*THE AVERSIVE CONTROL OF EXCESSIVE ALCOHOL
CONSUMPTION BY CHRONIC ALCOHOLICS IN THE
LABORATORY SETTING¹*

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The efficacy of several methods of aversive control of excessive alcoholic drinking was investigated in a semi-naturalistic setting that permitted objective measurement of the drinking behavior of chronic alcoholics. Studies 1A and 1B compared an escape-conditioning procedure with a control procedure in which aversive electrical shocks were administered before drinking. Neither procedure effectively decreased subjects' pretreatment, baseline alcoholic drinking behavior. In Study 2, aversive response-contingent shocks effectively suppressed alcoholic drinking, but drinking subsequently returned to its former levels after withdrawal of punishment. Self-administered shock appeared to be as effective as experimenter-administered punishment for controlling drinking, even when the punishment contingency was faded out over time. Study 3 replicated the suppressant effect of punishment, and demonstrated that contingent shock was significantly more effective than yoked, noncontingent shock. A direct comparison of self- *versus* experimenter-administered punishment suggested a possible slight advantage for the latter.

DESCRIPTORS: alcoholics, aversive control of alcoholism, escape conditioning, self-regulation, shocks, self-administration

Electrical aversion therapy has been widely recommended as the method of choice in the behavioral treatment of alcoholism (Eysenck and Beech, 1971; Franks, 1970; Rachman and Teasdale, 1969). However, this advocacy has been based more upon questionable theoretical predilections and inadequately controlled clinical investigations than on controlled outcome research (Nathan, *in press*; O'Leary and Wilson, *in press*). As Wilson and Davison (1969) suggested, electric shock might not be the optimal aversive stimulus; rather, successful conditioned aversion to the taste and smell of alcohol may require a

more "biologically appropriate" aversive stimulus, such as drug-produced internal malaise. In addition, the assumption that electrical aversion therapy classically deconditions the positive valence of alcohol may not be valid. Moreover, the available clinical outcome evidence does not lend strong support for its use in the behavioral treatment of alcoholism.

Blake (1965, 1967) reported that an electrical escape-conditioning technique, in which the patient terminated a painful shock by spitting out alcohol he had previously been instructed to sip but not swallow, produced significant improvement in approximately 50% of patients treated at 1-yr follow-up. The absence of an appropriate control group and the concurrent use of other therapeutic procedures renders any meaningful interpretation of the effects of aversive conditioning impossible. Vogler, Lunde, Johnson, and Martin (1970) compared Blake's (1965) escape conditioning paradigm with pseudoconditioning (random shock), sham conditioning (no shock), and routine hospital care in the treatment of 51 chronic alcoholics.

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There were no significant differences between the groups in terms of proportion of relapses at an eight-month follow-up, and while the authors claim that relapse took significantly longer for the aversive conditioning group, this difference was obtained by contrasting this group with all the other groups combined, rather than by more appropriate statistical comparisons between individual pairs of treatment groups. The results indicating statistically greater improvement in a booster conditioning follow-up group cannot be properly interpreted because patients were included in this group on a nonrandom, *post hoc* basis. Hallam, Rachman, and Falkowski (1971) found that a respondent aversive-conditioning procedure was not only therapeutically unsuccessful, but also failed to produce the predicted conditioned cardiac or GSR responses to alcohol-related stimuli during treatment. MacCulloch, Feldman, Orford, and MacCulloch (1966) and Regester (*unpublished*) reported similarly negative results.

Interpretation of these studies is complicated by the fact that evaluation of outcome has been based upon subjective judgements of whether the patient is abstinent or not at various follow-up periods of many months in duration. Bandura (1969) pointed out that outcome evaluation of psychological forms of treatment must distinguish between the initial *induction* of behavioral change, its *generalization* beyond the treatment center, and the *maintenance* of treatment-produced gains over time. The absence of treatment effects several months after therapy has been discontinued does not necessarily mean that aversive conditioning techniques are ineffective. Initial therapeutic gains might have been induced but may not have been maintained.

Because the use of aversion therapy is predicated on the assumption that it suppresses drinking by endowing the alcohol with conditioned aversive properties, it would seem desirable to demonstrate such aversions in a laboratory setting before testing their efficacy in a complex clinical outcome study. This initial laboratory centered approach would also permit the rigor-

ous, objective measurement necessary to specify the processes responsible for behavior change. Evaluation procedures that rely on self-reports, even in those instances where attempts are made to corroborate these reports by interviewing significant others in the patients' environment, or by checking arrest or rehospitalization records, are of questionable reliability and validity (Summers, 1970).

Miller, Hersen, Eisler, and Hemphill (1973) obtained an objective measure of alcohol consumption when comparing the electrical escape-conditioning method to two control groups; a conditioning procedure using barely perceptible shock intensity, and a confrontation therapy condition for the treatment of chronic, hospitalized alcoholics. Under the guise of an analogue "taste test", subjects were asked to rate the tastes of both alcoholic and nonalcoholic beverages as they needed to make accurate judgements (Osgood, Suci, and Tannenbaum, 1957). They were instructed to sample as much of the beverage about taste. Amount of alcohol consumed during the "taste test" served as the pre-post measure of treatment success, while the ratings provided an index of subjects' attitudes toward alcohol. No significant differences in alcohol intake or in attitudes towards alcohol were found among the three groups, all of which showed similar decreases in drinking of about 30% on the post-test. Miller *et al.* (1973) endorsed Hallam *et al.*'s (1971) conclusion that the effects of respondent electrical-aversion conditioning with alcoholics may be related more to general treatment factors such as therapeutic instructions and to placebo effects than to any specific conditioning process.

The use of especially contrived analogue indices of alcohol consumption (Marlatt, Demming, and Reid, 1973; Miller *et al.*, 1973) promotes greater objectivity of measurement. However, it is possible that these measures are insufficiently sensitive to treatment effects because of their relatively artificial time-limited nature. Accordingly, the present investigations focused on prolonged drinking in a more naturalistic, albeit controlled, situation in which the

effects of aversive treatments were directly assessed upon free-operant drinking baselines.

EXPERIMENTAL PROCEDURES

Setting

The research was carried out at the Alcohol Behavior Research Laboratory (ABRL), Rutgers University. This four-bed, inpatient research facility, which has been described in detail elsewhere (Nathan, Goldman, Lisman, and Taylor, 1973), allows continuous observation and measurement of alcoholics' *ad libitum* drinking behavior on a 24-hr basis. The alcohol available was either blended whiskey or bourbon (86 proof). During drinking phases in Experiment 1A, subjects obtained one-ounce quantities of alcohol by activating a computer-controlled operant console situated in their private rooms. In the remaining experiments, a subject pressed a buzzer located in a simulated bar setting to summon a research assistant, who then served him one ounce of alcohol.

Subjects

All subjects in the different experiments reported below were gamma-type male alcoholics (Jellinek, 1960) who were therapeutic failures from New Jersey and New York State institutions. No subject had previously received any kind of aversion therapy. Subjects were medically and psychiatrically screened to ensure that they satisfied the following criteria: (a) a history of problem drinking extending for more than 5 yr; (b) a history of alcohol withdrawal symptoms; (c) no history of neurological disease or psychotic disorder; (d) no history of nonalcoholic drug addiction; and (e) no current medical treatment or medication regime. This information was corroborated by hospital records, interviews with social workers, and interviews with the subjects. Subjects were recruited on a voluntary basis, and told that they would participate in an "experimental treatment program" for alcoholics that was part of a wider research program. All were carefully informed in advance and understood that they would receive some form of electrical

aversion therapy from which they could withdraw at any point. All subjects had been judged to be motivated for treatment by the referral agency, two members of the ABRL staff during subject selection interviews, and by a psychiatrist at the ABRL. Subjects were paid \$15 per week during their stay at the ABRL and also earned a bonus of \$10 per week for cooperating with the general operating procedures. Money accrued was given to subjects upon their discharge from the ABRL. Subjects clearly understood that this money was not contingent on drinking or non-drinking behavior; nor did any subject express doubt that he was not receiving authentic psychological treatment aimed at decreasing drinking.

EXPERIMENT 1A

Subjects

Subject 1 was a semi-skilled white worker, single, 43-yr old, with an alcoholism problem of at least 10 yr duration. Subject 2 was an unskilled white worker, separated, 54-yr old, who had been alcoholic for at least 15 yr.

Procedure

A crossover design was used that allowed both between- and within-subject comparisons of the effects of different treatment. After starting with blood alcohol levels of zero (as in all experiments reported here), both subjects were allowed *ad libitum* consumption of a maximum of 18 one-ounce drinks of alcohol over each of three consecutive 24-hr periods during an initial baseline drinking phase, with the single limitation that, for reasons of their physical well-being, they were not allowed to exceed a BAL of 250 mg/100cc. Day 4 was a recovery period, during which subjects were returned to a BAL of zero. On Days 5 to 7 Subject 1 received twice-daily sessions of 15 trials each of electrical escape conditioning; Subject 2 received the same number of trials of the control procedure. Subjects were allowed no alcohol during the treatment phases. Following a second three-day *ad lib* baseline drinking phase and a recovery day dur-

ing which zero BALs were recovered, the treatment procedures were reversed for the two subjects in a second treatment period. A final three-day baseline assessment phase concluded the study. To avoid intense physical discomfort caused by abrupt withdrawal from alcohol during detoxification phases, subjects were given carefully scheduled amounts of alcohol as BAL dropped. Alcohol was administered until BAL was down to 80 mg/100cc. Thereafter, subjects received 10 mg of Librium every 2 hr until zero BAL if they so desired. All subjects reached zero BALs at least 10 hr before the start of the next treatment day. Similarly, Librium was not administered beyond midnight of the recovery day so that these depressant drugs would not affect the conditioning treatment.

Escape-conditioning procedure. This was modelled on those of Blake (1965) and Vogler *et al.* (1970). Subjects were given a classical conditioning rationale emphasizing how the repeated association of shock with alcohol consumption would increasingly suppress the urge to consume alcohol. They were told that this procedure had been successfully used to help other alcoholics decrease drinking and that they were receiving treatment as part of a research program designed to prove the efficacy of the procedure. Each subject was treated individually, seated at the bar, across from the therapist, with Beckman electrodes attached to the index and middle fingers of the nondominant hand. The shock apparatus, Scientific Prototype model 102-k, produced a constant current source that was doubly isolated.

No one else was allowed to enter the bar during treatment sessions. Shock levels in this and subsequent experiments were individually determined according to subjects' subjective report of what was painful, and a definite flexion of the arm. Adjustments were made during treatment sessions if subjects appeared to be adapting to the shock. The intensities used ranged from four to five, and seven to eight milliamps for the respective subjects. The subject was instructed to look at, smell, and then

sip some alcohol without swallowing. A shock, administered contiguously with the sip, was terminated by the subject spitting the alcohol into a small bucket. Subjects were specifically instructed to retain the alcohol in their mouths until they could no longer tolerate the shock. As a result, shock duration was variable, ranging from approximately 0.5 to 2 sec. The intertrial interval was 90 sec, during which subjects were allowed to smoke, drink nonalcoholic beverages, and converse with the therapist on matters unrelated to the specific details of their drinking problem. On no occasion did any subject attempt to swallow any alcohol.

Control procedure. This procedure was intended to control for all the "nonspecific" treatment variables inherent in the escape-conditioning procedure, but excluding the necessary and sufficient parameters for aversive conditioning. An electric shock of approximately 0.5-sec duration was administered and terminated immediately before the instructions to look at, smell, and sip some alcohol without swallowing. Shock intensities were established as in the escape-conditioning procedure. Subjects in this condition received exactly the same rationale and expectations of therapeutic benefit as those in the escape-conditioning treatment.

All treatment procedures were administered by the first author, an experienced behavior therapist. Subjects were instructed to reflect on their treatment trials whenever they felt the urge to drink during posttreatment drinking days. Deliberate efforts were made to foster positive expectations of therapeutic success and structure the demand characteristics of the situation such that they called for little or no post-treatment drinking. To this end, not only were the subjects provided the appropriate rationale, but members of the nursing and research staff of the ABRL were, during Experiments 1A and 1B, also led to believe that demonstrably effective treatment methods were being applied. The staff were instructed to provide encouragement for subjects' attempts at reduced alcohol consumption.

Assessment and Measurement

The frequency, duration, and distribution of each subject's drinking were computer-recorded. Breathalyzer measurements of BAL were taken three times a day. Readings were taken a minimum of 20 min after a subject's last drink, and immediately after the subject had washed out his mouth with water. The breathalyzer was calibrated regularly throughout all experiments; at least 95% accuracy was obtained on all BAL readings. Furthermore, by summing the number of drinks consumed in conjunction with a "real-time" clock and each subject's sequentially readjusted, computer-estimated alcohol metabolism constant, the computer provided highly reliable estimates of each subject's BAL at all times. Subjects' attitudes towards alcohol were measured by daily administration of eight of the evaluative scales of the Semantic Differential (Osgood *et al.*, 1957). Twice daily, subjects' vital signs (temperature, pulse rate, blood pressure and respiration rate) were assessed by the nursing staff to ensure their continued well-being.

RESULTS

Neither the escape conditioning nor the control procedure substantively decreased the amount of alcohol consumed by either subject. With little variability, Subject 1 consumed a mean number of 10.7 ounces before escape conditioning, 9.7 during the second baseline phase, and, finally, 10.3 ounces over the third baseline period after receiving the control procedure. Subject 2 consumed means of 11.0 ounces before the control procedure, 11.3 ounces during the second baseline, and 11.7 ounces after the escape conditioning treatment.

Interviews by the first author with the subjects on the final day of treatment phases, as well as daily notes recorded by ABRL staff, gave no indication that the control procedure's rationale was not successful in generating therapeutic demand equal to that of the escape-conditioning treatment.

EXPERIMENT 1B

Experiment 1B, replicating the previous study, treated four additional alcoholic subjects with electrical aversive conditioning.

Subjects

Four white male high-school graduates served. Subject 1, aged 33, single, had worked as a mechanic and salesman with an alcoholism problem for 8 yr; Subject 2, aged 55, was a house painter, divorced, with a 10-yr history of alcoholism; Subject 3, aged 50, was an ex-executive with 2 yr of college education, separated from his wife, with a 5-yr alcoholism problem; Subject 4, aged 44, was a seaman, with at least a 9-yr history of alcoholism. Subjects 1 and 3 were failures from Alcoholics Anonymous programs.

Procedure

The methods, design, and measurement procedures were the same as those described in Experiment 1A, with the following exceptions. Treatment sessions were expanded to four days, resulting in 120 trials of the aversive conditioning. These treatments were equally administered by the senior author and two masters-level graduate clinical psychology students experienced in behavior therapy. Subjects' daily maximum of allowable alcohol consumption was increased to 30 ounces. Shock levels ranged from five to nine milliamps in intensity.

RESULTS

The data from Experiment 1B are consistent with those of Experiment 1A. Showing little daily variability in drinking patterns, Subjects 1 and 2 consumed 21.3 and 13.7 mean ounces respectively during the pretreatment baseline phase. Following escape-conditioning treatment, the respective mean amounts of alcohol consumed were 21.5 and 15.0 ounces, and after the treatment reversal, 23.0 and 15.5 ounces. Subjects 3 and 4 consumed 28.0 and 24.3 mean ounces respectively during the pretreatment

baseline phase. Respective mean consumption following the control procedure was 25.5 and 25.5 ounces, and 1.5 and 26.5 ounces after escape conditioning. Daily BAL readings indicated that neither procedure produced any significant differences in the pattern or distribution of alcohol consumption during the second and third baseline phases.

A one-way analysis of variance of subjects' attitudes towards alcohol revealed that attitudes during treatment phases were significantly less favorable than during baseline periods one and two ($F = 4.6$, $df = 4, 12$, $p < 0.05$). However, there were no differences between the escape conditioning and control procedure phases, and no significant differential effect of either form of treatment on posttreatment attitudes.

DISCUSSION

The electrical escape-conditioning procedure used in Studies 1A and 1B clearly failed to suppress drinking in five of the six subjects. Only Subject 3 showed a substantial reduction in amount of alcohol consumed following treatment; he returned to drinking within a week after release from the ABRL and was rehospitalized. These negative results were replicated when the same aversive treatment method was administered to two subsequent alcoholic subjects (Wilson, *unpublished*).

It might be objected that the number of aversive conditioning trials administered was insufficient to produce conditioned aversions strong enough to suppress drinking. However, the data show no evidence of any trend that might suggest that an increased number of trials would reduce subsequent drinking. Miller *et al.* (1973) obtained similarly negative results despite the administration of 500 aversive conditioning trials. Furthermore, the shock intensities employed are comparable to those reportedly used to produce the apparent clinical successes in the treatment literature. There are important clinical limitations on the extent to which aversive treatment procedures can be employed. All six subjects reported the procedures to be distinctly

unpleasant. Indeed, in a subsequent study using similar frequencies and intensities of shock, two subjects withdrew from the treatment program (Wilson and Tracey, *unpublished*). Subjects' attitudinal responses indicate transient placebo effects from both forms of treatment. Consistent with Miller *et al.*'s (1973) findings, the data yield no evidence that the escape-conditioning procedure resulted in any permanent conditioned aversive response to the properties of alcohol.

The failure of electrical escape conditioning to reduce drinking, even within the confines of a protective milieu free from the stress and turbulence that characterize the alcoholic's life in the natural environment, is striking. These findings clearly fail to support the claim of Eysenck and Beech (1971) and others that this method represents the "optimal" behavioral treatment technique for alcoholics. Of course they do not prove the null hypothesis, but the onus is on the proponents of this procedure to furnish data that justify its continued therapeutic use.

EXPERIMENT 2

In contrast to the conditioning procedures that unsuccessfully attempted to suppress drinking by reducing or reversing the positively valenced properties of alcohol *per se*, an operant conditioning approach emphasizes the response-contingent consequences of which alcoholic drinking behavior may be a function (O'Leary and Wilson, *in press*). Cohen, Liebson, Faillace, and Allen (1971) demonstrated that chronic alcoholics voluntarily restricted their drinking if their sobriety was contingent upon access to a relatively enriched social and physical environment (which was similar to our laboratory setting), as opposed to remaining in a very impoverished laboratory setting. These subjects drank significantly more during periods in which the reinforcement contingencies were not in effect, even if they were allowed free (non-contingent) access to the enriched environment. Experiment 2 explored the effects of a punishment procedure on alcohol intake in the ABRL,

under conditions similar to Cohen *et al.*'s enriched environment. In the punishment procedure, shock was delivered contingently immediately after consumption of each one-ounce drink.

Subjects

Subject 1 was white, single, aged 43, a semi-skilled worker with ninth-grade education; Subject 2 was white, separated, aged 56, and a high-school graduate who had worked as a cook and baker; Subject 3 was black, a widower, aged 40, and a high-school graduate who worked as a sheet metal layout man; Subject 4 was white, single, aged 31, and a laborer with eighth-grade education. All four subjects were failures from Alcoholics Anonymous programs, and had histories of alcoholism of at least 5, 12, 5, and 7 yr respectively.

Procedure

A modified ABAB single-subject reversal design was used in which the punishment procedure was consecutively introduced and withdrawn while subjects' drinking behavior was continuously recorded. Following an initial two-day drinking baseline phase and a recovery day, subjects received a 2-sec shock ranging from three to 10 milliamps whenever they finished consuming an ounce of alcohol on Days 4 and 5. As in Study 1B, subjects were allowed a maximum of 30 ounces a day. A limited-hold contingency required that a minimum interval of 10 min elapse before subjects were served another drink. This was arbitrarily introduced in Day 4 and continued throughout the remainder of this study and through Experiment 3, so as to allow the staff sufficient time to administer all of the experimental procedures. Subjects were instructed that making an aversive event, such as shock, contingent on their consumption of alcohol would help them acquire control over their desire to imbibe and would develop the ability to delay gratification. The nature of the punishment contingency was explained, and they were informed that subsequent drinks, as well as the

receipt of their bonus money at the end of the experiment, depended upon their receipt of contingent punishment, although they understood that they could terminate the experiment at any time. All subjects were totally cooperative throughout the experiment. The punishment contingency was withdrawn during Days 6 and 7, and, after another recovery day, re-introduced on Days 9 through 18. During this later phase, shock was self- rather than experimenter-administered. In the event that a subject had a drink, he was immediately taken into the nursing station where electrodes were attached to his wrist. At this point he was allowed to choose whether or not to self-administer the shock. It was pointed out to all subjects that the punishment procedure had effectively controlled their drinking on Days 4 and 5, and that they now had a means of regulating their drinking themselves. The staff made every effort to encourage and support self-administered shock. Furthermore, the punishment on Days 11 to 16 was delivered on a variable-ratio (VR) schedule as follows: VR 2 on Days 11 and 12, VR 4 on Days 13 and 14; and VR 20 on Days 15 and 16. The purpose of this schedule was to determine the degree to which punishment could be faded out while alcohol consumption remained suppressed. An extinction schedule was in effect on Days 17 and 18, although the electrodes were still attached. The subjects were told that they would not necessarily be shocked on every occasion that they chose to self-administer shock. Baseline conditions were re-instituted on Days 20 and 21 and 23 to 26, with a final return to a self-administered, 100% punishment schedule on Days 28 to 30. Days 22 and 27 were nonexperimental "rest" days, involving no treatment nor any availability of alcohol.

RESULTS

The results are presented in Figure 1. All subjects' drinking behavior showed a substantial decrease under the punishment procedure on Days 4 to 5, followed by a predictable return to pre-

Fig. 1. Total number of ounces of alcohol consumed by each subject across baseline (B) drinking, experimenter-administered (EAP), and self-administered punishment (SAP) conditions.

treatment levels after withdrawal of the punishment procedure. Re-instating punishment contingencies suppressed alcohol consumption again, although individual patterns of behavior varied

considerably during the self-administered punishment phase (see Table 1). The final return to baseline conditions produced consumption levels well below pretreatment baseline levels. Atti-

tudinal responses were not differentially influenced by the different phases of the experiment. Subjects rated the alcohol significantly less favorable coincident with introduction of the punishment contingency on Day 4, as compared

Table 1

Daily number of drinks consumed, subject-activations of shocker, and actual number of shocks received during self-administered punishment phase.

Subject	Days									
	9	10	11	12	13	14	15	16	17	18
DRINKS CONSUMED										
1	30	-	-	-	-	-	-	8	-	-
2	-	-	-	-	-	-	-	-	-	-
3	8	8	7	8	8	8	7	9	8	8
4	-	12	30	-	-	-	-	4	29	29
SHOCKER ACTIVATED										
1	13	-	-	-	-	-	-	8	-	-
2	-	-	-	-	-	-	-	-	-	-
3	8	8	7	8	4	8	7	9	8	8
4	-	6	29	-	-	-	-	2	-	-
SHOCKS RECEIVED										
1	17	-	-	-	-	-	-	1	-	-
2	-	-	-	-	-	-	-	-	-	-
3	8	8	4	4	2	2	1	1	-	-
4	-	6	12	-	-	-	-	-	-	-

to Days 1 to 3, but thereafter continued to record virtually unchanging negative ratings for the remainder of the study.

DISCUSSION

The punishment procedures effectively reduced alcohol consumption below pretreatment baseline levels. Of considerable interest is the fact that self-administered shock appeared to be as effective as experimenter-delivered punishment. Intrasubject variability during the self-punishment conditions may be explained by close perusal of Table 1. Subject 1 consumed 30 ounces on Day 9, but self-administered shock only after 13 drinks. Thereafter, he shocked himself after each drink. The only other occasion on which he drank was Day 16, when he had eight drinks and self-administered punishment each time. Owing to the VR 20 schedule in effect he received only one shock, which occurred

after his eighth and final drink. Because punishment can be more effective when delivered at early points in a behavioral sequence, it might be that self-punishment might have been effective on Day 9, had the subject administered the shock during the initial stages of drinking. Although this was explained to the subject after his excessive alcohol intake on Day 9, it is not clear what factors prompted immediate self-administration of punishment on Day 16, as opposed to his behavior on Day 9. Subject 2 ceased drinking from Day 9 onwards. Subject 3 displayed a pattern of controlled drinking during the self-punishment phase, imbibing 7 to 9 ounces, which were distributed throughout the day. At no point during this period did his BAL exceed 35 mg/100cc, whereas initial baseline BAL levels were frequently higher, and even reached 120 mg/100cc. This subject self-administered shock 95% of the time. Subject 4 drank the most and shocked himself proportionately the least on Days 9 to 18. However, it is difficult to explain his behavior on Day 11, when he consumed his full quota of 30 ounces while nonetheless activating the shock circuit on 29 occasions and actually receiving punishment on 12 of those trials. To summarize, these data suggest that, under controlled conditions, when it is encouraged and socially supported, self-punishment can be an effective method for regulating excessive alcoholic drinking.

The finding that amount of drinking during baseline conditions on Days 20 to 26 did not return to initial baseline levels on Days 1 and 2 and 6 and 7 cannot be unequivocally interpreted. Several factors might have been responsible: the cumulative effect of the shock, the introduction of the self- *versus* experimenter-administered shock, switching to an intermittent schedule and the gradual fading out of the aversive stimulus, or even placebo and expectancy factors. Nor is it possible to determine whether the trend on Days 25 and 26 indicates that pretreatment levels of drinking would have recovered with a more extended baseline, or whether this simply reflects variability in drinking behavior.

EXPERIMENT 3

The previous study indicated that alcoholic drinking could be substantially reduced using a punishment procedure. However, it is unclear whether this reduction in alcohol consumption was attributable to the shock contingency *per se* or to more general placebo effects or demand characteristics. Experiment 3 was designed to answer this question. In addition, it was designed to provide a comparison of the efficacy of experimenter- versus self-administered shock that was not confounded with treatment order, as had been the case in Experiment 2.

Subjects

Subject 1, aged 32, was white, single, with a ninth-grade education and worked as a maintenance man; Subject 2, aged 50, was white, single, with an eighth-grade education and a construction worker; Subject 3, aged 36, was white, separated from his wife, with a high-school equivalency education, and a semiskilled laborer; Subject 4, aged 44, was white, separated, a high-school graduate, who worked as an auditor in a hotel. All except Subject 3 were failures from Alcohol Anonymous programs, and had histories of alcoholism of at least 7, 9, 10, and 5 yr respectively.

Procedure

Contingent versus noncontingent shock. As in Experiment 2, all subjects were allowed unrestricted access to a maximum of 30 ounces of 86 proof blended whiskey during the first two days, followed by a recovery period on Day 3. During Days 4 and 5, the schedule of shock administration for Subjects 2 and 3 was yoked to the schedule of punishment received by Subjects 1 and 4 respectively, both of whom were placed on a 100% punishment schedule. Following another recovery day, the treatment conditions were reversed during Days 7 and 8, with Subjects 2 and 3 now determining the number and sequencing of shocks for both themselves and

their yoked partners. Baseline drinking was reinstated on Days 9 and 10.

The *contingent-shock procedure* was the same as the experimenter-administered punishment procedure used in Experiment 2. Shock intensities ranged from four to nine milliamps. Subjects in the *yoked* or *noncontingent-shock condition* were told that their treatment involved the periodic administration of electric shock according to a predetermined schedule. The rationale for this procedure emphasized the association of an aversive event with alcohol-related cues. These, they were informed, included the thoughts about and urges for alcohol that they inevitably experienced given the free and easy availability of alcohol. Coupling shock with these cues would help them acquire control over their desire and develop a capacity for delaying gratification. In order to preclude Subjects 2 and 3 from recognizing that their treatment was dictated by the other subjects' behavior, and the inevitable confounding of social pressure this would involve, the yoked partners were shocked on a variable-interval schedule of not less than 10 min and not more than 40 min after the subject that determined their shock was punished.

Self- versus experimenter-administered shock. In the second part of the experiment, the subject pairings were re-arranged, with Subjects 1 and 3, and 2 and 4, assigned to either a self- or an experimenter-administered punishment condition respectively on Days 13 to 16. Instructions and procedures in the experimenter-administered punishment condition were the same as used in the previous contingent shock procedure. In the self-punishment condition, subjects were asked, whenever and wherever they finished a drink, if they wished to enter the nursing station and administer a shock. The instructions duplicated those given in Experiment 2, but the procedure differed from that employed in the previous study in which subjects were automatically brought into the nursing station and had electrodes attached before being given the choice to self-administer shock. After a baseline phase on Days 17 and 18, the treatment conditions were

reversed for a further four-day period during Days 20 to 23. A final baseline phase completed the study (Days 24 and 25). A 100% frequency of punishment was scheduled throughout.

RESULTS

Figure 2 shows the effects of contingent *versus* noncontingent shock on subjects' drinking behavior. It is clear that alcohol consumption was suppressed more effectively in the contingent than in the noncontingent-shock condition. Noncontingent aversive stimulation did result in cessation of drinking by Subjects 1 and 4 on Day 7, although resumption of heavy drinking

by both subjects on Day 8 indicates that this was only a temporary effect. Had the contingent-shock procedure been administered after a baseline drinking period, rather than close after the punishment phase, it is possible that less suppression would have been obtained.

Interviews with the subjects by the first author at the end of the experiment, as well as daily notes recorded by ABRL staff members, gave no indication that subjects did not believe that they were participating in a genuine treatment program. Nor did they express any doubt that the yoked-control procedure was any less of a treatment than the punishment condition.

Fig. 2. Total number of ounces of alcohol consumed during baseline drinking and under conditions of contingent and noncontingent shock.

Fig. 3. Total number of ounces of alcohol consumed under conditions of self- *versus* experimenter-administered shock.

The outcome of the self- *versus* experimenter-administered punishment comparison is presented in Figure 3. The results are mixed. Subjects 1 and 3 consumed more alcohol under conditions of self-punishment than under experimenter-determined shock. Not surprisingly, neither subject self-administered shock on many of the appropriate occasions. Subject 1 had 24 drinks on Day 13, administering only six shocks after imbibing 16 ounces of alcohol. On Day 16, he had 25 drinks and took two shocks after his twenty-first drink. Subject 3 consumed 25 ounces on Day 16 without once shocking himself. In contrast, both punishment procedures completely suppressed drinking by Subjects 2 and 4.

GENERAL DISCUSSION

These data replicate the results of Experiment 2 in showing that excessive drinking by alcoholics can be regulated by its behavioral consequences. They further demonstrate that the specific punishment contingency that was applied was both necessary and sufficient for most effectively suppressing alcohol consumption. The relative ineffectiveness of the yoked-control condition demonstrates that the observed changes were not attributable to placebo effects or favorable demand characteristics.

The efficacy of the punishment procedure in Experiments 2 and 3 contrasts sharply with the

ineffectiveness of the escape-conditioning procedure in Experiments 1A and 1B. The difference may be attributable to the fact that shock was contingent on free-operant alcoholic drinking in the former but not in the latter. The escape-conditioning procedure failed to endow alcohol with aversive properties such that alcohol intake was suppressed during posttreatment baseline (free-operant) drinking periods when the aversive contingency was absent. The effectiveness of electrical aversion was clearest only when the punishment contingency was in effect. A failure to obtain generalization of suppression was evident in Experiments 2 (Days 6 and 7) and 3 when punishment was abruptly withdrawn, even though drinking had been punished as a free operant, *i.e.*, in the presence of the stimuli that usually govern its probability of occurrence.

Experimenter-administered shock appeared to be superior to self-punishment for two subjects, although these aversive control procedures were equally effective in completely suppressing drinking by the other two subjects. These findings obviously require replication with other subjects and for more prolonged drinking periods than those investigated in the present study. Nonetheless, taken in conjunction with the successful maintenance of moderate, controlled drinking by self-administered shock in Experiment 2, these results encourage the view that alcoholics can acquire self-control over their drinking by arranging corrective environmental consequences that may then be faded out to facilitate generalization.

The data from Experiments 2 and 3 extend Cohen *et al.*'s (1971) demonstration that alcoholics' drinking can be controlled by its consequences, by showing that punishment can suppress alcohol consumption. These findings may have important implications for the analysis and treatment of alcoholics. The finding that chronic alcoholics can successfully control their drinking, even after having ingested quantities of alcohol, is consistent with the accumulating evidence that challenges the disease theory of alcoholism. This

theory places heavy emphasis on involuntary loss of control, which is presumably caused by alcohol triggering a physiological addictive process (Jellinek, 1960). In contrast, these results, although they do not demonstrate that physiological factors are not responsible for alcoholism, do provide additional support for the conceptualization of loss-of-control drinking "as learned behavior, differing only in rate and quantity of alcohol consumed from normal social drinking" (Marlatt, Demming, and Reid, 1973, p. 234).

With regard to therapeutic considerations, the major problem lies in implementing this behavioral analysis of drinking to promote long-term maintenance of either abstinence or controlled drinking in the alcoholic's natural environment.

Some investigators have approached this problem by attempting to develop contingencies that remain in effect in the natural environment. One clinical illustration involved the use of contingency contracting as a punishment procedure.

Miller (1972) had an alcoholic sign a mutually agreeable contract limiting him to a specified number of drinks per day. Any violation of this limit resulted in a \$20 fine paid to his wife. She also withdrew her attention for a period, whereas moderate drinking by her husband was reinforced with affection. Conversely, if the wife criticized the client for appropriate drinking, she paid the \$20 fine and temporarily lost his attention. After the client had incurred several fines by exceeding his agreed-upon number of drinks, his drinking stabilized within acceptable limits. Using an alternative approach, Hunt and Azrin (1973) developed a community reinforcement program in which excessive drinking resulted in time out from vocational, social, and familial reinforcers. Compared to a control group that received a conventional hospital program for alcoholics, patients from the reinforcement program showed considerable improvement. Throughout an independently conducted six-month follow-up evaluation they spent significantly less time drinking, showed less unemployment, earned more money, and left their families

less. The efficacy of these procedures, like those in the present study, seems to be primarily evident when contingencies upon alcohol consumption remain in effect. The findings of Experiment 2 tentatively suggest that fading procedures might be a fruitful approach for producing long-term maintenance without continuously maintained treatment contingencies.

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