THE EFFECTS OF COMPETITIVE SOCIAL EXPERIENCES ON EMOTIONALITY OF THE RAT

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CHAPTER I

INTRODUCTION

The problem which is the subject of this study was originally proposed as an empirical question, that is, in the absence of theoretical considerations and information on related data. The question was asked, a review of the literature was made in search of an answer, and, that failing, a study was designed to provide the answer. The question posed may be stated as follows: Does success and failure in competitive social experiences have a differential effect on emotionality of the rat?

Hypotheses

Two hypotheses were put forth: (1) In competition for food, rats competing with rats 30 days younger than themselves will be more successful than will rats competing with rats 30 days older than themselves. (2) Successful and unsuccessful experiences in competition for food will have a differential effect on emotionality of the rat.

For the sake of clarification, the first of these two hypotheses will be designated as the treatment hypothesis in that the establishment of the treatment conditions, success and failure in food competition, is contingent upon the support of this hypothesis. The second hypothesis will be designated as the experimental hypothesis since it represents the question posed in the initial formulation of the study.

Due to the nature in which this study was conceived and the lack of supportive data available in the literature, the specification of directionality in the difference was avoided.

Clarification of the Term "Emotionality"

At the conceptual level the term emotionality is traditionally defined as a state of being emotional. The vagueness of such a definition makes the term useless, if not meaningless, in experimental investigations. However, within the last 30 years, through experimental usage, the meaning of the term has undergone change toward increased specificity and has gained widespread use and acceptance in animal studies as referring to a disturbed state of the organism, involving autonomic stress responses and expressive behaviors indicative of fearfulness, timidity, wildness, and general excitability.

At the operational level this disturbed state is typically defined in terms of such responses as urination, defecation, and limited ambulation as they occur in an unfamiliar or fear-arousing stimulus situation. Therefore, within the context of its experimental usage, the term emotionality may be seen as referring to a rather broad class of defensive behaviors which, generally speaking, may be subsumed under the heading of emotional behavior.

CHAPTER II

REVIEW OF THE LITERATURE

Rat Studies

A review of the literature reveals that a considerable volume of work dealing with emotionality in animals has been undertaken. Although no recent comprehensive reviews have been done, an early article by Hall (1941) and a later article by Ader (1959) give some indication of the scope of the area. In general, the studies which have been undertaken may be classified under one of two headings: (1) studies concerned with determining the validity and reliability of various indicies of emotionality, and (2) studies dealing with the effects of various independent variables on emotionality.

Of the various behaviors which have been used as indicies of emotionality, urination, defecation, and ambulation in the open-field test have been the most frequently used and the most thoroughly studied.[1] Reliability coefficients for these measures are generally reported in the range of .70 to .90 with validity coefficients from intercorrelational comparisons of urination, defecation, and ambula-

[1] The open-field test consists of placing an animal in an open-top enclosure usually ranging from nine to twenty-five square feet in area. Since the size of this enclosure is ordinarily several times that of the cages to which the animal is accustomed, it provides an unfamiliar or fear arousing-stimulus situation.

tion as they occur in different fear-provoking stimulus situations ranging from .30 to .80 (Anderson, 1938; Billingslea, 1940; Hall, 1941; Hall, 1936; Hall, 1934; Ivinski, 1966; Parker, 1938). Significant relationships also have been found between defecation in the open-field and increased heart rate (Candland, Pack, & Matthews, 1967), and defecation and increased size of the adrenal, thyroid, and pituitary glands (Hall, 1939; Yeakle & Rhoades, 1941). However, studies by Ader (1959) and Paré (1966) revealed no significant relationship between stress induced emotionality and size of the adrenal glands.

Although a large number of studies fall under the second heading, an extensive search of the literature from 1927 to 1969, using the subject headings of emotionality, fear, drive, competition, rat, and social, revealed no studies dealing with the question which is the subject of this investigation. A number of studies have been concerned with the influence of early experiences on emotionality; however, most of these have dealt with either the effects of traumatic stimulation, e. g. electric shock, or the effects of systematic gentling procedures. As may be seen below few studies have been concerned specifically with the influence of early social experiences on emotionality.

Denenberg & Morton (1962) in a study dealing with the effects of early handling experiences and social groupings found significant differences in emotionality along several dimensions. Handled animals were less emotional than unhandles animals as determined by activity and defecation in the open-field situation. Animals raised in groups in free-environment boxes were found to defecate less than animals raised in laboratory cages; however, there was no significant

difference between these two groups in activity.

In a follow-up study, Denenberg & Morton (1964) replicated the basic conditions of their 1962 study and introduced the additional factors of sex and prepubertal social interaction between sexes. Again, handling and free-environment experiences were found to reduce emotionality. Across groups females were found to be significantly less emotional than males, but there was no evidence that interaction between sexes affected emotionality.

Moyer & Korn (1965) sought to determine the effects of early isolation on emotionality. Animals raised in isolation from weaning until adulthood were compared to animals raised in groups. Testing for emotionality involved the use of several measures: ratings of emotional responsiveness to handling, startle response to auditory stimuli, runway activity, defecation, and cage emergence. Isolated animals were found to be significantly higher on all of the measures except the startle response to auditory stimuli.

Bovard & Newton (1955) studied the effects of normal versus late weaning on emotionality. Animals weaned at the ages of 23 and 42 days were tested for emotionality at maturity by the open-field test. Late weaned animals were found to be more emotional as measured by the frequency of urination and defecation than were normal weaned animals. However, Rosen & Wetjko (1962) in a study using identical treatment conditions found no significant difference between normal and late weaned animals in emotionaltiy as measured by cage emergence and defecation.

Broadhurst & Levine (1963) in a study concerned with the effects of litter size on emotionality compared animals from small

litters, two to four, with animals from large litters, five to nine. Following weaning, at the age of 21 days, these animals were reared in individual cages until adulthood at which time they were tested for emotionality in the open-field. Using the open-field test no significant differences in emotionality were found.

Of those studies dealing with the effects of early social experiences on emotionality, only two were found which dealt with the relationship between competition and emotionality. However, in both of these studies, competition was the dependent rather than the independent variable.

Rosen & Wetjko (1962) in their delayed versus normal weaning study also compared their animals in a food competition situation. Normal weaned animals were found to be significantly more successful in competing for food than were late weaned animals, but as was pointed out previously, there was no significant difference between the two groups in terms of emotionality.

Becker & Flaherty (1966) used early handling to establish significant differences in emotionality between two groups of animals. Handled animals were less emotional than unhandled animals as measured by cage emergence and reluctance to eat in a novel environment. Following the tests for emotionality, the animals were paired and allowed to compete for food over 12 encounters. The handled animals won a significantly greater number of bouts in the first encounter; however, no significant differences were obtained on the last 11 encounters.

Human Studies

Cross-species comparisons by virtue of the species difference alone pose considerable difficulties. This is particularly true when the comparison involves a social variable in two species as widely separated on the phylogenetic scale as are Rattus norvegius and Homo sapiens.

The problem of a cross-species comparison is further complicated by limitations in the information available on the point of comparison. Phillips & Devault (1957) in a critique of research on competition in humans pointed out that the majority of work in this area has been concerned either with the effects of competition on group dynamics or with the effects of cultural patterns on the development of competitive behavior, and that little information on the antecedent and developmental aspects of competition is available. In addition, studies of competition in humans become involved with numerous motivational and personality factors which conveniently can be ignored when studying the rat.

Quite obviously, human studies of competition have not been concerned with emotionality as it is operationally defined in this study. However, a few studies may be found dealing with the effects of competition on individual performance variables which reflect responses also thought to be involved in emotionality, for example, autonomic stress responses, fear, and heightened excitability. In relation to these competition studies, it is interesting to note that in studies of manifest anxiety and performance, high manifest anxiety has been shown to facilitate performance on simple tasks

(Davids & Eriksen, 1955; Reynolds, Blau, & Hurlbut, 1961; Wenar, 1954) and to hinder performance on complex tasks (Bendig, 1959; Grice, 1955; Taylor & Rechlschaffer, 1959; Wiggens, 1959). As may be seen in the studies reviewed below, competition has been found to have similar effects on the performance of simple and complex tasks.

Vaughn (1936) in a study of competitive rifle shooting sought to determine the effects of varying degrees of stress on performance in the competitive situation. Three conditions were used: (1) high stress which emphasized initial ability, (2) medium stress which emphasized improvement over initial ability, and (3) low stress which emphasized improvement over individual averages, with a handicap. Individuals were found to obtain significantly higher scores under the medium and low stress conditions as compared to the high stress condition.

Shaw (1958) attempted to determine the effects of a cooperative versus a competitive task orientation on two different types of performance. Using a perceptual-motor task, which consisted of pursuit-tracking, and a memory-reasoning task, which consisted of determining the onset sequence of four lights, Ss either worked in pairs for a team score, or competed in pairs for an individual score. The findings revealed that the cooperative condition resulted in higher scores for both tasks; however, a statistically significant difference between the cooperative and competitive conditions was obtained only on the perceptual-motor task.

A competitive reaction-time study by Church, Millward, & Miller (1963), although designed to determine the effects of winning and losing on the prediction of success and failure, nevertheless,

offers information on the effects of competition on this type of perceptual-motor task. The experimental Ss, working in pairs, were told that they were competing against the other S, and that they should predict prior to each trial whether they would win or lose on the following trial. Feedback of win and loss was predetermined and was provided by signal lights. The control Ss, also working in pairs, were simply told that they were to predict which of the two signal lights would come on on the following trial. In 20 preliminary trials given under neutral conditions, there was no significant difference in the reaction times of the two groups. Immediately after competition was introduced, the reaction times of the experimental Ss decreased and remained significantly lower than those of the control Ss over 140 trials. There was no evidence that the prediction of win or loss by the experimental Ss affected reaction time.

Bruning, Sommer, & Jones (1966) sought to determine the effects of cooperative and competitive sets on tasks of varying difficulty. On the basis of heightened motivation, it was predicted that competition would facilitate performance on simple tasks, but would impair performance on more difficult tasks as the results of competing responses stemming from the increased complexity of the task. Using a reaction-time task as the simple task and a pursuit-tracking task as the difficult task, Ss worked in pairs under either cooperative or competitive instructions without knowledge of the results of their performance. The findings revealed that the competitive Ss, as predicted, were faster on the reaction-time task than were the cooperative Ss; however, no significant difference was obtained between the two groups on the pursuit-tracking task. This

latter finding was explained in terms of the pursuit-tracking task being insufficiently complex to insure the occurrence of competing responses.

In a follow-up study, Bruning & Mettee (1966) ran the reaction-time task of the previous study under direct and indirect competitive conditions. In the direct competition situation, Ss worked in pairs and were told that they were competing against each other. In the indirect competition situation, Ss worked individually and were told that they were competing against a group norm. As in the earlier study, the Ss were not given feedback on their performance. No significant difference was found between the two groups; however, a significant trial by group interaction was obtained as the results of the direct competition Ss showing an increase in reaction time over trials. On the basis of this interaction effect, it was concluded that these results offer partial support of the hypothesis that in a competitive situation motivation is heightened by the opponent being present.

In a supplementary experiment in this study, the direct competition condition was run under predetermined win-loss feedback. Based on the number of trials which the Ss were told that they had won, three levels of feedback were given: winners, equals, and losers. Significant differences were obtained under all three feedback conditions with the reaction times of the "equals" being faster than those of the "winners" and the reaction times of the "winners" being faster than those of the "losers".

Vaught & Newman (1966) studied the effects of competition and anxiety on a motor-steadiness task. Ss high and low in manifest

anxiety were individually given the motor steadiness test under either competitive or noncompetitive conditions. No significant difference in performance was found between the competitive and noncompetitive conditions. However, across conditions high anxiety Ss were found to perform significantly poorer than the low anxiety Ss. Also, the competitive high anxiety Ss performed significantly poorer than the competitive low anxiety Ss and the noncompetitive high anxiety Ss. No significant difference was found between the competitive low anxiety Ss and the noncompetitive low anxiety Ss.

Summary and Conclusions

As revealed by the review of the literature, information regarding the effects of social experiences on the emotionality of the rat is limited. In addition, a number of those studies dealing with social experiences have also involved nonsocial factors, and thus, do not clearly delineate the role which social factors play in influencing emotionality. The assimilation of information is also further complicated by the lack of replicatory work.

From the information presented on rats, two very tentative generalizations may be drawn: (1) Early social experiences may have a significant influence on later emotionality (Bovard & Newton, 1955; Denenberg & Morton, 1964; Denenberg & Morton, 1962; Moyer & Korn, 1965). (2) Heightened emotionality may have a detrimental influence of later competitive behavior. As was previously noted there is no information available on which generalizations may be made in regard to the question which is the subject of this study.

While studies with humans do not provide an answer to this question, they do provide some information regarding the effects which a competitive task orientation has on performance, and a limited amount of information concerning the effects of success and failure on performance. Several studies indicate that on rather complex tasks a competitive set may have a detrimental effect on performance (Shaw, 1958; Vaughn, 1936; Vaught & Newman, 1966). However, it appears that on a simple reaction-time task, a competitive set may facilitate rather than hinder performance (Church, Millward & Miller, 1963; Bruning, Sommer, & Jones, 1966). Performance in a competitive situation may also be seen to vary in terms of the degree of success and failure experienced with an equal division of successes and failures being more facilitory than either complete success or complete failure (Bruning & Mettee, 1966).

CHAPTER III

METHOD

Subjects

The Ss in this study were 18 experimentally naive Sprague-Dawley male albino rats. These animals were purchased at the age of 28 days and were received at the age of 30 days. At the start of the investigation these animals were 60 days old.[2]

Thirty-six additional Sprague-Dawley male albino rats were used in the study as social animals. Eighteen of these animals were purchased at the age of 58 days and were received at the age of 60 days. These animals were 90 days old at the start of the investigation and were designated as Social Group-90 (SG-90). The other 18 animals were purchased at the age of 25 days and were received at the age of 28 days. These animals were 30 days old at the start of the investigation and were designated as Social Group-30 (SG-30).

The Ss and the animals in SG-90 were housed in individual cages for 30 days prior to the start of the investigation, and the animals in SG-30 were housed in individual cages for two days prior to the start of the investigation. During the period in which the animals were housed individual cages, food and water were provided ad libitum.

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[2]Sexual maturity in the male albino rat occurs at approximately 60 days with full maturity be reached at approximately 120 days.

Apparatus

The major piece of equipment used in the study was the open-field which consisted of a box measuring 45 inches X 45 inches X 11 1/4 inches. The entire box was painted flat black, and the floor was divided into a nine-inch square grid pattern with 1/4-inch white lines (see Figure 1).

The open-field box was placed on the floor of the experimental room. Illumination was provided by four 200-watt incandescent bulbs enclosed in translucent shades. Direct illumination within the box was approximately 25 foot candles at the center and an average of 15 foot candles along the sides.

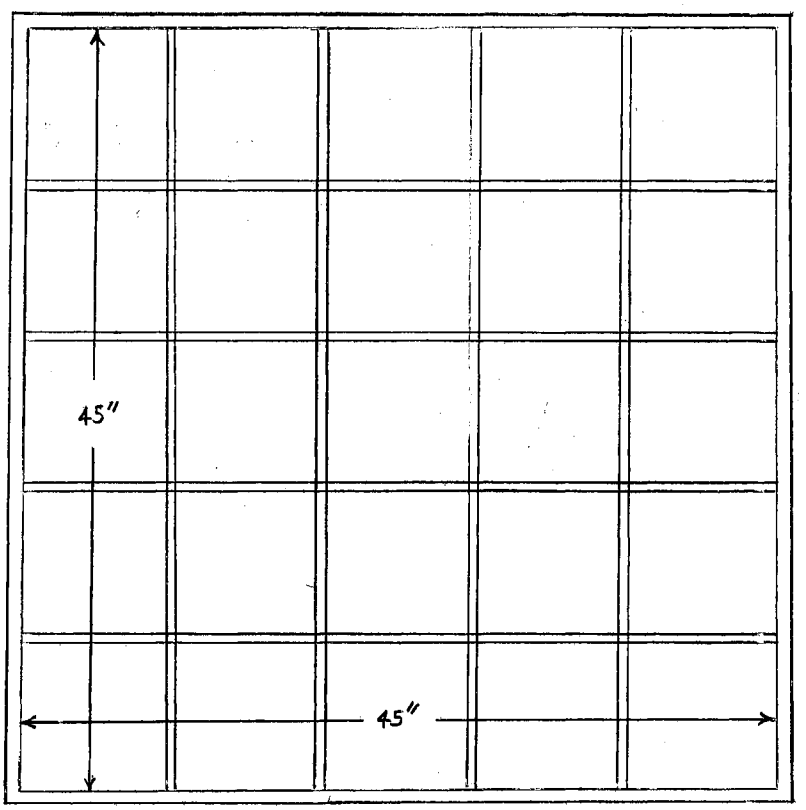
The timing of the length of the test trials and the measurement of response times involved the use of two types of clocks. The measures of response time were correct to one-tenth of a second.

Body weights of the Ss were taken on a set of triple-beam balances which weighed in increments of one-tenth of a gram. The adrenal glands of the Ss were weighed on a set of pharmaceutical scales which weighed in increments of one-sixteenth of a grain (.004 mg.).

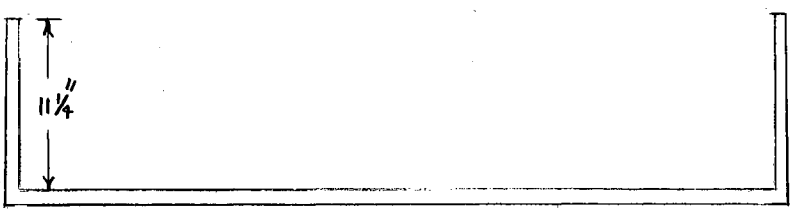
Two types of cages were used: (1) 8-inch X 9 1/2-inch X 7-inch individual cages and (2) 17 1/2-inch X 14-inch X 9-inch group cages. The cages were shielded so that there was no visual contact between animals in different cages.

Procedure

The experiment was divided into two phases; a competitive phase and a testing phase.



Top View



Exposed Side View

Figure 1. Open-Field Box

Competitive phase. The competitive phase was carried out over a 30-day period beginning when the Ss were 60 days old and ending when they were 90 days old. This phase began with the random pairing of the animals within each of the social groups, and the random assignment of each pair to a group cage. The Ss were then weighed and one S was randomly assigned to each pair of social animals.

As the results of this grouping procedure, each of nine 60-day-old Ss were housed with two 90-day-old animals from SG-90, and each of nine 60-day-old Ss were housed with two 30-day-old animals from SG-30. The nine Ss which were housed with the animals from SG-90 were designated as the Failure (Fa) Ss, and the nine Ss which were housed with the animals from SG-30 were designated as the Success (Su) Ss.

Water was provided ad libitum; however, feeding followed a twelve-hour schedule with two feedings per day beginning at 7:30 a.m. and 7:30 p.m. The procedure for feeding was as follows: One pellet of Purina Lab Chow was placed in each group cage, with the positions of the animals being unknown to the E, and the animals were allowed to compete for it for 15 minutes. At the end of this 15-minute period of food competition, a sufficient amount of food was placed inside each cage to insure that each animal would have access to all the food that it could eat within a one-hour period. At the end of one hour all excess food was removed. This competition for food was predicted to provide the required successful and unsuccessful competitive experiences due to the relative age and size difference of the Ss to the social animals with which they were housed.

In order to determine if the predicted success and failure in food competition was occurring, the Ss were momentarily observed during each period of competition. Five minutes after having placed a food pellet inside each of the cages, the experimenter, beginning in the order in which the pellets were presented, noted each animal's success and failure. Success and failure were defined in terms of possession of the food pellet, with possession at the time of observation being considered a success and being given a score of one, and nonpossession being considered a failure and being given a score of zero. These observations were always made in the order in which the pellets were presented. However, the order of presentation was reversed at each feeding period.

Observations were made twice daily, or at each feeding period throughout the 30 days of the competitive phase of the experiment. Thus, a total of 60 observations were made on each S.

Testing phase. The tests for emotionality were carried out over a seven-day period which began when the Ss were 91 days old and ended when they were 97 days old. Each S received four three-minute test trials in the open-field over the seven day period. These trials were spaced at 48-hour intervals with each S receiving one trial per test day. Therefore, there were 18 test trials daily and a total of 72 test trials for the four days of testing. All testing was carried out between the hours of 12:30 a.m. and 3:30 a.m. The order in which the Ss were tested was randomly determined for each test day.

In the test situation proper four basic measures of emotionality were taken: (1) Response Time - time from release of the S in the center square of the open-field to movement out of this square

with all four feet. This data was recorded in hundredths of a second.[3] (2) Urination - presence or absence of urination during the test period. Presence was given a score of one and absence was given a score of zero.[4] (3) Defecation - presence or absence of defecation during the test period. Presence was given a score of one and absence was given a score of zero. (4) Ambulation - total number of squares in the grid pattern of the open-field which were entered by the S with all four feet. With the exception of response time, these measures were chosen primarily because of the frequency with which they have been used in other studies of emotionality and because of their demonstrated reliability and validity.

Three additional measures were later extracted from the ambulatory data. (1) Exploration - the number of different squares in the grid pattern of the open-field which were entered by the S with all four feet. Since the grid pattern consisted of 25 squares, the maximum score on this measure was 25. (2) Open-Area Ambulation- the total number of squares not bordered by the walls of the open-field box which were entered by the S with all four feet. (3) Open-Area Exploration - the number of different squares not bordered by

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[3]Although response time is not typically used as an index of emotionality, it was employed here as a measure of "freezing behavior" which frequently occurs on initial exposure to a fear-arousing stimulus situation. Thus, the more emotional animal would be expected to have a longer response time.

[4]An attempt to measure urination by absorbing the urine with filter paper and then weighing it was unsuccessful. The pharmaceutical scales which were used in this attempt did not provide units of measure which were precise enough to test the technique. Defecation was not weighed as the result of the limited number of animals which defecated during the test trials.

the walls of the open-field box which were entered by the S with all four feet. Since there were nine such squares in the grid pattern, the maximum score on this measure was nine.[5]

A modified version of the rating scale used by Moyer & Korn (1965) was also employed in an effort to determine the Ss' emotional responsiveness to the handling involved in removing the Ss from their home cages prior to each test trial (See Appendix A). The Ss' responses to the handling required for placement in and removal from the open-field and the return to their home cages was not rated.

The procedure for testing was as follows: Each S was removed from his home cage, placed in an enclosed carrying cage and carried to the experimental room by the E. Testing was initiated by the E placing the S within the center square of the open field. Each S was placed in a position facing away from the E and his assistant with the direction of placement being consistent over all trials.

The E activated, by a hand held switch, the clock use in recording response time upon the release of his grip on the S. At the same time the assistant activated the clock used in timing the length of the test trial.

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[5]As in the case of response time, exploration, open-area ambulation, and open-area exploration, are not generally used as measures of emotionality. The use of exploration was based on the same line of reasoning as is the use of ambulation. The less emotional animal displays more ambulatory behavior, and the less emotional animal should be expected to display more exploratory behavior. Open-area ambulation and open-area exploration were employed as measures of wall-crowding. It is generally recognized that more emotional animals show a greater amount of movement along the walls of the open-field than less emotional animals (Ader, 1959). Thus, movement within those squares not bordered by the walls of the apparatus provides an additional measure of emotionality.

The assistant, seated in a chair placed on top of a table located approximately five feet from the open-field, recorded ambulation. Using a specially prepared data sheet on which a facsimile of the grid pattern of the open-field was represented (see Figure 2), the assistant recorded movement from one square to another by placing a mark in the corresponding square of the data sheet. Termination of the three-minute test period was made known to the assistant by a touch signal given by the E.

Following the termination of the trial, the S was removed from the open-field, placed in the carrying cage, and returned to its home cage by the E. The presence or absence of unination and defecation was then noted and recorded by the assistant. Also, both the carrying cage and the floor of the open-field were washed with fresh water and dried before the start of the next trial.

On the day after the last test trials were given, the Ss were once again weighed. Following the weighing of each S, the S was sacrificed and the adrenal glands were removed and weighed.

COMPETITION-EMOTIONALITY

Group _____ Animal No. _____

Time _____ Date _____

Measures of Emotionality

1. Rating _____
2. Response Time _____
3. Urination _____
4. Defecation _____
5. Ambulation _____
6. Exploration _____

Figure 2. Data Sheet

CHAPTER IV

RESULTS

Food Competition

The observations of success and failure revealed, as predicted, that the Su Ss were significantly more successful in the food competition than were the Fa Ss. An Analysis of Variance of the number of successes occurring in each group over the 30 days of food competition yielded an F value significant beyond the .005 level (see Table I). The accummulation of the success scores over the 30 days of the competitive period may be seen in Figure 3. The raw scores of these observations may be seen in Appendix B.

TABLE I

ANALYSIS OF VARIANCE OF NUMBER OF SUCCESSES IN FOOD COMPETITION

Source	df	SS	MS	F
Total	17	3,123.112		
Treatment	1	1,647.556	1,647.556	17.865**
Error	16	1,475.556	92.222	

** $p < .01$

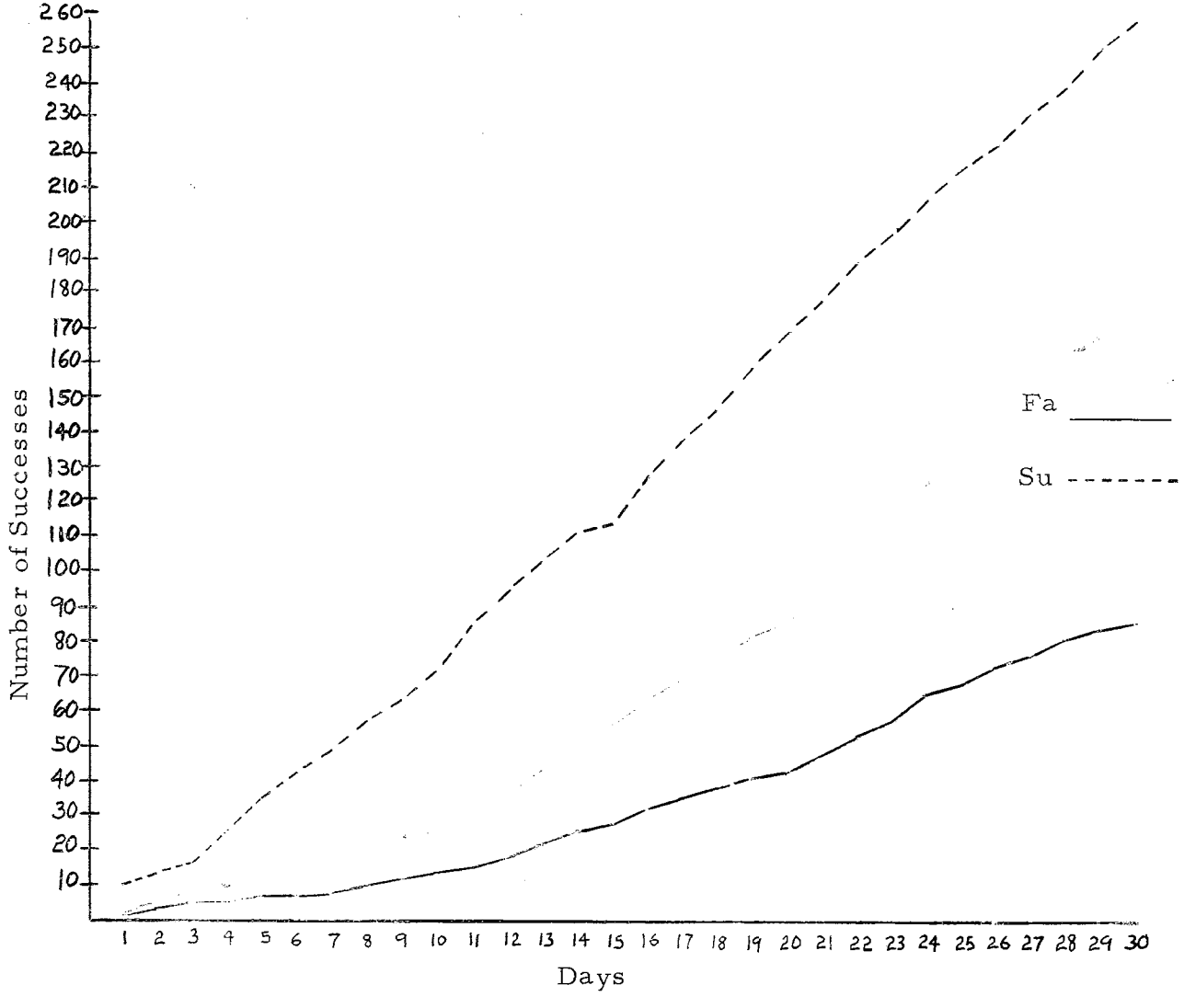

Figure 3. Cummulative Successes In Food Competition

Measures of Emotionality

Response Time. An Analysis of Variance for a two-factor experiment with repeated measures (Winer, 1962) revealed no significant treatment effect on this measure; however, a significant F value ($p < .01$ two-tailed) was obtained on the day's effect (see Table II). A comparison of means by use of the Newman-Kuels procedure revealed that the mean response time on Day 1 was significantly higher than the mean response times on Days 2, 3, & 4. No significant differences were found between the mean response times of Days 2, 3, & 4 (see Table III). Although no significant treatment effect was found, the response times of the Fa Ss were slightly lower than the response times of the Su Ss, and both groups tended to show a decrease in response time over days (see Figure 4). The scores on this measure may be seen in Appendix C.

TABLE II

ANALYSIS OF VARIANCE OF RESPONSE TIME

Source	df	SS	MS	F
Total	71	2,389.229		
Treatment	1	1.787	1.787	.085
Error	16	333.197	20.824	
Days	3	852.554	284.184	11.407**
D X T	3	5.813	1.937	.077
Error	48	1,195.838	24.913	

** $p < .01$

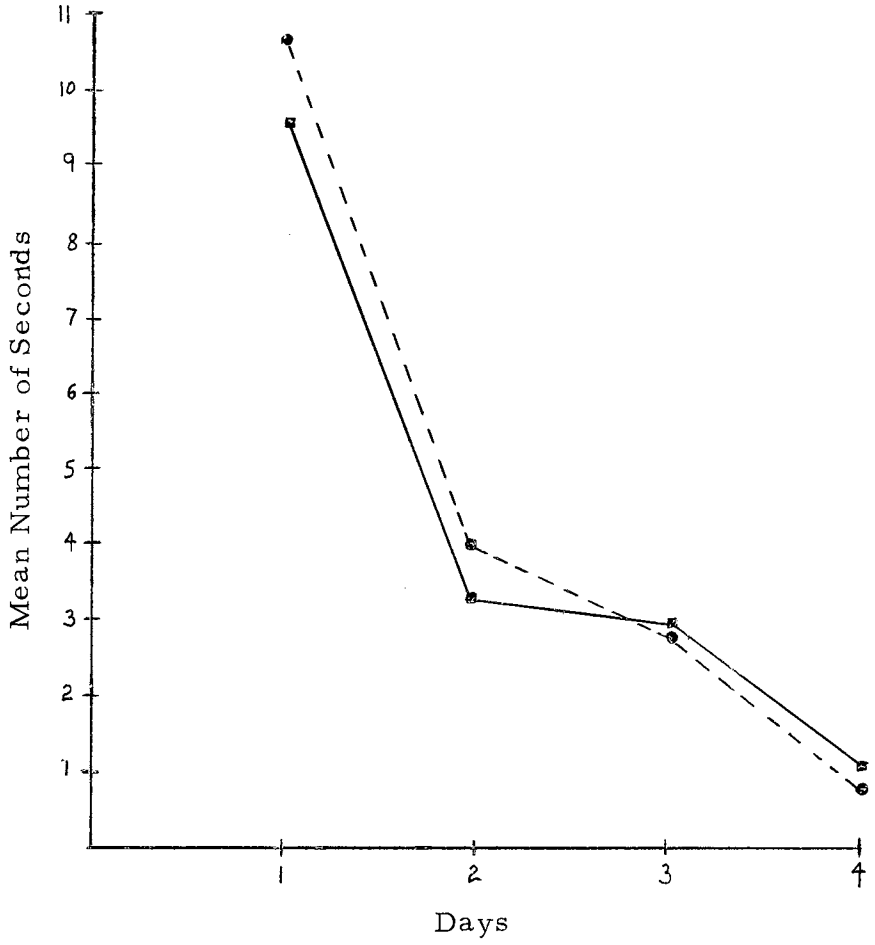

Figure 4. Response Times

TABLE III

NEWMAN-KUELS FOR RESPONSE TIME MEANS OVER DAYS

Days		4	3	2	1
Ordered Means		.99	2.90	3.67	10.16
Differences between pairs of means	4		1.91	2.68	9.17**
	3			.77	7.26**
	2				6.49**
S = 1.17		r = 2	r = 3	r = 4	
S q.99 (r,48)		4.43	5.06	5.26	

Note: Response times in seconds
** $p < .01$

Urination. Comparisons of the two groups on the frequency of urination over 36 test trials were made with the Chi Square Test. The use of repeated measures with this test violates the independent response assumption; however, in view of the lack of clear-cut alternatives with nominal data, this test was employed. The results revealed there were no significant differences between the two groups (see Table IV). A days effect test was made with Cochran's Q Test (Siegel, 1956). A Q value which was significant beyond the .01 level was obtained (see Table V). A comparison of the day totals was made by McNemar's Test (Siegel, 1956). As may be seen in Table VI, the frequency of urination on Day 1 was significantly greater than on Days 3 and 4, and the frequency on Day 2 was greater than on Day 4.

TABLE IV

CHI SQUARE ANALYSIS OF FREQUENCY OF URINATION

	Fa Ss	Su Ss	
Trials Urinating	19	25	44
Trials not Urinating	17	11	28
	36	36	72

$\chi^2 = 1.46$ n.s.

TABLE V

COCHRAN'S Q TEST FOR DAYS EFFECT ON URINATION

Days	1	2	3	4
Total Frequency of Both Groups	16	13	10	7

Q = 12.85; df = 3; p < .01

TABLE VI

COMPARISON OF DAYS BY MCNEMAR'S TEST

df = 1

Days	1	2	3	4
χ^2 values from comparisons	1	1.80	6.00*	9.00**
	2		1.80	4.50*
	3			1.00

*p < .05 **p < .01

A plot of the frequency of urination across days may be seen in Figure 5. The scores on this measure may be seen in Appendix D.

Defecation. Only two Ss, one from each group, defecated over the four days of testing. Therefore, no analysis of this measure was undertaken.

Ambulation. The two-factor Analysis of Variance on ambulation revealed no significant differences for either treatment or days effect (see Table VII). While neither the treatment nor days effect was significant, the Fa Ss did have a slightly higher ambulation score than the Su Ss, and both groups did tend to show a small increase in ambulation over days (see Figure 6). The raw scores on this measure may be seen in Appendix E.

TABLE VII

ANALYSIS OF VARIANCE OF AMBULATION

Source	df	SS	MS	F
Total	71	79,494.320		
Treatment	1	496.125	496.125	.257
Error	16	30,802.445	1,925.152	
Days	3	1,983.153	661.051	.696
D X T	3	811.153	270.384	.285
Error	48	45,401.444	945.863	

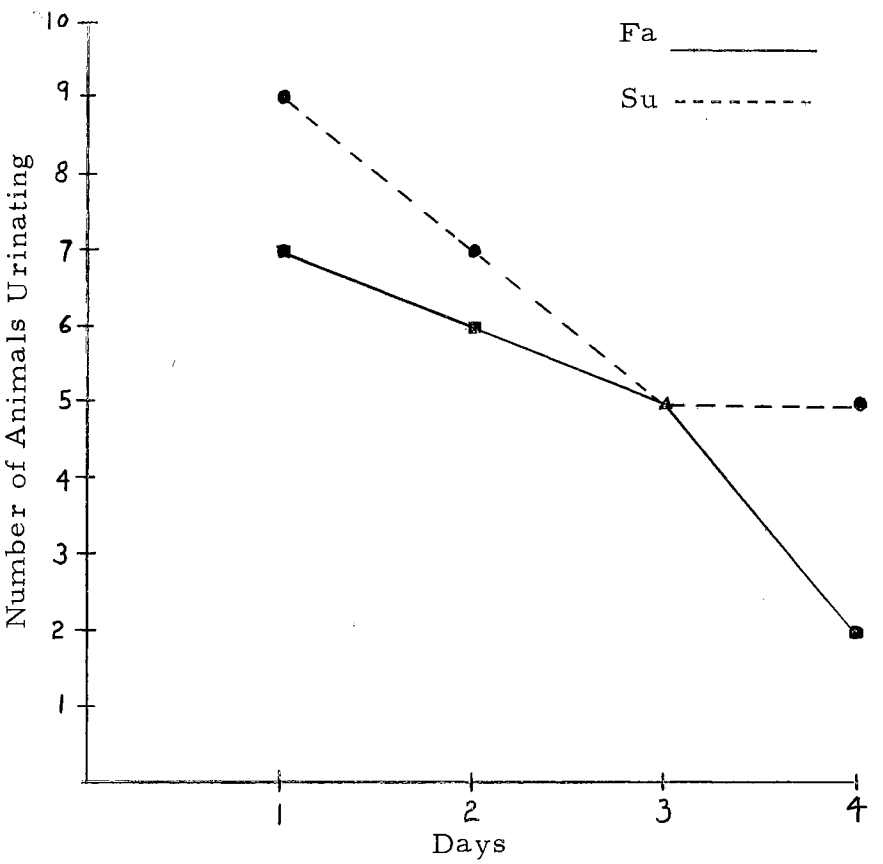

Figure 5. Urination: Presence or Absence During Test Period

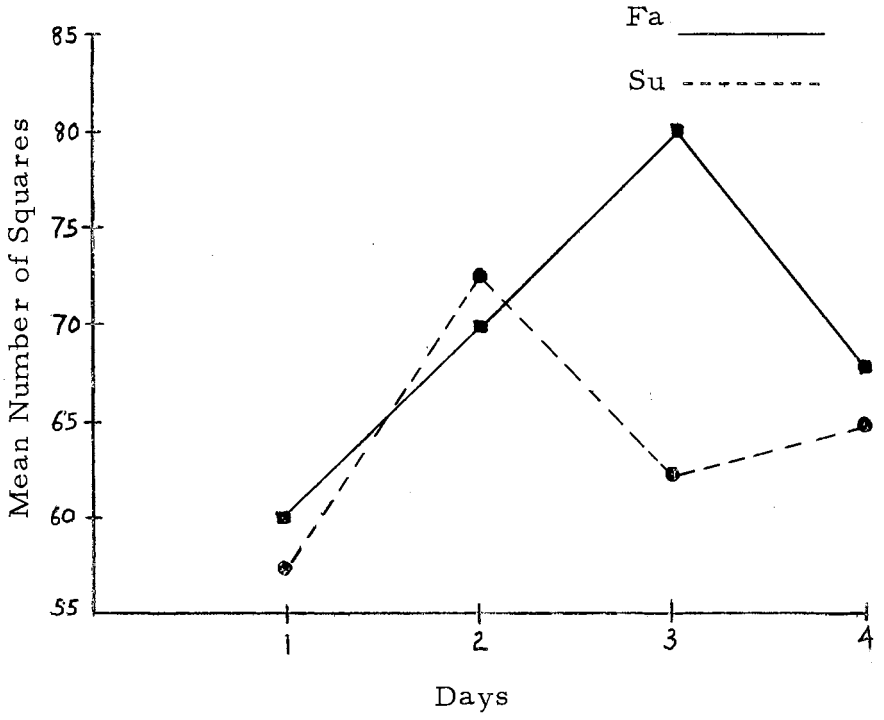

Figure 6. Ambulation: Total Number of Squares Entered With All Four Feet

Exploration. The Analysis of Variance on exploration also revealed no significant differences for treatment or days effect (see Table VIII). As in the case of ambulation, the Fa Ss had a slightly higher total score on this measure than did the Su Ss, and both groups tended to show a small increase in exploration over days (see Figure 7). The raw scores on this measure may be seen in Appendix F.

TABLE VIII

ANALYSIS OF VARIANCE OF EXPLORATION

Source	df	SS	MS	F
Total	71	2,167.875		
Treatment	1	54.125	54.125	.839
Error	16	1,032.000	64.500	
Days	3	75.125	25.041	1.252
D X T	3	45.820	15.273	.763
Error	48	959.653	19.992	

Open-Area Ambulation. As with the measures of ambulation and exploration, there was no significant treatment or days effect. The Analysis of Variance on this measure may be seen in Table IX. Although there were no significant differences between the two groups, the Fa Ss, again, had a slightly higher overall score, and this measure also appeared to reflect a tendency towards an increase in

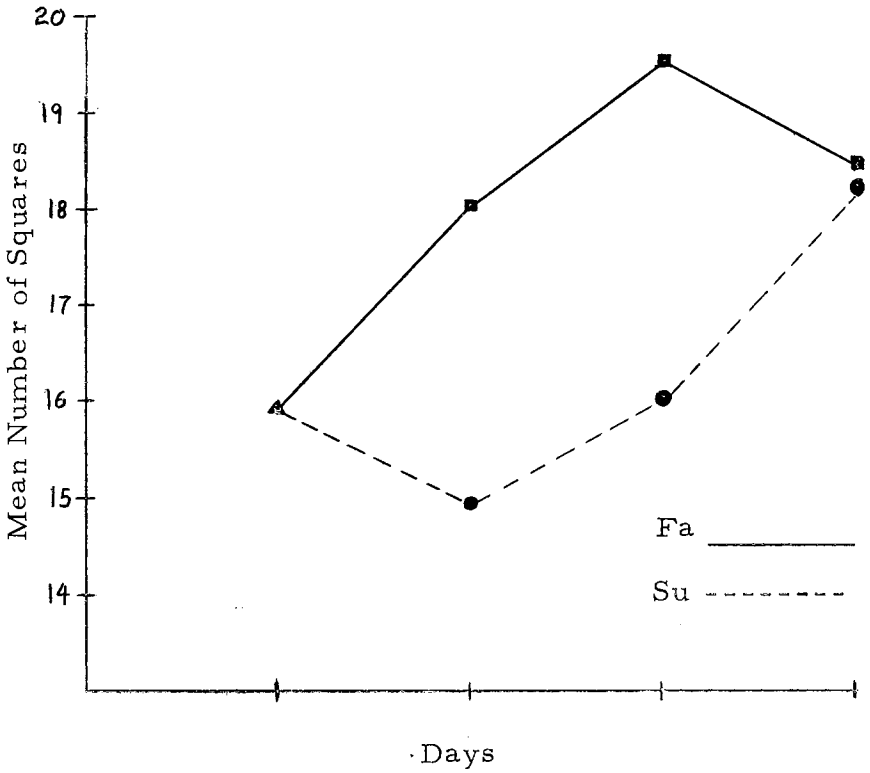

Figure 7. Exploration: Number of Different Squares Entered With All Four Feet

response over days (see Figure 8). The raw scores on this measure may be seen in Appendix G.

TABLE IX

ANALYSIS OF VARIANCE OF OPEN-AREA AMBULATION

Source	df	SS	MS	F
Total	71	2,013.320		
Treatment	1	95.681	95.681	2.442
Error	16	626.890	39.180	
Days	3	117.486	39.162	1.621
D X T	3	15.041	5.013	.208
Error	48	1,158.223	24.129	

Open-Area Exploration. The Analysis of Variance for open-area exploration yielded an F value for the treatment effect which was significant beyond the .05 level (two-tailed). However, the F value for the days effect was not significant (see Table X). As with the previous measures of movement within the open-field, the Fa Ss had a higher score on this measure than did the Su Ss. Although the days effect was not significant, this measure was consistent with the previous measures in reflecting the tendency towards an increase in response over days (see Figure 9). The raw scores on this measure may be seen in Appendix H.

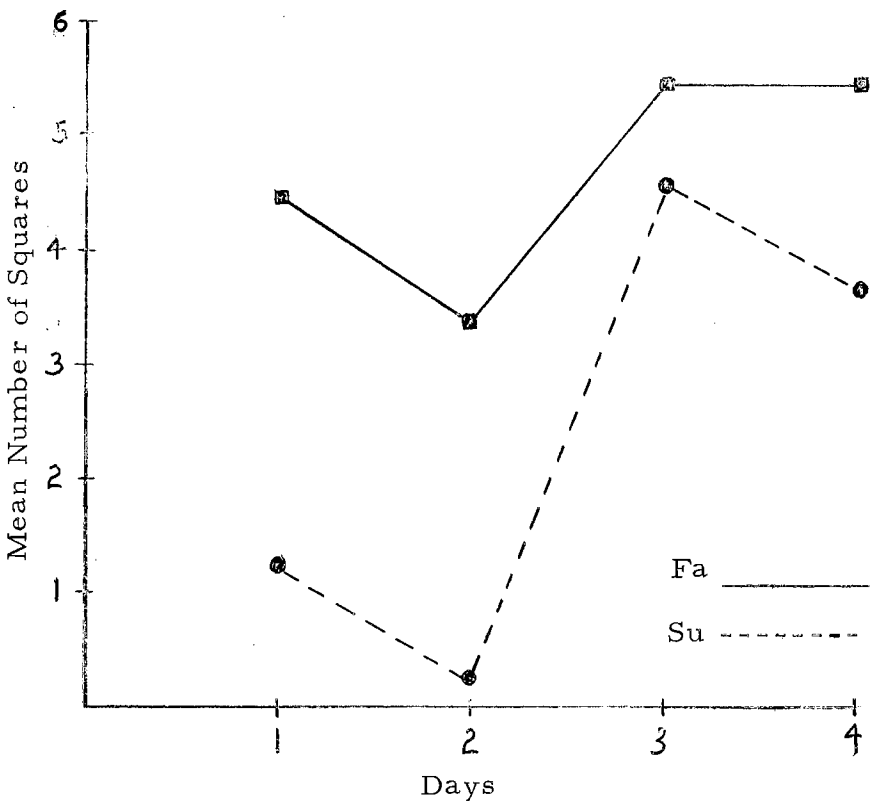

Figure 8. Open-Area Ambulation: Total Number of Squares not Bordered by Walls Which were Entered with all Four Feet

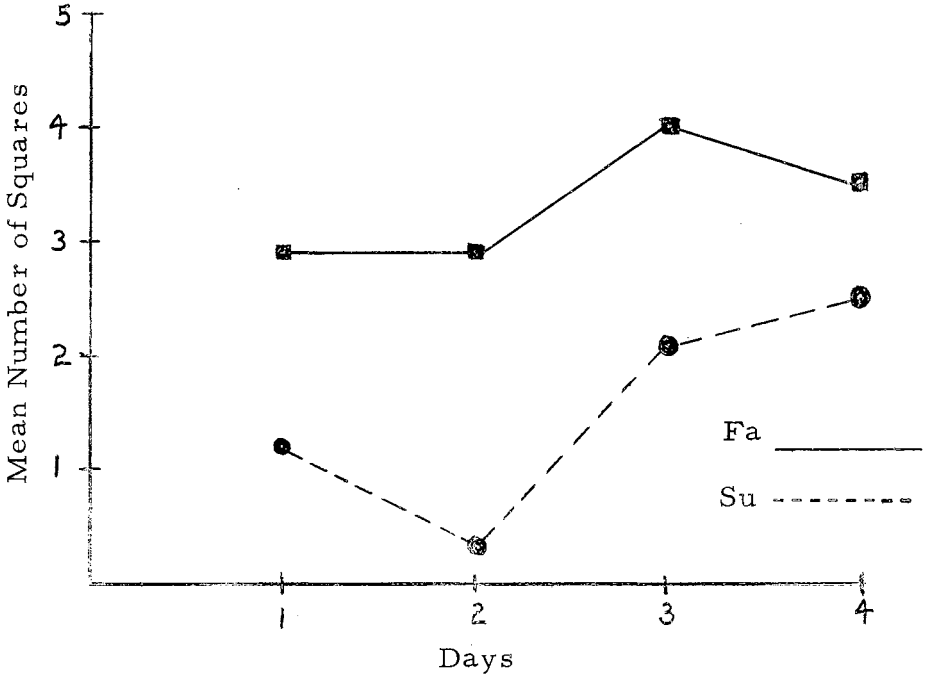

Figure 9. Open-Area Exploration: Number of Different Squares not Bordered by Walls which were Entered with all Four Feet

TABLE X

ANALYSIS OF VARIANCE OF OPEN-AREA EXPLORATION

Source	df	SS	MS	F
Total	71	621.778		
Treatment	1	56.889	56.889	4.755*
Error	16	191.389	11.962	
Days	3	28.666	9.555	1.351
D X T	3	5.556	1.852	.262
Error	48	339.278	7.068	

*$p < .05$

Ratings of Response to Handling. As was the case with the nominal data of the urination measure, there is no suitable statistical test for a repeated measures design using ordinal data. However, the scores of each animal were summed across days and the two groups were compared by the Mann-Whitney U Test (Siegel, 1956). The ratings of the Su Ss were higher than those of the Fa Ss, but the difference was small and not significant (see Table XI). Days effect was tested by Friedman's Two-Way Analysis of Variance (Siegel, 1956), and was found not to be significant (see Table XII). The ratings of both groups, however, did tend to decrease over days (see Figure 10). The raw scores on this measure may be seen in Appendix I.

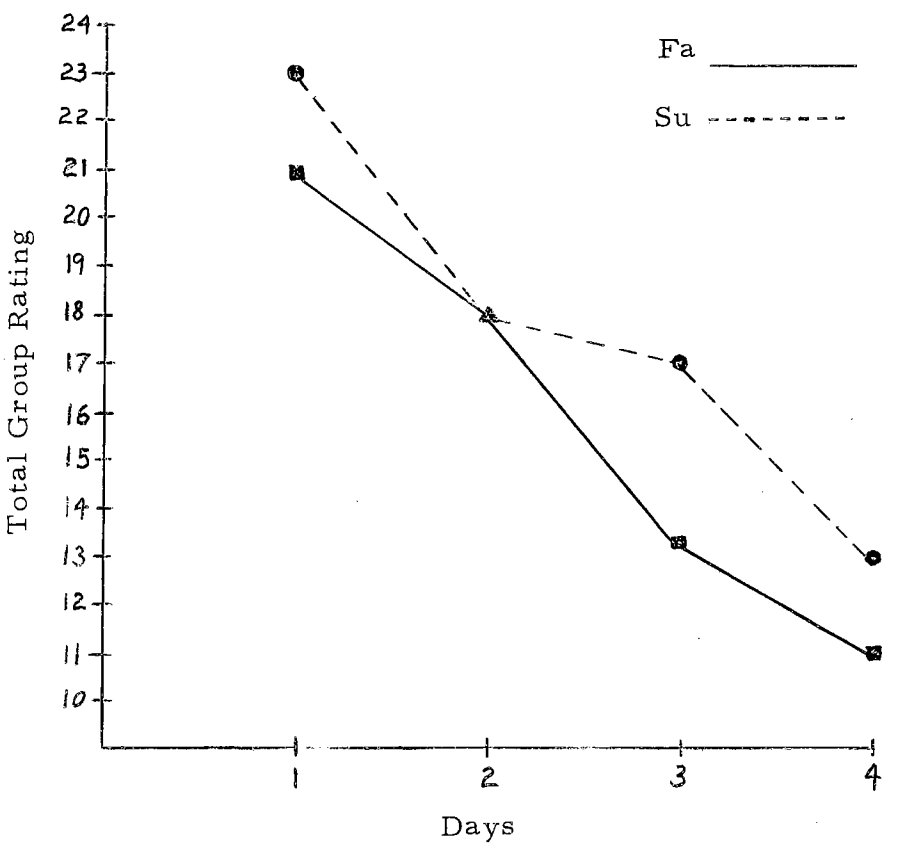

Figure 10. Ratings of Response to Handling

TABLE XI

MANN-WHITNEY U ANALYSIS OF RATINGS OF RESPONSE TO HANDLING

	Fa	Su
Sum of Ranks	89.5	81.5
	$U = 36.5$; $n_1 = 9$, $n_2 = 9$; n.s.	

TABLE XII

FRIEDMAN'S TWO-WAY ANALYSIS OF VARIANCE OF RATINGS OF RESPONSE TO HANDLING

Days	1	2	3	4
Ratings	44	36	29	24
Sum of Ranks	57	47	43	32
	$\chi_r^2 = 4.92$; df = 3; n.s.			

In considering these results, it should be noted that each of the measures of emotionality as well as the food competition data involved taking repeated observations of the same S. Thus, as the result of correlated error, the different observations on a given S are not independent.

Weights

An Analysis of Variance of the weight increase of the Ss between the ages of 60 and 98 days revealed no significant difference between the two groups (see Table XIII). The weights of the individual animals at 60 and 98 days may be seen in Appendix J.

TABLE XIII

ANALYSIS OF VARIANCE OF THE WEIGHT INCREASE BETWEEN 60 AND 98 DAYS

Source	df	SS	MS	F
Total	17	5,563.945		
Treatment	1	68.056	68.056	.198
Error	16	5,495.889	343.493	

The Analysis of Variance on the weights of the adrenal glands also revealed no significant difference between the two groups (see Table XIV). The weights of the adrenals of each animal may be seen in Appendix K.

TABLE XIV

ANALYSIS OF VARIANCE OF ADRENAL WEIGHTS

Source	df	SS	MS	F
Total	17	.289		
Treatment	1	.004	.004	.235
Error	16	.285	.017	

CHAPTER V

DISCUSSION

As may be seen, the results do not support the experimental objective that successful and unsuccessful experiences in food competition have a differential effect on emotionality of the rat. With one exception, that being open-area exploration, none of the measures of emotionality revealed a significant treatment effect. The related physiological measures of body weight and size of the adrenal glands also revealed no significant differences between the treatment conditions.

In an exploratory study of this nature what are essentially nonsignificant results may be accepted with little qualification and would be in this study were it not for the occurrence of what appears to be a trend effect. A between group directionality difference, indicating greater emotionality among the Su Ss, was found. Excepting the defecation measure which was dropped from the analysis due to a lack of response on the part of both groups, this difference was consistent across each of the measures of emotionality. The Su Ss had a slightly longer response time, a higher frequency of urination, lower scores on ambulation, exploration, open-area ambulation, and open-area exploration, and higher ratings in response to handling. The weights of the adrenal glands of the Su Ss were also slightly greater than those of the Fa Ss; however, this difference was quite

small and may probably be accounted for in terms of the slightly greater initial and terminal body weights of the Su Ss. Although unknown, it would appear unlikely that this weight difference would have had an influence on the measures of emotionality.

The responses of both groups of Ss on the measures of emotionality also tended to reflect decreasing emotionality over the four days of testing. However, a statistically significant days effect was obtained only on the response time and urination measures. In the case of both measures the days effect was attributable primarily to a difference between responses on the first day of testing and the remaining days.

While this latter trend is a common finding in studies of emotionality involving repeated measures and may be accounted for relatively easily in terms of the animal adapting to the stimulus situation as the result of increasing exposure, the directionality difference trend effect is not so easily dismissed. Even in the absence of statistical significance, it is felt that further consideration of this difference is warranted.

In considering this trend effect, at least, two basic approaches may be taken. First, the consistency of the difference may simply be dismissed as a chance occurrence. But, if each of the seven measures of emotionality, response time, urination, ambulation, exploration, open-area ambulation, open-area exploration, and the ratings to handling, are viewed as separate and distinct indicies of emotionality, the dismissal of this difference as a chance occurrence becomes somewhat tenuous.

Viewed objectively, however, this is a questionable position. Ambulation, exploration, open-area ambulation, and open-area exploration may be seen as highly related measures which may represent only different ways of measuring the same basic type of response. Also, as may be recalled, the rating scale employed in determining emotional responsiveness to handling involved responses common to each of the measures taken in the open-field test situation. Thus, instead of seven distinct measures of emotionality we may, at best, be dealing with only three. Such a perspective makes the dismissal of this difference as being due to chance more acceptable.

A second approach which may be taken is to assume that the trend effect is real and indicative of an actual tendency toward greater emotionality on the part of the Su Ss. Making such an assumption, the task then becomes one of identifying factors contributing to the nonsignificance of the results.

While a number of factors might be identified as possibly contributing to the lack of significance in this study, it is felt that there are three variables of major importance both in terms of their influence on the findings of this study and as they relate to future research. The first of these is the degree of success and failure experienced in the food competition situation. Although a highly significant difference was obtained between the two groups on success in food competition, it should be noted that out of the 60 periods of competition experienced by each animal the mean number of successes achieved by the Su Ss was 28, slightly less than one-half. The Fa Ss, however, had an average of only nine successes. Also, there was overlap between the two groups in terms of the number of successes

achieved. Four of the Fa Ss had higher success scores than three of the Su Ss. It is, thus, suggested that a greater differential in the degree of success and failure experienced in the food competition situation may serve to differentiate the two groups more clearly on emotionality.

The age of the Ss is also seen as a potentially significant factor. Since sexual maturity in the rat is reached at the age of 60 days and full maturity is reached at approximately 120 days of age, the 60 to 90 day age range used in this study may be seen as a latter stage in the developmental period. Therefore, it is suggested that success and failure occurring earlier in the developmental period may have a more differential effect on emotionality. There appears to be sufficient evidence of a critical period effect with other experiential variables to warrant, at least, a search for such an effect in relation to competitive experiences. The age range used in this study was not chosen with any critical period effect in mind. The initial age of 60 days for the experimental Ss was used because a 30 day age difference between the social animals and experimental animals was seen as necessary for insuring success and failure in food competition.

Finally the open-field test situation alone might be seen as an insufficiently emotionally arousing stimulus situation to produce a significant response difference between the two groups. The lack of defecation on the part of both groups of Ss is, at least, suggestive of such a position. The use of fear-provoking auditory or visual stimuli in the test situation might prove facilitory to obtaining a greater response differential.

Assuming that this trend effect is real, a question may also be raised as to the reason for the direction of the difference. Unfortunately, due to the lack of related research, there is no answer. However, two studies, one by Henderson (1966) and the other by Meyers (1965), do offer an interesting if not potentially profitable approach to the question. The results of both of these studies suggest that the relationship between the amount of "stimulus input" associated with various experiences and later emotionality is U-shaped rather than monotonic. While it is considered far too speculative to suggest that the relationship between the degree of success and failure experienced in competition and later emotionality is U-shaped, the suggestion that the relationship may be nonmonotonic, or that various degrees of success and failure may have similar effects on later emotionality provides an interesting objective for further research.

Although considerable attention has been devoted to the discussion of a trend effect, it should be noted that the actual existence of this trend effect remains questionable. Care should be taken not to lose sight of the basic findings revealed by the data. Looking at these findings, they may be seen as rather conclusively indicating that the success and failure experienced in food competition in this study did not have a differential effect on emotionality.

CHAPTER VI

SUMMARY

This study represented an attempt to investigate the effect of competitive social experiences on emotionality of the rat. Two hypotheses were put forth: (1) In competition for food, rats competing with rats 30 days younger than themselves will be more successful than will rats competing with rats 30 days older than themselves. (2) Successful and unsuccessful experiences in competition for food will have a differential effect on emotionality of the rat.

Eighteen 60-day-old male albino rats were used as Ss. Nine of the Ss were each housed with two 90-day-old animals and nine of the Ss were each housed with two 30-day-old animals. These groups were placed on a feeding schedule involving two daily periods of food competition. Observations were made during the periods of competition to determine each S's success and failure. At the age of 91 days, the Ss were tested for emotionality using the open-field test and ratings of emotional responsiveness to handling.

Observations of success and failure revealed, as predicted, that those Ss competing with younger animals were significantly more successful in competing for food than were those Ss competing with older animals. The open-field test as well as the ratings on handling revealed no significant difference between the two groups. However, there did appear to be a trend effect with the successful Ss being

more emotional on each of the measures employed in the open-field test and the ratings on handling.

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APPENDIX A

RATING SCALE

0 - no startle; no escape attempts; no vocalization

1 - startle response; no escape attempts; no vocalization

2 - startle response and/or escape attempts; no vocalization

3 - startle response and/or escape attempts with vocalization

Note: One point was added to the rating received by an animal for the occurrence of urination and/or defecation during the handling process.

Definition of Terms

Startle: cowering or freezing upon approach of experimenter's hand

Escape attempts: excessive flight and/or vigorous struggling

APPENDIX B

SUCCESS SCORES IN FOOD COMPETITION

		Fa									Su								
Ss		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
	1.	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0
		0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	0
	2.	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
	3.	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
	4.	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1
		1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1
	5.	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1
		0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	1
	6.	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0
		0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0
	7.	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	8.	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0
		1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0
	9.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
		1	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0
	10.	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1
		1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1
Days	11.	1	0	0	0	0	1	0	0	0	1	1	1	0	1	1	0	1	1
		0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0
	12.	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	1
		0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1
	13.	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0
		1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1
	14.	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0
		1	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0
	15.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
		0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1	1
	16.	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0
		0	1	0	0	0	0	0	1	0	1	0	1	1	1	0	0	1	0
	17.	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0
		0	1	0	0	1	0	0	0	0	0	0	1	1	1	1	0	1	0
	18.	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	0
		0	1	0	0	1	0	0	0	0	1	0	0	1	1	0	0	1	1
	19.	0	0	0	0	1	0	0	0	0	1	0	1	1	0	1	0	1	1
		0	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	1	1
	20.	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0	1	1
		0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1

		Fa									Su								
	Ss	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
Days	21.	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0
		0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1
	22.	0	1	0	0	1	1	0	1	0	0	0	0	1	1	1	0	1	1
		0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	0	1	1
	23.	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1	0	1	1
		0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0
	24.	0	1	0	0	0	1	0	0	0	1	0	0	1	1	1	0	1	1
		0	1	0	0	1	1	0	0	0	0	0	0	1	1	0	1	1	1
	25.	0	0	0	0	1	0	0	1	0	1	0	0	0	1	1	0	1	1
		1	1	0	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0
	26.	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0
		0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	1
	27.	0	0	1	0	1	0	0	1	0	0	1	0	1	0	1	0	0	1
		0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	0
	28.	1	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0
		0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	1
	29.	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	1	1	1
		0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	0	1	1
	30.	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1
	Totals	13	26	1	1	17	15	2	12	0	24	11	27	35	36	34	17	43	32

APPENDIX C

RESPONSE TIMES

Fa

Days		1	2	3	4	Totals
Subjects	1.	.81	2.86	3.77	.83	8.27
	2.	13.66	2.52	3.17	1.71	21.06
	3.	29.23	9.59	1.43	1.16	41.71
	4.	2.35	1.76	1.51	2.63	8.25
	5.	8.46	6.97	2.66	.93	19.02
	6.	9.21	.80	7.36	1.38	18.75
	7.	8.07	.70	.72	.73	10.22
	8.	10.30	2.10	4.52	.63	17.55
	9.	4.53	2.64	1.43	.82	9.42
Totals		86.62	30.24	26.57	10.82	154.25

Su

Days		1	2	3	4	Totals
Subjects	1.	30.24	.92	2.06	.50	33.90
	2.	9.83	10.18	1.17	.63	21.81
	3.	9.92	1.04	1.04	.69	12.69
	4.	9.04	1.04	.76	.64	11.48
	5.	9.36	7.77	1.29	.41	18.83
	6.	7.29	9.67	1.55	.63	19.14
	7.	5.24	2.17	.77	.89	9.07
	8.	13.19	1.70	.77	.57	16.23
	9.	2.10	1.33	16.38	2.76	22.57
Totals		96.39	35.82	25.79	7.72	165.72

APPENDIX D

URINATION

Fa

Days	1	2	3	4	Totals
1.	1	1	1	1	4
2.	1	0	0	0	1
3.	1	0	1	0	2
4.	1	0	0	0	1
5.	1	1	1	1	4
6.	1	1	1	0	3
7.	1	1	1	0	3
8.	0	1	0	0	1
9.	0	0	0	0	0
Totals	7	5	5	2	19

Subjects

Su

Days	1	2	3	4	Totals
1.	1	1	1	0	3
2.	1	1	0	1	3
3.	1	1	0	1	3
4.	1	1	1	0	3
5.	1	0	1	1	3
6.	1	0	0	0	1
7.	1	1	1	0	3
8.	1	1	1	1	4
9.	1	0	0	1	2
Totals	9	6	5	5	25

Subjects

APPENDIX E

AMBULATION

Fa

Days	1	2	3	4	Totals
1.	8	3	139	62	212
2.	98	66	89	105	358
3.	41	119	34	88	282
4.	76	76	128	112	392
5.	88	82	85	73	328
6.	90	36	64	55	245
7.	44	82	76	58	260
8.	89	68	97	57	311
9.	13	103	9	6	131
Totals	547	635	721	616	2519

Subjects

Su

Days	1	2	3	4	Totals
1.	79	129	118	80	406
2.	76	29	52	69	226
3.	69	98	67	35	269
4.	58	65	11	38	172
5.	22	77	36	79	214
6.	56	54	77	83	270
7.	67	92	125	114	398
8.	79	106	50	26	261
9.	8	3	39	64	114
Totals	514	653	575	588	2330

Subjects

APPENDIX F

EXPLORATION

Fa

Days		1	2	3	4	Totals
Subjects	1.	5	3	24	18	50
	2.	21	19	22	23	85
	3.	18	23	20	20	81
	4.	15	18	25	24	82
	5.	20	20	20	22	82
	6.	18	20	18	21	77
	7.	16	20	22	17	75
	8.	25	19	19	17	80
	9.	6	20	7	6	39
Totals		144	162	177	168	651

Su

Days		1	2	3	4	Totals
Subjects	1.	17	17	17	17	68
	2.	19	10	17	22	68
	3.	18	17	17	17	69
	4.	22	17	7	17	63
	5.	9	17	14	17	57
	6.	17	19	24	24	84
	7.	20	17	25	24	86
	8.	17	17	17	10	61
	9.	5	3	7	17	32
Totals		144	134	145	165	588

APPENDIX G

OPEN-AREA AMBULATION

Fa

Days	1	2	3	4	Totals
1.	0	0	7	0	7
2.	6	2	8	17	33
3.	1	11	4	3	19
4.	0	1	18	12	31
5.	4	4	7	7	22
6.	1	3	1	7	12
7.	13	3	4	4	24
8.	15	4	1	0	20
9.	0	3	0	0	3
Totals	40	31	50	50	171

Subjects

Su

Days	1	2	3	4	Totals
1.	0	1	0	0	1
2.	2	0	0	7	9
3.	1	0	1	0	2
4.	5	0	1	0	6
5.	1	0	0	0	1
6.	0	2	15	13	30
7.	3	0	25	11	39
8.	0	0	0	0	0
9.	0	0	0	0	0
Totals	12	3	42	31	88

Subjects

APPENDIX H

OPEN-AREA EXPLORATION

Fa

Days	1	2	3	4	Totals
1.	0	0	7	0	7
2.	4	2	6	7	19
3.	1	7	4	3	15
4.	0	1	9	8	18
5.	3	4	3	6	16
6.	1	3	1	5	10
7.	8	3	5	3	19
8.	9	3	1	0	13
9.	0	3	0	0	3
Totals	26	26	36	32	120

Subjects

Su

Days	1	2	3	4	Totals
1.	0	1	0	0	1
2.	2	0	0	6	8
3.	1	0	1	0	2
4.	4	0	1	0	5
5.	1	0	0	0	1
6.	0	2	8	8	18
7.	3	0	9	9	21
8.	0	0	0	0	0
9.	0	0	0	0	0
Totals	11	3	19	23	46

Subjects

APPENDIX I

RATINGS OF RESPONSE TO HANDLING

Fa

Days		1	2	3	4	Totals
Subjects	1.	2	3	2	2	9
	2.	3	2	2	2	9
	3.	1	0	1	0	2
	4.	2	3	3	1	9
	5.	3	2	0	1	6
	6.	2	3	2	1	8
	7.	3	2	0	1	6
	8.	2	0	2	2	6
	9.	3	3	2	1	9
Totals		21	18	14	11	64

Su

Days		1	2	3	4	Totals
Subjects	1.	3	2	1	0	6
	2.	2	2	2	2	8
	3.	2	2	3	2	9
	4.	2	3	3	2	10
	5.	3	2	0	2	7
	6.	2	0	1	0	3
	7.	1	1	1	1	4
	8.	4	3	3	3	13
	9.	4	3	3	1	11
Totals		23	18	17	13	71

APPENDIX J

WEIGHTS OF THE Ss AT 60 AND 98 DAYS

	Fa			Su	
	Weight (gms.)			Weight (gms.)	
Subject	60 Days	98 Days	Subject	60 Days	98 Days
1.	278.0	365.0	1.	285.0	367.0
2.	269.5	372.5	2.	284.0	356.0
3.	277.0	373.0	3.	273.0	368.5
4.	253.0	308.5	4.	273.0	346.0
5.	275.0	355.5	5.	264.0	332.0
6.	250.0	325.0	6.	277.0	349.0
7.	269.0	375.5	7.	268.0	358.0
8.	287.0	319.5	8.	271.0	319.5
9.	288.0	360.0	9.	287.0	384.5

APPENDIX K

WEIGHTS OF THE ADRENAL GLANDS

Fa		Su	
Subject	Weight (gr.)	Subject	Weight (gr.)
1.	.875	1.	.625
2.	.625	2.	1.125
3.	.750	3.	.750
4.	.812	4.	.812
5.	.750	5.	.750
6.	.750	6.	.750
7.	.937	7.	1.063
8.	.750	8.	.750
9.	.875	9.	.750

VITA

Ben Douglas Monroe

Candidate for the Degree of

Doctor of Philosophy

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