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Weight loss as an operant response

John Emerich Orban

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WEIGHT LOSS AS AN OPERANT RESPONSE

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JOHN EMERICH ORBAN

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Psychology in the Graduate School of the University of Richmond

June, 1973
ACCEPTANCE

This thesis has been accepted in partial fulfillment of the requirements for the Degree of Master of Arts in Psychology in the Graduate School of the University of Richmond.

Date 4/1/73

Chairman

Member

Member
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The present study was designed to show that reinforcing a loss of body weight relative to a previous measurement would affect an increase in the frequency of trials during which a weight loss was observed. Volunteer females who reported problematic eating leading to overweight served as Ss. Baseline data were collected indicating each S's daily body weight and the median amount of daily body weight change across baseline. Ss were then reinforced for any daily weight loss which exceeded this median value. An extinction period followed during which no reinforcement followed a weight loss. The data failed to indicate either a reduction of body weight or an increased rate of trials during which a weight loss was observed. It was suspected that too large of a weight loss was required for reinforcement, preventing successful conditioning. A second experiment was conducted during which any daily weight loss, regardless of its magnitude, was reinforced. The results did not appreciably differ from those of the first experiment.
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Chapter 1

INTRODUCTION

In recent years psychologists have become interested in the problems of overeating and weight control, and a number of studies employing behavior modification techniques have appeared in the literature. One group of these studies has utilized aversive counterconditioning of the smell, taste, and thought of food, using either electric shock (Meyer and Crisp, 1964; Thorpe et al, 1964), noxious odors (Kennedy and Foreyt, 1968; Foreyt and Kennedy, 1971), or cognitively produced nausea (Cautela, 1967) as aversive stimuli. A second group of studies has used the self-management approach (Ferster et al, 1962; Stuart, 1967; Harris, 1969; Wollersheim, 1970; Harris and Bruner, 1971; Penick et al, 1971; Stuart, 1971) and has informed Ss of basic learning principles and advised them how these principles might be used to modify problematic eating. Extinction (Ayllon, 1963) and punishment by contingent withdrawal of positive reinforcement (Harmatz and Lapuc, 1968) have also been used to modify problematic eating.

A final group of studies (Bernard, 1968; Moore and Crum, 1969; Harris and Bruner, 1971) has employed an operant conditioning paradigm in which weight measurement, if of decreased magnitude relative to a preceding measurement, implied forth-
coming positive reinforcement. Although the practical success of this procedure, as indexed by decreased body weight, is well substantiated, certain methodological restrictions leave open to question the notion that weight loss occurred because each recorded loss was positively reinforced producing an increase in rate of weight loss. Two qualities of a behavior are desirable for classification as an operant response in the framework of a positive reinforcement operant conditioning paradigm. First, the behavior should be measurable in terms of a rate (Skinner, 1938). Second, it follows from Skinner's (1938) Law of Conditioning Type R that if the strength of an operant is increased when it is followed by a reinforcing stimulus, and if this strength is measured as a rate, then the rate of the response should be a function of the frequency of reinforcement. In short, it is desirable to show that a behavior can be conditioned if it is to be classified as an operant response. The central tenet of this paper is that previous research has adequately met the first condition, manipulating weight loss in such a manner that it could be measured as a rate, but it has failed to measure rate and thus has failed to show a change in rate of response as a function of conditioning trials.

Moore and Crum (1969) worked with a 24-year-old schizophrenic and made use of social reinforcement in the form of attention and praise. Prior to conditioning, E saw S frequently and became discriminated as socially reinforcing agent by providing acceptance and approval. A baseline
indicating a weight of 165-170 lbs. was established by collecting data at three day intervals for two weeks before the following procedure was initiated. S was escorted to the ward chart room where she was met by E who weighed her and recorded her weight on a chart. If S had lost weight from the previous day, social reinforcers were immediately delivered. If there was no weight loss or a weight gain, E shook his head in a negative fashion and asked S to return to the ward. This procedure was followed on a daily basis for five months and then on an intermittent schedule for an additional month.

An analysis of the day-to-day weight records indicated that S lost a total of 35 lbs. during the entire procedure. During the eighth week, S was allowed to visit home and the effects of discontinuing the reinforcement schedule were observed. A reversal of the 56-day trend of weight loss was exhibited as S demonstrated a 0.5 lb. per day increase during the seven day period. Eight weeks later, S was again removed from the ward for a two week period. The reversal did not occur as a steady weight level was maintained throughout the period.

In the above study, weight loss meets the condition for measurement as a rate. The frequency of the observed weight decrements relative to respective preceding measurements could have been divided by a time measure (blocked trials) to form a rate measure. However, only body weight data were reported,
and no conclusive statement can be made regarding an increase in the rate of the weight loss response as a function of reinforcement. The reversal of the weight loss trend during the visit home probably indicates that the termination of the reinforcement schedule caused cessation of weight loss. However, in the strictest logic, it is only known that the removal from the hospital caused the reversal. It is possible that the weight loss pattern was maintained by environmental contingencies other than the experimentally manipulated social reinforcement.

Regardless of this problem the fact remains that no measure of the rate of weight loss response was taken, and it is possible for an individual to exhibit a stable trend of weight loss without showing an increased frequency of the manipulated weight loss response. For example, S could lose weight on X trials during the first week of conditioning and on an equal number of trials during the remaining weeks of conditioning. Such a situation reflects no progressive effect due to reinforcement.

Bernard (1968) worked with a female schizophrenic patient weighing 407 lbs. at the initiation of treatment. S was placed on an 1800 calorie diet, her store privileges were restricted to control her consumption of sweets, and she was denied the privilege of receiving "goodie packages" from home. S was then told that she would receive ten tokens for each pound lost and that these tokens could be exchanged for walk privileges,
telephone calls, etc. During a 20-week conditioning period, weight measures were taken three times per week and tokens were delivered immediately after the weigh-ins. Following this procedure, a six-week follow-up was instituted during which the same weigh-in schedule was used, but no tokens were delivered and store privileges were returned.

S lost a total of 89 lbs. during conditioning; a loss of 22 per cent of initial body weight. During follow-up, S continued to lose weight, shedding 18 lbs. during this period. Although practical success was demonstrated, a failure to measure change in the frequency of the weight loss response precludes any statement of successful conditioning. Thus, there is no evidence to suggest that the loss of body weight was not caused by a number of uncontrolled factors.

A more recent study (Harris and Bruner, 1971) used normal Ss and compared a contract procedure with self-control and attention-placebo conditions. Ss of the contract condition agreed to make a cash deposit with E of XN dollars prior to treatment and to receive the money back at the rate of X dollars per pound lost during treatment. It was stipulated that S would forfeit all remaining dollars if he failed to appear at the weekly weigh-ins or notify E that he would not be present. All dollars were paid weekly for the losses observed during the previous weekly session. Ss of the self-control condition underwent a procedure almost identical to that employed by Harris (1969). Briefly, over a 12-week period, the group heard a series of
eight lectures which informed them how to use positive reinforcement to refrain from eating, how to punish eating, and how to use stimulus control procedures. The attention-placebo control group was encouraged to keep records of their daily weight fluctuations, but no attempt was made to modify their eating habits. Pseudo-counseling which consisted of passively listening to describe his eating problems was also employed with this group. All three groups participated in weekly weigh-ins.

Both contract and self-control groups lost a significant proportion of body weight between weeks 1 and 12. In addition, after twelve weeks, the contract group had lost a significantly larger proportion of body weight than the self-control group. Specifically, the contract group lost a mean of 13.4 lbs.; the self-control group lost a mean of 7.4 lbs.; and the control group gained a mean of 1.5 lbs.

The problem of body weight loss as the only data is again manifested by the above study. No data were reported to show that the frequency of the weight loss response increased as a function of reinforcement. This would have been shown by an increase in the frequency of the pay-offs which correlated with the sequential order of trials, demonstrating that the probability of a weight loss response increased after the response had been followed by reinforcement.

All three of the studies employing a positive reinforcement paradigm have the two following characteristics in common:
1) weight loss was manipulated so that it could be measured as a rate of response, but it was not measured as a rate; and 2) only gross weight data were collected. Although a loss of body weight should occur concomitantly with an increased rate of the weight loss response, a loss of body weight does not, in itself, indicate successful conditioning. For example, consider two Ss who each lose a total of 2.5 lbs. over five response opportunities. S1 loses .5 lb. on each opportunity, but S2 loses 2.5 lbs. on the final opportunity. While the rate of weight loss would be the same for both Ss, the rate of weight loss response would differ.

The present study hypothesizes that weight loss, if manipulated and measured in a specific manner, is an operant response. Whereas previous studies have collected data representing gross body weight, the present study emphasizes data representing frequency of weight loss responses per unit of trials. If this response rate can be shown to be controlled by reinforcement within an ABAB design, then the response will have been shown to be an operant.
Chapter 2

EXPERIMENT I

The study was originally designed as a single experiment. It was to span a 13-week period and consist of a 2-week baseline condition, a 6-week treatment condition, a 2-week reversal condition, and a 3-week maintenance condition. However, it became obvious during the fourth week of treatment condition that the desired experimental effect was not being manifested. The original experiment was terminated after the fifth week of treatment condition so that the procedure could be modified in an effort to affect the desired experimental manipulations.

The first experiment occurred over a 9-week period and utilized only baseline, treatment, and reversal periods. The remainder of the 13 weeks was used to conduct a second experiment which modified the technique of the original study. Because the experimental procedures and environmental contingencies of the two studies are inequitable, they are necessarily reported as separate experiments.

Method

Subjects. Five females who reported problematic eating leading to overweight volunteered for participation in the study. S1 was a 176 lb., 5'5", 28-year-old psychiatric aide;
S2 was a 222 lb., 5'7", 23-year-old psychiatric nurse; S3 was a 176 lb., 5'6", 22-year-old secretary; S4 was a 168 lb., 5'7", 31-year-old social worker; and S5 was a 167 lb., 5'4", 21-year-old psychiatric aide. S5 withdrew during the third week of the study.

Setting operations and contract procedure. Prior to entry into the study, all Ss were required to acknowledge acceptance of the regulations of a contract. The terms of the contract and purpose of the experiment were discussed with those interested in volunteering. The experimental nature of the program was emphasized and related research was elucidated.

Volunteers were given a copy of the agreement which both E and S signed. This contract, based upon the planned 13-week program, stipulated that each S was to complete the program by appearing for daily (Monday through Friday) weigh-ins over the period. It was further stipulated that all Ss were to deposit $10 with E at the conclusion of the second and tenth weeks of the study. It was noted in the contract that any absence without prior notification being given to E would be considered unexcused and that two unexcused absences would result in disqualification from the program.

Although it was not deliniated in the contract, as setting operation Ss were told that the procedural sequence of the experiment would involve a 2-week baseline
condition, a 6-week treatment condition, a 2-week reversal condition, and a 3-week maintenance condition with daily weigh-ins occurring during all conditions. It was explained that during treatment condition a token would be awarded after a weigh-in whenever a weight loss relative to the preceding day was observed. These tokens would be stored in receptacles located in the experimental room and cashed in for a proportion of the total group cash deposit at the conclusion of treatment condition. Ss were told that individual earnings would be determined by multiplying each individual's proportion of the total chips delivered to the group by the total cash deposit. For example, each of the 5 Ss who completed baseline condition contributed $10 to the group pool, making the total cash deposit equal to $50. If it is assumed that a total of 100 tokens were earned by the entire group and each of the four Ss who completed the experiment earned 25 tokens, then each S would be paid off at the rate of 25/100 X $50, or $12.50. It was further explained that an identical reinforcement procedure would be followed during the maintenance condition with cash earnings being drawn from the second deposit.

To avoid confusion it should be noted that the above schedule explained to Ss was based upon the planned 13-week experiment. When it was decided to modify the procedure during the fourth week of treatment condition, Ss were told
that the planned 6-week treatment condition would terminate one week earlier than scheduled and that cash pay-offs would be made during the first meeting of the 2-week reversal condition. Ss were also advised that the maintenance condition was cancelled and that the second $10 deposit to be collected at the conclusion of reversal condition would be used during a second experiment which would replace the cancelled maintenance condition.

Thus, the modified experiment, now designated Experiment I, incorporated a 2-week baseline condition, a 5-week treatment condition, and a 2-week reversal condition.

Response measures. Two response measures were used. During each daily weigh-in, data were gathered representing gross body weight and direction of weight change from the previous measurement. Direction of weight change was classified with regard to three categories: No change (NC); weight gain (WG); and weight loss (WL).

The use of the NC category has not been previously explored in this area of research and its rationale and method of definition deserve explanation. It was reasoned that, to a degree, daily weight fluctuations would be due to random and uncontrolled factors such as variations in clothing weight, retention of fluids, etc. Thus it was necessary to establish a NC bandwidth which would account for this random variation. Without such a bandwidth the frequency of WGs and WLS could be spuriously high.
Unfortunately, the absence of related literature precluded the use of an experimentally validated technique for determining the NC bandwidth, and it was necessary to employ a logically rather than empirically based method for specifying the NC bandwidth. On an individual basis, the median daily weight deviation during the first two weeks (baseline condition) of the study was calculated. This median value was then used to specify the limits of the NC bandwidth. For example, if this value was 8 ozs., then, on any given day, weight within a range of ±8 ozs. of the preceding measurement was considered to be a NC. Essentially, this procedure assumed that any change in weight which equalled or exceeded the 50th percentile of baseline deviations was due to nonrandom factors. After this value was calculated it was applied retrospectively to baseline condition data to determine the frequencies of NCs, WLS, and WGs and used to specify the directional categorization of weight fluctuations during treatment and reversal conditions. Obviously, any weight gain which exceeded the NC bandwidth was a WG while any weight loss which exceeded the NC bandwidth was a WL. This procedure is admittedly crude and arbitrary, but with an absence of related literature its justification is simply that, as a new technique, its experimental utility in this research area was tested by the present study.

Procedure. All weight measurements were made with
a Continental Health-O-Meter scale located in an examining room at the Adolescent Clinic of the Medical College of Virginia. This scale was calibrated and adjusted for accuracy one day before the initial weight measurement was made. While the scale was calibrated no finer than quarter lbs., measurements to the oz. were made by requiring Ss to hold one, two or three 1 oz. standard weights whenever the scale's indicator rested between quarter lb. calibrations. The added ozs. necessary to bring S's weight to a marked calibration were then subtracted from the total measured weight. All measurements were taken on a Monday through Friday schedule at about 11:30 A.M. This time immediately preceded S's lunch breaks. Ss were weighed in street dress after removing their pocket contents and shoes. All measurements were made on an individual basis with only E and S in the examining room.

During baseline condition, each S's weight was announced to her after each daily weigh-in. In addition, E announced to her whether her weight increased, decreased, or remained the same relative to the preceding measurement. All Ss contributed $10 to the group pool on the last day of this condition.

Upon entering the first treatment condition weigh-in, S's attention was directed to the pooled deposit of $50, framed and positioned so that S directly faced the money while standing on the scale. S was told the bandwidth of
NC, and the method of earning tokens was repeated. Weigh-ins continued in standard fashion with E announcing S's weight and indicating whether a NC, WG, or WL was observed. Whenever a WL was exhibited, E handed S a poker chip and instructed her to deposit it through the slot in the lid of a transparent 1 qt. mason jar marked by her name. All jars were placed on a table to the left of the scale where they were arranged according to the alphabetic order of Ss' first names. Whenever a NC or WG was observed, E said in a neutral voice, "No chip today because you didn't lose any weight."

Reversal condition began immediately following the last treatment condition weigh-in. On the first day of this condition all Ss received cash pay-offs in accord with the number of tokens earned during treatment condition. As during baseline condition, daily weigh-ins and announcements of weight occurred during reversal condition. No reinforcers were available. All Ss contributed $10 on the last day of reversal condition. This money was to be used in the second experiment.

Results

Body weight loss. Figure 1 presents the mean weekly weights for all Ss. It can be seen that only S1 and S2 yielded data indicative of a systematic weight loss during treatment condition. When the mean weekly weights for all Ss across all conditions were subjected to an analysis of
Fig. 1. Mean Weekly Weight During Baseline (BC), Treatment (TC), and Reversal (RC) of Experiment I
variance, no statistically significant differences were found, \( F(8,24)<1 \). Table 1 shows the total change in weight for each \( S \) between the mean baseline weight and the mean weight at the last week of treatment condition. Also presented in Table 1 are the individual changes in weight between the mean weight at the last week of treatment condition and at the final week of reversal condition.

**Direction responses.** Because only one direction response occurred on each weigh-in, it was necessary to block trials for statistical analysis. A rate was established for each direction response by forming a proportion represented by the weekly frequency of the response divided by the number of weigh-ins attended during that week. This proportion rather than a raw weekly frequency was used to facilitate the handling of \( S \) absences.

Table 2 presents the weekly rates of the three direction responses for all \( S_s \). A Friedman two-way analysis of variance (Siegel, 1956) was applied to each direction response rate to determine if the weekly rates differed as a function of weeks, and therefore treatment. No statistically significant differences were found: WC yielded \( \chi^2(8)=12.53, \ p>.05 \); WG yielded \( \chi^2=7.99, \ p>.05 \); and NC yielded \( \chi^2=.32, \ p>.05 \).

The individual curves of WL rate as a function of experimental conditions are presented in Figure 2. Inspection
Table 1

Total Weight Change in Pounds Between Mean Baseline Weight and Mean Weight of Final Week of Treatment (TC\textsubscript{5} - BC) and Between Mean Weight During Final Week of Treatment and Mean Weight of Final Week of Reversal (RC\textsubscript{2} - TC\textsubscript{5}) During Experiment I

<table>
<thead>
<tr>
<th>Subject</th>
<th>TC\textsubscript{5} - BC</th>
<th>RC\textsubscript{2} - TC\textsubscript{5}</th>
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<tbody>
<tr>
<td>1</td>
<td>-5.29</td>
<td>-0.25</td>
</tr>
<tr>
<td>2</td>
<td>-2.77</td>
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</tr>
<tr>
<td>3</td>
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</tr>
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<td>4</td>
<td>2.46</td>
<td>-1.68</td>
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Table 2
Weekly Proportion of Weight Loss Response (WL), No Change Response (NC), and Weight Gain Response (WG)

<table>
<thead>
<tr>
<th>Subject</th>
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<th>Reversal</th>
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<td></td>
<td></td>
<td>1 2</td>
<td>3 4 5 6 7</td>
<td>8 9</td>
</tr>
<tr>
<td>1</td>
<td>WL</td>
<td>.60 .20</td>
<td>.25 .20 .25 .40 .20</td>
<td>.00 .20</td>
</tr>
<tr>
<td></td>
<td>NC</td>
<td>.20 .60</td>
<td>.75 .60 .75 .40 .60</td>
<td>.60 .80</td>
</tr>
<tr>
<td></td>
<td>WG</td>
<td>.20 .20</td>
<td>.00 .20 .00 .20 .20</td>
<td>.40 .00</td>
</tr>
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<td>WL</td>
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<td>.25 .60 .50 .40 .25</td>
<td>.20 .60</td>
</tr>
<tr>
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<td>.25 .00 .50 .40 .25</td>
<td>.60 .20</td>
</tr>
<tr>
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<td>.50 .40 .00 .20 .50</td>
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<tr>
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<td>.25 .40 .66 .60 .20</td>
<td>.60 .60</td>
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</tbody>
</table>
Fig. 2. Weekly Proportion of Weight Loss Responses (WL) During Baseline (BC), Treatment (TC), and Reversal (RC) of Experiment I
of these curves reveals that no individual S demonstrated a systematic increase in rate during treatment condition. Of particular importance is the fact that S1 and S2, who showed a systematic weight loss during treatment condition, failed to exhibit the predicted operant curves.

For each S, the amount of weight lost during each week of treatment condition was correlated with the rate of WLs observed during each week by means of the Spearman rank correlation (Siegel, 1956). It would be expected that as the magnitude of the weight loss increased a corresponding increase in WL would occur, producing a positive correlation. No statistically significant correlation was found for any S. rS ranged between -.25 and .59; rS=1.00 was needed for statistical significance at the .05 level.

The NC bandwidth specified the weight change necessary for reinforcement. As such it is an important variable which should be described. The daily weight fluctuations during baseline condition of S1 ranged 1-35 ozs. with a median and NC bandwidth of 12 ozs.; the fluctuations of S2 ranged 5-15 ozs. with a median of 12 ozs.; the fluctuations of S3 ranged 1-33 ozs. with a median of 9 ozs.; and the fluctuations of S4 ranged 6-32 ozs. with a median of 8 ozs.

Discussion

The failure to find a statistically reliable reduction in weight as a function of treatment condition is disappointing and restricts the number of statements that can be made.
about the operant qualities of WL. Previous studies have used a similar paradigm which produced a significant reduction in body weight. However, no attempt was made to measure the rate of the experimentally manipulated response. The present study was designed to determine if reinforcing WL increased its rate under conditions where a reduction of body weight was also demonstrated. If a reduction of body weight was observed, an increase in the rate of WL would permit the conclusion that the increased rate of WL is correlated with, if not causative of, the reduced body weight. If an increase in the rate of WL did not occur under conditions where a reduction of body weight was observed, it could be inferred that the rate of WL is not related to loss of body weight. Unfortunately, a statistically reliable weight reduction was not established in the present experiment. Thus, when group behavior is analyzed, the central question of the extent to which conditioning of WL is related to systematic weight reduction remains unanswered.

An attempt to answer this question by analysis of individual data is equally fruitless. It will be recalled that two Ss did demonstrate a systematic weight reduction during treatment condition. If the data permitted the conclusion that this weight reduction was under experimental control, then reference to the two Ss' weight loss data would allow a cautious statement of the extent to which
the two response variables are related. This analysis is termed cautious because of its post hoc character. That is, being done after the group data failed to yield statistical significance it is susceptible to capitalization on chance error, and any conclusions drawn from the individual data would presume experimental reliability. Reference to Figure 1 indicates that S1 and S2 lost weight during baseline condition as well as during treatment condition. Such a situation does not yield sufficient evidence to conclude that the reduction in weight during treatment condition was under experimental control. If those variables controlling weight reduction were under experimental control and introduced appropriately, then a stable weight would have been observed during baseline and reversal and a decrement in weight observed only during treatment. Thus, a statement concerning the correlation of the two variables becomes meaningless for the purpose of this paper. The only conclusions that the data permit are that when group and individual data were analyzed conditioning of WL was not established and experimental control over body weight was not demonstrated.

The failure of the experiment to establish a reliable weight reduction and to condition WL may be traceable to the use of the NC bandwidth. Too wide a bandwidth would imply that many actual WLS and WGs were falsely classified as NCs. This would mean that the WL behavior was reinforced on an intermittent schedule: Only those WLs of high
magnitude were reinforced. The NC bandwidths were larger than expected and caused the amount of weight necessary for reinforcement to range between 8 ozs. and 12 ozs. This, in turn, restricted the number of reinforcements per 8 to a range of 6-9 out of a possible 25. This low rate of reinforcement viewed in conjunction with the unexpectedly large NC bandwidths supports the notion that reinforcers for actual daily weight losses were delivered on a variable ratio schedule. If this notion is correct, then conditioning would necessarily be difficult to achieve. The literature substantiates as an empirical fact the desirability of using a CRF schedule to initiate an increased rate of responding and an intermittent schedule to maintain the rate. The use of the postulated intermittent schedule caused by inordinately wide NC bandwidths may have been responsible for a failure to condition the WL behavior.

A second experiment was conducted which did not specify a NC bandwidth limiting the frequency of reinforcement. Instead, any weight loss relative to the preceding measurement was reinforced. If an intermittent schedule was maintained because of the NC bandwidth, then more successful conditioning should occur in its absence when a CRF schedule is maintained.
Chapter 3

EXPERIMENT II

The original study was terminated after 9 weeks although Ss had agreed to participate in a 13 week study. During the remaining 4 weeks a variant of the original study was conducted. The NC bandwidth, which may have been responsible for the use of an intermittent schedule in Experiment I, was not used in Experiment II. Instead, reinforcers were delivered during conditioning for any weight loss regardless of its magnitude. It was assumed that, although random factors would cause a measurable rate of WL, the weekly rate of WL should increase above the random rate if conditioning occurred.

Method

Subjects. The four female volunteers who completed Experiment I served as Ss.

Design and procedure. Due to time restrictions, only baseline and treatment conditions were used. The reversal condition data of Experiment I were rescored to determine the baseline rate of WL in Experiment II. This rescored involved determining the weekly rate of WL when defined as any amount of weight loss relative to the preceding measurement. Gross body weight measurements made during the reversal condition of Experiment I served as a baseline for this
variable in Experiment II.

An identical procedure to that employed during the treatment condition of Experiment I was used during Experiment II with the exception that a reinforcer was delivered whenever a weight loss of any magnitude was observed during the daily weigh-ins. In addition, the pooled deposit money collected on the last day of reversal condition during Experiment I totalled $40 as there were only four Ss starting this phase. Cash pay-offs were made during an additionally scheduled group meeting held during the week following the last measurement.

Results

Body weight loss. The mean weekly weights for all Ss are presented in Figure 3. It can be seen that only S1 exhibited a systematic weight decrement during treatment condition. However, an analysis of variance performed upon these data indicated that the weekly means were not homogeneous, $F(5, 15) = 3.58, p < .05$, and a Newman-Keuls test of ordered means was performed. The mean weight of the group was found to be significantly greater during the first week of baseline condition than during the final week of treatment condition, $p < .05$. No other statistically significant differences were found. Summaries of the analysis of variance and Newman-Keuls test are found in Table 3 and Table 4 respectively.

Table 5 presents the mean weekly weight of each S during baseline condition and the final week of treatment condition
Fig. 3. Mean Weekly Weight During Baseline (BC) and Treatment (TC) During Experiment II
### Table 3
Summary of Analysis of Variance Performed On Fig. 3 Data

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>11,201.93</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within People</td>
<td>.2760</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeks</td>
<td>15.01</td>
<td>5</td>
<td>3.00</td>
<td>3.58*</td>
</tr>
<tr>
<td>Residual</td>
<td>12.59</td>
<td>15</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11,229.53</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05
Table 4

Summary of Newman-Keuls Test Applied to the Ordered Means of Weekly Weight Expressed in Pounds Across Baseline (B₁, B₂) and Treatment (T₁, T₂, T₃, T₄) Conditions of Experiment II

<table>
<thead>
<tr>
<th></th>
<th>T₄</th>
<th>T₃</th>
<th>T₁</th>
<th>B₂</th>
<th>T₂</th>
<th>B₁</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>179.93</td>
<td>181.16</td>
<td>181.43</td>
<td>181.66</td>
<td>181.94</td>
<td>182.49</td>
</tr>
<tr>
<td>T₄</td>
<td>-</td>
<td>1.23</td>
<td>1.50</td>
<td>1.73</td>
<td>2.01</td>
<td>2.56*</td>
</tr>
<tr>
<td>T₃</td>
<td>-</td>
<td>-</td>
<td>.27</td>
<td>.50</td>
<td>.78</td>
<td>1.33</td>
</tr>
<tr>
<td>T₁</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.23</td>
<td>.51</td>
<td>1.06</td>
</tr>
<tr>
<td>B₂</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.28</td>
<td>.83</td>
</tr>
<tr>
<td>T₂</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.55</td>
</tr>
<tr>
<td>B₁</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*p < .05
Table 5
Mean Weight in Pounds During Experiment II at Baseline (BC) and at the Final Week of Treatment (TC₄ₕ) and the Change in Weight Between the Two Measurements

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean BC Weight</th>
<th>Mean TC₄ₕ Weight</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>167.50</td>
<td>159.00</td>
<td>-8.50</td>
</tr>
<tr>
<td>2</td>
<td>218.37</td>
<td>217.31</td>
<td>-1.06</td>
</tr>
<tr>
<td>3</td>
<td>173.67</td>
<td>174.60</td>
<td>+0.93</td>
</tr>
<tr>
<td>4</td>
<td>168.75</td>
<td>168.80</td>
<td>+0.05</td>
</tr>
</tbody>
</table>
along with the change in weight between these two measurements. Reference to this table indicates that the change in body weight ranged between -8.50 lbs. and .93 lbs.; the mean change was -2.15 lbs. However, the median weight change was -.50 lbs., and inspection of the data reveals that the mean weight change reflects the extreme behavior of $S_1$ rather than being indicative of a shift in central tendency which realistically describes the group.

**WL response rate.** As in Experiment I, a rate of responding was established for each $S$ by forming a proportion represented by the weekly frequency of WL divided by the number of weigh-ins attended during that week. These weekly proportions are presented in Figure 4. A Friedman two-way analysis of variance was performed upon the data and yielded no statistically significant differences between weekly proportions, $X^2 = 7.56, p > .05$.

For each $S$, a Spearman rank correlation between the amount of weight lost per each week of treatment condition and the rate of WLs observed during each week of treatment condition was calculated. It would be expected that as the magnitude of weekly weight loss increased, a corresponding increase in WL rate would occur, producing a positive correlation. No statistically significant correlation was found for any $S$. $r_s$ ranged between .20 and .75; $r_s = 1.00$ was needed for statistical significance at the .05 level.
Fig. 4. Weekly Proportion of Weight Loss Responses (WL) During Baseline (BC) and Treatment (TC) During Experiment II
Discussion

As in Experiment I, the data failed to show either a reliable reduction in body weight as a result of treatment condition or successful conditioning of WL. The mean weight of the group was significantly greater during the first week of baseline condition than during the final week of treatment condition. However, the failure of the mean at the final week of treatment condition to differ from both baseline means logically precludes the inference that the mean difference was a function of treatment condition. It may be argued that the appropriate control for the effect of treatment is the mean of the two baseline points. Inferences, according to this argument, should be based upon differences between this point and treatment means. This argument is sound only when there is sufficient evidence to conclude that a stable baseline was established. This evidence is necessary because reference to the grand baseline mean does not consider the variation of baseline measurements. Thus, if only the mean is considered without reference to the variation, erroneous conclusions can easily be drawn. For example, it is hypothetically possible to observe a steeply sloping baseline curve which asymptotes at the final baseline measurement. If the treatment measurements are equal to this asymptotal value, they may all significantly differ from the mean baseline point. The conclusion that treatment manipulations changed the rate of the behavior would be totally erroneous. Indeed, the data would indicate that a
transitional behavioral state occurred during baseline and a steady state occurred during treatment. This, of course, is contrary to the desired experimental manipulation.

While the data of the present study are not as extreme as those of the above example, only two baseline points were established, and it is impossible to determine if baseline stability was accomplished. Thus, comparison of treatment means to the grand baseline mean would make the gratuitous assumption that a steady state behavior was measure during baseline condition, increasing the probability that chance differences would be ascribed to experimental treatment. In such a situation, it appears wiser to make a conservative test of mean differences and require treatment measures to differ from both baseline measures. No such differences were found, and the conclusion that treatment caused a reduction in weight is not warranted.

The results also failed to indicate successful conditioning of WL. When the data were analyzed in group fashion no significant differences were found. Inspection of the individual WL rate curves reveals that all but one S exhibited an increase in rate during baseline conditions. Thus, even if significant weekly differences were found, the baseline rates indicate a lack of experimental control which would preclude any inference of successful conditioning.
Chapter 4

GENERAL DISCUSSION

The results of both experiments provide little information to answer the question of the extent to which reinforcement of WL is related to systematic weight reduction. The literature quite adequately reflects practical clinical success of the positive reinforcement operant conditioning paradigm in causing a reduction of body weight. However, the research is unsatisfactory from a methodological viewpoint, lacking the data to conclude that weight loss was a function of conditioning. Based upon the success of the paradigm in affecting a weight change, the design of the present study was based upon the naive assumption that a reduction in weight would be evidenced. If this assumption were met, it would have been a simple matter to determine if reinforcement of WL were related to reduction of body weight: If WL were conditioned it could be concluded that the two variables, body weight and rate of WL, were related; if conditioning did not occur it could be assumed that the two measures did not covary. When a reliable weight loss was not exhibited, it was realized that an exhaustive hypothesis was not developed. Thus, the results provide little useful information.

There are several possible alternative explanations for the failure of the experiment to affect a reduction in body weight.
The most tenable explanation is that the reinforcer lacked potency. It will be recalled that all Ss contributed $10 to a group pool and received a token whenever a WL was emitted. While delivery of the token was dependent upon the occurrence of a WL, the temporal occurrence of the cash pay-off was not. Ss merely appeared at the appropriate time and place to receive the cash. Moreover, the tokens had no specified value because their worth could not be calculated until the conclusion of treatment condition. (Each S's cash pay-off was proportionate to the number of tokens that she received in relation to the group.) Perhaps a better system would have been to specify the value of a WL to Ss as a setting operation and to make a small cash pay-off dependent upon the occurrence of a WL.

The use of the NC bandwidth in Experiment I failed to show experimental utility. A requirement of a CRF operant design is that the organism must be capable of emitting the response on every trial. Due to the conditions imposed by the NC bandwidths, Ss, according to their respective bandwidth, had to lose between 8 ozs. and 12 ozs. on every trial to satisfy this requirement. While it is possible for human Ss to maintain such a rigorous rate of weight reduction, the possibility must be entertained that the reinforcer was not of sufficient magnitude to condition or maintain this behavior. Crespi (1942), Zeaman (1949), and Metzger et al. (1957), to name a few, have shown that the magnitude of reinforcer is significantly related to performance. Establishment of an empirically valid NC bandwidth for use in this
area of operant research will require an investigation of both the daily variability of body weight and the effect of magnitude of reinforcer on performance. By way of example, assume that reinforcer A can be used to condition a weight loss of 4 ozs. per day and that reinforcer B can be used to condition a weight loss of 8 ozs. per day. If an NC bandwidth of 8 ozs. per day were used in an experiment employing reinforcer A, then few reinforcers would be delivered and it is doubtful that conditioning would occur. Thus, the latitude of daily fluctuations considered to be random (NC) is partially dependent upon the latitude of fluctuations which can be controlled by the parameters of reinforcement.

Additional research in this area of operant psychology will have to contend with the problem of empirically determined baseline stability. In both experiments reported here all Ss evidenced a change in both weight and rate of WL across the two baseline points. Because only two points were collected, it is impossible to determine if this variability was indicative of random factors or a systematic trend. A minimal improvement upon the present research will require the inclusion of additional baseline points. Greater experimental precision would be gained by continuing baseline measurement until the variability decreases to the point of being within an a priori established range.

In conclusion, the present exploratory research provides little information to answer the question for which it was designed. Nevertheless by the trial of new experimental techniques
it provides information which implies the direction which future research must take. First, the definition of NC bandwidths on the basis of baseline daily weight fluctuations alone is unsatisfactory. Certainly, an empirical method for specifying NC bandwidths must be determined unless all fluctuations are to be considered nonrandom. As argued above, this definition should be based upon the parameters of reinforcement as well as a baseline of daily weight fluctuations. Second, the weekly rate of WL behavior was seen to be variable under baseline conditions. An empirical method for determining baseline stability will have to be developed. Until these improvements in experimental technique are developed and applied, we are left with only the conclusions and questions which served as a rationale for conducting the present research.
REFERENCES


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APPENDIX

Sample subject - experimenter contract
Subject - Experimenter Contract

The following agreement, when signed, serves as a statement of faith between the subject and experimenter. It's endorsement reflects an intent to fulfill the following responsibilities.

Subject Responsibilities:

1. To appear for daily weigh-ins on a Monday through Friday basis from June 2 through September 1.
   a. Any absence without prior notification being given to the experimenter is unexcused. Two unexcused absences result in disqualification from the program.
2. To deposit $10 with the experimenter at the conclusion of the second and tenth weeks of the program.

Experimenter Responsibilities:

1. To implement the program as described making modifications with only the unanimous consent of subjects.
2. To assume responsibility for the contributed money if lost, stolen, etc.

__________________________________ Subject

__________________________________ Experimenter
VITA

John Emerich Orban was born on March 2, 1947, in Philadelphia, Pennsylvania. In 1970, he was awarded a Bachelor of Arts degree from Gettysburg College, Gettysburg, Pennsylvania. He began graduate study in psychology at the University of Richmond during the same year and anticipates completing the requirements for a Master of Arts degree in psychology in June, 1973. Since September, 1972, he has served as psychologist for the schools of Dorchester County, Maryland.