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THE EFFECT OF ANXIETY LEVEL AND RESPONSE COST ON THE EATING BEHAVIOR OF NORMAL-WEIGHT AND OBESE SUBJECTS

by

Harrell Mark Reznick

A Dissertation Submitted to the Faculty of the
DEPARTMENT OF PSYCHOLOGY
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

1977
I hereby recommend that this dissertation prepared under my direction by Harrell Mark Reznick
entitled THE EFFECT OF ANXIETY LEVEL AND RESPONSE COST ON THE EATING BEHAVIOR OF NORMAL-WEIGHT AND OBESE SUBJECTS
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ABSTRACT

Sixty-four normal-weight and obese undergraduate volunteers were randomly assigned to a 2 x 2 x 2 factorial experiment that assessed the effect of anxiety level and response-cost on their eating behavior. All participants were initially told that the study was concerned with concept formation. Half of them (high-anxiety condition) were told that the concept formation was related to general intelligence level, that the task was difficult, and that they would receive painful electric shock contingent on incorrect response. The other group (low-anxiety condition) was told that the task was not related to intelligence, and that they should not worry about their performance anyway, since they had been assigned to a "control" condition. In addition, half of the individuals in each group were given either tightly-wrapped (high response cost condition) or unwrapped (low response cost condition) chocolate candies for "participation in the experiment." After the fifteen-minute delay—ostensibly because the experimenter "forgot" a piece of equipment—the number of candies eaten was measured and state anxiety scores were obtained for each participant.

These scores suggested that the anxiety manipulation had a significant effect on anxiety levels. In addition, data were collected on a number of variables that could
affect eating. These included number of hours since the last meal and last food eaten, a taste rating of the candies on a seven-point scale, and per cent overweight. However, these variables were not significantly correlated with the number of chocolates eaten. Statistical analyses indicate that neither the anxiety nor response cost manipulations had an effect on the number of normal-weight subjects eating the candies. However, more obese subjects in the low response cost and low-anxiety conditions tended to eat candies than their counterparts in the high response cost and high-anxiety conditions. Furthermore, the estimates of the number of candies eaten were more inaccurate for obese than normal-weight subjects. There is also evidence to suggest that the modest differences between normal-weight and obese groups may have been larger if within-group heterogeneity had been minimized by different subject selection procedure.

Findings are discussed in relation to both previous literature and their implications for treatment programs which stress making access to food more difficult. The data do not seem to offer support for the effectiveness of treatment programs focusing on anxiety management.
INTRODUCTION

Anxiety as a Determinant of Eating Behavior

The fact that at least one in five American is overweight (Stuart, 1973) has undoubtedly enhanced interest in obesity as a topic of speculation, but until recently, very little research had actually be conducted in the area. In attempting to explain the etiology of obesity, most of the earlier investigators adhered to the psychosomatic hypothesis, which regards overeating as either a response to emotional disturbance, or the result of an oral fixation, or regression attributable to unresolved dependency needs. For example, Kaplan and Kaplan (1957) conceptualized overeating as a learned coping response associated with anxiety reduction that was usually established in childhood. In later years, personal and social difficulties related to obesity were thought to eventuate in increased anxiety, which the obese individual handled by resorting to the well-established response of overeating. Consequently, a vicious cycle involving overeating and anxiety was perpetuated. Theorizing within this framework, Bruch (1961) suggested that the obese have not learned to discriminate between the psychological cues associated with hunger and emotional arousal, such as fear or anger. Therefore, they were thought to eat in response to all aversive emotional states.
Behaviorally-oriented theorists have also postulated that emotional arousal plays an important role in the eating habits of overweight individuals. For example, Bornstein and Sipprelle (1973) reported that their obese subjects were able to lose significant amounts of weight by using desensitization as an anxiety-management technique. As Schachter, Goldman, and Gordon (1968) have observed, however, the lack of consistent evidence supporting psychosomatic theories of obesity is strikingly incongruent with their implicit acceptance by most therapists. One method of assessing the validity of these hypotheses involves comparing obese and normal-weight groups in order to determine whether or not there is an "obese personality," i.e., whether or not membership in these groups is significantly correlated with differences in personality. While a few studies have demonstrated differences between obese and normal-weight groups (e.g., Levitt and Fellner, 1965; Held and Snow, 1972), others have not (e.g., Freidman, 1959; Weinberg, Mendelson, and Stunkard, 1961; Silverstone and Cooper, 1972). Obviously, the correlational nature of this research precludes causal statements regarding the relationship between anxiety and obesity. The interpretability of these studies is further obscured by their lack of comparability: different instruments are used to assess different "traits" in differently selected groups. Moreover, of those indices that can predict membership in normal-weight
and obese groups, many are not clearly related to emotional arousal (e.g., conformity, masculinity-femininity, etc.).

The failure of these studies to show consistent findings has prompted Singh and Sikes (1974) to reject assumptions that obese individuals can be distinguished from their normal-weight counterparts on the basis of invariant, underlying personality traits. Similarly, Leon and Chamberlain (1973a; 1973b) suggest that overeating is not reflective of a global "obese personality," but rather is a consequence of different learning experiences. In support of this contention, they found that their previously and presently obese subjects did not exhibit greater amounts of psychopathology than normal-weight control subjects, as reflected in tests of body image and clinical histories. However, on the basis of responses to questionnaires, Leon and Chamberlain found that both successful and unsuccessful dieters related eating to specific arousal states significantly more than the control group subjects. Furthermore, a wider range of emotional states--particularly loneliness and boredom--and environmental cues evoked eating in unsuccessful than successful dieters. The assumption that overeating is an idiosyncratic overlearned response rather than the result of an underlying personality disposition may also help explain the inconsistent findings from another set of studies attempting to compare the anxiety levels of successful and unsuccessful dieters before and after any weight
losses. For example, some researchers have found sizeable increases in anxiety and depressive symptomatology during and subsequent to weight reduction (Glucksman, Hirsch, McCully, Barron, and Knittle, 1968), others have found modest increases (Shipman and Plesset, 1963) and still others have found no changes (Grinker, Hirsch, and Levin, 1973). It is likely that the strength of negative emotional reactions to weight loss is largely determined by the individual's ability to find activities that can substitute for eating (Leon and Chamberlain, 1973a), a learning process that probably varies considerably among persons prone toward overeating. Subject-selection differences and differences in procedures for measuring anxiety and depression consequently may only be a secondary source of variability in the results from these studies.

Unfortunately, there are few controlled experiments examining the relationship between anxiety and obesity. Rodin (1974a) found evidence to support the hypothesis that obese people are more susceptible to emotion-arousing stimuli than normal-weight individuals. All subjects worked on two tasks (reaction time and proof-reading) with distracting task-irrelevant stimuli introduced either during or before performance on the tasks. The distracting stimuli were tape recordings ranging in emotional content from minimally arousing (recitations of random numbers) and moderately arousing (descriptions of sea shells and scenes
of rain or snow) to maximally arousing (narrations of the atomic blast over Hiroshima and one's own death from leukemia). Overweight groups performed better on the reaction-time and proof-reading tasks than normal-weight groups when listening to neutrally-toned or uninteresting tape recordings, but did worse when listening to emotion-arousing tapes. However, the disrupting effects of the tapes were minimized when they were heard before performance on the tasks. Pliner (1974) also demonstrated enhanced responsivity of the obese to emotion-arousing stimuli. Obese and normal-weight adult males rated film slides on seven-point scales labeled at the extremes with the following pairs of adjectives: disliked-liked, tensing-relaxing, ugly-beautiful, unpleasant-pleasant, unappetizing-appetizing, frightening-calming, and nauseating-not nauseating. Ratings indicated that the obese reacted significantly more positively to the positive affective stimulus (an attractive nude female) than normal-weight subjects and almost significantly more negatively to the negative affective stimulus (bloody human organs on an autopsy table). In contrast, ratings to the neutral slide (a glacier on a mountain) did not differ appreciably between the two groups. The results of Rodin's (1974b) study of shock avoidance behavior are also consistent with these findings. Obese individuals worked longer and more efficiently on insoluble puzzles than normal-weight persons to
avoid an electric shock, but worked for less time on the puzzles when a monetary reward was offered. Similarly, Rodin, Elman, and Schachter (1974) found that the performance of overweight individuals on mazes was superior to that of normal-weight subjects when no shocks were administered for errors. However, with the introduction of error-contingent shocks, the performance of the normal-weight groups exceeded that of the obese group.

The consistent group differences obtained in the Rodin and Pliner studies have been construed as extending the applicability of the "externality hypothesis" (Schachter and Rodin, 1974). As originally formulated, this explanation stated that the eating behavior of obese individuals is governed more by external cues (e.g., the time of day or the sight of a refrigerator) and less by internal cues (e.g., gastric contractions or changes in blood sugar levels) than the eating behavior of persons of normal weight. In view of the evidence presented by this recent research, it is possible that the greater "externality" of the obese with respect to eating and food-relevant cues is only one consequence of their greater responsiveness to some external cues, particularly emotion-arousing ones.

Those few experiments directly assessing the impact of arousal manipulations on eating behavior also tend to reveal some differences between normal-weight and overweight groups, but the differences are not as large as those
obtained in the research on emotional responsiveness discussed above. Schachter et al. (1968) tested the psychosomatic hypothesis in a study ostensibly concerned with the effects of tactile stimulation on taste. Food-deprived normal-weight and overweight individuals were asked to fill out food-preference questionnaires while either eating roast beef sandwiches for 15 minutes (preloading condition) or not eating anything (control condition). Half of the subjects in each of these conditions were then informed that they would be exposed to weak electrical stimulation that produced a slight tingling sensation (low-fear condition). The remaining subjects were allowed to view a large console cluttered with electronic junk while an experimenter—who was dressed in a white lab coat—informed them that they would be exposed to a "painful shock" (high-fear condition). All subjects were then asked to respond to a five-point rating scale indicating how anxious they were in the experimental situation and how nervous they felt about receiving the shocks. After responding to the rating scale, which served as a validation check for the anxiety manipulations, subjects were asked to "wait for the experiment to begin" in a room where crackers were freely available. Fifteen minutes later, the experimenter returned to the room and again asked the subject to indicate his anxiety about the experiment and the shocks, after which the experiment was terminated and subjects debriefed. Schachter et al. found
that normal-weight individuals ate significantly fewer crackers when anxious than when not. In contrast, obese participants ate only slightly more crackers when anxious than when not, a difference interpreted as too trivial to provide support for a psychosomatic explanation of their eating behavior. Furthermore, eating resulted in only slight declines in fear levels for both normal-weight and overweight groups, and there was a nonsignificant correlation between fear and number of crackers eaten for both groups. Both of these findings contradict psychosomatic hypotheses.

McKenna (1972) also tested the psychosomatic and externality formulations in an experiment which factorially varied weight level (obese vs. normal-weight), food-cue valence (good-tasting cookies vs. bad-tasting cookies), and anxiety level (high vs. low). McKenna reasoned that if the psychosomatic hypothesis is correct, then obese subjects in a state of high anxiety will eat any available food, whether good-tasting or not. Schachter's externality hypothesis makes the contrasting prediction that eating under such conditions will occur only if the external food cues are positive. The psychosomatic hypothesis also predicts that the eating behavior of the obese will be facilitated under conditions of low anxiety and positive food cues, while the externality hypothesis predicts that these circumstances will inhibit their eating behavior. Ostensibly, McKenna's
experiment was a market research study of a new product which participants were to taste and evaluate. Both normal-weight and overweight subjects were first preloaded with weight-reducing candies and roast-beef sandwiches and asked to eat and evaluate either good-tasting home-made chocolate chip cookies or bad-tasting greenish-gray shortbread cookies with the sugar content halved. Subjects within these groups were also assigned to either a low-anxiety or a high-anxiety condition. In the low-anxiety conditions, participants were told that they were in a "pilot phase" of the study, were asked to make themselves comfortable, and were given minimally threatening instructions. Subjects in the high-anxiety conditions were confronted with an experimenter in a white lab coat who ushered them into a room containing various medical paraphernalia, including several cotton balls with what looked like dried blood on them. They were informed that several "physiological measures" would be taken, along with blood, urine, and stool samples. In addition, several pulse readings were taken for each participant, after which the experimenter commented that several readings were high. Finally, each high-anxiety subject was asked if he had any history of fainting, convulsions, or heart trouble, with the intent of making him more anxious about further participation in the study. Pre- and posttest measures of anxiety were also recorded for each subject to determine if eating resulted in anxiety
reduction and to validate the anxiety manipulations. Results from this experiment did not consistently support either the psychosomatic or externality hypothesis. Overweight individuals ate more under high- than low-anxiety conditions, while the opposite occurred for normal-weight persons. Furthermore, there was no significant interaction between weight level and test food valence. Both of these findings are contrary to the externality hypothesis and support the psychosomatic explanation. However, the externality formulation was supported by the fact that all groups ate more good-tasting than bad-tasting cookies and that eating did not result in anxiety reduction under any circumstances. Based on these findings, McKenna concluded that elements of both hypotheses are needed to explain eating behavior in overweight individuals.

The results of the Schachter et al. (1968) and McKenna (1972) studies suggest that anxiety inhibits eating in normal-weight individuals and facilitates eating in overweight persons. These results were replicated in a study by Herman and Polivy (1975), who compared the amount of ice cream eaten by "restrained" and "unrestrained" eaters. The restrained-unrestrained classification system was derived from Nisbett's (1972) theory that most obese individuals are underweight with respect to their own "biological set points," which are assumed to vary directly as a function of the number of fat cells in the body. In
turn, the number of fat cells is determined by genetic endowment and early feeding experiences. Herman and Polivy (1975) predicted that restrained eaters should resemble behaviorally the obese subjects in the Schachter et al. (1968) and McKenna (1972) studies because they would become obese if they were to "let themselves go" and eat without discipline, i.e., until they reached their individual set-points. In contrast, unrestrained eaters are those individuals whose body weights are comparable to their set-points. Consequently, their eating behavior should resemble the normal-weight subjects in the Schachter et al. and McKenna experiments. After differentiating their groups on the basis of responses to an 11-item restraint questionnaire, which included items about diet, weight history, and concerns about eating, Herman and Polivy (1975) obtained results consistent with their hypotheses. These findings suggest the importance of genetic and maturational factors in determining the eating behavior of overweight individuals, factors that have been ignored in the psychosomatic and externality explanations of obesity.

A recent study by Abramson and Stinson (1976) also examined the impact of affective state on eating in normal-weight and obese subjects, but varied tasks instead of instructions as experimental manipulations. Under the guise of an experiment on mood states, normal-weight and overweight individuals worked on either a boring task (writing
the consonant pair "cd" over and over again) or an interesting task (writing stories to Thematic Apperception Test cards). Wheat crackers were present in all conditions, and the number eaten constituted the dependent measure. Unlike the experiments discussed above that relate anxiety to eating behavior, Abramson and Stinson failed to find a significant subjects-by-task interaction: both subject-groups ate more crackers during the boring than interesting task. However, the discrepancy may likely be the result of procedural differences between this and the other studies, particularly in those manipulations that resulted in the somewhat contrasting emotional states of anxiety and boredom. In addition, Abramson and Stinson do not consider the more pedestrian alternative hypothesis that individuals in both groups ate more during the boring task because they could afford to do so without disrupting their performance appreciably.

Response Cost as a Determinant of Eating Behavior

Effort expended in preparing food for eating (hereafter referred to as "response cost") is another variable that has been implicated as a significant determinant of eating behavior. Several studies have shown that response cost particularly influences the eating behavior of overweight individuals. Schachter, Friedman, and Handler (1974) observed significantly fewer obese than normal-weight
Americans using chopsticks in two Oriental restaurants instead of "conventional" silverware. Schachter et al. (1974) interpreted these findings as evidence that the obese--lacking experience with chopsticks--are disinclined to tolerate delays in eating that normal-weight people would accept. However, a plausible alternative explanation is that they are more intolerant of the work involved.

Schachter and Friedman (1974) experimentally assessed the influence of response cost on eating behavior by making shelled or unshelled almonds available to subjects while they waited for an "experiment" to begin. Cue prominence--defined as conspicuousness of the edible portions of food and manipulated by keeping the nuts in a transparent cellophane bag or brown paper bag--had no effect on the number of overweight and normal-weight participants eating the almonds. Likewise, the response cost manipulation did not affect the number of normal-weight individuals who ate. However, 19 out of 20 obese subjects ate the shelled nuts, while only one of 20 ate the unshelled nuts. Apparently then, response cost affects the eating behavior of obese individuals more than cue prominence. Unfortunately, this conclusion is debatable: both variables are confounded in the response cost manipulation, since unshelled nuts not only require more of an energy expenditure to render them edible, but are also more remote as food cues than shelled nuts because they cannot be seen. Since
Johnson (1974) found that cue prominence affected the amount of work that obese—but not normal-weight—individuals would expend to obtain food, this confounding apparently limits the interpretability of the Schachter and Friedman (1974) study. In Johnson's investigation, obese and normal-weight subjects who had been deprived of food for at least four hours before participating in the experiment were required to pull a ring with the index finger of the preferred hand for 12 minutes with a force sufficient to turn on a light, which allowed them access to high-quality delicatessen sandwiches. Some subjects were exposed to the food during the task and had an opportunity to taste them prior to the task. Consequently, they were exposed to two food cues: one visual and one gustatory. Other subjects were exposed to one cue or the other, while the remaining participants were exposed to neither of them. Obese subjects worked hardest to obtain food when both food-related cues were present, although the food-visible cue exerted much more influence on their task behavior than the prior taste cue. In contrast, normal-weight individuals worked hardest under conditions in which no food cues were present and worked the least in the double-cue condition.

Like Schachter and Friedman (1974), Singh and Sikes (1974) also confounded response cost with cue prominence in a "taste discrimination" study. Hershey chocolate kisses or cashew nuts—both either wrapped in aluminum foil or
unwrapped--were offered to normal-weight and obese individuals. The wrapping manipulation did not affect the number of chocolates eaten by either group, but inhibited the consumption of wrapped cashews by the obese group.

Singh and Sikes interpreted these results in terms of prior response tendencies: obese individuals are less motivated to expend effort in preparing food for eating than normal-weight individuals only when they must work harder than they are accustomed to, e.g., when they must unwrap cashews in order to eat them. Singh (1973) provided support for the prior response tendency hypothesis in a study requiring obese and normal-weight participants to perform hand movements in a situation where food (crackers) was freely available. The hand movements consisted of moving 14 metal disks along a bent wire until they could be removed from the wire. Completion of this task enabled the subjects to gain access to the crackers, which were also mounted on the wire. Individuals were subsequently assigned to one of two testing conditions. In the compatible testing condition, they were required to perform the same response initially learned, while in the incompatible testing condition, they had to engage in hand movements opposite of those initially learned. Normal-weight individuals ate comparable amounts of crackers in the two testing conditions, but obese subjects ate significantly more crackers in the compatible than incompatible testing condition.
While the research cited above has provided some consistent findings, the paucity of controlled experiments relating the variables of response cost and anxiety to eating behavior precludes specification of their effects in obese and normal-weight groups. The purpose of the present study was to assess the impact of these variables—singly and in combination—on the eating behavior of normal-weight and overweight individuals.

Hershey chocolate kisses were used in the present study after pilot research indicated that they were rated as more tasty than cheese kisses or nuts. Furthermore, since many researchers have observed that obese people gain weight by eating preferred foods with high caloric content (e.g., Leon and Chamberlain, 1973a), it was felt that using chocolate kisses would enhance the external validity of the experiment. More importantly, the fact that these candies are usually wrapped counters arguments regarding the contaminating effects of prior response tendencies and allows a test of the prior response tendencies hypothesis. As in the Singh and Sikes (1974) study, aluminum foil was used to cover the chocolates. However, since cue prominence refers to the extent to which the edible portions of food are conspicuous, it was possible to minimize the confounding of response cost and cue prominence to a greater degree than in previous research. This was accomplished by using unwrapped chocolates or wrapped chocolates with portions
exposed as the two levels of response cost. The exposure of the surface area of the chocolates in both levels of the response cost treatment was intended to at least partially control for the contaminating effects of cue prominence in order to provide a more interpretable test of the effects of response cost. In addition, the provision for low-anxiety and high-anxiety conditions allowed a test of the psychosomatic hypothesis of obesity.

While research in the area is scant, the following predictions were made: (1) obese subjects would eat more candies than normal-weight subjects; (2) more obese subjects would eat candies under high-anxiety than low-anxiety conditions, as predicted by the psychosomatic hypothesis and contrary to the externality hypothesis; (3) fewer subjects would eat candies in a obese/high-response cost condition than in a obese/low-response cost or normal-weight/high-response cost condition, contrary to predictions based on the prior response tendency hypothesis; (4) more normal-weight subjects would eat candies in low-anxiety than high-anxiety conditions; (5) response cost manipulations would have no effect on the number of normal-weight subjects eating candies; and (6) the effects of response cost and anxiety would be additive for obese subjects such that (a) more of them would eat candies in a high-anxiety/low-response cost condition than in any other condition, and (b)
fewer of them would eat candies in a low-anxiety/high-response cost condition than in any other condition.
METHOD

Design and Subjects
Three variables were factorially combined in a 2 x 2 x 2 between-subjects design: subjects (obese vs. normal-weight), anxiety level (high vs. low), and response cost (high vs. low). Subjects were randomly assigned to conditions with the constraint that the conditions contain roughly the same proportions of men and women. Each of the eight conditions contained eight subjects, all of whom were student volunteers from an introductory psychology class and who received extra credit points for participation in the experiment. Of these 64 subjects, 46 were women and 18 were men.

Procedure
The experiment was introduced as a "concept formation study" during recruitment of subjects and was conducted between 2:00 p.m. and 4:30 p.m. in order to minimize random error attributable to prior eating. Upon arriving for the experiment, the participant was escorted down a corridor to a room cluttered with formidable-looking laboratory equipment that included two Hunter interval timers, an amplifier with transistor parts exposed, a section of a telephone switchboard, and a remote control device leading from a
slide projector located in an adjacent room. The subject was allowed to view the first room from the corridor while the experimenter told her that during the experiment, he would use this equipment to control another set of equipment that she would use in the adjacent room. She was then asked to seat herself at a table in the adjacent room in front of the projector. On the table was a match-to-sample apparatus with one large sample panel, five matching panels, and a four-letter nonsense syllable label next to each matching panel. It was explained that each of the five labels denoted a concept that she would learn during practice trials by looking at training slides projected onto the wall in front of her. Each training slide ostensibly included a pictorial representation of an exemplar from one of these five concept categories above its corresponding nonsense syllable label. The subject was simply to observe these training slides in order to learn the class of stimuli that was associated with each label, i.e., to learn the meaning of the label. During the testing phase of the experiment, the subject purportedly would be exposed to slides in which the pictures were presented without these labels. For each one of the test slides, her task was to press the appropriate matching panel if the picture was a member of any one of the five concept categories denoted by the labels. If the picture did not belong in any one of the concept categories, she was to press the larger sample panel. In order
to enhance the credibility of the deception and to assess awareness of the real purpose of the experiment, participants were then asked if they had questions concerning any part of the experimental procedure.

Individuals assigned to low-anxiety conditions received instructions that were intended to minimize the arousal-inducing aspects of participation in the experiment. They were told that the concept formation task was fairly easy, that performance on the task was not related to intelligence level, and that they should not worry about their performance anyway, since they had actually been assigned to a "control condition." In contrast, participants in the high-anxiety conditions were exposed to a variety of manipulations designed to promote anxiety. They were first told that like an intelligence test, trials were successively more difficult. Then, they were informed that a painful electric shock would be administered for every incorrect response they may because the experimenter was investigating "the effect of stress on concept formation." Subjects were also given a consent form explaining that participation in the experiment was voluntary and that they could withdraw at any time. This was followed by a medical symptom checklist, which required the individual to indicate whether or not he or she suffered from any of 28 ailments (e.g., dizziness, inability to sleep, high blood pressure, etc.), ostensibly because of the potential dangers posed by
the shocks to individuals in poor health. Each "high-anxiety" subject was then told that because of wide individual differences in reactivity to electric shock, the experimenter would have to determine her particular tolerance level in order to "calibrate the equipment." This would be accomplished by passing a "subliminal current" through her forearm in order to determine her "galvanic skin response." The participant was instructed to remove all metal items, such as watches and jewelry, from the forearm to be "shocked." Electrodes from a regulated high voltage power supply situated next to the match-to-sample apparatus were attached to the forearm of the subject, who saw a needle drift toward the upper ranges of a voltage meter while the experimenter manipulated a dial that ostensibly controlled the intensity of the current. However, the power supply was actually wired to be inoperative.

After the appropriate instructions and procedures were administered, the participant's attention was directed to a bowl of Hershey chocolate kisses located near the match-to-sample apparatus on the table. The chocolates were offered as "a small reward for participation in the experiment," and each subject was encouraged to eat as many as he or she wanted. As further inducement, the experimenter modeled the response by taking a candy and eating it in front of him or her. For half of the participants in each anxiety condition, the chocolates were unwrapped.
(low-response cost condition). For the other half (high-
response cost condition), the chocolates were tightly
wrapped except that approximately one-tenth of the surface
area of each candy remained exposed. In addition, the paper
strands were removed from all chocolates in the high-
response cost conditions in order to maximize the effort
expended in unwrapping each candy.

As a means of assessing the participant's awareness
of the purpose of the experiment, the experimenter again
asked if he or she had any questions about the procedure.
After answering these questions, if any, he moved to the
back of the room and announced that he would begin pre­
senting the training slides. Immediately after turning on
the projector however, he exclaimed in an exasperated manner
that he had mistakenly brought along the wrong slides,
allegedly because he had forgotten to change the slides
after running the previous subject. It was further ex­
plained that changing the slides was necessary because
participants had been randomly assigned to different experi­
mental conditions. The experimenter then told the subject
that he would have to retrieve the correct slides from his
"laboratory down the hall" and "re-program the equipment,"
all of which would take several minutes. During this time--
which was actually 15 minutes--the subject was asked to wait
in the room, and the door to the hallway was closed.
After leaving the laboratory complex for seven or eight minutes, the experimenter returned to his "control room" and for the remainder of the 15 minutes, could be heard in the adjacent room putting slides into slide trays, pressing buttons, and pulling toggle switches. He then re-entered the participant's room and again asked if he or she had any questions about the procedure. The subject was also asked to respond to the state-anxiety section of the Self-Evaluation Questionnaire (Spielberger, Gorsuch, and Lushene, 1970) before the "experiment" began.

Upon completing this form—which served as a validity check on the anxiety manipulations—the experimenter informed the subject that the experiment was over except for a debriefing session. This consisted of asking the subject to provide information on a number of variables that could affect eating behavior (apart from the two independent variables), explaining the nature of the experiment, and obtaining measures of each participant's height and weight. Debriefing information obtained from subjects included number of hours since the last meal and last food was eaten, a taste rating of the chocolates on a scale from one ("don't like them at all") to seven ("very delicious"), even if none had been eaten, an estimate of the number of chocolates eaten, and whether or not the participant was on a diet, suffered from diabetes, and participated in intercollegiate athletics. Since the number
of chocolates available to each participant was predetermined, the experimenter was able to measure the number consumed by counting the number of candies remaining after the subject had been debriefed. The accuracy of this measure was further insured by asking the participant if he or she had taken any candies without eating them. An individual was classified as normal-weight if his or her weight was in the range from 10% under to 10% over the median weight for medium-framed individuals of that height, according to tables of recommended weights published by the Associated Press Almanac (1974). Subjects were classified as obese if their weights exceeded this standard by at least 15%.
RESULTS

Because of the nature of this study, it was anticipated that some individuals assigned to high-anxiety conditions would refuse to participate and that the deception might be ineffective for others. Of a total of 79 individuals receiving instructions, five assigned to high-anxiety conditions refused to participate. On the basis of observations of participants' verbal and nonverbal behavior during the experiment, their scores on the Self-Evaluation Questionnaire (a score of 40 was arbitrarily used as a cut-off point), and post-experimental queries regarding their awareness of the intent of the experiment, it was also determined that data from nine individuals were invalidated. Seven of these people had been assigned to high-anxiety conditions and were either suspicious about the deception or felt that the shocks would not be painful. The other two were individuals assigned to low-anxiety conditions whose apprehensiveness in the experimental situation was reflected in Self-Evaluation Questionnaire scores indicating high levels of state anxiety. Data from another person were invalidated after it was discovered that she was diabetic. Consequently, only data from the remaining 64 participants are reported here. However, inclusion of the invalidated data in the statistical analysis did not significantly
affect the results obtained, either in terms of number of candies eaten, number of individuals eating candies, or state anxiety test scores.

The normal-weight and overweight groups were well-differentiated with respect to weight. Normal-weight participants ranged from 8% under to 10% over the median-weight standard, while obese participants ranged from 17% to 95% over this standard.

Differences in state anxiety test scores between high-anxiety and low-anxiety groups were also large and provided convincing evidence for the validity of the anxiety manipulations. The mean score of 32.31 obtained by participants in the low-anxiety conditions was significantly lower than the mean of 54.51 for individuals in high-anxiety conditions, $t(30) = 11.42$, $p < .005$. According to normative data presented by Spielberger et al. (1970), these means correspond to the 41st and 95th percentiles for state anxiety scores obtained in an undergraduate sample.

The effects of obesity, anxiety, and response cost on eating behavior are presented in terms of number of candies eaten (Table 1) and number of participants eating and not eating candies (Table 2). Table 1 shows that obese subjects ate more candies than normal-weight subjects (80 vs. 48), but owing to the relatively large variances in amounts eaten within cells, this difference was not statistically significant. In fact, no unconfounded comparison
Table 1. The effects of weight status, anxiety, and response cost on the number of chocolates eaten (column numbers represent the number eaten by each participant).

<table>
<thead>
<tr>
<th>Response Cost</th>
<th>Obese groups</th>
<th>Normal-weight groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low anxiety</td>
<td>High anxiety</td>
</tr>
<tr>
<td>Low</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3</td>
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<td>4</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Totals</td>
<td>39</td>
<td>41</td>
</tr>
</tbody>
</table>
Table 2. The effects of obesity, anxiety, and response cost on the number of participants eating and not eating candies.

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>Response Cost</th>
<th>Obese groups</th>
<th>Normal-weight groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Number of participants eating</td>
<td>11</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Number of participants not eating</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
between treatments—i.e., comparisons in which levels of only one variable were compared—that involved number of candies eaten attained statistical significance, except one. For obese individuals who ate at least one candy, the mean number of chocolates eaten in the high-anxiety/high response cost condition was significantly less than the mean number eaten in the low-anxiety/low response cost condition, \( t(7) = 2.82, p < .05 \). Comparisons involving the number of individuals eating chocolates were less vulnerable to random error because of less within-cell variability and consequently provided more powerful tests of treatment effects than comparisons involving amounts eaten. Table 2 shows that anxiety and response cost manipulations had negligible effects on the number of normal-weight participants eating candies. Approximately 44% of the normal-weight sample ate at least one chocolate in the high-anxiety and high response cost conditions. These percentages are very close to chance, \( \chi^2 = 0.12, p > .20 \). In contrast, both of these variables influenced the number of overweight individuals eating at least one candy. Whereas 37% of the obese sample ate candies in the high-anxiety and high response cost conditions, 69% ate in the low-anxiety and low response cost conditions. These differences approached significance, \( \chi^2 = 3.14, p = .08 \). However, the difference in the number of obese individuals eating candies in the low-anxiety/low response cost condition (88%) and the high-anxiety/high
response cost condition (25%) was significant, \( \chi^2 = 6.35, p < .02 \).

While fewer overweight participants ate in high-anxiety than in low-anxiety conditions, Table 1 indicates that the six obese people who ate chocolates in either the high-anxiety or high response-cost conditions accounted for one-third of the total number consumed. These findings contributed to a trend indicating that of those individuals eating chocolates, a higher proportion of obese than normal-weight subjects ate more than one (88% vs. 67%), \( \chi^2 = 2.17, p < .20 \).

The most conspicuous differences between the normal-weight and overweight samples involved the proportion of individuals eating candies who inaccurately estimated the number eaten (Table 3). Only 29% of the normal-weight individuals who ate candies gave inaccurate estimates, compared to 71% for the overweight group, \( \chi^2 = 8.19, p < .005 \). Furthermore, all of these errors were underestimates rather than overestimates. However, the correlation between the number of candies estimated to have been eaten and the extent of the inaccuracy of the estimate failed to attain significance for the obese sample (\( r = .49, p < .20 \)) or the entire sample (\( r = .06, p < .20 \)).

The only other conspicuous difference between the normal-weight and overweight groups involved the number of participants who reported being on a diet; 39% of the obese
Table 3. Number of obese and normal-weight participants eating candies who gave accurate and inaccurate estimates of the number eaten.

<table>
<thead>
<tr>
<th></th>
<th>Number of obese participants eating at least one candy</th>
<th>Number of normal-weight participants eating at least one candy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate estimate</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Inaccurate estimate</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

Sample reported being on a diet, compared to only 14% for the normal-weight groups. However, this difference was not significant, $\chi^2 = 3.03$, $p < .10$. Furthermore, the same general relationships were obtained whether or not the groups were classified on the basis of self-reports of being on a diet. There was also no significant correlation between the number of candies eaten and the diet variable for groups differentiated on the basis of obesity, anxiety level, or response cost. The same was true for correlations between the number of candies eaten and other variables measured during the experiment, which included hours elapsed since the last meal and the last food eaten, taste ratings, per cent overweight, and state anxiety scores. However, the Pearson correlation coefficient between hours since last eaten and number of chocolates eaten during the experiment was negative for the obese sample ($r = -.18$, $p > .20$) and
positive for the normal-weight sample ($r = .26, p > .20$).

It should also be noted that the mean taste rating for the entire sample was 5.67, indicating that most participants liked the candies. In fact, only seven gave the candies a taste rating of 3 or lower; i.e., below the mid-point or "neutral" rating category of 4.
DISCUSSION

While the effects of the anxiety and response cost variables did not quite attain statistical significance in terms of the number of obese individuals eating chocolates, both of these manipulations can be interpreted as having considerable impact on their eating behavior, especially when contrasted to the almost total absence of these effects in the normal-weight groups.

The results generally supported the hypotheses that more overweight persons would eat candies in the low response cost than high response cost conditions, but that the wrapping manipulation (i.e., the response-cost manipulation) would not affect the number of normal-weight individuals eating the chocolates. These findings are also consistent with the results of Schachter and Friedman (1974) and suggest that while obese individuals are more likely to eat than normal-weight individuals when little effort must be expended, they are less likely to eat under conditions requiring more effort. However, these obese/normal-weight differences are not great (11 vs. 6 vs. 7, respectively).

Interpretation of the data with respect to the "prior response tendency" hypothesis (Singh and Sikes, 1974) is more ambiguous. The hypothesis states that obese individuals will be less motivated to eat than their
normal-weight counterparts only when they must expend more effort in preparing food for consumption than they expect. Since chocolate kisses are usually wrapped, the greater number of chocolates eaten in high response-cost conditions by obese than normal-weight subjects lends support to this explanation, which was also derived from parametric data (i.e., in terms of amounts eaten). The comparability in amounts eaten by obese subjects in high response-cost and low response-cost conditions may be construed as further support for the prior response tendency hypothesis. However, the nonparametric data (i.e., data expressed in terms of the number of individuals eating candies) contradict it. Fewer subjects ate chocolates in obese/high response cost conditions than in either normal-weight/high response cost or obese/low response cost conditions. Again, since these data appear to be more sensitive to treatment effects than the parametric data, more credence may be placed on interpretations derived from them. Consequently, the present results cannot be construed as lending support to the prior response tendency hypothesis, at least as universally applied to the eating behavior of all obese persons. However, despite the nearly significant differences between the number of obese subjects who ate in high response cost and low response cost conditions, the modest size of the differences between the number of obese and normal-weight
eaters in high response cost conditions precludes an explicit rejection of Singh's formulation.

The same problems arise in assessing the influence of the anxiety manipulations on eating behavior as those that occurred in interpreting the effects of the response cost manipulations. In terms of the number of individuals who ate at least one candy, the eating behavior of obese participants was inhibited in high-anxiety relative to low-anxiety conditions, although this difference did not emerge in the corresponding normal-weight groups. Conversely, normal-weight individuals in high-anxiety conditions ate 40% more chocolates than their counterparts in low anxiety conditions, while the difference between amounts eaten among the corresponding overweight groups was only 5%. These parametric data are consistent with research that shows that obese individuals eat nonsignificantly more when anxious than when not, but they are inconsistent with results from the same studies showing that normal-weight subjects eat significantly less when anxious than when not (e.g., Schachter et al., 1968; McKenna, 1972).

The fact that a greater number of overweight subjects ate chocolates in the low-anxiety than high-anxiety conditions is particularly surprising and contradicts the widespread—though largely unsubstantiated—psychosomatic hypothesis that high levels of arousal lead to overeating among obese people. It could be argued that the
high-anxiety manipulations in the present study evoked too much anxiety among obese subjects and therefore failed to facilitate their eating behavior. This reasoning would explain the failure of this study to replicate the results of prior research concerning the relationship between anxiety and the eating behavior of the obese. Yet, if the anxiety levels of obese subjects in the high-anxiety conditions of this study were too high to facilitate eating, one may question why eating was not also inhibited among normal-weight participants in those conditions, who received similar state-anxiety test scores. Certainly one would expect this to occur, given the sympathetically-mediated inhibitory effect of fear on eating in animals.

The finding that the anxiety manipulations had nearly significant effects on the eating behavior of obese subjects also contradicts Schachter et al.'s (1968) externality hypothesis, which predicts that eating in the presence of positive food cues (e.g., chocolate candies) should be unaffected by internal states (e.g., anxiety) for obese but not normal-weight individuals. In fact, the opposite effects were obtained here. Differences between the eating behavior of obese subjects in the high response-cost and low response cost conditions were also evident, but since the two levels of response cost differed primarily on an effort expenditure rather than a cue prominence dimension, comparisons involving these conditions do not provide an
adequate test of the externality hypothesis. However, there is some suggestive--albeit weak--evidence to support it. The negative correlation obtained for the obese sample between the hours since food was last eaten and the number of candies eaten is consistent with the externality explanation, since the greater cue prominence of food eaten more recently would be expected to facilitate eating in overweight persons. The positive correlation obtained between these variables for the normal-weight sample is also consistent with this explanation, since hunger (an internal cue associated with eating for non-obese individuals) increases with duration of abstinence. However, the differences in eating behavior between the obese/high-anxiety and obese/low-anxiety groups provide more compelling evidence against the externality hypothesis than these modest correlation coefficients offer in support of it.

As suggested in the previous discussion, the lack of correlation between the parametric and nonparametric data of this study creates some interpretive difficulties. The most plausible explanation for the absence of a positive correlation between these measures is that the experimental manipulations exerted different effects among participants assigned to the same conditions. In general, the fewer the number of individuals who ate candies in a given treatment, the greater was the average number of candies they ate. Thus, the seven obese subjects who ate candies in the
low-anxiety/low response cost condition consumed an average of only three. In contrast, only two obese individuals ate chocolates in the high-anxiety/high response cost condition, but they managed to eat 21 chocolates between them. Data collected from obese subjects in the low-anxiety/high response cost condition and the high-anxiety/low response cost condition were between these extremes. A roughly similar but less conspicuous trend characterized the eating behavior of normal-weight participants. Consequently, differences in eating behavior were most extreme in conditions in which the fewest number of individuals ate candies, particularly for the obese sample. Although only limited inferences can be made from these data, it appears that the four anxiety/response cost conditions exerted different amounts of inhibition on the eating behavior of overweight subjects, in terms of the number of individuals who ate chocolates. The greater this inhibitory effect, the greater was the failure of the individual to inhibit eating once it was initiated, in terms of the number of chocolates eaten. The data also suggest that the anxiety and response-cost variables may have had an additive effect in determining these inhibitory thresholds for the obese groups, as indicated by the significant differences between the high-anxiety/high response cost and low-anxiety/low response cost obese groups on both measures of eating. Perhaps the effects of these variables were additive only because
anxiety is an internal cue, whereas response cost is an external cue. Again, however, the results obtained here are not substantial enough to defend these interpretations with great conviction, especially in the absence of evidence from other research. A more conservative but justifiable conclusion is that the absence of a positive correlation between the parametric and nonparametric measures of eating behavior—particularly for the overweight groups—reflects their heterogeneous composition. Apparently, these groups were composed of individuals whose eating behaviors are elicited in different kinds of situations by different cues.

Despite this probable source of random error, obese participants gave significantly more inaccurate estimates of the number of candies they had eaten than their normal-weight counterparts. There are at least two explanations that can account for this difference, one emphasizing the greater perceptual distortions of amounts eaten that are experienced by the obese, and the other stressing the greater perceived social pressure on the obese to deliberately underestimate amounts eaten. The data seem to support the latter explanation for several reasons. First, the fact that all errors were underestimates rather than overestimates is consistent with the social pressure interpretation, although this finding conceivably could also be explained in terms of some perceptual distortion. However, there was not a significant positive correlation between the
number of chocolates reportedly eaten and the extent of the inaccuracy of subsequent estimates of amounts eaten. One would expect a significant positive correlation if inaccurate estimates were due to a perceptual distortion; e.g., it is probably easier to judge accurately that one has eaten only one candy rather than six or seven candies. The "social pressure" explanation is also supported by the fact that significantly more obese persons reported being on a diet than normal-weight individuals, even though self-reports of being on a diet were not correlated with differences in eating behavior in the present study. Consequently, if this explanation is true, then differences in perceived social pressure against eating—like the probable heterogeneity within groups—may have lessened differences in eating behavior between the obese and normal-weight groups.

Despite these probable contaminants, the results of this study indicate that the anxiety and response cost manipulations exerted an appreciable influence on the eating behavior of overweight individuals, with the high response cost and high-anxiety conditions generally having an inhibitory effect. In contrast, these manipulations had negligible effects on the eating behavior of normal-weight persons. The modest size of the effects obtained probably reflects the fact that obesity is a complex, multiply-determined phenomenon.
Implications for the Treatment of Obesity

The results and conclusions presented here provide some clues as to the effectiveness of various treatments of obesity. In particular, the inhibitory effect exerted by the high response-cost condition on the eating behavior of most obese subjects suggests the effectiveness of treatment strategies based on making preferred (i.e., high calorie) food either unavailable, difficult to obtain, or difficult to prepare. Certainly, the fact that an easily removed aluminum foil wrapping had such a great impact on the eating behavior of obese subjects in this study attests to the power of such techniques, as do the successful outcomes reported in research using these techniques (e.g., Stuart, 1967).

The possibility that inaccurate estimates of amounts eaten may be motivated by perceived social pressure against reporting excessive food intake supports the well-established principle that social reinforcement is an effective tool in the treatment of obesity (e.g., Wollersheim, 1970). More importantly, the possibility that these inaccurate estimates were not due to a motivational perceptual distortion suggests that treatments relying solely on self-monitoring techniques, such as calorie-counting and keeping records of weight change, may be ineffective weight-reduction interventions (e.g., Thoresen and Mahoney, 1974). Likewise, the inhibitory effects of high
anxiety on the eating behavior of most obese participants in this study indicate that treatments of obesity that are based on anxiety-management procedures, such as relaxation, thought-stopping, or desensitization, may also be of limited value.

Limitations of the Present Study and Implications for Future Research

While some differences were evident across conditions in this investigation, they may have been larger under more ideal circumstances. One obvious limitation was the sample size, which if larger may have revealed more substantial treatment effects. There were also several probable sources of random error which obscured group differences. In particular, the eating history of participants immediately prior to their participation in the experiment was not controlled. Undoubtedly, much of the within-cell variance obtained here would have been eliminated had prior eating histories been controlled. Heterogeneity within groups also probably contributed significantly to random error and may have obscured differences between obese and normal-weight groups that would have been larger had these groups been selected according to criteria that differed from the simple overweight/normal-weight dichotomy used here. Alternative classification systems include the constraint system used by Herman and Polivy (1975) and the age-at-onset system of Grinker et al. (1973). Apart from these
sources of random error, the obese groups may have experienced greater social pressure to curtail their consumption of chocolates than the normal-weight groups during the experiment. This source of bias may have further diminished "true" group differences, but unfortunately, it may be difficult to eliminate in controlled experiments.

Undoubtedly, the limitations of this investigation are made more conspicuous by the paucity of research in the area. Straightforward replications may contribute to the literature, but research which systematically varied the important features of this experiment would advance our knowledge even further. For example, the use of samples drawn from populations other than college undergraduates would enhance the generalizability of results obtained from this research. Modifications in the two sets of experimental manipulations would also have great heuristic value. Aluminum foil wrapping provided the basis for the response-cost manipulation here, but more complex physical or mental activities could also be used on a contingent basis in obtaining food-rewards. Similarly, anxiety manipulations other than those used in this study, such as perceived social disapproval, performance on a frustrating or aversive task, or exposure to films of varying emotional content, could yield some interesting findings. However, the effects of these manipulations are likely to be influenced by the kinds of "test stimuli" used. Consequently, every effort
should be made to use foods of different caloric content and taste. A coordinated program of research which systematically varied these factors across separate studies would contribute immeasurably to our knowledge of the etiology and treatment of obesity.
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