-5 ($\bar{X} = 2.9$) than on trials 6-10 ($\bar{X} = 1.2$). Likewise, the same significant ($p < .05$) effect is seen under delayed reward ($\bar{X}$ - trials 1-5 = 3.5; $\bar{X}$ - trials 6-10 = 2.6).

Table 4 summarizes the analysis of variance on the average tapping rate differences from base-level performance for both groups under no reinforcement and delayed reward. The significant group effect is reflected in the average change in response rate of the two groups. Combining over both conditions, the alcoholics' mean tapping

rate decreased 2.2 from base-level; whereas the non-alcoholics showed a mean increment in performance of 3.4. The significant main effect of reinforcement type is reflected in the average increase in response rate under the delayed reward condition compared with no reinforcement. Tapping rate increased an average of 3.7 under delayed reward, while under no reinforcement there was a mean decrement of 2.5. The significant trials effect is based on an average increase in performance rate of 3.3 under the first five trials, whereas performance under the second five trials decreased an average of 2.1.

Comparison of No Reinforcement and Delayed Punishment

Table 5 presents the analysis of variance on the groups' average success scores under no reinforcement and delayed punishment. The significant effect of reinforcement type reveals that delayed punishment was the more effective in increasing performance, the mean success scores being 9.1 under delayed punishment compared with 4.1 under no reinforcement. The significant trial effect is based on there having been an average of 3.5 successes in trials 1-5 compared with an average of 2.6 in trials 6-10. Examining the significant interaction of reinforcement type by trials, the Tukey test indicated that a difference between the means of 0.53 is needed for significance at $p < .05$,

Table 5

Analysis of Variance of No Reinforcement Schedule and Delayed Punishment Tapping Behavior - Success Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	1.250	0.799
Reinforcement Type (B)	1	80.000	51.154***
A x B	1	1.250	0.799
Ss/A x B	36	1.563	
Within Ss	40		
Trials (T)	1	16.200	17.408***
A x T	1	0.050	0.053
B x T	1	12.800	13.754***
A x B x T	1	2.450	2.632
Ss x T/A x B	36	0.930	

*** $p < .001$

and a difference of 0.71 is required for significance at $p < .01$. The interaction is explained by the fact that there was a significant ($p < .01$) decrease in success scores under no reinforcement from the first trial block to the second ($\bar{X}$ - trials 1-5 = 2.9; $\bar{X}$ - trials 6-10 = 1.2), while under delayed punishment there was no differential effect of trials on success scores ($\bar{X}$ - trials 1-5 = 4.1; $\bar{X}$ - trials 6-10 = 4.0).

Table 6 presents the analysis of variance for the no reinforcement-delayed punishment difference scores. The significant main effect of reinforcement type is due to the fact that performance rate decreased an average of 2.5 under no reinforcement while under delayed punishment there was an average <u>increase</u> in rate of 9.0. The significant reinforcement type by trials interaction is presented in Figure 7.

Figure 7

Mean Trial Tapping Rate Change Under No Reinforcement and Delayed Punishment

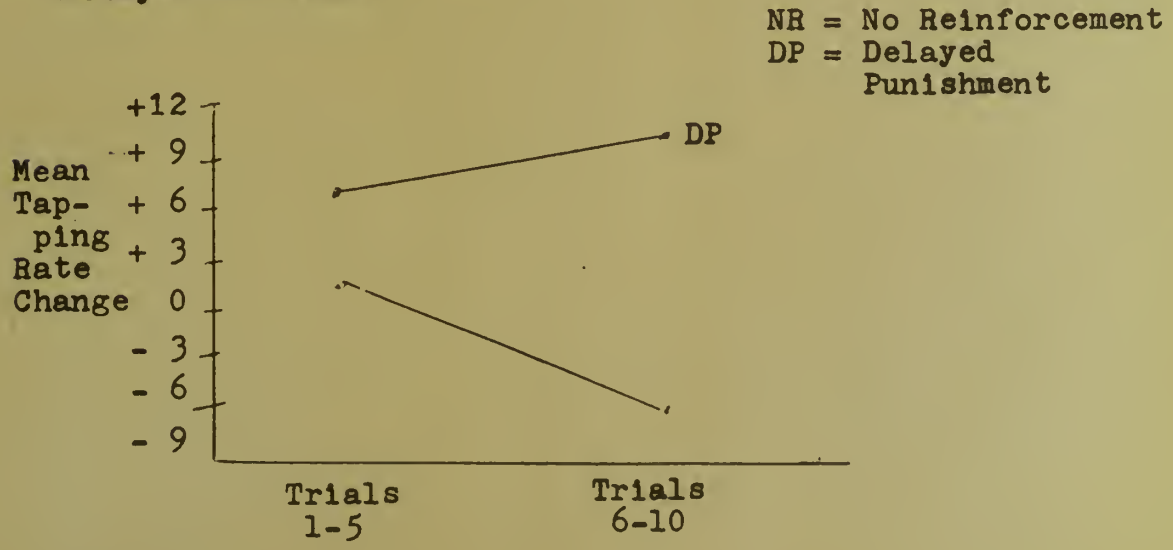


Table 6

Analysis of Variance of No Reinforcement Schedule and Delayed Punishment Tapping Behavior - Difference Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	9.646	0.104
Reinforcement Type (B)	1	2661.355	28.816***
A x B	1	191.642	2.075
Ss/A x B	36	92.355	
Within Ss	40		
Trials (T)	1	77.973	3.838
A x T	1	1.866	0.091
B x T	1	605.990	29.833***
A x B x T	1	2.106	0.013
Ss x T/A x B	36	20.312	

*** $p < .001$

Results from the Tukey test indicated that differences between the means of 3.9 and 5.3 are needed for significance at $p < .05$ and $p < .01$ respectively. As is seen from the figure while performance rate under no reinforcement was significantly ($p < .01$) decreased from the first five trials ($\bar{X} = +1.2$) to the second ($\bar{X} = -6.2$), under delayed punishment there was a slight but insignificant rise in tapping rate over trials ($\bar{X}$ - trials 1-5 = +7.2; $\bar{X}$ - trials 6-10 = +10.7).

Comparisons of No Reinforcement and Immediate Reward

In looking at the data for the no reinforcement-immediate reward conditions, it is clearest to examine both dependent measures together. Tables 7 and 8 present the analysis of variance for the success scores and difference scores respectively on these conditions. The main effect of reinforcement type was as expected; immediate reward was more effective in increasing performance than was no reinforcement. The average number of successes under immediate reward was 8.8, compared with 2.5 under no reinforcement. Similarly, while tapping rate decreased an average of 2.5 under no reinforcement, it showed an average increase under immediate reward of 12.1. The significant main effect of trials seen in Table 7 is based on the fact that over both conditions more successes were achieved on trials 1-5 ($\bar{X} = 3.6$) than on trials 6-10 ($\bar{X} = 2.8$). The

Table 7

Analysis of Variance of No Reinforcement Schedule and Immediate Reward Tapping Behavior - Success Scores'

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	0.012	0.009
Reinforcement Type (B)	1	108.112	84.153***
A x B	1	4.512	3.512
Ss/A x B	36	1.284	
Within Ss	40		
Trials (T)	1	13.612	17.105***
A x T	1	0.312	0.392
B x T	1	15.312	19.241***
A x B x T	1	0.612	0.769
Ss x T/A x B	36	0.795	

*** $p < .001$

Table 8

Analysis of Variance of No Reinforcement Schedule and Immediate Reward Tapping Behavior - Difference Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	46.818	0.572
Reinforcement Type (B)	1	4280.738	52.334***
A x B	1	308.898	3.776
Ss/A x B	36	81.795	
Within Ss	40		
Trials (T)	1	77.618	3.044
A x T	1	28.322	1.111
B x T	1	607.202	23.820***
A x B x T	1	29.282	1.148
Ss x T/A x B	36	25.490	

*** $p < .001$

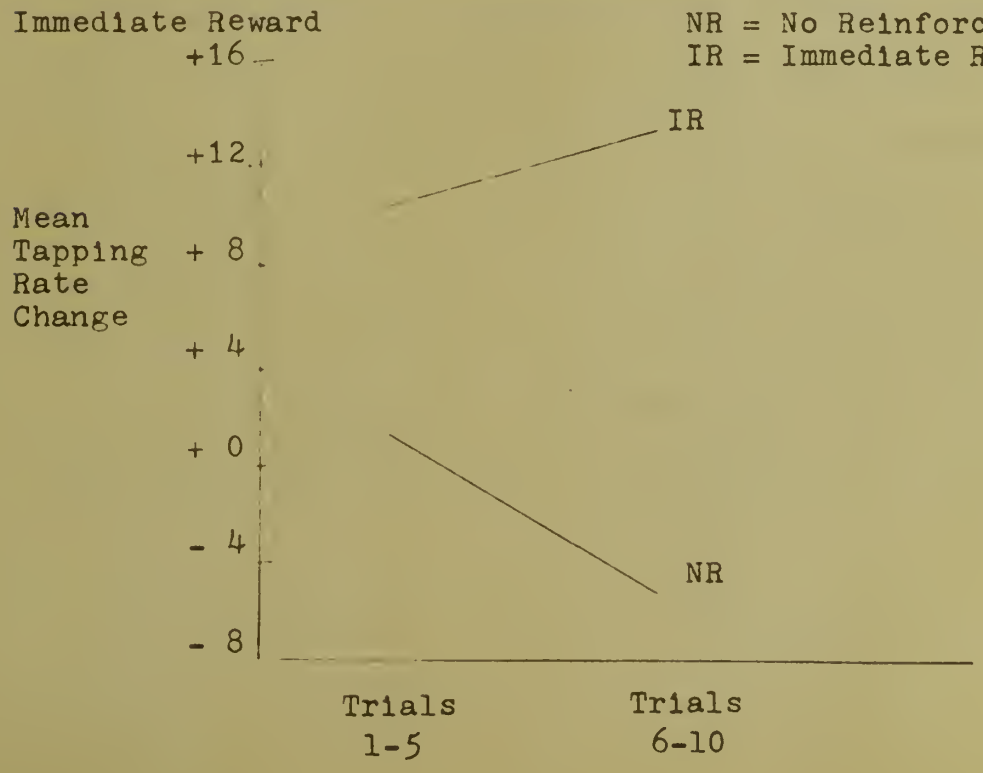
difference score measure in Table 8 revealed no such effect.

The significant interaction of reinforcement type by trials is seen on both measures. On the success scores, using the Tukey procedure, a difference between the means of at least 0.25 is required for significance at $p < .01$. The interaction is based on the fact that while mean number of successes decreased significantly ($p < .01$) from the first trial block ($\bar{X} = 2.9$) to the second ($\bar{X} = 1.2$) under no reinforcement, they remained essentially constant across trials under immediate reward ($\bar{X}$ - trials 1-5 = 4.3; $\bar{X}$ - trials 6-10 = 4.4).

This same interaction using the difference score measure is most clearly seen in Figure 8.

Figure 8

Mean Trial Tapping Rate Changes Under No Reinforcement and Immediate Reward



On this measure, the Tukey test revealed that a difference between the means required for significance at $p < .05$ is 4.4 and at $p < .01$ the difference required is 5.9.

As the figure indicates, tapping rate decreased significantly ($p < .01$) from trials 1-5 ($\bar{X}$ = +1.2) to trials 6-10 ($\bar{X}$ = -6.2) under no reinforcement. Under immediate reward, however, trials did not differentially effect performance rate ($\bar{X}$ - trials 1-5 = +10.3; $\bar{X}$ - trials 6-10 = + 13.8).

Comparisons of No Reinforcement and Immediate Punishment

Tables 9 and 10 summarize the analysis of variance of both dependent variables for the no reinforcement-immediate punishment scores. The significant reinforcement type effect was as expected. The avoidance of immediate punishment was more effective in increasing performance than was no reinforcement. An average of 4.0 successes were achieved under immediate punishment, compared with a mean of 2.0 under no reinforcement, and while tapping rate showed a mean increase of 9.4 under immediate punishment, it decreased an average of 2.5 under no reinforcement. The significant main effect of trials is reflected by the fact that, combining over groups and conditions, performance decreased from the first five trials to the second. An average of

Table 9

Analysis of Variance of No Reinforcement Schedule and Immediate Punishment Tapping Behavior - Success Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	0.012	0.007
Reinforcement Type (B)	1	78.012	46.153***
A x B	1	5.512	3.261
Ss/A x B	36	1.690	
Within Ss	40		
Trials (T)	1	17.112	25.195***
A x T	1	0.312	0.460
B x T	1	12.012	17.686***
A x B x T	1	0.612	0.901
Ss x T/A x B	36	0.679	

*** $p < .001$

Table 10

Analysis of Variance of No Reinforcement Schedule and Immediate Punishment Tapping Behavior - Difference Scores

Source of Variance	df	ms	F
Between Ss	39		
Groups (A)	1	40.869	0.829
Reinforcement Type (B)	1	2846.736	57.777***
A x B	1	293.454	5.955*
Ss/A x B	36	49.270	
Within Ss	40		
Trials (T)	1	169.303	8.300**
A x T	1	3.370	0.165
B x T	1	417.606	20.475***
A x B x T	1	3.689	0.180
Ss x T/A x B	36	20.395	

* $p < .05$

** $p < .01$

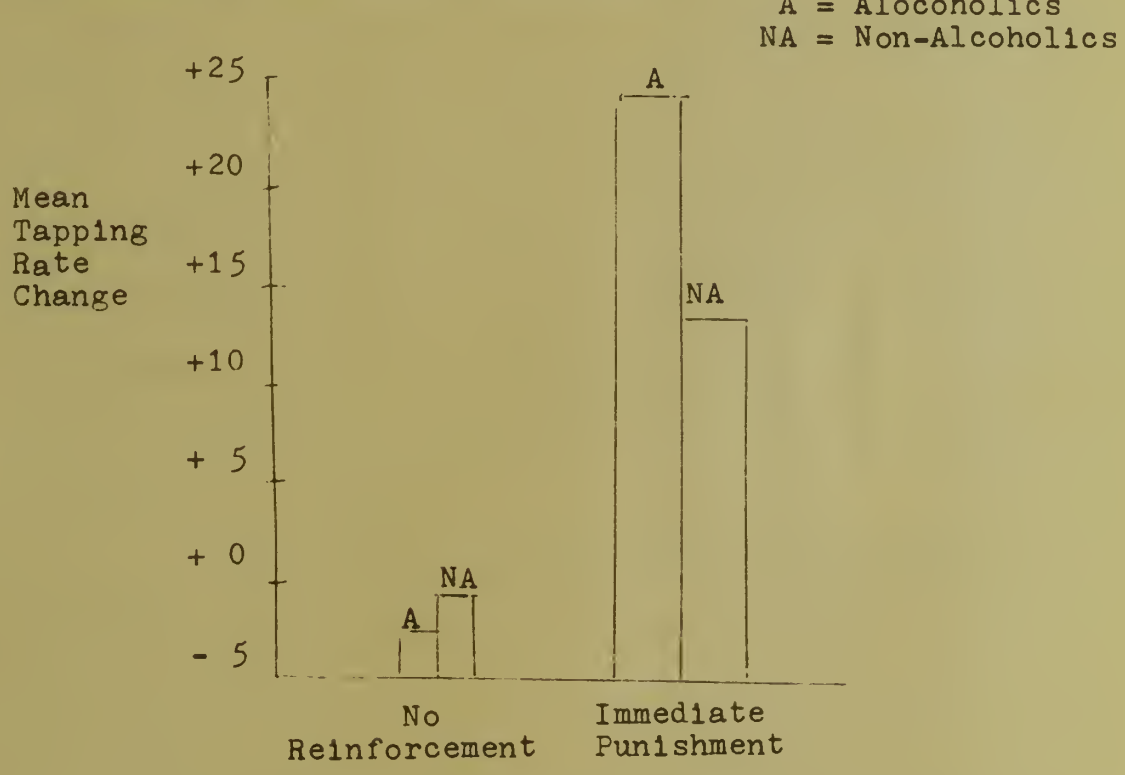
*** $p < .001$

3.5 successes were achieved in trials 1-5, compared with a mean of 2.5 in trials 6-10. Moreover, while the average magnitude of the rate increase was 4.8 in the first five trials, it was only 1.9 in the second five.

The difference score measure alone reveals a significant interaction of groups by reinforcement type. This interaction is presented in Figure 9.

Figure 9

Mean Group Tapping Rate Changes as a Function of No Reinforcement and Immediate Punishment.



The minimum difference between the means for significance at $p < .05$ is 6.16, and at $p < .01$ it is 8.18.

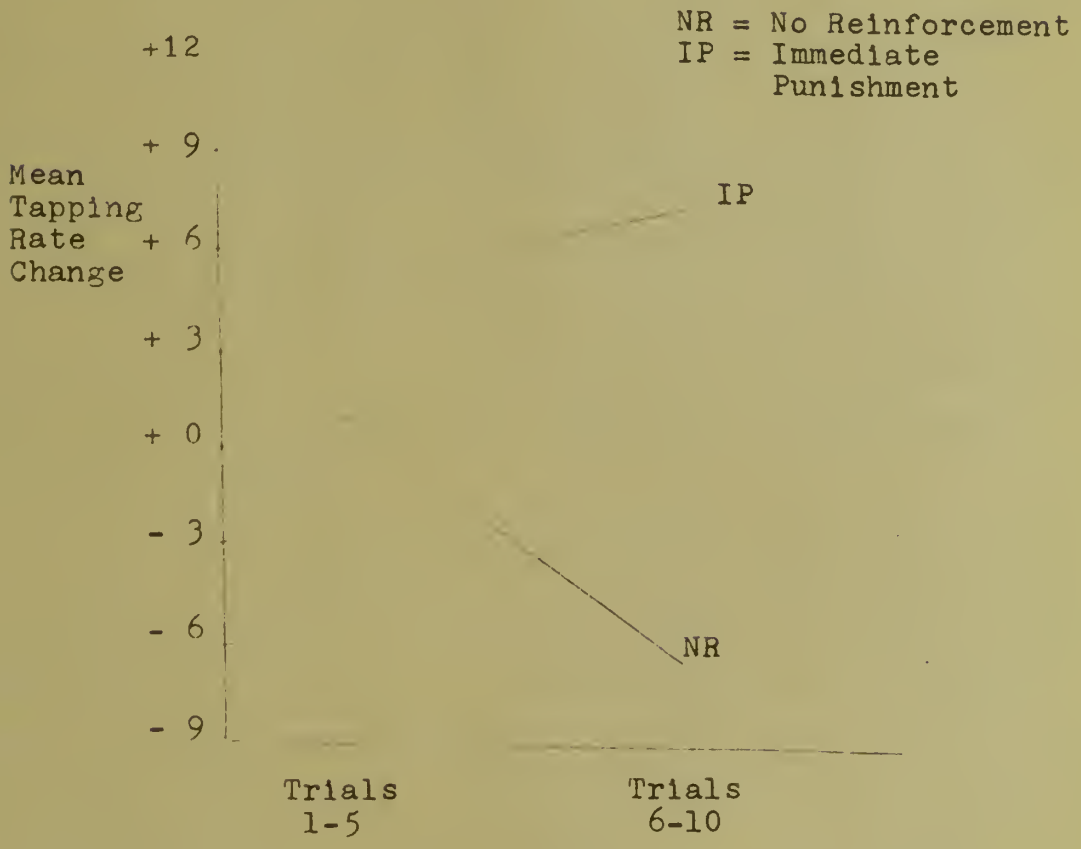
As Figure 9 indicates, while the groups were essentially comparable within each reinforcement type, the alcoholics' magnitude of increase from no reinforcement ($\bar{X}$ = -3.7) to immediate punishment ($\bar{X}$ =+24.0) was significantly ($p < .01$) greaer than that of the non-alcoholics' ($\bar{X}$ - no reinforcement = -1.3; $\bar{X}$ immediate punishment = +13.5).

The significant interaction of reinforcement type by trials is seen in both Tables 9 and 10. Examining the success scores first, the Tukey test indicated that the difference between the means required for significance at $p < .05$ is 0.23, and at $p < .01$ it is 0.3. Under no reinforcement, significantly ($p < .01$) more successes were obtained in trials 1-5 ($\bar{X}$ = 2.9) than in trials 6-10 ($\bar{X}$ = 1.2). While under immediate punishment the number of successes was not differentially effected by trials ($\bar{X}$ - trials 1-5 = 4.1; $\bar{X}$ - trials 6-10 = 3.9).

This same interaction for the difference score is seen in Figure 10.

Figure 10

Mean Trial Tapping Rate Changes Under No Reinforcement and Immediate Punishment



The Tukey test revealed that the minimum difference between means required for significance at $p < .05$ is 3.9, and at $p < .01$ it is 5.3. While tapping rate decreased significantly ($p < .01$) across trials under no reinforcement ($\bar{X}$ - trials 1-5 = +1.2; $\bar{X}$ - trials 6-10 = -6.2), trials did not significantly effect performance under immediate punishment ($\bar{X}$ - trials 1-5 = +8.5; $\bar{X}$ - trials 6-10 = +10.2).

DISCUSSION

The results of this study generally demonstrated that alcoholics differ from other non-psychotic hospitalized patients by their marked lack of ability to continue to work in a situation in order to obtain a delayed reward. The results also revealed that when the reinforcements for responding are immediate, alcoholics are able to perform at a significantly higher rate than are non-alcoholics. The results did not indicate that alcoholics are less able than non-alcoholics to maintain a response in order to avoid delayed punishment.

The responding of both groups under the no reinforcement condition was as anticipated. This condition was included in the study for two purposes: (1) to determine if both groups were essentially comparable in their responding under no reward or punishment contingencies; and (2) to make certain that the task itself was fatiguing and required instrumental activity, but that the fatigue effect did not differentially effect the two groups. The results indicated that the two groups did not significantly differ from each other in performance under the no reinforcement schedule. Secondly, the desired fatigue effect of the task was present as evidenced by the fact that under no reinforcement both groups obtained significantly more successes on the first five trials than on the second, and by the result that

both groups decreased their rate of tapping comparably from the first five trials to the second five. Thus, the no reinforcement condition can be viewed as an extinction-like procedure where the rate of responding of non-reinforced responses gradually drops. Importantly, the rate of response decrease for both groups was essentially equivalent.

All comparisons of the no reinforcement schedule with each of the four reinforcement conditions (Tables 3-10) revealed that under all reinforcement conditions there was a higher number of success scors and a greater increase in tapping rate than under no reinforcement. Thus, as was expected, the no reinforcement condition did not serve to maintain high rates of responding. Furthermore, since the groups performed comparably under no reinforcement, it can be assumed that whatever differences existed between them under other reinforcement conditions cannot be accounted for by differences in their base-rate responding.

There was no theoretical reason to predict a differential effect on responding of reward and punishment, given the fact that the effect of anticipated punishment on humans is not well documented. The lack of a significant reinforcement type effect in the two major analyses of variance (Tables 1 and 2) indicated that the two reinforcement conditions had an overall similar effect on performance. There was, however, considerable evidence to predict a

significant effect of reinforcement time. Immediate reinforcement did in fact serve to increase performance significantly more than did delayed.

The major hypothesis of this study was that alcoholics would not be able to maintain as high a rate of responding as non-alcoholics on a fatiguing task when the reinforcements for responding were delayed. Analysis of the results revealed that this hypothesis was confirmed only for the delayed reward schedule. Under delayed punishment, contrary to expectations, both groups averaged the same number of successes, and, moreover, the alcoholics' average increase in response rate exceeded that of the non-alcoholics'. While the difference was not a significant one, it was a reversal of the predicted effect, namely, that the non-alcoholics' performance under delayed punishment would exceed that of the alcoholics.

In contrast to the results under the delayed punishment schedule, the results from the delayed reward condition represented the most clear-cut finding from this study. As predicted, delayed reward differentially effected the behavior of the alcoholics and non-alcoholics. The non-alcoholics were able to maintain their same level of performance regardless of the timing of the reward. Under the immediate reward they obtained essentially the same number of successes as under delayed reward. In contrast,

the alcoholics achieved less than half as many successes under delayed as under immediate reward.

These differences were even more apparent in examining the tapping rate change data under the reward condition in Figure 4. The alcoholics' average rate of responding under delayed reward was significantly less than under immediate, whereas the non-alcoholics maintained essentially the same response rate under immediate and delayed reward. Thus, it is clear that for non-alcoholics immediate and delayed reward were functionally equivalent, i.e., non-alcoholics were able to perform as well for the promise of obtaining a reward in the future as they were for actually receiving the reward immediately after responding. In contrast, for alcoholics the anticipation of a future reward was not an effective incentive for them to maintain responding; they continued to perform on a task only when their behavior resulted in an immediate reward.

The prediction was made that the alcoholics' performance under delayed reinforcement would not exceed their performance under the no reinforcement schedule. In terms of delayed punishment this was obviously not the case; both groups were as successful in avoiding delayed punishment as immediate, and the responding of both groups under delayed punishment clearly exceeded their no reinforcement level of responding. However, in examining the behavior of

alcoholics under delayed reward as compared with no reinforcement, this prediction was confirmed. Whereas for non-alcoholics delayed reward was functionally equivalent to immediate reward, the results indicated that for alcoholics delayed reward operated functionally equivalent to a no reinforcement schedule. That is, the alcoholics' mean number of successes under delayed reward did not significantly exceed their average successes under no reinforcement. Considering that the concept of frustration has been defined as non-reward, (Ryan and Watson, 1968) it appears that for alcoholics it may equally as well be defined as delayed reward, given the fact that there was no essential difference in their behavior under the two conditions. This finding gives a highly plausible explanation to the widely held speculation that alcoholics have difficulty in maintaining long-range goals. Boos and Albers (1965) found that the temporal orientation of the alcoholic is characterized by a short range view of the future. Given the fact that alcoholics were not able to work to achieve delayed rewards any more effectively than they were able to work for no rewards at all, long-range goals for them were subjectively equivalent to no goals. They were unable to mediate a temporal gap that non-alcoholics could successfully bridge because for non-alcoholics, delayed rewards and goals were clearly distinguishable from no rewards.

This study made no prediction that immediate reinforcement would operate differentially on the two groups. Rather, it was assumed that alcoholics and non-alcoholics would perform comparably under the two immediate conditions. Given this assumption, it was a somewhat surprising finding that the alcoholics' behavior under both immediate reward and immediate punishment significantly exceeded that of the non-alcoholics. These results strongly point out that the orientation of the alcoholic is geared toward immediate gain or satisfaction. A closer look at the behavior of the groups under immediate reinforcement reveals a rather interesting and important finding about alcoholics.

For a subject to receive an immediate reward or avoid an immediate punishment on the task, all that was required of him was to exceed his base-rate level of responding by one tap per trial. Any response above that one tap was, in a sense, unnecessary effort. Under immediate reward the alcoholics exceeded their base-level performance by an average of 29.6, and under immediate punishment they exceeded it by an average of 24.1. In contrast, the non-alcoholics' mean increase in tapping rate from base-level under immediate reward and punishment were 18.7 and 13.1 respectively; these increases being significantly lower than those of the alcoholics.

Thus, given the opportunity to work for an im-

mediate reward or to avoid an immediate punishment, the alcoholics' behavior was more than sufficient to insure his reaching his aim. He was able to behave in a highly effective msnner for certain accomplishment of his goals. While this style of responding may be considered effective in the sense that it guaranteed the immediate aims, it was inappropriate in another sense, for it considerably exceeded that which was necessary to obtain the immediate goal. In other words, the alcoholic over-worked under immediate reinforcement, just as he under-worked for delayed rewards.

To state that his behavior is "non-integrative", in the sense that its punishments ultimately outweigh its' rewards, does not tell the whole story. It is also non-integrative because it is over-driven toward immediate satisfactions to a degree far beyond that which the situations require. In contrast, the behavior of the non-alcoholic is considerably more adaptive; it is appropriately aimed at both immediate and delayed rewards. As Shapiro (1965) has pointed out, when an orientation toward an immediate gain or satisfaction prevails, the given need is likely to be provided with a well practiced set of techniques for quick accomplishment of its aims. This is a rather primitive process compared with more adaptive behavior that places immediate needs in proper perspective and is able to work for delayed gains. Calling the alcoholics' behavior

impulsive actually means that it is impulsive in the long-term sense. In terms of short-range planning and adaptation, it is highly developed, if not overly-developed. Subjectively, this behavioral style is evident in the manner in which the alcoholic is able to obtain alcohol, often in times when he has minimal financial or personal resources. If he were really impulsive in the traditional sense, his behavior would be characterized by chaotic-like bursts of actions. However, under circumstances of seeking immediate gains he is able to act efficiently and these actions which in one sense do not take into account delayed consequences are frequently executed with a high degree of efficiency. Shapiro (1965) and others have stated that the alcoholic "operates" well. What this indicates is that his behavior is very well suited only to the competent execution of his short-range immediate needs.

The prediction that the alcoholics' performance under the delayed conditions would decrease significantly from the first half of the task to the second was not confirmed. Two factors accounted for this. First, under delayed punishment, contrary to expectations, the alcoholics' mean rate of increase on the first five trials was slightly less than their average rate increase on the second five, although this difference was not significant.

This is further evidence for the conclusion that alcoholics are comparable to non-alcoholics in the ability to work to avoid punishment, whether this punishment be immediate or delayed. Secondly, in terms of the delayed reward schedule, the results were in the predicted direction, but were not significant. The alcoholics increased their performance on the first five trials, and they showed a mean decrease in tapping rate from base-level on the second five. Thus, while the predicted interaction effect was not observed, the alcoholics' over-all performance under delayed reward was suppressed to such an extent that there was little opportunity, within the ten trial limit of the experiment, for alcoholics and non-alcoholics to differ to a greater degree on the last five trials than they did on the first five.

Implications For Future Research

The results of this study have implications for the treatment of alcoholics and for additional research dealing with the variable of delay of gratification deficits in alcoholics. First, the finding that alcoholics are able to perform excessively under immediate reinforcement conditions, while, at the same time, they are significantly less able than non-alcoholics to maintain their behavior under delayed reward, is important for understanding treatment of alcoholism. It is accepted knowledge that tradi-

tional psychotherapy has been markedly ineffective with alcoholics. (Blum and Blum, 1967) Given the results of this study, this is not surprising. Most psychotherapies demand that the patient must stay in treatment for a long enough time (usually undefined) in order for change to take place. This demand necessitates on the part of the patient an orientation toward an indefinite long-range goal, which, as has been shown, is the very orientation that the alcoholic does not possess.

In contrast to the relative lack of effectiveness of psychotherapy with alcoholics as Fox (1957) has pointed out, "The single most effective method of treatment that exists is that of Alcoholics Anonymous." A closer look at the fundamental assumptions of A.A., as these assumptions relate to the results of this study, indicate why this may be so. First, an important feature of the program is that A.A. members who are helping newcomers spend all the time that is necessary in order to protect the newcomers from urges to drink. They make themselves available at any time, day or night, wherever the new member happens to be. For the person who feels the need to drink, all he has to do is make a phone call and he receives help immediately; no delays are necessitated. This is clearly different from psychotherapy where the delay interval between the urge to drink and the receiving of help may be as much as a week. As this study has demonstrated,

a week's interval for receiving a reward is not a delay that the alcoholic can bridge. Secondly, as McMillan (1967) has stated, a cardinal slogan for new A.A. members is the motto "Twenty-four hours at a time." What this means is that the member is urged not to make a long-range pledge of not drinking. The motto makes it possible for him to have successive short-range goals for which he can work in the early phases of sobriety. McMillan also reports that one particularly successful A.A. chapter has adopted the procedure of passing out poker chips to new members at the end of every twenty-four hours of sobriety. Additional chips are subsequently passed out as the members achieve longer periods of non-drinking. It thus sems clear that although the basic orientation of A.A. is more religious in nature than it is based on learning theory principles, in an unsystematic fashion it does make use of learning theory. Much of its success is attributable, at least in part, to its understanding of the principle that repeated immediate rewards are essential for sobriety to be maintained.

The issue of the "Twenty-four hours at a time" motto raises an interesting research question, one which this investigator will be studying. This present study demonstrated rather conclusively that alcoholics are not able to work for delayed rewards, the delay between

response and reward being one week. It can be argued that twenty-four hours is also a delay period, yet it appears to be one tha A.A. members are able to bridge. Consequently, it seems reasonable to assume that the shorter the delay period between response and reward, the more similar the alcoholics' behavior will be to that of non-alcoholics. While this study revealed a significant difference between alcoholics and non-alcoholics in terms of the effectiveness of delayed rewad in maintaining performance, it did not measure the extent of this difference. Two studies follow from this observation. First, the delay interval for non-alcoholics can be extended beyond one week in order to determine the maximum period between responding and reward that will serve to maintain their behavior. Secondly, for alcoholics, the delay interval can be reduced in order to determine the minimal delay that is required for them to continue to respond. In a future study, alcoholics will be working under 12, 24, 48 and 96 hour delays, while non-alcoholics will be performing under 7. 14, and 21 day delay intervals. Based on the results of this study and the effective procedures of A.A., it is expected that the two groups' delayed reward performance will be comparable when alcoholics are working under 24 hour delays, and non-alcoholics are performing under two or three week delays.

A second issue that is implied from the results of this study is the question of why alcoholics are unable to work for delayed rewards, and why delayed reward is comparable to no reward for them. The capacity of a person to tolerate delay of gratification is seen by Renner (1966) as an acquired expectancy based on past learning experiences with reality demands and frustrations. Renner's position that past learning effects the ability to tolerate delay of gratification has implications for theorizing as to why alcoholics and non-alcoholics behave differently under immediate and delayed rewards. The possibility exists that the reinforcement histories of the two groups may be very different. It may be speculated that the pre-alcoholic person has been exposed to fewer situations where frustrations and delays had to be tolerated in order to attain distant goals. Such a person's past reinforcements would be characterized by a more immediate satisfaction of needs than that of the non-alcoholic's. Conversely, the inability to tolerate delayed rewards might also be found in a person whise past learning history demanded too much frustration tolerance and too much delaying capacity so that delayed rewards were in fact seldom achieved.

A possible fruitful area of research to examine this question lies in the concept of expectancy. This concept is important both in cognitive and social learning

theories of behavior. The fundamental notion is that a person's choices are determined not only by what he wants but also by what he expects to receive. Rotter and Mulry (1965) state that the perception of a situation as controlled by chance, fate, or powerful others will lead to predictable differences in behavior in comparison with situations where a person feels that reinforcement is controlled by his own behavior. The question then arises whether alcoholics differ from non-alcoholics by their perception of a delayed reward situation as one where the obtaining and not obtaining of the reward is independent of how they behave, but, rather, is determined by factors beyond their control. A preliminary test of this question could be made by use of the Rotter (1966) scale of internal-external control. This is concerned with subjects' expectations about how reinforcement is controlled. If the alcoholic does not expect his behavior to be related to receiving delayed rewards, then a part of the treatment process for him may involve "shaping" his behavior toward longer and longer delay periods, a technique which A.A. appears to use unsystematically.

The speculation that past reinforcement histories may be an important variable in understanding the differences between alcoholics and non-alcoholics suggests a return to the idea of psychological predisposition as a

causative factors in alcoholism. However, this "predisposition" does not refer to invariable personality traits or psychiatric syndromes that would necessarily result in a person's becoming an alcoholic. Rather, it implies that specific patterns of past rewards and punishments and differential histories of gradual experiences with frustrations and delays may be important causative factors behind alcoholism. The answers to these questions can be found only through experimental and longitudinal studies. Since it is not certain what the alcoholic was like before he became an alcoholic, he must be studied in his pre-alcoholic state.

These speculations lead to an important conclusion about the results of this study. It may be argued that the findings are a result of alcoholism, rather than a predisposing condition of it. Three possible explanations can be given for the findings. First, the inability to delay gratification may serve to lead to alcoholism. Support for this position could be found if it were determined that teaching the alcoholic to delay gratification resulted in a reduction of his drinking. Secondly, prolonged immoderate use of alcohol could conceivably result in the inability to work for delayed rewards. If this argument is correst, it suggests that inability to work for delayed rewards may be directly correlated with length

of time of excessive drinking. Thirdly, it may be argued that some as yet unknown predisposing factor may lead to both alcoholism and the inability to delay gratification. Longitudinal research is needed to test this argument.

This study represents the second experiment that has failed to demonstrate a differential effect of delayed punishment on alcoholics and non-alcoholics (Vogel-Sprott and Banks, 1965). It may be argued that the delayed punishment interval in both of these studies was too short to be considered an adequate delay, and that subjects were actually responding to both punishment conditions as if they were immediate in nature. Mischel, Grusec, and Masters (1969) point out that while little is known about how anticipated delay time affects the subjective value of punishments, ..."in most life situations, adaptive human choice behavior requires the individual to cope with alternatives involving lengthy delay periods of days, weeks, and even longer durations, rather than the artificially short intervals favored in previous laboratory research and in animal studies." In a future study, both the nature and the timing of the punishment can be changed. For example, subjects could be made to do an unpleasant task or chore either immediately after the experimental task or a week later, and alcoholics and non-alcoholics could be compared in terms of their ability to work on the task in

order to avoid the immediate and the delayed punishment. Clearly, for such an experiment to be carried out the experimenter would have to be able to exercise control of the reinforcement contingencies on a ward of alcoholic patients.

One additional implication for future research comes from the finding that the alcoholics' behavior under immediate reinforcement is excessive. Such behavior is not adaptive or integrative because it is over-driven to the achievement of immediate gains. This finding raises the question whether alcoholics are able to learn moderation and less intensity of behavior under immediacy of reward. Using the same paradigm as the present experiment, a reward-punishment contingency could be devised where in order to receive an immediate reward a subject has to exceed his base-rate performance level, as in the present study. However, if the magnitude of increase over the base level is too great, the subject would either lose the reward or receive a punishment, depending on the reinforcement schedule in operation. The implication here is that the orientation of alcoholics toward immediate satisfactions might be to such an extent that it precludes their modifying their behavior to a more adaptive level.

In general, the results of this study add support

to the relatively recent trend that further research on alcoholism should not attempt to identify personality traits or psychiatric syndromes that typify the alcoholic. Rather, it appears that a more appropriate approach to alcoholism should analyze the alcoholics' behavior insofar as that behavior resembles the response of excessive drinking. What is needed to be known is an understanding of the variables that seem to be operating to result in the alcoholic being unable to work for delayed rewards while, at the same time being able to work intensely for immediate satisfactions. Given the findings of this study, implications for the treatment of alcoholism suggest that treatment cannot be geared solely at the elimination of the response of drinking. Rather, it must be a two stage process involving both the elimination of the old drinking response and the acquisition of the new response of abstinance. For the alcoholic, sobriety is not simply the absence of drinking, it is a series of behaviors that need to be rewarded frequently and consistently if the behaviors are to be maintained.

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Appendix A

Age, Educational, Ethnic, and Socio-Economic Characteristics of Subjects*

	Alcoholics		Non-Alcoholics	
	Mean Years Ed.	Mean Age	Mean Years Ed.	Mean Age
No Reinf.	10.5	41.8	12.2	39.5
Im. Reward	11.2	40.6	9.0	38.2
Del. Reward	11.8	43.4	9.8	44.5
Im. Pun.	9.1	37.7	10.9	39.5
Del. Pun.	8.5	44.2	10.1	41.6

*Each of the above cells of ten subjects was made up of 40% Irish-American subjects, 40% Italian-American, and 20% "other". This latter category consisted primarily of Swedish, Greek, and Polish ethnic groups. While no accurate estimate of socio-economic class information could be obtained, all subjects who were tested reported an average income for the past three years of between one and four thousand dollars.

The Commonwealth of Massachusetts
Department of Mental Health

DAVID J MYERSON, M D
SUPERINTENDENT

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WORCESTER MASS. 01604

APPENDIX B

NOTE OF PROMISE OF PAYMENT

This note certifies that Mr._____ has taken part in a psychological study on _____. For having participated he has earned _____. This money will be paid to him one week from the above date on _____ by the principal investigator of the study.

David A. Finkel
David A. Finkel
Principal Investigator

Richard A. Rablen
Richard A. Rablen, Ph.D.
Director of Research

Appendix C

Mean Group Success Scores Under Immediate and Delayed Reward and Punishment

Alcoholics				Non-Alcoholics			
Reward		Punishment		Reward		Punishment	
Im.	Del.	Im.	Del.	Im.	Del.	Im.	Del.
9.2	4.1	8.6	8.1	8.3	8.2	7.5	8.1
$\bar{X}_{Rew.}=6.6$		$\bar{X}_{Pun.}=8.3$		$\bar{X}_{Rew.}=8.2$		$\bar{X}_{Pun.}=7.8$	
$\bar{X}_{Im.}=8.9$ $\bar{X}_{Del.}=6.1$				$\bar{X}_{Im.}=7.9$ $\bar{X}_{Del.}=8.1$			

Appendix D

Mean Group Difference Scores Under Immediate and Delayed Reward and Punishment

Alcoholics				Non-Alcoholics			
Reward		Punishment		Reward		Punishment	
Im.	Del.	Im.	Del.	Im.	Del.	Im.	Del.
+29.6	-1.3	+24.1	+21.8	+18.7	+16.2	+13.1	+14.2
$\bar{X}_{Rew.}=+14.1$		$\bar{X}_{Pun.}=+22.9$		$\bar{X}_{Rew.}=+17.5$		$\bar{X}_{Pun.}=+13.6$	
$\bar{X}_{Im.}=+26.8$ $\bar{X}_{Del.}=+10.2$				$\bar{X}_{Im.}=+15.8$ $\bar{X}_{Del.}=+15.2$			

Appendix E

Mean Group Success Scores and Difference Scores Under No Reinforcement

Alcoholics		Non-Alcoholics	
Success Scores	Difference Scores	Success Scores	Difference Scores
3.6	-3.7	4.6	-1.3

Temporal Gradient of Reinforcement and Temporal Gradient of Punishment Differences Between Alcoholics and Non-Alcoholics

A Dissertation

By

David A. Finkel

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