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RELATIONSHIPS AMONG WEIGHT, SEX, DEPRIVATION, TIME OF
EATING, EATING PATTERNS, TASTE, AND EATING BEHAVIOR

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Patricia McKay Baker, B.A., M.A.

The Ohio State University
1973

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I. INTRODUCTION

In the last six years, Stanley Schachter has opened a whole new avenue of approach to the study of obesity by observing the behavior of obese persons as compared to that of nonobese persons. This approach stands strikingly in contrast to that of earlier psychologists and psychiatrists who studied the personality structure rather than the behavior of the obese with numerous contradictory findings. With Schachter's approach, a number of replicable findings have been demonstrated with regard to the behavior of obese males, largely college undergraduates.

Among these findings is the fact that obese males do not alter their food intake in accordance with how much they have previously eaten. By contrast, the nonobese have been found to eat significantly less food when they have eaten previously than when they have not (Schachter, Goldman, and Gordon, 1968; Pliner, 1970).

The meaning of these data is not as clear as it might seem at first glance. It has been interpreted by Schachter and his colleagues as indicating that the obese are less sensitive to the physiological concomitants of food deprivation than the nonobese. Such a hypothesis is supported by other data which indicate that the obese report less discomfort or hunger associated with food deprivation than the nonobese (Misch, 1966; Goldman, Jaffa, and Schachter, 1968).
However, there are also data which conflict with this evidence of a lack of internal sensitivity in the obese. A presentation of some of this data and a discussion of other possible explanations of the eating behavior of the obese can be found in an unpublished paper by Baker (1971). Suffice it to say here that the eating behavior of the obese and the nonobese has often been found to be different depending on previous hard food intake. The results are somewhat different with previous liquid food intake, however (Pliner, 1970; Wooley, 1969; Wooley, 1971).

While it has been found that the obese do not eat solely, if at all, in response to food deprivation, it has been found that they do eat in response to the prominence of food cues. The more prominent the cue, the more they eat (Schachter, 1971b). Ross (1969) provides the most intriguing demonstration of this phenomenon. He had Ss sit at a desk with a can of shelled nuts on it. When a 40 watt bulb illuminated the desk nonobese Ss ate slightly fewer nuts than when a 7.5 watt red bulb was used. Obese Ss, however, ate significantly more nuts than nonobese Ss under high illumination, and somewhat fewer nuts than nonobese Ss under low illumination. The differential prominence of the food cues in the two lighting conditions had a significant effect on the behavior of the obese but no effect on the nonobese.

Another indication of hyper-responsiveness in the obese to prominent food cues is the frequent finding that obese Ss given sandwiches to eat for a meal eat significantly more of them than do nonobese Ss (Schachter et al., 1968; Nisbett, 1966, 1968a; and Johnson and
Wunderlich, 1970). Schachter's explanation of this effect was "what could be a more prominent cue than food on the plate?" (Schachter, 1971b, p. 141).

The taste of food is also a cue which can vary in prominence and thereby affect obese eating behavior. Schachter et al. (1968), Nisbett (1966), Decke (1971), Hashim and Van Itallie (1965), and Goldman et al. (1968) have all demonstrated that the food intake of the obese is much more affected by the prominence of taste cues than is the case for the nonobese.

Johnson and Wunderlich (1970) found that the obese will not only eat more when food cues are prominent, they will even work harder than the nonobese to obtain food. Johnson and Wunderlich had their Ss use one finger to pull on a ring which attached by wire to a weight. Subjects received quarter sandwiches on a variable ratio 50 schedule of reinforcement. There were two different food cues—the visibility and the taste of the sandwiches. When obese Ss had a sandwich in front of them which was wrapped in transparent paper (high visual cue prominence) they worked significantly harder than either nonobese Ss or those obese Ss who were confronted with a sandwich in plain white paper (low visual cue prominence).

Finally, Schachter and Gross (1968) collected some questionnaire data on the eating habits of the obese which they interpret as demonstrating the propensity of the obese to eat only when food cues are prominent. The authors found that for male undergraduate Ss, while 56% of the nonobese Ss reported that they usually ate breakfast, only 21% of the obese Ss did so. Also, obese Ss were significantly more
likely to skip lunch on weekends than were nonobese Ss. Schachter and Gross's comment on the breakfast statistics was "For students, breakfast is probably the meal least involved with external cues and most confounded by competing alternatives such as sleeping late, dozing and daydreaming, or taking one's ease at shaving and washing. The obese, then, should be less prone to eat breakfast than normals" (p. 104). For the lunch data, their explanation went as follows: "During weekdays, virtually all undergraduates have morning classes. Come noontime, all students are up and about, surrounded by crowds on their way to lunch, inevitably passing lunch counters and dining halls. Whether for internal or external reasons, under such circumstances all students should be equally likely to eat lunch. On weekends, however, with no classes, the student may choose to stay in his room and study, go to the library, visit a museum, or indulge in countless activities that remove him from food-related cues. We should then anticipate that on weekends fat Ss are more likely to forego lunch than are normals" (p. 104).

In summary, this body of literature suggests that obese male undergraduates as a group do not regulate their food intake in response to how much they have previously eaten, but rather to the prominence of the available food cues. Such knowledge gives us important new clues as to possible causes of obesity in males and to the optimal type of treatment plan. For example, Schachter (1971b) has noted the similarities between this behavior observed in humans and that observed in rats made obese by lesions in the ventromedial hypothalamus. The similarity is so striking that Schachter has raised the possibility
that obesity in humans as well as rats may be due to an impairment of the ventromedial hypothalamus.

In terms of treatment ramifications, it would seem logical on the basis of these findings to attempt both to train the obese to eat in response to internal cues signalling food deprivation and to try to get their excessive responsiveness to external food cues at least somewhat under control by behavior modification techniques. However, before becoming engrossed in the planning of such programs for the obese population as a whole, it would be beneficial to consider the question of whether all obese persons can be expected to behave similarly to male undergraduates at Columbia University. For example, there are data to suggest that the etiology of obesity in women may not be the same as that in men. Stunkard and his co-workers have found that while obesity in men may be caused largely by excessive food intake, obesity in women may be primarily due to low activity level. Chirico and Stunkard (1960) used a pedometer to make accurate recordings of the physical activity of obese and nonobese men. Summarizing the findings of this study, Stunkard said "Although obese men are, indeed, somewhat less active than nonobese men, their great body weight results in a caloric expenditure due to physical activity which is probably no less than that of nonobese men" (Stunkard, 1962, p. 216). From this, Stunkard concluded that obesity in men was more likely to be due to excessive food intake than to dramatically lower caloric expenditure than that of normals. Obese women, however, have been found to be much less active than nonobese women (Dorris and Stunkard, 1957). Stunkard concluded "this inactivity is of such a severe degree as to
contribute to the production and maintenance of their obesity. The caloric expenditure due to physical activity of some women appears to be small enough for them to become obese on a diet containing no more calories than that of more active nonobese women" (Stunkard, 1962, p. 215). If this analysis is correct, one might obtain differences between females and males in studies similar to those run by Schachter and his colleagues.

Since Schachter did include women in three of his field studies on internal sensitivity and obesity, there are at least some data on how well the behavior of women accords with his theory. Unfortunately, he did not analyze male and female data separately in one of these—the "Yom Kippur" study (Goldman et al., 1968). In this study, analysis of the data for both sexes combined indicated that the obese had less difficulty fasting the fewer the food cues in their environment, and they were less sensitive to food deprivation than the nonobese. It is possible that these findings reached a level of significance because of a very large difference in the behavior of obese and nonobese men with obese and nonobese women's responses essentially identical. However, the combined statistical analysis does not allow for confirmation or disconfirmation of this hypothesis.

A second study which used females as well as males was the "Air France" study by Goldman et al. (1968). Subjects included 194 male and 42 female airline personnel. The authors were investigating the incidence of complaints about physical discomfort due to the altered meal schedule encountered in overseas travel. They hypothesized that complaints of discomfort indicated sensitivity to the
internal cues associated with food deprivation.

Each S's weight was expressed as a percentage deviation from the norm for people of his or her sex, height, and build as established by the Metropolitan Life Insurance Tables. Then Ss were grouped into five equal groups on the basis of the extent of their weight deviation. Those 20% of Ss who were the most overweight constituted one group, the next most overweight 20% constituted the second group, etc. This type of grouping was done for males alone, females alone and both sexes combined. Then the percentage of complainers in each group was noted. Goldman et al.'s graphical presentation of their data is presented in Figure 1.

A close look at the range of weight deviation for males and females reveals that while the heaviest fifth of males were between 9.8% and 29.2% overweight, the heaviest fifth of females were between 0.6% and 11.4% overweight. In grouping Ss in the majority of their studies, Schachter et al. used 15% overweight as the lower limit for a designation of "obese" and 10% overweight as the upper limit for a designation of "nonobese." According to those criteria, Goldman et al. did not have any obese women in their study. However, it is possible to compare how the percentage of complainers varied for the two sexes as weight increased within the nonobese range (i.e., below a 10% positive deviation). While 42% of the group of most underweight females (-21.5% to -12.5% deviation) complained of discomfort, only 31% of the group of most underweight males (-20.7% to -9.2% deviation) did so. At the positive extreme of the nonobese range, none of the females in the +0.6% to +11.4% deviation group complained of discomfort, while
Ranges of Weight Deviation:

Males: (-20.7% to -9.2%) (-9.1% to -3.4%) (-3.1% to -1.7%)
(41.9% to 49.0%) (49.8% to 52.9%)

Females: (-21.5% to -12.5%) (-10.7% to -7.5%) (-6.9% to -4.1%)
(-3.8% to +0.5%) (+0.5% to +1.4%)

Fig. 1. Relationship of weight deviation to complaining about the effects of time-zone changes on eating.
(Goldman, et al, 1968, p. 121)
11% of the males in the +1.9% to +9.0% deviation group did so. This discrepancy suggests that in nonobese women sensitivity to the cues associated with food deprivation decreases more rapidly with increasing weight than is the case for nonobese men. It is plausible, therefore, that Schachter's findings on a lack of internal sensitivity in obese men may also characterize obese women, although the Goldman et al. study lends only indirect support for this hypothesis.

The remaining study which included females concerned supermarket shopping behavior (Nisbett and Kanouse, 1969). Eighty-one per cent of the Ss in this study were female. As predicted, nonobese shoppers bought significantly more (p < .05) food the more deprived they were. The authors interpreted this as support for their hypothesis of internal sensitivity to the physiological cues associated with food deprivation in the nonobese. The results for obese Ss were the opposite of those for nonobese Ss. Obese Ss bought significantly less (p < .01) food the more deprived they were. In interpreting this finding, the authors emphasized the importance of external cues to the obese.

Nisbett and Kanouse proposed that obese persons who had not tasted food in the recent past were not very reactive to the packaged food in the store, while those who had recently eaten were in a state of high reactivity to food cues and consequently bought a lot of food. However, an alternative interpretation of the data for obese Ss is that obese persons are sensitive to the physiological cues associated with food deprivation, but their response to these cues is different from that of nonobese persons. Internal cues associated with food deprivation may serve to inhibit eating in the obese while they initiate eating in
the nonobese. At the other extreme, the feeling of fullness in the stomach after eating may stimulate more eating in the obese instead of less as with normals. Since neither an external nor an internal interpretation can be ruled out on the basis of this study, Nisbett and Kanouse's results can not be definitively seen as indicating a lack of internal sensitivity to food deprivation in obese women, as has been found for obese men.

In addition to these studies on internal sensitivity and obesity, some of Schachter's colleagues have attempted to replicate with female Ss the finding of Rodin, Herman, and Schachter (1972) that obese male undergraduates perform better at a short-term memory task than their nonobese counterparts. Following the procedure of Rodin et al., Decke, Gold, and Porikos (see Rodin et al., 1972) showed slides with 13 words on them for five seconds each to female undergraduates. In reporting their results, the authors separated the data from 8 Ss who were "superobese" from those of 27 Ss who were just "obese" and then made separate comparisons of these two groups with 35 normal weight Ss. The "obese" Ss remembered more words than the nonobese Ss, as had been found for males (p < .06). However, the "superobese" performed worse than normals (p > .10). Presumably, if data for all "obese" and "superobese" Ss were grouped together, as had been done with the original study using male Ss, no significant differences between the behavior of the obese and the nonobese females would be obtained. Such a possibility raises again the question of whether or not Schachter's findings on males are really relevant for females.

Even if differences between males and females exist, however,
the incidence of obesity among women may not be large enough to make it worthwhile to investigate the etiology of obesity in this particular group. Information on the incidence of obesity by sex seems to be available only in bits and pieces. A United States Department of Health, Education, and Welfare bulletin on obesity published in 1966 states unequivocally "At this time data do not exist upon which to make statements concerning the incidence of obesity in the total United States population or in any particular group of this population" (Heart Disease Control Program, 1966, p. 21). No new statistics could be located for the period 1966 to the present.

However, there are two studies with fairly large samples which have reported the incidence of obesity in adults of both sexes. One of these was done by the Metropolitan Life Insurance Company in 1960. It found for both males and females in the 20-29 year old range that 12% of them were 20% or more above their most desirable weight. In the 30-39 year old range, 25% of both sexes were at least 20% overweight. After age forty, the incidence of obesity continued to climb in both groups until age 60, with the women gaining more rapidly than the men. By ages 60-69, the percentage of obese males (i.e., 20% or more overweight) dropped from its high in the 50-59 year old range of 34% to 29%. For women, the percentage of those who were obese was 46% and 45% in the 50-59 and 60-69 year old groups, respectively. These data, presumably on a selected population of life insurance holders, suggests that between the ages of 20 and 40 the incidence of obesity in the two sexes is the same, while after 40 more women are obese.
Somewhat different results were found in the Midtown Manhattan study. The Ss in this study represented a cross section of the people in a residential area of New York City. Moore, Stunkard, and Srole (1962) analyzed the data from this study to investigate the relationships among socioeconomic status, obesity, and psychopathology. They found the incidence of obesity to be from 5% to 15% greater in males than females between the ages of 20 and 50. In the 50 to 60 year old group, the percentages of obese men and women were identical. Although the percentage of obese men was generally somewhat higher, they found that the percentage of women who were obese ranged from 5% for those in their early twenties to 35% for those in their late forties.

The exact incidence of obesity in the two sexes is left in doubt by some of the contradictory findings of these two studies, but it does seem clear that there are enough obese women to merit further exploration of the behavior of this subgroup of obese persons. One of the goals of the present study, then, was to find out whether or not females would respond as males did in a laboratory eating situation similar to those employed by Schachter et al. (1968), Schachter and Gross (1968), Nisbett (1966), and others.

A second problem to which the present study addressed itself was why the obese tend to eat least in the morning and to increase their intake as the day goes on, eating the most at night. This eating pattern has been observed in a number of studies. Schachter and Gross (1968) found that the obese, as compared to the nonobese, were significantly more likely to skip breakfast, and to skip lunch, at least on
weekends, while both groups ate dinner almost all of the time. On the basis of their investigations of 847 cases of "simple" obesity seen at a Nutrition Clinic, Truson, Walsh, and Caso (1947) noted that "The obese patient often eats lightly during the day and excessively at night" (p. 945). Dole, Schwartz, Thaysen, Thorn, and Silver (1954) described the intake of 42 healthy obese patients who were hospitalized for weight reduction as follows:

Like most fat persons, they tended to have poor appetites in the morning and to be hungry at night. At home, many of them ate little or no breakfast, and often took a light lunch. They usually ate once or twice in midafternoon, choosing something like a sandwich or a milkshake, then ate a good supper, and continued to eat throughout the evening, especially before going to bed. (p. 386)

Finally, Lesses and Myerson (1938) studied 17 private patients who were suffering from anhedonic obesity (i.e., neurotic obesity), and commented "The excess food ingestion of the anhedonic obese person rarely occurs in the morning, when desire and mood are especially low, but comes later in the day and in the evening" (p. 120). The authors ascribed the lack of appetite in the morning to neurotic fatigue.

Schachter's explanation of the tendency of the obese to skip breakfast in the Schachter and Gross study was that there are few prominent external cues to initiate eating of this meal. However, it also seems possible that the obese may eat very little in the morning for other reasons. In addition to Lesses and Myerson's hypothesis, another possibility is that the obese function on a different physiological cycle concerning food intake and digestion than the nonobese. Perhaps the obese are predisposed to eat little in the morning and much at night in response to this physiological cycle. If Schachter's
hypothesis is correct, the obese should eat identical amounts of food in the morning and the evening as long as the external cues are identical. If they eat less in the morning than at night when external cues are identical, a simple explanation of the eating behavior of the obese based exclusively on their hyper-responsiveness to external cues would be insufficient to adequately explain the data.

A third and closely related issue which this study explores is whether the eating behaviors of those persons Stunkard has called "night-eaters" differs from that of other obese persons, and from the nonobese. Stunkard, Grace, and Wolff (1955) first noted the presence of the night-eating syndrome in 20 out of 25 obese patients who were being seen at a special study clinic for persons who were severely obese and had a history of difficulty in controlling their weight. The syndrome, which tends to appear during periods of life stress and weight gain, includes morning anorexia, evening hyperphagia and insomnia. Operationally, these three symptoms were defined, respectively, as negligible eating at breakfast (never more than orange juice and coffee); an intake of at least one quarter of the day's total calories after dinner; and inability to sleep at least until midnight more than 50% of the time.

There is evidence from Stunkard (1959b) to suggest that night-eaters may be significantly less hungry and less responsive to internal cues, at least in the morning, than either other obese persons or the nonobese. The authors had Ss come in at 9:00 A.M. after an overnight fast. Gastric balloons were inserted in Ss' stomachs and every 15 minutes they were asked if they were hungry. The gastric balloon was
used to determine whether the S was having stomach contractions at the
moments when she was asked to report her hunger. Obese night-eaters
reported hunger in the presence of contractions significantly less
often than either other obese Ss or nonobese Ss. The latter two
groups did not differ significantly from one another. Such a finding
raises the possibility that the apparent lack of sensitivity to the
physiological concomitants of food deprivation reported by Schachter
and his colleagues is due to the behavior of the subgroup of obese
persons who are night-eaters. The insensitivity of this group may be
marked enough to have caused the overall differences in the behavior
of the obese and the nonobese found by Schachter.

In a later study, however, Stunkard and Fox (1971) obtained dif­
ferent results when they compared the association of reports of hunger
with the presence of stomach contractions by a somewhat different
procedure. In this study, an open-tipped catheter was used to record
contractions instead of a gastric balloon, and rather than making
simple "yes-no" discriminations of hunger, Ss rated their hunger along
a six inch line which was labelled "not at all hungry" at one end and
"as hungry as you have ever felt" at the other. There were three
groups of Ss--nonobese, "neurotic" obese, and another group of obese
persons whose psychopathology, if they had any, was not related to
their obesity. The "neurotic" obese were obese persons who showed
both a deviant eating pattern such as night-eating or binge eating
(the latter being defined as a tendency to eat huge amounts of food
when under stress) and a body-image disturbance (i.e., had strongly
negative feelings about their bodies and saw their gross body size as
central to the problems in their lives). Consequently, this group was characterized by people other than those who simply manifested a night-eating syndrome as in the previous study. The findings were that although a few Ss in each of the three groups demonstrated a high correlation between reports of hunger and stomach contractions, the majority of Ss in all three groups did not do so. There were no significant differences among the three S groups. This finding was contrary to the expectation that the "neurotic" obese would be significantly less likely to report hunger in response to their stomach contractions than either of the other two groups, as had been true for night-eaters in the Stunkard study.

It is difficult to determine the cause of the differences in the results of these two studies. Stunkard and Fox themselves say that the reliability of the results obtained with at least the second procedure was low. "Repeat studies revealed considerable variability within the subjects from one test to the next" (Stunkard and Fox, p. 130). Their reported results were apparently from one arbitrarily selected set of data. If they had used the data from one of the "repeat studies," the findings might not have been as discrepant from those of the Stunkard study.

Another possible cause of the difference in the results of the two studies is the switch from the use of a gastric balloon to an open-tipped catheter to measure stomach contractions. Apparently the change was due to the finding that a gastric balloon increases gastric motility in a food deprived person (Stunkard and Reinhard, 1965). It is possible that the differential sensitivity of the night-eating
obese versus the other groups appears only when there is a large amount of gastric activity. In such a situation, which presumably would be similar to a long period of food deprivation, perhaps the nonobese and the non night-eating obese manifest sensitivity to their contractions while the night-eating obese remain insensitive. If so, the discrepant findings concerning the sensitivity of the nonobese and the non night-eating obese in the two studies would be expected.

It is interesting to note that Stunkard and Koch's original findings of less internal sensitivity in at least some obese persons than in nonobese persons was the impetus for all of Schachter's work on obesity. If the findings with the open-tipped catheter had been published first instead of the work with the gastric balloon, Schachter might never have begun his explorations of obesity.

A further question of interest concerning night-eaters is whether their sensitivity to external food cues varies with the time of day. For example, perhaps their sensitivity to external cues increases as the day goes on, accounting for their increased food consumption in the latter part of the day. This is another question which is explored in the present study.

It is important to clarify the difference between a night-eater and the apparently general tendency of the majority of obese persons to eat little or no breakfast and to increase their intake as the day progresses. The night-eating syndrome also includes insomnia and the requirement that at least 25% of the person's total caloric intake be eaten after dinner. The proportion of obese persons who are found to manifest this syndrome in various studies differs with the means of
acquiring data on eating and sleeping habits, and with the nature of the obese population being studied. Beaudoin and Mayer (1953) found that obese women tend to "minimize the frequency and size of the snacks taken after lunch throughout the rest of the day as well as the size of dinner" (p. 31). If asked to record their own daily intake, obese women so underestimate this part of their food consumption that their total estimate of daily intake is less than that of the nonobese. If an interviewer inquires with prodding questions, however, the increased intake later in the day is disclosed. Consequently, the manner of collecting data on eating habits significantly affects the data obtained.

In terms of the effects of the type of obese population studied on the obtained incidence of night-eaters, it appears as though obese persons who are the most overweight and have a history of problems in attempting to control their weight are those who are most likely to be night-eaters. In the original paper describing the night-eating syndrome, Stunkard et al. (1955) reported that 80% (i.e., 20 out of 25 Ss studied) manifested at least major portions of the syndrome. Sixteen (or 64%) actually reported the syndrome in its entirety, while two reported drinking alcohol instead of eating food at night, and two reported no insomnia. Nineteen of these night-eaters were women and one was a man. These people were the first 25 patients to be seen in a special study clinic for problem obesity. Assessment of eating behavior was made by self-reports of patients, interviews on eating habits, and careful observation of Ss' eating habits while they were in the clinic. Stunkard noted again the marked tendency of the obese
to underestimate their intake when keeping records of their own eating behavior. In a subsequent report on patients in this special clinic, Stunkard (1959a) reported that the incidence of the syndrome in the next 15 patients to be seen in the clinic was 66%. He compared this with the results he obtained from 100 obese patients seen consecutively in the general nutrition clinic of the same hospital. This group received a questionnaire on their eating and sleeping habits, and the results indicated that only 12% were night-eaters. As Stunkard says, "It is not clear whether this discrepancy results from different selection of subjects, different methods of collecting information, or both" (Stunkard, 1959a, p. 291).

In his study on the relationship of gastric motility and reports of hunger in obese women, Stunkard (1959b) found that 8 out of 17 obese women used as Ss were night-eaters. These women, all patients in a general medical clinic of a hospital who were in good health except for their obesity, were "questioned" as to their eating and sleeping patterns. It is unclear as to whether "questioned" meant an interview or a questionnaire.

Stunkard and McLaren-Hume (1959) did not state the means by which they collected their data, but they reported that 14 out of 100 obese females who were seen as outpatients in a Nutrition Clinic were night-eaters. Mendelson, Weinberg, and Stunkard (1961) did an intensive study of 25 lower and lower middle class obese men (20 medical outpatients and 5 psychiatric referrals). Also without stating their means of data collection, they reported that four of their Ss (16%) were night-eaters.
Finally, Nisbett (1966) tried to discriminate night-eaters on the basis of responses to the single question "Do you have difficulty stopping yourself from eating at night?" Twenty out of 56 obese male college undergraduates responded "yes." Nisbett then referred to these Ss as examples of Stunkard's night-eaters. This means of assessing the presence of the night-eating syndrome obtained information on only one of the three criteria which constitute the syndrome, and gave incomplete information on the one. Consequently, Nisbett's data is not very helpful in trying to assess the actual incidence of the syndrome in a college population. The inadequacy of his criterion is clearer when it is noted that 10 of his nonobese Ss also responded "yes" to the question and were consequently referred to by Nisbett as night-eaters. This can be compared to the findings of Stunkard et al. (1955) who made a careful study of 38 nonobese Ss, looking for all components of the syndrome and found no night-eaters. Although most of Stunkard's Ss had a snack in the evening, this never approached 25% of their day's total caloric intake. A few of them reported little appetite at breakfast time, and one reported insomnia. However, none of them met enough of the criteria to a sufficient degree to be called night-eaters, and Stunkard considers the syndrome to exist only in the obese. It is unclear from the preceding list of studies on night-eaters what proportion of a fairly healthy, obese, undergraduate population would be night-eaters.

Summary of Experimental Questions

In summary, the present study was designed to explore the dif-
ferences in the eating-related behavior of obese and nonobese Ss of both sexes in response to food deprivation, food cue prominence (here represented by taste), and different times of day. A post hoc analysis of the behavior of night-eaters versus other types of Ss was also planned. The experimental questions of primary interest were as follows:

I. Would obese males and females be found to be hypo-responsive to food deprivation and hyper-responsive to prominence of food cues, as compared to nonobese Ss, as Schachter et al. found for males in their studies?

II. Would (a) the total intake of the obese, and/or (b) their responsiveness to food deprivation, and/or (c) their responsiveness to prominence of food cues be found to vary more with the time of day than would be true for the nonobese?

III. If any of the differences in the behavior of the obese and the nonobese proposed in Questions I and II are found to be significant (i.e., the two groups respond differently to food deprivation, food cue prominence and/or time of day), could night-eaters alone be seen to account for these differences?
II. METHOD

Overview

Obese and nonobese Ss of both sexes were initially selected on the basis of their responses to a classroom questionnaire describing physical characteristics. They were solicited by telephone to participate in the study. Ss came to the study twice, half coming both times in the morning and half both times in the evening (manipulation of time). Although they came food deprived both times, one time they were fed sandwiches before consuming the test food (manipulation of deprivation). Ss' task was to rate four kinds of crackers, two of which were bad-tasting and two of which were good-tasting (manipulation of taste). The dependent measures were the amount of crackers Ss ate and a self report of hunger taken immediately after the preload period. At the end of the study several physical measurements were taken, and Ss filled out a questionnaire designed to indicate whether they were night-eaters.

Subjects

Ss for this study were undergraduate students enrolled in an introductory psychology course at Ohio State University. Part of the course requirements was for each student to participate as an S in some psychological experiments. A population of normal and overweight Ss was found by giving out a questionnaire the first day of class.
which asked for a number of physical characteristics, including height, weight, and estimated body build. Ostensibly, the questionnaires were to be used to help instructors get to know all of their students. Students who labelled themselves as "somewhat heavy" or "very heavy" were contacted to be obese Ss. A random group of those students who were at or slightly below the 50th percentile of weight for their height and sex according to United States Public Health Service data (U. S. Public Health Service, 1966) were contacted to be nonobese Ss.

Over the course of the first week of the academic quarter, 160 students were contacted by telephone and scheduled to be in the experiment. (For a copy of the telephone speech, see Appendix A.) Students were told on the telephone that "The purpose of this study is to investigate the effects of hunger on your sense of taste. You would be asked to rate how certain foods tasted to you on two different occasions, either one or two weeks apart." If students indicated an interest in being in the study after hearing this introduction, the deprivation requirements were explained to them. If after being informed that they would have to skip either breakfast or dinner to be in the study they still wanted to participate, (and almost all did), they gave the caller a number of times that they would be free to come. E then coordinated the assignment of Ss to experimental conditions.

Ss were sent letters informing them of the day and hour they were scheduled to participate (see Appendix B). Ss who were scheduled to be in the last half of the experiment also received postcards a few days before they were scheduled to participate to remind them to come.
Ss were run in groups of four of one sex, with two obese and two nonobese Ss in a group. There were four possible running times—two in the morning at 9:00 and 11:00, and two in the evening at 6:30 and 8:00. The male and female groups were divided between morning and evening, and then between the two different times within each overall time category. Then they were distributed as evenly as possible over the five days of the week. Most groups came to the study the second time at the same time of the day exactly one week later. One group, however, had to wait two weeks between their sessions because of a school holiday. The order in which Ss received the two deprivation conditions was also counterbalanced.¹

In making final assignment of Ss to weight conditions for the purpose of data analysis, two criteria were considered. These were weight and triceps skinfold measurement. An S was considered to be obese or nonobese only if his weight and skinfold measurement both placed him in the same category. (In reality, the criteria were not quite this strict. If an S fell in the obese weight category he was classified as obese as long as his skinfold measurement was within

¹ There were indications from a pilot study that the repeated measures design might be having an effect on the dependent variable of the study, i.e., the number of crackers eaten. The 15 pilot Ss were all run in the order nondeprived-deprived in the two session pilot. They ate an average of 10.13 crackers on the nondeprived day and 9.52 crackers on the deprived day—the opposite from what was predicted for these basically nonobese Ss. One S volunteered the information that she had eaten very few crackers the second day because she remembered the taste from the first day. It also seemed possible that there was some confounding effect occurring as a function of the order nondeprived-deprived. Consequently, order was seen as a very important variable and was not only counterbalanced in the design but was analyzed as an independent variable in the data analysis.
two and one half millimeters of the obese criterion skinfold. The same was true for nonobese classification.) This is a much stricter criterion than that employed by most other studies which considered only weight. However, weight is not always an accurate indicator of obesity by itself. The 240 pound tackle who is only six feet tall would be considered overweight by a height-weight table, but he is not obese in the sense of having excessive fatty tissue. Consequently, the present investigator decided to use measures of both weight and adipose tissue.

On the basis of its demonstrated utility in their own studies, Seltzer and Mayer (1965) advocate that the triceps skinfold gives a reliable estimate of percent body fat as well as being relatively accessible for measurement. They propose that a good criterion of obesity is if a person's triceps skinfold is greater than one standard deviation above the mean for his or her age and sex. They have prepared a table of these values which was used as the criterion for obese skinfolds in the present study (Seltzer and Mayer, 1965, p. A105). All Ss' triceps skinfold measurements were taken at the end of the study.

Most of the studies by Schachter and his colleagues have used the average weight table published by the Metropolitan Life Insurance Company (1959) as their basis for classifying Ss' weights. Generally, Ss who were 15% or more above the average for their age, sex, and height were classified as obese, while those who were 10% above average or less were classified as nonobese. These average weights were developed from a study done by the Society of Actuaries on life
insurance holders in Canada and the United States between 1935 and 1954. The methods of taking heights and weights varied greatly in this study, in addition to the fact that some of the data were only of a self-report variety and not measurements at all.

This contrasts greatly with the study done by the U. S. Public Health Service (1965, 1966) which sent out two mobile clinics with highly trained personnel to collect all of their data. Their Ss were composed of a nationwide probability sample of noninstitutionalized adults between the ages of 18 and 79. They collected data on 6,672 persons between 1960 and 1962. The present investigator felt the Public Health Service data were of better reliability to use as the standards for weight classification in this study. The particular table employed to determine obesity classification was one of smoothed averages and quartile weights for men and women by age and height (U. S. Public Health Service, 1966, p. 16).

As mentioned previously, an S was considered to be nonobese if his weight fell at or below the average for his height, age, and sex. The 75th percentile or above was considered to be the criterion for a classification of "obese." This was chosen because this percentile mark resulted in criterion weights for obesity which were very close to those of 15% above the average weight for a particular height, age, and sex on the Metropolitan Life Insurance Tables. For shorter people, the weight at the 75th percentile on the Public Health Service table is a bit higher than the comparable 15% figure on the Metropolitan tables, while for taller people the weights on the Metropolitan tables are a little higher.
Aside from those people whose weight and skinfold classifications did not match, one other group of Ss was not included in the data analysis. These were nonobese Ss who had a history of overweight. The reason for their exclusion was that Nisbett (1966) found that "subjects with a history of overweight were more similar to currently overweight subjects than to currently normal subjects" (p. 83). See Table 1 for a summary of the characteristics of those Ss included in the final data analysis.

**Preliminaries**

Ss were scheduled to participate in the experiment four at a time. Whatever actual number arrived at a scheduled hour were run. In only one instance did this necessitate an S being run alone. Ss sat at the ends of two long tables, each of which had a vertical partition in the center. In between the two tables was a sliding screen which could be used to completely divide the room. The tables and screen were arranged in such a way that once Ss had sat down they could see only E and not the other Ss. Ss sat in the same seat each of the two times they came.

On both of the days they were run, Ss were requested to come to the experiment food deprived. For Ss who were run in the morning, this meant that they were not to eat anything in the morning before they came to the experiment. For those run in the evening, this meant that they were not to eat anything after one o'clock in the afternoon. The first thing E did as each S entered the experimental room and sat down was to ask him if he had adhered to the deprivation requirement.
TABLE 1

PHYSICAL CHARACTERISTICS OF THE SUBJECTS

(Means)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age</th>
<th>Height in Inches</th>
<th>Weight in Pounds</th>
<th>Sknfd. Msmt.</th>
<th>No. lbs. above 75%tile</th>
<th>No. mm. above Obese Sknfd. Crit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese Females</td>
<td>35</td>
<td>18.6</td>
<td>64.7</td>
<td>186.7</td>
<td>35.3</td>
<td>36.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Obese Males</td>
<td>29</td>
<td>19.7</td>
<td>70.1</td>
<td>217.8</td>
<td>26.1</td>
<td>35.6</td>
<td>10.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age</th>
<th>Height in Inches</th>
<th>Weight in Pounds</th>
<th>Sknfd. Msmt.</th>
<th>No. lbs. below 50%tile</th>
<th>No. mm. below Obese Sknfd. Crit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonobese Females</td>
<td>27</td>
<td>18.3</td>
<td>63.2</td>
<td>120.6</td>
<td>21.8</td>
<td>-9.3</td>
<td>-5.3</td>
</tr>
<tr>
<td>Nonobese Males</td>
<td>26</td>
<td>19.2</td>
<td>69.4</td>
<td>152.5</td>
<td>10.9</td>
<td>-10.2</td>
<td>-4.6</td>
</tr>
</tbody>
</table>
A few Ss reported infractions of the rules, but none of these appeared severe enough to warrant discarding their data from the experiment.

At this point, Ss were given the following introductory remarks:

As you already know, this is a study concerning taste. There are a lot of things which can affect how things taste. One of these, of course, is the ingredients contained in a food. Another is temperature. Things sometimes taste different depending upon whether they are served hot or cold. A third is how hungry you are when you eat something. This third factor is the subject of the present investigation.

You will all be participating in this study twice. One of the days you participate, I will give you something to eat before you rate the test food, which is crackers. The other day you will test the crackers without eating anything beforehand. It is essential that you follow the deprivation requirement even on the day that you are to be fed before tasting crackers. This is necessary so that the eating experiences of all subjects will be similar when they begin their cracker ratings.

On both days you are here, you will be asked to eat four different kinds of crackers and indicate how they taste on a set of rating scales. For example, there is a nine-point scale for saltiness with "extremely salty" at one end and "not at all salty" at the other. There are similar scales for "sweetness," "goodness," and so on. You will be asked to rate each of the crackers on all of these scales.

In addition, before you start rating the crackers each day, you will be asked some general questions about how you are feeling. This is because how you are feeling physically and mentally may affect your taste sensitivity.

Deprivation Condition

On the table in front of each S were four aluminum covered containers each holding 25 of one kind of cracker. The containers were shallow rectangles about five by eight by one inch in size. This type of container was chosen because the dwindling number of remaining crackers as Ss ate was less obvious in this type of container than it would have been in a deeper bowl. The bottom of the container was
lined with a red and white checked napkin to make it attractive. Each container was labelled with a letter.

The four kinds of crackers in order from the S's left to his right were Keebler "Onion Toasts" (good-tasting), Keebler "Waldorf Low Sodium Crackers" (bad-tasting), Nabisco "Royal Lunch Milk Crackers" (bad-tasting) which were cut in half to look like half moons, and Keebler "Cinnamon Crisps" (good-tasting). The number of crackers an S ate was assessed by counting the number remaining in each of the containers after he had left. (The form on which all such S data was recorded can be found in Appendix C.) In addition to the cracker containers, all tables had a pencil and two magazines for Ss to look at if they wished.

On the first day after the introductory remarks, or on the second day right after asking Ss about adherence to the deprivation requirement, E said a version of the following:

Today you will be rating the crackers without eating any-

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2 A pilot study was run to select good and bad tasting crackers. Ss rated ten commercial brands of crackers on a number of nine point rating scales—one of them being a scale with 1 = Delicious and 9 = Terrible. Then the two worst and the two best rated crackers were chosen for the study. The average taste ratings of the two good crackers were 3.11 (σ = 1.98) for Keebler "Cinnamon Crisps," and 4.08 (σ = 2.34) for Keebler "Onion Toasts." The average ratings of the two bad crackers were 8.36 (σ = .95) for Keebler "Waldorf Low Sodium Crackers," and 7.08 (σ = 1.96) for Nabisco "Royal Lunch Milk Crackers." In order to make the visual stimulus value of the crackers as similar as possible, the Nabisco "Royal Lunch Milk Crackers" were cut in half so that their surface area was more nearly equivalent to that of the other crackers. The fact that the crackers were of different weights was also taken into account in the analysis of results. The Keebler "Cinnamon Crisps" each weighed 3.96 gms., the Keebler "Onion Toasts" weighed 3.12 gms., the Keebler "Waldorf Low Sodium Crackers" weighed 3.36 gms., and the Nabisco "Royal Lunch Milk Crackers" halves weighed 5.72 gms.
thing beforehand. I need a couple of more minutes to get ready, so why don't you just relax a bit. Please don't touch the bowls on your tables just yet.

After saying this, \( E \) went behind a screen in the experimental room out of the \( S_s \)‘s sight. The purpose of the two minute waiting period was to allow \( S_s \) who might have just rushed to the experimental room to relax some before rating the crackers.

**Nondeprivation Condition**

On the days when \( S_s \) were in the nondeprived condition, the tables were set up in the same way except for the addition of a plate of sandwiches and a glass of water. There were two roast beef and two sliced ham sandwiches, each of which was cut in half. \(^3\) After the introductory remarks on the first day, or on the second day after inquiring about adherence to the deprivation requirement, \( E \) said the following:

*Today you will be eating something before you evaluate the taste of the crackers. You will find ham and roast beef*  

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\(^3\) It was decided to use two types of sandwiches so that \( S_s \) who did not like one of them would have a choice of something else to eat. This seemed safer than having only one kind of sandwich because if \( S_s \) did not like that one particular kind they might not eat anything in the preload condition. Chicken roll sandwiches and ham sandwiches were used in the pilot study of the present investigation. \( S_s \) found the ham sandwich to be quite tasty. They gave it a mean rating of 2.60 \((\sigma = 1.35)\) on a rating scale where 1 = delicious and 9 = terrible. The chicken roll sandwich, however, was not perceived as being so tasty. It received a mean rating of 4.36 with greater variability in \( S_s \)‘s responding \((\sigma = 2.56)\) than for the ham sandwich. It was felt that such a high rating might result in \( S_s \) not eating very many of the chicken roll sandwiches in the study itself. Since it was desirable that \( S_s \) fill up in the preloaded condition, it was decided to use roast beef sandwiches along with the ham sandwiches instead of the chicken roll ones. Other studies had established roast beef as being a highly desirable type of sandwich.
sandwiches on your table. Be sure to eat enough sandwiches to fill up. This is very important for the experiment. I have lots of sandwiches, so if you want to eat all four of yours in order to fill up, feel free to do so. The important thing is that you are full. Be sure that you eat at least a half sandwich as a bare minimum.

You can read some magazines if you want to during the 15 minutes you will have to eat. Please do not communicate with anyone else in the room during this period. Also, do not touch the containers of crackers on your table. When you have finished eating your sandwiches, please remain seated until I return. Any questions? Okay, why don't you uncover your plate of sandwiches and begin eating. I'll leave you alone now.

After saying this, E closed the room divider all the way so that two Ss were alone on one side of it and two on the other side were with E who was out of sight behind a screen. After 15 minutes, E asked Ss to re-cover any remaining sandwiches they might have. Then she came out from behind the screen, opened the room divider, and picked up the remaining sandwiches. Notation was made of how many of each kind of sandwich Ss ate.

Rating Task

At this point, water cups of those Ss in the nondeprived condition were refilled, while those Ss in the deprived condition were given cups of water. The magazines were removed and replaced with a sheet of "Instructions for Rating" and either five or six blank forms (see Appendix D).

The "Instructions for Rating" explained with examples how Ss should use the nine point rating scales on the blank forms. The "Physical and Emotional State Index" was composed of five scales asking Ss how they were feeling, one of them being a scale for hunger
going from "Extremely full" to "Extremely hungry." According to Schachter's theory, deprivation condition should be unrelated to reports of hunger for the obese, whereas for the nonobese reports of hunger should be greatest in the deprived condition. On the days when Ss were fed sandwiches, there was also a sheet labelled "Sandwich Evaluation" which asked Ss to evaluate the taste of the sandwiches on a scale going from "Delicious" to "Terrible." Finally, there were four cracker rating sheets, one for each of the types of crackers. Ss were asked to write in the letter of the crackers at the top of the sheet as they did their ratings. This allowed them to go in any order they wished. The first 11 scales inquired about specific taste dimensions of the crackers. For example, one of them went from "Extremely sweet" to "Not at all sweet." After these 11 scales, the form said "The last four scales ask for your overall impressions of the taste of this cracker." The last four scales were of a bipolar form with opposites as the two ends of the scale, such as "delicious" and "terrible."

After the forms were given out, Ss were given some verbal rating instructions. For the first day, these were as follows:

On your table you will find six (seven) sheets of paper. The first one is a set of instructions on how to do your ratings. You should read this before you begin. The second one is the "Physical and Emotional State Index" which asks you how you are feeling at the present moment. (The third one asks you how well you liked the sandwiches.) The last four sheets are to be used for rating the four kinds of crackers in the containers in front of you. You are to use one of these sheets for each of the four types of crackers. It is very important that you put the letter of the cracker you are rating on the top of each sheet. Also, be sure to put your name on all of the sheets except for the "Instructions for Rating."
I have given each of you a cup of water. Please take at least a sip in between rating each of the different kinds of crackers. There are plenty of crackers so feel free to eat as many as you like. The important thing is to be sure to make your taste ratings as accurate as possible.

There will be some music playing during the 15 minutes you will have to do your ratings. If you finish early, please remain seated. I would like you to uncover all four containers of crackers now and leave the covers off until the end of the rating period. Any questions? Okay, I will leave you alone now to read the instructions and do your ratings.

On the second day, the instructions were essentially repeated with the insertion of the following two sentences:

It is very important that you do not let your last week's ratings affect how you rate the crackers today. Try to make today's ratings as independent as possible of those you made last time.

After giving these instructions, E closed the divider in the room and went behind the screen set up in one half the room. She turned on a tape recording of exactly 15 minutes of Henry Mancini orchestral pieces, just loud enough to muffle the sound of crunching crackers, but not so loud as to be disturbing to the Ss.

At the end of 15 minutes, E turned off the music and opened the room divider. If someone had not finished all the rating scales, he was allowed to do so. E noted in a separate record any crackers eaten by any Ss once the 15 minute period was up. Only those crackers eaten during the 15 minute rating period were included in the data analysis since the presence of an onlooker to eating could have differential

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White noise had been tried with and without earphones, but it made for a very artificial, unnatural eating situation. Music from a radio had worked quite well during a pilot study, so it was decided to use some standardized mood music for the study itself. The same music was played during the cracker rating period both times Ss were there.
effects on the obese and the nonobese. The obese would presumably limit their consumption more than the nonobese in these circumstances. Ss were also asked to check and make certain that they had put their names on all of the forms they had filled out.

If it was the first day of the experiment, Ss were then reminded of the next day and time they were due back, and were dismissed. If it was the second day of the experiment, Ss were asked to cover their cracker containers and then go into the half of the room without E's partition. The room divider was then closed. Ss sat so that they could not see what others were writing.

Post-Experimental Measures

Ss were asked to fill out three forms. They were given the first one separately from the other two. This first one said the following:

The way subjects behave in a psychological experiment is usually influenced by their theories as to what the experiment is about. Consequently, I would appreciate your telling me what you thought the actual purpose of this experiment was. This form was given to see if any Ss had correctly guessed that the experiment was concerned with the number of crackers people ate as a function of weight. Since no Ss noted this connection, no one was discarded on this basis.

Upon returning the first form to E, Ss were given a second form entitled "Factors Affecting Intake" (see Appendix E). This questionnaire informed Ss that E had been counting the number of each type of cracker Ss ate as an additional measure of S's liking of the crackers. The form asked a number of specific questions concerning factors
which might have been affecting Ss' intake—such as medication, weight-watching, self-consciousness, etc. This data was collected in the event that it might be used in post hoc analyses.

The last form Ss received was entitled "Personal Information" (see Appendix F). There were two essential pieces of data desired from this form. The first of these was whether people had a past history of overweight. When nonobese Ss indicated that they did, they were not retained for the analysis. The rationale for this has already been given.

The second piece of data obtained from this form was whether an S was a night-eater. The questions used to assess this were as

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5 A number of ways of finding out who were night-eaters had been considered. A seven page questionnaire was piloted which asked Ss to estimate the amount of food they ate at each meal and each snack during the day. It quickly became clear that trying to translate people's estimated amounts into caloric values would be very inaccurate. In addition, Beaudoin and Mayer (1953) have shown that when doing a self-report, paper and pencil measure "obese subjects have a tendency to minimize the frequency and size of the snacks taken after lunch throughout the rest of the day as well as the size of dinner" (p. 31). The possibility was then considered of training undergraduates to do dietary interviews with Ss. The problems with this were twofold. First a great deal of training would have been involved in order to make undergraduates into reliable interviewers. Secondly, according to Linda J. Bethel, Senior Dietitian of the Ambulatory Nutrition Services, Nutrition Clinic, Ohio State University Hospitals, people who were actually night-eaters often did not disclose this until a long time into a relationship with a dietitian. Consequently, she did not think that all the night-eaters would actually be identified during single interviews. The decision was made to do two things: (a) ask Ss in the present study a few simple, straightforward questions to see how many night-eaters could be identified this way (knowing some would not identify themselves), and (b) run a replication of the present study using people whom the Nutrition Clinic workers were certain were either night-eaters or non night-eaters, on the basis of extended contacts. Unfortunately, this replication was unable to be carried out because of the small number of night-eaters found to be Ss by the Nutrition Clinic.
follows:

1. Are there days when you are not hungry in the morning and have nothing more than maybe coffee and orange juice for breakfast? (check one)

   ____never  ____occasionally  ____frequently  ____always

2. Are there days when you eat or drink at least 25% of your total intake of calories in the evening after supper? (check one)

   ____never  ____occasionally  ____frequently  ____always

3. Are those days when you are not hungry in the morning usually the same ones when you eat or drink a great deal at night after supper? (check one)

   ____yes  ____no

IF YES: How often do you have such days? (check one)

   ____occasionally  ____frequently  ____always

Have the last few days been of this kind? (check one)

   ____yes  ____no

Do you usually have trouble getting to sleep on these same days? (check one)

   ____yes  ____no

The first two questions were used to create a set for the third question, the latter being used as the determining factor in deciding whether to consider a person a night-eater for purposes of this study. People were considered to be night-eaters if in response to question three they said "yes" to the first part, and then either "frequently" or "always" to the second part. This was the most direct set of questions which could be devised that reflected the major criteria given for night-eaters by Stunkard et al. (1955) who originally delineated the syndrome.
As soon as an S had finished all of the forms, he was taken individually to the other half of the room where E's screen was located. Behind the screen there was a weight-type scale where Ss' height and weight were taken with their shoes off. For one fourth of the Ss, an assistant took the heights and weights. All others were done by E. Ss were also asked their age. Then measures of the triceps skinfold were taken with Lange skinfold calipers. These measures were taken halfway between the shoulder and the elbow in the manner described by Mayer (1968):

The person making the measurement pinches up a full fold of skin and subcutaneous tissue with the thumb and forefinger of his left hand at a distance about 1 cm. from the site at which the calipers are to be placed, pulling the fold away from the underlying muscle. The fold is pinched up firmly and held while the measurement is being taken. The calipers are applied to the fold about 1 cm. below the fingers, so that the pressure on the fold at the point measured is exerted by the faces of the caliper and not by the fingers. The handle of the caliper is released to permit the full force of the caliper arm pressure; and the dial is read to the nearest 0.5 cm. Caliper application should be made at least twice for stable readings. (p. 31)

If the first two readings taken on a person were within one millimeter of each other just the two readings were considered sufficient. If the first two readings were not that close, a third reading was also taken. An S's skinfold measurement was considered to be the average of his readings.

Lastly, the Ss were asked if they wanted a letter describing the results of the experiment when it was finished. This letter was also to serve as a means for debriefing Ss about the actual nature of the experiment.
III. RESULTS

The basic procedure for testing the experimental questions was a 2 X 2 X 2 X 2 X 2 X 2 analysis of variance. (A summary table of this analysis of variance is given in Appendix G.) The six variables involved were weight of S (obese versus nonobese), sex of S (male versus female), time of day (morning versus evening), deprivation level (deprived versus nondeprived), taste condition (good versus bad), and order of deprivation conditions (deprived–nondeprived versus nondeprived–deprived). Analyses of variance were run with both the number and the weight of crackers eaten as the dependent variables. Results from the two analyses were so similar it was felt that the data from only one of them need be presented. Since there seemed to be a strong tendency for Ss to eat whole crackers rather than parts of crackers, it was decided to present the results on the number of crackers eaten.

The main effects will be presented first, then the first order

---

6 A third analysis of variance was also run with the number of crackers eaten as the dependent variable. This analysis excluded six Ss—three obese and three nonobese—who did not finish all of their cracker ratings within the 15 minutes allotted. The results of this analysis were almost identical to the analysis done on the number of crackers with all the Ss included. It was decided to use the analysis with all the Ss included to present the tests of the experimental hypotheses. Only the crackers eaten by the overtime Ss within the 15 minute rating period were included in the data analysis.
interactions, followed finally by the second order interactions. The main effect for deprivation was significant at \( p < .01 \) (\( F = 39.27, \) \( df = 1,101 \)). The mean number of crackers eaten in the deprived condition was 7.28 while that eaten in the nondeprived condition was 5.51. Taste was the second significant main effect (\( F = 217.47, \) \( df = 1,101, p < .01 \)). The mean number of crackers eaten in the good and bad conditions was 9.31 and 3.49, respectively. These data illustrate that the deprivation effect worked and the taste phenomenon occurred, lending validity to the methodology employed in the study. The final significant main effect was that of time (\( F = 15.55, \) \( df = 1,101, p < .01 \)). The consumption of crackers in the evening (\( M = 7.42 \)) was significantly greater than that in the morning (\( M = 5.40 \)).

In presenting the first and second order interactions, those which turned out to be significant will be presented first. This will be followed by those which turned out to be nonsignificant, but which are nevertheless critical for the present study.

There were four first order interactions which proved to be significant. The means in the various cells for these interactions are presented in Tables 2, 3, 4, and 5. One of these significant interactions was that of deprivation with taste (\( F = 15.31, df = 1,101, p < .01 \)) such that there was a greater difference in the number of crackers eaten in the nondeprived and deprived conditions for the good than for the bad crackers. A second significant interaction was that of taste with time (\( F = 7.30, df = 1,101, p < .01 \)) such that the difference in the number of crackers eaten in the morning as opposed to
### TABLE 2
#### CELL MEANS FOR DEPRIVATION BY TASTE INTERACTION

<table>
<thead>
<tr>
<th>Deprivation Condition</th>
<th>Taste Condition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Deprived</td>
<td>10.67</td>
<td>3.90</td>
</tr>
<tr>
<td>Nondeprived</td>
<td>7.95</td>
<td>3.08</td>
</tr>
</tbody>
</table>

### TABLE 3
#### CELL MEANS FOR TASTE BY TIME INTERACTION

<table>
<thead>
<tr>
<th>Taste Condition</th>
<th>Time Condition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A.M.</td>
<td>P.M.</td>
</tr>
<tr>
<td>Good</td>
<td>7.77</td>
<td>10.88</td>
</tr>
<tr>
<td>Bad</td>
<td>3.03</td>
<td>3.96</td>
</tr>
</tbody>
</table>
### TABLE 4
CELL MEANS FOR ORDER BY TIME INTERACTION

<table>
<thead>
<tr>
<th>Order Condition</th>
<th>Time Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A.M.</td>
</tr>
<tr>
<td>Deprived–Nondeprived</td>
<td>5.95</td>
</tr>
<tr>
<td>Nondeprived–Deprived</td>
<td>4.74</td>
</tr>
</tbody>
</table>

### TABLE 5
CELL MEANS FOR DEPRIVATION BY ORDER INTERACTION

<table>
<thead>
<tr>
<th>Deprivation Condition</th>
<th>Order Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deprived–Nondeprived</td>
</tr>
<tr>
<td>Deprived</td>
<td>6.81</td>
</tr>
<tr>
<td>Nondeprived</td>
<td>5.66</td>
</tr>
</tbody>
</table>
the evening was significantly greater for the good than for the bad crackers. The interaction of order with time ($F = 6.97$, $df = 1,101$, $p < .05$) was a third significant interaction. In this interaction, there was a significantly greater difference between the number of crackers eaten in the morning and the evening under the order non-deprived-deprived than under the order deprived-nondeprived. Fourthly, the interaction of deprivation with order ($F = 5.22$, $df = 1,101$, $p < .05$) was also significant. The difference in the number of crackers eaten in the deprived condition versus the nondeprived condition was significantly greater under the order nondeprived-deprived than under the order deprived-nondeprived.

Those first order interactions which were not significant but which are critical for the present study are those interactions which test the experimental questions. With regard to the first part of Experimental Question I, if obese Ss differ from nonobese Ss in terms of the relationship between crackers eaten and food deprivation, then the interaction of food deprivation and weight should be significant, as Schachter found in his studies. The interaction of food deprivation and weight was not significant in the present study ($F = 2.99$, $df = 1,101$, $p > .05$) so Schachter's findings were not replicated. Concerning the second part of Experimental Question I, based on Schachter's work, a significant interaction between weight and taste should occur, indicating that Ss differ in the pattern of their responses to taste depending on their weight. The present study did not find such a significant interaction ($F = .13$, $df = 1,101$, $p > .25$), again demonstrating a failure to replicate Schachter. If there is a
difference in obese and nonobese persons in the form of the relationship between the number of crackers they eat and the time of day, according to part of Experimental Question II, there should be a significant interaction between weight and time. This final interaction was not found to be significant \((F = 1.50, df = 1,101, p > .10)\). As was the case with Experimental Question I, in Experimental Question II weight was not found to interact significantly with other variables at the first order interaction level.

There was one second order interaction which was found to be significant. This was the three way interaction of deprivation, taste, and order \((F = 11.44, df = 1,101, p < .01)\). Under the order deprived-nondeprived, there was no difference in the number of crackers eaten on the deprived versus the nondeprived days as a function of taste condition. However, under the order nondeprived-deprived, there was a greater difference in the number of crackers eaten under the deprived as opposed to the nondeprived condition for the good tasting crackers than for the bad. The means involved in this three way interaction can be found in Table 6.

<table>
<thead>
<tr>
<th>Deprivation Condition</th>
<th>Deprived-Nondeprived</th>
<th>Nondeprived-Deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Deprived</td>
<td>9.60</td>
<td>4.01</td>
</tr>
<tr>
<td>Nondeprived</td>
<td>8.32</td>
<td>3.00</td>
</tr>
</tbody>
</table>
There were also four second order interactions which did not turn out to be significant, but which tested the experimental questions. According to Experimental Question I, if the hypothesis that the pattern of responses of males and females to food deprivation differs as a function of weight is correct, the interaction of sex, weight, and food deprivation should be significant. It was not (F = 2.51, df = 1,101, p > .10). The failure to find this interaction to be significant suggests that males and females do not differ in terms of the way they respond to these two variables. With respect to Experimental Question II, if it is true that the relationship between weight and taste in terms of the number of crackers eaten is different for males than for females, then the interaction of sex, weight, and taste should be significant. Since this study failed to find such a significant interaction (F = .36, df = 1,101, p > .25), it provides no evidence that sex is a differentiating factor in terms of the form of the relationship between weight and taste. In terms of both of these hypotheses which are part of Experimental Question I, then, weight was not found to interact significantly with any other variable at a second order level.

The second experimental question deals with the effect of time of day on S's behavior. If it is correct that obese and nonobese Ss differ in terms of the relationship between the number of crackers they eat and the time of day depending on their deprivation level, then the interaction of weight, time, and deprivation should be significant. Since it was not found to be significant (F = .09, df = 1,101, p > .25) there was no evidence that obese and nonobese Ss differ in
the pattern of their response to time and deprivation. A significant interaction among weight, time, and taste should occur if the hypothesis is correct that the form of the interaction between taste and time is different for obese and nonobese Ss. This three way interaction was not found to be significant \( (F = .82, \text{df} = 1,101, p > .25) \), suggesting that the obese and the nonobese do not differ in the way they respond to taste and time.

The last experimental question concerned night-eaters. If any part of Experimental Questions I or II had disclosed significant interactions then the effects of night-eaters versus non night-eaters on these interactions was going to be explored. Some after the fact analyses were done on night-eaters even though none of the interactions which were part of the experimental questions proved to be significant. It was wondered whether night-eaters were behaving significantly differently from non night-eaters in any way. There was a total of only 20 night-eaters. Consequently, some of the six variables were deleted from further analysis to avoid cells with zero entries. The variable of order was deleted for this reason alone. The variable of sex was deleted both because it was not a significant main effect in the six way analysis of variance and because there was no logical reason to expect it to interact meaningfully with night-eating. Thirdly, taste was deleted because eliminating it did not change the pattern of relationships of the remaining variables. Consequently, three way analyses of variance involving night-eating, deprivation, and time were done on obese and nonobese Ss separately. The one significant finding was a main effect of deprivation for obese Ss only \( (F = 11.54, \text{df} = 1,39, p < .001) \).
A further question at this point was whether night-eating and weight interacted to a significant degree. It was decided to do an analysis of variance including these two variables. A graphical presentation of the data suggested that weight, night-eating, and time might all interact meaningfully, so it was decided to do the further analysis on these three variables. However, nothing was found to be significant in this analysis of variance of weight, night-eating, and time.

The other primary dependent variable which was investigated in this study besides cracker consumption was Ss' hunger ratings. These were taken either immediately after the 15 minute preload in the non-deprived condition or immediately after the 2 minute waiting period in the deprived condition. A 2 X 2 X 2 X 2 X 2 analysis of variance was done with the same independent variables as in the six way analysis of variance for cracker ratings with the exception of taste which was omitted from the hunger rating analysis.

Fewer differences between treatment cells were apparent with hunger ratings than was the case with crackers. Only two effects were found to be significant in the analysis of hunger ratings. One of these was the main effect of deprivation ($F = 904.44, df = 1,101, p < .01$). On a scale with "1" equivalent to "extremely full" and "9" equivalent to "extremely hungry," while they were in the non-deprived condition Ss gave a mean rating of 2.42 while when in the deprived condition they gave a mean rating of 7.55. The other significant effect was a main effect for weight ($F = 7.96, df = 1,101$, $p < .01$).
Obese Ss' average hunger rating was 4.78 while nonobese Ss' average rating was 5.23. This indicates that obese Ss rated themselves as fuller than nonobese Ss overall.
IV. DISCUSSION

In this discussion, initial consideration will be given to the basic experimental questions. This will be followed by a discussion of those findings which were statistically significant.

Experimental Question I

Experimental Question I asked whether obese Ss are hypo-responsive to food deprivation and hyper-responsive to prominence of food cues, as compared to nonobese Ss, as Schachter et al. found for males in their studies. The experimental findings in the area of hypo-responsiveness to food deprivation conflict. Some researchers found what Schachter predicted—i.e., that the obese do not regulate their food intake in accordance with their level of food deprivation the way the nonobese do. Other researchers found that neither the obese nor the nonobese show responsiveness to level of food deprivation. Yet other investigators have found that both the obese and the nonobese regulate their intake in accordance with their level of food deprivation. The present study falls in this last category. In addition to the conflicting data, there are also conflicting theories which can be used in an attempt to explain one consistent set of experimental findings. For example, at least four alternative theories can be presented to explain Schachter's finding that the obese do not regulate their intake in accordance with their level of
food deprivation while nonobese Ss do.

This discussion of the area of hypo-responsiveness to food deprivation will commence with a statement of what the predicted outcome of the present study was. Then it will mention studies from the literature which supported the predicted outcome. Thirdly, Schachter's theoretical explanation of this outcome will be given, followed by three other equally plausible explanations of these findings. Next, the two other conflicting types of experimental findings will be discussed—i.e., those where neither the obese nor the nonobese were found to regulate their intake in terms of level of food deprivation, and those where both the obese and the nonobese were found to do so. Possible theories to explain some of this data will also be presented. Lastly, the results of the present study will be discussed.

The predicted outcome of this study, at least for the male Ss, was taken from the findings of Schachter that the nonobese are responsive to their level of food deprivation while the obese are not. Schachter et al. (1968) and Pliner (1970), both working with male Ss and solid foods, found this to be true.

There are a number of possible explanations of these data. Schachter's is that the obese are less sensitive to the physiological concomitants of food deprivation than the nonobese. However, even the behavior of the nonobese Ss in these experiments could be accounted for solely on a cognitive, rather than a physiological basis. Ss may have varied the amount they ate in accordance with their knowledge of their current need for food based on recent intake. Although obese
Ss would also have had access to such knowledge, they might have had more difficulty controlling their eating in terms of it because of the degree to which obese persons are attracted by food. The attractiveness of the test food presented to both deprived and nondeprived obese Ss may have caused them to eat the same amounts in spite of their cognitions concerning previous intake. This interpretation explains the eating data without reference to the issue of internal sensitivity for either the obese or the nonobese.

A second interpretation of this eating data allows for the possibility that the obese may have been equally as aware as the nonobese of the experience of hunger. Their discomfort may have been one of the stimuli which initiated obese Ss eating in the food deprived condition. However, the strong attractiveness of food to the obese may have served as an additional stimulus to their eating in the food deprived condition, and even have been strong enough by itself to stimulate as much food consumption in the nondeprived condition when it was the only stimulus to eating. This hypothesis demonstrates that the eating data can also be explained while positing that both the obese and the nonobese are equally responsive to the physiological concomitants of food deprivation.

One can form yet another feasible interpretation of the eating data by hypothesizing that even though the obese are aware of the physiological changes occurring with deprivation, they do not associate them with a desire for food, and consequently, do not eat in response to them. Such an interpretation still posits some degree of responsiveness to internal cues in the obese. The behavior of the
obese S in the experiment by Griggs and Stunkard (1964) lends support to this hypothesis. When the Es increased the S's awareness of his stomach contractions by a reinforcement procedure, there was no increase in his reports of hunger. He consistently reported hunger only 10% of the time in both the presence and absence of contractions. His increased sensitivity to his visceral sensations was still present a year later, but "the obese S felt that these changes had no effect upon his experience of hunger, his regulation of food intake, or his night-eating syndrome" (p. 87).

Now that Schachter's findings have been discussed, the group of studies in which neither the obese nor the nonobese showed responsiveness to level of food deprivation will be considered. One of these was a study done by one of Schachter's students—Nisbett (1968b) who found "the deprivation manipulation had virtually no effect on the amounts eaten by normal and overweight subjects" (p. 113). The author explained this unexpected finding by positing that the test food—ice cream—was too rich to make a good test of the deprivation hypothesis.

Another study in which neither the obese nor the nonobese were responsive to food deprivation level is a recent study by Price and Grinker (1972) whose design was very similar to the present one in that they used both sexes of Ss in a repeated measures design, but found the opposite of the present study in terms of the effects of level of deprivation on subsequent eating behavior. They found no effect of deprivation level for either obese or nonobese Ss. Another study which showed no effect of deprivation level was one done by
S. Wooley (1969). She found that all her Ss regulated their intake of test food sandwiches according to the apparent rather than the actual caloric value of her liquid preloads, i.e., Ss were insensitive to deprivation level.

Finally, O. W. Wooley, S. Wooley, and Dunham (1972) did a study which reflects a lack of sensitivity to food deprivation. One of their Ss' tasks was to identify at several intervals after a liquid meal whether they thought it had been high or low calorie. Ss' accuracy at this task was very poor.

The final area of research is that in which both the obese and the nonobese regulated their food intake in accordance with their level of deprivation. Pliner (1970) and Nisbett (1969) found this to be the case when they used liquid foods as a preload. O. W. Wooley (1971) found that both obese and nonobese Ss showed significant although incomplete caloric adjustment to liquid food of high and low calorie when it was the only available food for many days.

Pliner (1970) proposes a theory to explain these findings of regulation by the obese to liquid foods. She sees the obese and the nonobese as differing along a continuum of ability to discriminate between high and low calorie foods. The nonobese are higher on the continuum than the obese, i.e., they are better able to discriminate. Pliner sees foods as differing in the ease with which they are discriminated as being of high or low calorie. Solids are more difficult to discriminate than liquids. Consequently, the obese, who are poorer discriminators than the nonobese, have significantly more difficulty discriminating solids than they do liquids, as compared to
With regard to the present study, it was found that both the obese and the nonobese regulated their food intake according to their level of food deprivation. However, unlike the studies described in the preceding section, the present study did not use liquid foods as the preload or test food. Instead, both the preload and the test food were solids, although glasses of water were given to Ss with both the preload and the test food.

There are at least two possible explanations of these findings. One is that the obese are equally as sensitive as the nonobese to the physiological concomitants of food deprivation. There is some support from other sources besides eating studies for this explanation. Although Schachter found that his obese Ss almost never reported discomfort or hunger under conditions of food deprivation while his nonobese Ss did, there is other evidence which opposes this view. In the present study, both obese and nonobese Ss rated themselves as significantly more hungry in the food deprived condition ($p < .01$). Fellows (1931) found that at least "some" of the 294 physically healthy obese persons he was studying "complained of hunger and weakness" when they were put on a restricted diet. Swanson and Dinello (1970) found that physical sensations of hunger were reported for 48 to 72 hours in a group of 25 severely obese Ss who were put on a starvation diet. Glucksman, Hirsch, McCully, Barron, and Knittle (1968) found that during a starvation regimen there was "an increase in hunger symptoms" in six extremely obese persons. Certainly, Schachter's contention that the obese are totally unresponsive to the
internal changes accompanying food deprivation cannot be confirmed in the face of such contradictory data.

In addition, there is a recent study done on supermarket shopping behavior which can be interpreted as reflecting internal sensitivity in the obese. The Ss in this study were 40 obese women who were volunteers in a weight reduction program. Half of them did their grocery shopping between the hours of 3:30 and 5:00 p.m. while the other half did their shopping between 6:30 and 8:00 p.m., assuming they would have finished dinner by 6:30 p.m. Stuart (see Stuart and Davis, 1972, p. 79) found that the women who shopped in the late group bought 19.7% less than those who shopped in the early group. Then the groups were reversed, and women who were now shopping in the late group bought 15.7% less than those in the early group. This could be interpreted as support for the contention that the obese are sensitive to the physiological concomitants of food deprivation.

The second theory which could be formulated to explain the findings of the present study is that of cognitive regulation of food intake. The present study was presented to Ss as a study of the effects of hunger on taste. Consequently, Ss were alerted to the variable of hunger. This may have served to make them aware of the amount of food they were eating as a function of hunger level.

There is some data from the present study which mitigates against this cognitive hypothesis. At the end of the study, Ss were asked an open-ended question as to what they thought the actual purpose of the experiment was. Only a few verbalized the notion that they thought the amount of food they ate was being observed. It is possible,
however, that a differential response to the announced variable of hunger was occurring at a subconscious level.

It is interesting to note that in the study by Schachter et al. (1968) which was also presented as a taste study, obese Ss did not adjust their food intake appropriately to their level of deprivation. However, this study was not presented as one on the effects of hunger on taste, but rather as one on the effects of tactile stimulation on taste. Consequently, there was no reason for Ss to be focused on regulating their intake in this study, either consciously or unconsciously.

This concludes the discussion of the first part of Experimental Question I—i.e., the issue of hypo-responsiveness of the obese to level of food deprivation. The present study added to the confusion in an already conflicting body of research with its finding that both the obese and the nonobese regulated their food intake in accordance with their deprivation level. It could be the case that Schachter's results are valid and those of the present study invalid, or vice versa. A third and more likely possibility is that methodological differences such as type of food used, criteria for S selection, length of deprivation period, time of day of eating, etc. are causing the different results. Further research needs to be done controlling for more of these variables if some of the confusion in this area is to be alleviated. Further research would also help in selecting among the alternative explanations of some of the findings as, for example, for the present study.

The second part of Experimental Question I deals with whether or
not obese Ss are hyper-responsive to the prominence of food cues, as compared to nonobese Ss, as Schachter et al. found for males. The prominence of food cues was represented here by the variable of taste. The literature in this area is as conflicting as the literature on the question of the hypo-responsiveness of obese persons to food deprivation level. There is a fairly large body of literature which supports the hypothesis that the obese are more responsive to taste than the nonobese. Operationally, this generally means that the obese eat more good tasting and less bad tasting food than the nonobese. On the other hand, there is a smaller body of literature which supports the position that the obese and the nonobese do not differ significantly in terms of their degree of responsiveness to taste. They both eat more good tasting than bad tasting food. The present study falls within this latter group.

In discussing the question of hyper-responsiveness to food cue prominence, the studies which support the hypothesis that the obese are more responsive to taste than the nonobese will be presented first. This will be followed by the presentation of a theory which attempts to explain these findings. After this, the research supporting the position that the obese and the nonobese are the same in terms of their responsiveness to taste will be presented. The findings of the present study will be discussed last.

There is quite a number of studies which support the hypothesis that the obese are hyper-responsive to taste. For example, Schachter et al. (1968), Nisbett (1966, 1968a), and Johnson and Wunderlich (1970) all found that the obese ate more good tasting sandwiches than
Nisbett (1966) and Nisbett (in press) found that overweight Ss ate more good tasting ice cream and cake, respectively, than did other Ss. When the ice cream and cake were very bad tasting, however, all Ss ate approximately the same amounts. When Decke (1971) did a similar experiment with a moderately good tasting milkshake as the good food and a moderately bad tasting milkshake as the bad food, she found her obese Ss drank somewhat more good and considerably less bad milkshake than the nonobese Ss.

Working with infants, Nisbett and Gurwitz (1970) found that the heaviest babies were the more responsive to a sweetened formula. Also, female infants were significantly more responsive to the sweetened formula than were male infants.

In Price and Grinker's study (1972) which was very similar to the present study in design, they found a significant interaction between body weight and Ss' preference for crackers when they analyzed their data by weight of crackers consumed. When they analyzed their data by number of crackers consumed, they did not find this interaction to be significant. Schachter et al. (1968), who also used crackers as their test food, found that obese Ss ate significantly more crackers they rated as good than they did ones they rated as bad, whereas this was not found to be the case for the nonobese.

A couple of studies dealt with responses to bad tasting food only. Hashim and Van Itallie (1965) found that obese persons dropped their intake of a bland liquid diet food to 500 calories per day while nonobese persons maintained their caloric intake at their usual level. Goldman et al. (1968) found that a higher percentage of obese fresh-
men dropped their meal contracts at the university than did nonobese freshmen, presumably because the dormitory food was bad tasting.

In an excellent, thoughtful article, Nisbett (1972) presents a theory to explain these findings of the hyper-responsiveness of obese persons to the taste of food. He introduces the idea that the obese are biologically programmed to be fat. They have a particular "set point" which represents their natural level of excess adipose tissue. If their weight is below this set point they are in a state of food deprivation and are hungry. Because of societal pressure to be thin, most obese persons are probably chronically below set point and, therefore, are chronically hungry. This explains why they are generally found to be more taste responsive than the nonobese. It is because one of the characteristics of the hungry organism is hyper-responsiveness to the taste of food (Nisbett, 1972).

Attention will now be given to those studies in which the obese and the nonobese did not differ in their responsiveness to the variable of taste. First of all, in contrast to some studies mentioned earlier, Wooley (1969) and the present study both found no differences in the amount of good tasting sandwiches eaten by obese and nonobese Ss. The obese Ss were not more hyper-responsive to the good tasting food as had been found in the other studies. Both Wooley (1969) and the present study did find that males ate significantly more sandwiches than females.

McKenna (1972) found no interaction between body weight and taste in a study using one good tasting and one bad tasting cookie as the test foods. He analyzed his results by the weight rather than
by the number of cookies eaten. He did find a significant main effect for taste, with all Ss eating more good than bad tasting cookies.

Price and Grinker (1972) found no interaction between body weight and Ss' taste preference when they analyzed their data by number of crackers eaten, although they did find this interaction to be significant when they analyzed their data by weight of crackers eaten. Price and Grinker also found a significant main effect for Ss' taste preference, with Ss eating more of those crackers they liked than of those they disliked.

The present study also did not find a significant interaction between body weight and objective taste when the data were analyzed by either the weight or the number of crackers eaten. However, both the analyses by number and weight found a significant main effect for objective taste, with Ss eating more good than bad tasting crackers.

Further data analysis was done with Ss' subjective ratings of taste rather than the E's designation of good and bad (previously referred to as "objective" taste). First, the difference in consumption of those crackers Ss rated as "good" (rating of 1-4) versus those crackers Ss rated as "bad" (rating of 6-9) was analyzed. Schachter et al. (1968) had found in their study that there was a significant difference between these for their obese Ss while this was not the case for their nonobese Ss. In the present study, all the differences for all the groups of Ss investigated were significant at p < .001. For obese Ss, the average consumption of good crackers was 19.58 (s = 10.59) and the average consumption of bad crackers was 5.02 (s = 3.12). For nonobese Ss, the average consumption of good crackers
was 18.99 ($\sigma = 9.30$) and the average consumption of bad crackers was 4.64 ($\sigma = 2.96$). Consequently, these differences seem quite pronounced and significant.

The second analysis on Ss' subjective ratings was the correlation between the number of crackers eaten and the Ss' rating of taste. If the obese are hyper-responsive to taste, one might expect a higher correlation between the number of crackers eaten and the Ss' rating of taste for the obese than for the nonobese. This was not found to be the case, either for females alone, males alone, or both sexes together.

It is interesting to conjecture why the present study may have turned out differently from most of the literature in the area. One possible reason relates back to Nisbett's (1972) article in which he presented the notion that the obese have a fairly high set point for excess adipose tissue. It is only if obese people are below their set point that they would be expected to be hyper-responsive to the taste of food. In the present study, the obese Ss were quite obese, and may have generally been at or above their set points. Obese females, for example, weighed an average of 36.3 pounds above the 75th percentile of the weight distribution for females. Obese males weighed an average of 35.6 pounds above the 75th percentile of the weight distribution for males. These Ss, then, may have been too near their set points to show the hyper-responsiveness to the taste of food characteristic of the hungry organism.

This concludes the discussion of the question of the hyperresponsivity of obese persons to the prominence of food cues. The
present study did not find such a hyper-responsiveness to exist in the obese, although much literature in the past has found it. One reason for this may be that the Ss in the present study may all have been at or above their set point for weight. Other reasons for differences in the studies may have been partly methodological in origin, for example, the differences caused by repeated versus non-repeated measures designs, and the differences created by presenting good and bad tasting test foods simultaneously rather than singly. Other factors which may have been causing the different results were also discussed under the question of hypo-responsiveness to food deprivation in the obese and include such things as the particular foods used, the criteria for S selection, the length of the deprivation period, and the time of day of eating. It is this writer's opinion that the differences in the results obtained between Schachter's studies and the present study are due to some of these reasons, and not to the possibility that any of the studies are methodologically deficient.

Before leaving Experimental Question I, something should be said about the findings for the two sexes since this issue was an important part of Question I. There were no differences in the behavior of the two sexes of Ss either in the area of hypo-responsiveness to food deprivation or in the area of hyper-responsiveness to the prominence of food cues. This means that obese females were not hypo-responsive to food deprivation nor were they hyper-responsive to taste. These results are what would have been expected from the research by Dorris and Stunkard (1957), Decke, Gold, and Porikos (see Rodin et al., 1972)
and Stuart (see Stuart and Davis, 1972) discussed earlier in this paper. However, they contradict the implications of the Air France study (Goldman et al., 1968) and the findings of Nisbett and Gurwitz (1970) on female infants. One of the few things this finding reveals is that whatever caused the surprising finding of a lack of hypo-responsiveness to food deprivation and a lack of hyper-responsiveness to taste for obese males in the present study did not have a differential effect upon females.

Experimental Question II

Experimental Question II deals with the relationship between the time of the day and the intake of crackers by obese and nonobese Ss. Specifically, the question asked if (a) the total intake of the obese, and/or (b) their responsiveness to food deprivation, and/or (c) their responsiveness to prominence of food cues varied more with the time of day than was true for the nonobese. The answers to all three parts of this question are negative.

In terms of the total intake of the Ss (the first part of the question), although there was not a significant interaction of time and weight, there was a significant main effect for time, with Ss eating more crackers in the evening than in the morning. This finding contradicts what Schachter would have predicted for obese Ss. Schachter and Gross (1968) found that while both obese and nonobese Ss ate dinner almost all of the time, the obese were significantly more likely to skip breakfast than the nonobese. They attributed this to the relative lack of external cues to eating at breakfast time.
and to the presence of numerous alternative behaviors to eating breakfast such as sleeping or getting dressed. In the present study, the external cues were identical at the morning and evening eating times. Consequently, if Schachter's theory is correct that for the obese external cues determine eating, obese Ss should have eaten identical amounts of food in the morning and the evening experimental sessions. They did not. This indicates that something other than external cues is affecting the differing eating behavior of the obese in the morning and the evening.

What are some of the things which could be causing obese and nonobese Ss both to eat significantly less in the morning than in the evening? (Further evidence that the nonobese are also behaving this way comes from Schachter and Gross (1968) who found that while nonobese Ss ate dinner 85% of the time they ate breakfast only 56% of the time.) One of the things could be cultural conditioning. Our culture may place a stronger emphasis on eating dinner than on eating breakfast. Another possibility is physiology. Perhaps the period during which we are waking up in the morning is not one in which we are predisposed to eat. It is possible, of course, that the causes of the pattern of low morning intake and high evening intake are different in the obese and the nonobese.

The second part of Experimental Question II dealt with the question of whether the obese and the nonobese differed with respect to the relationship between the number of crackers they ate and the time of day, depending on their deprivation level. Not only was the three way interaction of time, weight, and deprivation not significant,
neither was the interaction of time and deprivation. Consequently, there is little for discussion in this part of the question.

The third part of Experimental Question II dealt with whether or not the obese and the nonobese differed with respect to the relationship between the number of crackers they ate and the time of day, depending on taste. Although the three way interaction of taste, time, and weight was not significant, the two way interaction of taste and time was. Significantly (p < .001) more good crackers were eaten in the evening than in the morning, while a uniformly low number of bad crackers were eaten at both times of day. This finding is open to at least two interpretations. One of these is that people may tend to eat more of most kinds of food at night, perhaps for cultural reasons. Price and Grinker (1972) made a finding similar to this when they compared the food intake of Ss in the afternoon and the evening. Their evening Ss ate more, as was found in the present study. The second possible interpretation is that Ss' responsiveness to taste increases in the evening, causing them to eat more good tasting food then. (Their intake of bad crackers should also decrease if this is the case, but it was already at a very low level leaving little room for a decrease.) Price and Grinker (1972) found in their study that when they analyzed their results by weight of crackers eaten that such an increase in taste responsiveness did occur in the evening as compared to the afternoon. Deciding between the two alternative hypotheses is not possible without further information.

None of the Experimental Question II hypotheses about possible differences between the obese and the nonobese with regard to the issue
of time of day was borne out. Also, Schachter's theory that external cues are the sole determinants of eating behavior in the obese was contradicted in the fact that obese Ss given identical external cues to eating in the morning and the evening ate more in the evening.

**Experimental Question III**

Experimental Question III dealt with night-eaters. In discussing night-eaters, the findings relating directly to Experimental Question III will be discussed first. Then some post hoc analyses and other findings concerning night-eaters will be discussed.

Experimental Question III asked "If any of the differences in the behavior of the obese and the nonobese proposed in Questions I and II are found to be significant (i.e., the two groups respond differently to food deprivation, food cue prominence and/or time of day), could night-eaters alone be seen to account for these differences?"

None of the differences in the behavior of obese and nonobese Ss proposed in Questions I and II were found to be significant. Consequently, no analyses concerning night-eaters were done for Question III.

However, some post hoc analyses were done to see if night-eaters differed from non night-eaters in any systematic way. The particular post hoc analyses chosen to be done were selected partly on the basis of whether or not they looked like they might be significant based on some graphical presentations of the data. Three analyses of variance were selected to be done partly in this way. They included a three way analysis of the interaction of weight, night-eating, and time for all Ss; a three way analysis of the interaction of time, night-eating,
and deprivation for obese Ss only; and a three way analysis of the interaction of time, night-eating, and deprivation for nonobese Ss only. Only one thing proved to be significant in these three analyses. That was the effect of deprivation in the analysis done on obese Ss only. However, if these interactions had been explored in other studies where the number of night-eaters was greater it would have been a better test of the significance of these trends.

One of the questions proposed in the Introduction concerning night-eaters was whether their sensitivity to external food cues varies with the time of day. It was suggested that perhaps night-eaters' sensitivity to external food cues increases as the day goes on, accounting for their greater food intake at night. This question would entail looking at the three way interaction of time, taste, and night-eating. However, it did not appear from the graphical presentations of the data as though this would be a significant interaction. Consequently, an analysis of variance was not done on this three way interaction. It does not appear as though the external responsiveness of night-eaters increases from morning to evening.

One of the graphs revealed some interesting trends in the data concerning the intake of obese night-eaters at different times of the day. As Figure 2 shows, obese night-eaters tended to increase their intake proportionally less at night as compared to their morning intake than obese non night-eaters did ($F = .548$, $df = 1,20$, $p > .25$). In addition, within the conditions deprived and nondeprived, the obese night-eating Ss ate less crackers at night than the obese non night-eating Ss. This is in direct contradiction of what constitutes
Fig. 2. Mean number of crackers eaten as a function of time, deprivation level, and night-eating condition for obese Ss.
an essential part of the definition of a night-eater, i.e., that he eats excessively at night as compared to those who are not night-eaters.

The data suggests, at the least, that the obese night-eaters in this study were not eating excessively at night. Perhaps this was due to the fact of being in the experiment. The unique setting may have caused Ss to eat differently than they would normally have eaten at home. Another possible explanation of this finding is that the paper and pencil method of identifying night-eaters used in the present study was not an effective way to identify actual night-eaters. There is no available data to aid in the selection of one or the other of these alternative explanations of the findings.

It is interesting to compare the incidence of the night-eating syndrome in this study with that found by Stunkard in some of his studies. In one of his studies, Stunkard (1959a) used a questionnaire to assess the eating and sleeping habits of his Ss. This is similar to the procedure used in the present study, making it reasonable to compare the results of these two investigations. Stunkard's Ss were 100 obese patients who were seen consecutively in the general nutrition clinic of a hospital. Of these, 12 were identified as night-eaters. In the present study, 12 out of the 64 obese Ss were identified as night-eaters. The chi square comparing these two groups is 1.423 (df = 1, p > .20). It is apparent that while there was some difference, the two studies did not differ significantly in the incidence of night-eaters in their obese populations.

The situation is a little different for the incidence of night-
eating in the nonobese population. Stunkard asserted that the night-eating syndrome occurs exclusively in obese persons. He investigated 38 nonobese females looking for the syndrome (Stunkard et al., 1955). None of the women manifested it, so he concluded it appeared only in the obese. However, in the present study, 3 out of 27 nonobese females were identified as manifesting the syndrome. The chi square for comparing the two groups is 4.427 (df = 1, p < .05). In the present study, then, there was a significant number of nonobese female night-eaters compared to the zero incidence of the syndrome in Stunkard's nonobese female group.

This finding of the presence of the syndrome in a nonobese population would presumably be somewhat distressing to Stunkard who has defined the syndrome as occurring exclusively in the obese. He might object to the particular questions used in the questionnaire in the present study as not being adequate or appropriate to detect the syndrome.

In selecting night-eaters in the present study, it is true that one of Stunkard's criteria was not utilized in identifying night-eaters. This was the criterion that Ss have difficulty getting to sleep when they were in a night-eating phase. In the present study, 37% of the obese night-eaters answered "yes" to the question "Do you usually have trouble getting to sleep on these same [i.e., night-eating] days?" For nonobese night-eaters the comparable percentage was 28%. Consequently, even for obese night-eaters in the present study the percentage who had difficulty going to sleep was low compared to the 90% who had such difficulty in the study by Stunkard.
et al. (1955) in which the syndrome was originally delineated. However, in that study, Stunkard et al. referred to not meeting the sleep criterion as a "minor variation" in the syndrome and still considered the people who did not meet this criterion to be night-eaters. That is why it was not considered to be an essential criterion in the present study. Since Stunkard himself did not consider it to be a crucial criterion, he could not assert that the reason the present study found some nonobese female night-eaters was because the present investigator did not include the criterion of difficulty in going to sleep as part of the definition of the syndrome.

This concludes the discussion concerning night-eaters. No analyses were ever done on Experimental Question III because neither Experimental Questions I or II produced any significant results. However, three post hoc analyses were done on night-eaters. These included a three way analysis of the interaction of weight, night-eating, and time for all Ss, and two three way analyses of the interaction of time, night-eating, and deprivation—one for obese and one for nonobese Ss. From graphical presentations of the data, it did not appear as though the external responsiveness of night-eaters increased as the day progressed. The interesting observation was made that the obese night-eaters in the present study were not eating excessively at night as compared to the obese non night-eaters. Finally, some comments were made on the incidence of the night-eating syndrome in the obese and the nonobese populations.

Statistically Significant Results
In looking at the main effects for deprivation and taste, as well as the first and second order interactions involving these two variables, it would be useful to look at Figure 3. This represents the deprivation by taste interactions at the two different orders. It is apparent that the deprivation by taste interaction occurred only under the order nondeprived-deprived. Under this order, there was a much larger difference between the number of good crackers consumed under the deprived and nondeprived conditions than was true for bad crackers under the two deprivation conditions. In terms of the deprivation by order interaction, it is apparent that there was a much larger difference between the number of good crackers eaten in the deprived versus the nondeprived conditions under the order nondeprived-deprived than under the order deprived-nondeprived. For bad crackers, there was very little difference for the two orders in the number of crackers eaten under the two deprivation levels.

This leads to an interesting observation about bad crackers. The consumption of bad crackers does not appear to be highly influenced by any of the other variables in the study. Ss tended to eat a uniformly small number of these crackers regardless of the experimental conditions.

In considering the three way interaction of deprivation, taste, and order, one explanatory hypothesis is available which is supported by some outside evidence. It will be noted from looking at Figure 3 that the mean number of good crackers eaten on the deprived day under the order deprived-nondeprived was 9.60. By contrast, the average consumption of good crackers on the deprived day under the order
Fig. 3. Mean number of crackers eaten as a function of taste and deprivation level at the two orders of deprivation conditions.
nondeprived-deprived was 11.71. This difference could be due to a suppression of cracker eating on the first day of the experiment due to uneasiness in the experimental situation. The outside evidence which supports this explanatory hypothesis comes from some of the post-experimental forms which Ss filled out. In explaining what factors had affected their intake on both experimental days, a few mentioned the fact that they ate more the second day because they felt more at ease in the experimental situation then.

An inspection of Figure 3 also allows us to make some comments about the main effects of deprivation and taste. It is apparent that deprived Ss ate more crackers than nondeprived Ss in all conditions. However, deprivation had the biggest effect for good crackers under the nondeprived-deprived order. In terms of taste, Ss ate fewer bad than good crackers under all conditions. The most pronounced difference in the consumption of good and bad crackers occurred in the deprivation condition for those Ss in the order nondeprived-deprived.

Figure 4 presents the interaction of taste with time and Figure 5 presents the interaction of order with time. Figure 4 suggests that for bad crackers the variable of time had no significant effect. It is apparent that a uniformly low number of bad crackers were eaten regardless of the experimental condition. By contrast, significantly more good crackers were eaten in the evening than in the morning (p < .001). The implications of this finding have already been discussed in detail in the first part of the Discussion section. Suffice it to say here that two possible explanations were given for this finding. One was the possibility that people may eat
Fig. 4. Mean number of crackers eaten as a function of taste and time.
more of most kinds of food at night, including good tasting crackers. The significant main effect for time supports this hypothesis. The other possible explanation was that people's responsiveness to taste may increase in the evening, causing them to eat more good tasting food then. More research would need to be done to determine whether one or both of these hypotheses is correct.

Figure 5 presents the relationship between order and time. As the graph suggests, there was no significant difference in cracker consumption in the morning and the evening under the order deprived-nondeprived. However, a significant difference occurred under the order nondeprived-deprived (p < .05).

Finally, there is the main effect for time. It is clear from Figures 4 and 5 that more crackers were eaten in the evening than in the morning under all experimental conditions. The greatest difference in the consumption of crackers in the morning and the evening occurred for good crackers (p < .001) and occurred under the order nondeprived-deprived (p < .05).

Summary

On the basis of research on obesity by Stanley Schachter and Albert Stunkard, three questions were formulated for investigation in the present study. The first of these was whether, in comparison to the nonobese, obese males and females are hypo-responsive to food deprivation and hyper-responsive to the prominence of food cues, as Schachter found for males in his studies. The second question was whether (a) the total intake of the obese, and/or (b) their respon-
Fig. 5. Mean number of crackers eaten as a function of time and order of deprivation conditions.
siveness to food deprivation, and/or (c) their responsiveness to prominence of food cues varies more with the time of day than is true for the nonobese. The third question asked whether if any of the differences in the behavior of the obese and the nonobese proposed in the first two questions were found to be significant, could night-eaters alone be seen to account for these differences. An experimental procedure was established to test these questions. The present study did not support any of the hypotheses derived from Schachter's work. There are several ways to interpret this finding. One is that Schachter's research is somehow invalid, and the findings of the present study valid. Another is that the present study is somehow invalid, and that Schachter's results are valid. A third possibility (and the one subscribed to by this writer) is that the results of the two studies differed because of methodological differences such as the criteria for S selection, the particular foods used, or the time of day the studies were run. This possibility would suggest that there are no "valid" or "invalid" overall results in this area of investigation, but rather that the results in any study are determined by the particular independent and dependent variables of that study. If this is so, additional research is needed to determine exactly what differences in independent and dependent variables account for what differences in results.
APPENDIX A

TELEPHONE SPEECH
"Hello, my name is _________________. I am calling to see if you would be interested in participating in a study which would fulfill three of the four hours which you are required to be a subject in experiments for Psychology 100. The purpose of this study is to investigate the effects of hunger on your sense of taste. You would be asked to rate how certain foods tasted to you on two different occasions, either one or two weeks apart. Do you think you might be interested in being a subject?"

**If yes:** "Okay. Let me tell you a little more about the study. Because the purpose of the study is to observe the effects of hunger on taste, you would have to skip the meal before you came to the study each of the two times. For example, if your experimental sessions were in the morning, you would have to skip breakfast. If they were in the evening, you would have to skip dinner and not eat any snacks in the afternoon. You will, of course, be eating at the experiment. This requirement of skipping meals before sessions is ESSENTIAL. Do you think you could meet this requirement?"

**If yes:** "Let me tell you about the time requirements for the study. The first time you came you would be through in less than an hour. The second time, however, it would take a full hour, and perhaps even a little over an hour. At the end of the second session you would be given three hours of experimental credit. As we talk about possible times you could come, remember that the second session will take at least one whole hour. Why don't you get your class schedule and a piece of paper and a pencil and we'll see when you could come."
We will be running subjects starting Monday, October 16 and ending Monday, November 13. We will schedule you so you come on the same day of the week at the same hour twice, either one or two weeks apart. You have a choice of 20 running times. The study will be run Mondays, Tuesdays, Wednesdays, Thursdays, and Fridays at 9:00 and 11:00 A.M., and 6:30 and 8:00 P.M. in the Stadium. I would like to know all of the days and hours that you would be free to come. Will you be free at the times you have given all during the period from October 16 to November 13? Are you certain you don't have any special appointments or commitments which would make it impossible for you to come on any one particular date during this period?

We will send you a letter telling you exactly where to come and when you have been scheduled for the experiment. I need your local mailing address for this. In addition to sending you a letter, we will post the running schedule on the bulletin boards for Psychology 100 experiments on the second floor of Arps Hall and on the West Campus outside of Room 485, Bevis Hall. Please find your name and put your signature next to it on one of these two lists. It is important that you do this so we will know you are aware of when to come.

You should write down the following information. The experiment number is PS-1. The experimenter's name is Pat Baker. The telephone number where you can leave messages regarding the experiment during the day is 422-6649. If you drop Psychology 100 or cannot attend the experiment at your scheduled time for some reason, please call that number and leave a message.
Do you have any questions?"
APPENDIX B

LETTER TO Ss
TO: _________________________________
FROM: Pat Baker

INFORMATION ON EXPERIMENT PS-1

We called you early in the quarter and talked to you about Experiment PS-1 which will fulfill three of the four hours which you are required to be a subject in experiments for Psychology 100. This letter tells you exactly when and where to come for the experiment.

TIMES:

You have been scheduled for two sessions. The first one will probably take less than an hour, and the second one will take at least one full hour and maybe a little more. You are to come at the following times:

First time: ____________________________
Second time: __________________________

DEPRIVATION REQUIREMENT:

MORNING SESSIONS: If your experimental sessions are at 9:00 or 11:00 A.M., you must remember to skip breakfast. Do not eat anything before you come to your sessions. (You may have coffee or tea.)

EVENING SESSIONS: If your experimental sessions are at 6:30 or 8:00 P.M., you must not eat anything after 1:00 P.M. on the days you come. Do not have any dinner or any snacks after lunchtime.

REMEMBER: The deprivation requirement is ESSENTIAL to the study. Please be sure to follow it.
LOCATION:

Enter the door marked 404-B which is on the East side of the stadium at Gate 20. Use the stairs or the elevator immediately inside the door to go up one floor. Go through the door on the first floor landing into the building. Immediately on your left you will see a door which says "Behavioral Sciences Laboratory". Go through it and be seated in one of the chairs you will see there. You will be called when we are ready for you. We will have signs posted for PS-1 telling you where to go so you should not have any trouble finding us.

SIGN A LIST:

By the time you receive this letter, there should be two schedules for PS-1 posted. Your name and the days and hours you are to come will be on them. One of these lists will be on the bulletin board for Psychology 100 experiments on the second floor of Arps Hall. The other one will be in the hall next to Room 485 of Bevis Hall on West Campus. Please find your name on one of these two lists and sign your name next to it. That way we will know you received your letter and know when to come.

PROBLEM PHONE:

If your schedule has changed or if you have dropped Psychology 100 by the time you receive this letter, please call immediately and leave a message explaining the situation. This will give us a chance to either try to re-schedule you or put someone else in your place.
PHONE NUMBER: 422-6649 — Leave a message for Pat Baker

SUMMARY:

Here is a summary of what you are supposed to do for PS-1:

(1) Sign one of the two scheduling lists.

(2) Come to the experiment as scheduled following the deprivation requirement.

(3) Call 422-6649 and leave a message for Pat Baker if you have any problems.

See you at the experiment!

Pat Baker
APPENDIX C

S RECORD SHEET
BAKER--SUBJECT RECORD SHEET

Name: ___________________________ Study: 1 2
Seat: 1 2 3 4 Day: M T W TH F
Sex: M F Date: _______________________
Class. 1: O N Time: 9 11 6:30 8
Class. 2: O N Condition: Dep Ndep

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DEPRIVATION REQUIREMENTS:

Last time eaten?
What eaten?

COMMENTS:
APPENDIX D

INSTRUCTIONS FOR RATING AND RATING FORMS
INSTRUCTIONS FOR RATING

First, you will be rating yourself on a number of scales which ask about your current physical and emotional state. After you complete this Physical and Emotional State Index, you will be filling out four sets of rating scales to evaluate the taste of four kinds of crackers.

Here is how you are to use the rating scales:

If you feel the object you are rating (which will be either yourself or one of the kinds of crackers) is extremely similar to one or the other end of a scale you should place your check-mark as follows:

delicious X::___:___:___:___:___:___:___:___:___:___:terrible

or

delicious___:___:___:___:___:___:___:___:___:___:___:X:terrible

If you feel that the object is quite similar to one or the other end of a scale (but not extremely), you should place your check-mark as follows:

delicious___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:terrible

or

delicious___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:X:terrible

If you feel that the object is somewhat similar to one or the other end of a scale, you should place your check-mark as follows:

delicious___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:terrible

or

delicious___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:___:X:terrible
If the object seems only slightly similar to one side as opposed to the other side, then you should check as follows:

\[ \text{delicious} \quad \_ : \_ : X \quad _ \_ \quad \text{terrible} \]

or

\[ \text{delicious} \quad _ : _ : _ : X \quad _ : _ : \text{terrible} \]

The direction toward which you check, of course, depends upon which of the two ends of the scale seems most characteristic of the object you are judging. If you consider the object to be in the middle with respect to the ends of a scale, then place your check-mark in the middle space.

**IMPORTANT:**

1. Place your check-mark in the middle of spaces, not on the boundaries.
2. Be sure you put a check-mark on every scale.
3. Never put more than one check-mark on a single scale.

Now go ahead and fill out the Physical and Emotional State Index. When you have finished with it, go on and rate the crackers. Fill out the whole page of rating scales for the first cracker, and then proceed to the second cracker, using a new page of rating scales, and so on.
SANDWICH EVALUATION

1. On the following nine-point scale, please evaluate the taste of the ham sandwiches if you ate some.

   delicious____:____:____:____:____:____:____:____:____terrible

2. On the following nine-point scale, please evaluate the taste of the roast beef sandwiches if you ate some.

   delicious____:____:____:____:____:____:____:____:____terrible
PHYSICAL AND EMOTIONAL STATE INDEX

Indicate how you feel at the present time by placing an "X" in the appropriate space on each of the following scales.

Extremely tired:___:___:___:___:___:___:___:___:___:Not at all tired

Extremely anxious:___:___:___:___:___:___:___:___:___:Not at all anxious

Extremely full:___:___:___:___:___:___:___:___:___:Extremely hungry

Extremely hot:___:___:___:___:___:___:___:___:___:Extremely cold

Very physically uncomfortable:___:___:___:___:___:___:___:___:___:Very physically comfortable
Please indicate how this cracker tastes to you by placing an "X" in the appropriate space on each of the following scales:

Extremely sweet:____:____:____:____:____:____:____:____:Not at all sweet
Extremely spicy:____:____:____:____:____:____:____:____:Not at all spicy
Extremely salty:____:____:____:____:____:____:____:____:Not at all salty
Extremely sour:____:____:____:____:____:____:____:____:Not at all sour
Extremely tangy:____:____:____:____:____:____:____:____:Not at all tangy
Extremely cheese-flavored:____:____:____:____:____:____:____:____:Not at all cheese-flavored
Extremely nut-flavored:____:____:____:____:____:____:____:____:Not at all nut-flavored
Extremely garlic-flavored:____:____:____:____:____:____:____:____:Not at all garlic-flavored
Extremely corn-flavored:____:____:____:____:____:____:____:____:Not at all corn-flavored
Extremely onion-flavored:____:____:____:____:____:____:____:____:Not at all onion-flavored
Extremely wheat-flavored:____:____:____:____:____:____:____:____:Not at all wheat-flavored
The last four scales ask for your overall impressions of the taste of this cracker.

Delicious: ___:___:___:___:___:___:___ Terrible

Extremely strong: ___:___:___:___:___:___:___ Extremely weak
(Bland)

Strong aftertaste: ___:___:___:___:___:___:___ No aftertaste

Extremely "different" tasting: ___:___:___:___:___:___:___ Not at all "different" tasting
APPENDIX E

FACTORS AFFECTING INTAKE QUESTIONNAIRE
Another way to find out what people think about the taste of a food besides asking them is to observe how much of it they eat. Consequently, I noted how many of each type of cracker you ate each time you were here. However, it is apparent that factors other than how good you think a food tastes may affect how much you eat of it. Accordingly, I would appreciate your answering the following questions which ask about factors besides taste which may have affected your intake of crackers (i.e., factors which either increased or decreased what your intake would otherwise have been).

1. On either of the days you participated in this experiment did you purposely limit the number of crackers you ate so as not to spoil a meal you were planning to eat after the experiment? If yes, on which day did this happen? How much was your intake of crackers affected? (check one)
   
   _____ very little     _____ medium     _____ a lot

2. Was your eating in this experiment affected by a desire to watch your weight? If yes, how did this affect your intake of crackers?

3. Are you on any medication which might have affected your food intake?
If yes, what is the medication?
How did it affect your eating in the experiment?

4. Were you self-conscious about the amount of food you were eating during the experiment?
   If yes, how did this affect your intake of crackers?

5. Could you hear other people eating their crackers?
   If yes, how did this affect your intake of crackers?

6. Did you have any physical discomfort which affected your appetite or food intake on the two days you participated in the experiment?
   If yes, please explain which day(s) it occurred, what it was, and how it affected your intake of crackers.

7. Do you consider crackers to be an appropriate food to eat at the time of day you were eating them in the experiment?
   If no, how did this affect your intake of crackers?

8. Please indicate on the following scale how much you like crackers as a food.
   hate crackers____:____:____:____:____:____:____:____:love crackers
9. Were there any other factors besides those mentioned here which affected your intake of crackers?
   If yes, what were these factors and how did they affect your intake?

10. Was your intake of sandwiches affected by any of the above factors?
    If yes, please explain.
APPENDIX F

PERSONAL INFORMATION QUESTIONNAIRE
A person's taste sensitivity is related to a number of other personal characteristics. As I am interested in investigating some of these relationships, I would appreciate your responding as accurately and honestly as possible to the questions below. Your answers will be held in confidence by the few persons involved with this study.

1. Are there days when you are not hungry in the morning and have nothing more than maybe coffee and orange juice for breakfast? (check one)
   ___ never    ___ occasionally    ___ frequently    ___ always

2. Are there days when you eat or drink at least 25% of your total intake of calories in the evening after supper? (check one)
   ___ never    ___ occasionally    ___ frequently    ___ always

3. Are those days when you are not hungry in the morning usually the same ones when you eat or drink a great deal at night after supper? (check one)
   ___ yes    ___ no

   IF YES: How often do you have such days? (check one)
   ___ occasionally    ___ frequently    ___ always

   Have the last few days been of this kind? (check one)
   ___ yes    ___ no
Do you usually have trouble getting to sleep on these same days? (check one)

_____yes  _____no

4. Do you think you have ever weighed more than ten percent above or below the ideal weight for a person of your height?
   If yes, which one? (check one)  ____underweight  ____overweight
   Please list your age, approximate height and weight at that (those) times.

5. Have you ever been on a diet in order to lose weight?
   To gain weight?
   If yes, say when and describe the circumstances briefly.

6. Are you currently gaining weight?
   Losing weight?

7. Have you ever been diagnosed as having any metabolic disorder (e.g., hypo- or hyperthyroidism, etc.)?  If yes, what?

8. Please list any exercise in which you engage on a fairly regular basis (e.g., walking, sports, calisthenics, etc.) including the number of hours per week that you do each type of activity.
   (Use other side of paper if necessary.)
APPENDIX G

SUMMARY OF ANALYSIS OF VARIANCE
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