

EMOTIONALITY AND INTELLIGENCE IN THE HOODED RAT
AS A FUNCTION OF DIFFERENT PERIODS OF POST-
WEANING REARING IN A "MEANINGFUL" ENVIRONMENT

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requirements for the degree of Master of Arts in Psychology

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SUMMARY PAPER

4 groups of Ss (N = 24) were exposed for different lengths of time to a situation where the variable of "meaningfulness" (in terms of contingency of food and water presentation on behaviour) was manipulated. Predicted differences in weight gain and emotionality but not in problem-solving ability were found. Certain shortcomings of the design as well as the inadequacy of testing tools presently available, were discussed as possible confounding factors. It was concluded that the experimental analysis of behaviour framework offered a useful alternative approach in investigating problems of early development.

The majority of early environment research involves passive presentation of one or more independent variables. These usually take the form of either decreased stimulation, e.g., depriving the animal of light or opportunity to move about, or increased stimulation in the form of handling, shocking or rearing in various types of "enriched" environments. One of the main difficulties with this kind of approach is an inability to specify exactly the variables critical for producing changes in functioning as a result of these manipulations.

The present research adopts an alternative approach to the study of early determinants of behaviour which involves the use of an experimental analysis of behaviour framework. This framework allows for a precise definition of rearing environments, as well as for control of the stimulus and response variables involved so that behaviour of individual Ss may be easily analysed. Moreover, it emphasises the importance of the relationship between an organism's responses and the consequences of such responses.

One way in which such an approach may be used in studying the effects of manipulating the reinforcement contingencies ("meaningful") of rearing environments, Radloff (1970, 1971), in a series of experiments found interesting differences in terms of weight gain, emotional reactivity and learning ability between rats exposed to a "meaningful" environment in which food and water presentation was contingent upon the Ss' lever-pressing behaviour, and two groups of control Ss -- one being yoked to the experimental condition and thus dependent on the responses of the experimental Ss for their food and water supply, and the other provided with food and water ad libitum. It is important to note that all three groups were exposed to the same physical environment; the only difference between groups was in terms of the sorts of meaningful interactions possible to each.

The present study attempts to replicate Radloff's initial findings with regard to weight gain, emotionality, and "intelligence" (problem-solving rather than learning ability) and also by extending the design, to investigate the relationship between time spent in a meaningful environment and subsequent behavioural changes.

Method

Subjects: The subjects were 24 male hooded rats from the rat colony of the Department of Psychology, University of Cape Town. They were divided into 4 groups, each comprising 3 experimental and 3 control Ss. The subjects for each group were drawn from two litters born within a day of each other.

Apparatus: The apparatus for each group consisted of two cages 70 cms³ made of aluminium with stainless steel wiremesh floors and open tops. Each was provided with two containers, one for food and one for water, and two levers, the depression of which (in the experimental situation only) deposited one 45 mg. pellet of food or resulted in 0,7 secs. of water flow (just enough to fill the container). The levers in the yoked control group could be depressed but were not connected to a food or water supply, for which the control Ss depended on the responses of the experimental group.

The cages were housed in separate temperature-controlled (22° C) rooms with an artificial light - dark cycle (6 to 6), and inspected at least twice daily when food and water supplies were replenished. Cleaning was done approximately once a week by changing woodshavings in a tray underneath the cages.

The apparatus for testing emotional reactivity consisted of a circular open field, 84 cms. in diameter with a black-painted aluminium surround 61 cms. high. The floor was of white formica divided by thin black lines into an inner circle ($31\frac{1}{2}$ cms. diameter) and 6 radial segments to facilitate recording of Ss' ambulation. A single unshaded frosted 100 watt globe suspended above the apparatus provided 100 candle illumination at the centre of the field. A motion detector connected to a cumulative recorder gave a measure of activity in the field.

The apparatus was situated in a temperature (22° C) and air-conditioned room. "White noise" (75 decibels) masked extraneous noise.

Problem-solving ability was measured by the Hebb-Williams standardized closed field test of intelligence adapted for water escape (Rabinovitch and Rosvold, 1951; Rosvold and Mirsky, 1954). The test apparatus was housed in a temperature-controlled (22° C) room with light provided by a single window and fluorescent lighting.

Procedure:- At weaning (23 to 25 days) Ss were sexed, marked and weighed. The males were assigned to experimental and control cages in such a way that weights did not differ significantly between the conditions, either in terms of means or of standard deviations.

After the appropriate number of days (group I, 20; group II, 30; group III, 40; and group IV, 50 days) Ss were removed from the experimental cages, weighed and returned to their home cages, 3 in a cage (1 experimental, 2 control; 1 control, 2 experimental, randomly assigned). Rats were housed in the rat colony room, and removed only during testing. Food and water were provided ad libitum.

A day after removal from the experimental situation, testing began in the open field. Each S was given one 4 minute trial a day for six days, testing being carried out between 6 and 9 p.m. Testing order was systematically varied. Recordings were made of the following variables:- defaecation, rearing, grooming, "other" (sniffing the sides of the field, and "eating" behaviour), general ambulation, inner circle ambulation, and activity as recorded by the motion detector. Separate recordings were made for the first and second half of each trial, to investigate for any qualitative or quantitative changes in responding over time.

Ss were weighed after the third and after the final trial.

At the end of the open field testing, Ss were rested for a day and then run on the closed field test for the following 11 days. The procedure employed was very similar to that outlined by Rosvold and Mirsky, 1954, with a few minor changes.

Ss were weighed at the start and end of testing on the 12 test problems.

Results

Weight:- Significant weight differences were found between experimental and control Ss at removal from the experimental situation, experimental Ss weighing more than control Ss. This difference was not found at any of the later weighings.

Emotionality:- Groups I and IV (20 and 50 days) showed clear differences in emotionality, experimental Ss being less emotional than control Ss. Group II (40 days) showed no such differences while in group III (40 days) these differences were significant but in the opposite direction, control Ss exhibiting less emotional behaviour than experimental Ss.

Differences between groups, were significant and when scores obtained for the various variables were plotted on graphs, these revealed that there was a tendency for defaecation and ambulation (especially inner circle ambulation) to increase with age.

Differences between the first and second half of trials, tended to be in the direction of decreased frequency of responding on the variables measured.

Both the age and time differences are in line with previous findings.

Problem-solving:- Results on the Hebb-Williams (both time and score measures) revealed no differences between experimental and control conditions but there were significant differences in

performance between groups. When these were plotted on a graph, it became obvious that the significant F was largely due to the superior performance of group III (40 days). There was also a slight trend towards improvement, with age, with respect to times and scores.

Discussion

The results obtained for weight support those obtained by Radloff (1970). But the later negative findings suggest that weight differences are short-term. It is possible that experimental Ss utilize their food intake better than controls, or that they are less active in the experimental situation than controls. There is no means at present of ascertaining whether either of these explanations is correct.

The positive results obtained on the OFT, support those of Radloff (1970). The negative results in groups II and III may be due to uncontrolled variables in the form of placement in new experimental cages lacking olfactory traces, and extra stimulation in the form of building noise, respectively. The variable of unused cages seems to be an important one since similar emotionality results were obtained with another group of animals (pilot group, 50 days) also placed in unused cages. The reasons for this are not clear.

The findings on the Hebb-Williams suggest that there are no differences in problem-solving ability between Ss reared in a "meaningful" environment and control Ss. However, problems with regard to reliability of the test as well as some procedural difficulties may have confounded the results.

Conclusion

It would appear that the approach outlined in the present study, is a useful one for the investigation of developmental processes. The framework outlined allows for innumerable manipulations of stimulus and response variables in a controlled setting as well as for precise analysis of changes in individual and social behaviour in the environmental setting.

What remains as the biggest impediment to progress in the field of early development, is the scarcity of valid and reliable tests which can be used to assess changes in functioning following the introduction of various modifications on the organism's environment.

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INTRODUCTION

The statement that the early experiences of an organism are important for its later development and behaviour has become almost a truism. The psychoanalytic approach traditionally stressed the significance of early development while work with institutionalized children, and cross-cultural studies of child-rearing practices have further underlined its importance.

Laboratory studies usually using the rat as a subject, have attempted to investigate the exact nature of the variables responsible for these effects. When one examines these studies as a group, it becomes clear that certain uniform trends are present which strongly influence both the kinds of problems being investigated and the framework in which this is being done.

Firstly, the main postulate has been that it is the amount of stimulation (physical, social, or "psychological") that is the important variable in producing later changes in behaviour (Denenberg, 1964).

This has led to studies which have either reduced the amount of stimulation an animal receives by, for example, blinding, confining to a small living area, or depriving of social interaction, or increased by handling or "gentling", shocking, and exposure to various types of "enriched" environments. The most usual findings have been that animals which receive stimulation (noxious or otherwise) over and above that normally available to them in a laboratory setting, show often marked changes in functioning in terms of lower emotional reactivity and enhanced problem-solving ability, as well as anatomical and physiological changes in the brain.

Secondly, much emphasis has been placed on investigating the possible effects of the time in the organism's development at which stimulation is varied. Numerous studies have attempted to uncover a critical period during which the organism is most susceptible to environmental manipulation. Most studies have concentrated on the earliest developmental phases, involving the first few weeks or even the first few days of life. (See Denenberg, 1964; 1966 for a review).

Unfortunately, despite the great increase in the numbers of studies in this area especially in the last five years, little real progress has been made with regard to reaching a clearer understanding of early determinants of development. Two factors have, in our opinion, been responsible for this failure.

In the first place, there has been a tendency on the part of workers in the field towards a rather simplistic view of the problems involved in trying to analyse developmental processes. As a result, some investigators have set out to discover and isolate the critical variable or the critical age in early experience: without the prior consideration that the kind of questions they were asking are possibly meaningless and unrealistic in terms of what we know about the complexity of developmental processes.

In the second place, methods used to investigate early determinants of behaviour have frequently lacked precision with regard to definition of actual environmental variables being manipulated so that findings obtained are often difficult to interpret. Moreover, the techniques used to vary; levels of stimulation usually involve the passive presentation of one or more independent variables with little regard for, or interest in, the organism's responses to the situation. In addition, the methods used to test for any changes following manipulation are sometimes unacceptable since they involve subjecting the animal to a condition, e.g. handling, which is one of the independent

variables being studied (Abel, 1971). Clearly, such factors are important and may invalidate many of the explanations offered. Of results previously obtained in studies where no control for them was provided.

What seems to be needed in the area is an alternative approach which allows for more precise definition and control of the variables operating in an individual's early environment and thus leads to a clearer understanding of them.

Such an alternative has been offered in the form of an experimental analysis of behaviour framework which involves "merely applying to the developmental field that technology which allowed control of stimulus and response variables in short term parametric studies on adult animals" (Radloff, 1970).

The present study is but one example of the possibilities this kind of approach opens up for workers in the area. Basically, it involves testing the general hypothesis that animals which are raised in an environment where food and water availability is contingent on a specific type of response, e.g. lever-pressing, will differ on a number of variables such as weight, emotionality and problem-solving ability, from controls not exposed to this kind of environment. The actual differentiating factor of importance is the "meaningfulness" of the situation in terms of the animal's ability to control its environment through its behaviour.

Evidence for the importance of this variable comes from a number of sources although the actual relationship between the animal and its environment has not been explicitly stated in the terms used above. Rosenzweig (1969a) in discussing the possible causes of behavioural changes and especially anatomical and physiological changes in the brain of rats after exposure to a complex environment, concludes that what appear to be the most significant variables are the presence of other animals (social stimulation) and the provision of inanimate playthings with which animals could interact. Obviously, both these forms of extra

stimulation were very likely to result in meaningful interaction on the part of the Ss. This is especially true of interaction with other Ss, the variable which Rosenzweig actually found to be the most important in producing later effects.

McCall (1967) found that rats allowed access to objects which were moveable on contact (and whose movement could thus be controlled by the Ss) showed behaviour in the open field of a kind which suggested that they had experienced a more "enriched" ("meaningful" in our interpretation) environment than had control Ss who were exposed to objects identical in appearance but immovable. It could be argued of course that it was the variable of movement rather than the fact that the Ss were initiating it, which was important. (The way this possibility can be tested is by yoking the experimental to the control cages in such a way that the stimulus objects present in the latter, would move only if and when the experimental Ss interacted with the equivalent stimulus objects in their cages). Nevertheless, the finding as it stands can be interpreted as lending support to our hypothesis.

Additional, though perhaps more indirect evidence, comes from the study done by Bennett and Ellis (1968) following on from the work of Kerpelman (1965), which investigated the importance of nondifferential reinforcement in the form of food on later discriminatory learning of various geometric shapes. Their findings suggest that animals fed in the presence of these stimuli, performed significantly better on the later discrimination task than animals not fed in the situation. We would interpret this as suggesting that the former combination of variables in a meaningful relationship for the Ss between the food and the stimuli, although there was no contingency behaviour involved. Moreover, Ss who were allowed to interact with these stimuli, performed better than those who only had visual contact with them.

The studies mentioned all involved some form of active behaviour on the part of the Ss, but the implications of this fact in terms of meaningfulness were not made explicit. Indeed, no worker in the field seems to have considered this interpretation of the results obtained, although it is in fact possible to reinterpret many previous studies in terms of meaningfulness, especially those concerned with handling effects, where the animal's reactions to being picked up and held are important in terms of the experimenter's behaviour which may or may not be sensitive to the Ss responses. In other words, the interaction between experimenter and subject is emphasized.

Radloff (1970; 1971) seems to have been the first to investigate systematically the variable of meaningfulness with respect to later differences in weight, emotionality, and learning ability. He carried out a series of experiments which specifically involved the manipulation of this variable. The experimental Ss had access to food and water supplies by behaving in a specific manner (lever-pressing); the yoked controls depended for their food and water on the behaviour of the experimental Ss; and a control group were provided with food and water adlibitum. The results, although not conclusive because of certain methodological problems (See Radloff, 1971 for an outline of these), suggest that the experimental animals were indeed superior to control Ss in terms of weight gain and on a habit-reversal task, as well as being less emotional when tested in the open field.

Our study involves a continuation of this type of research but with certain additional factors included, the most important being variations in time spent in the meaningful situation (Radloff used a 16 and a 30 day period but did not compare the results) as well as the provision of a problem-solving rather than a learning test, the former we felt being more likely to reveal any differences in "intelligence". Basically, however, our designs were essentially the same.

The main reason why we felt this study to be necessary was our belief that the approach used is potentially a most important one in terms of the kind of control of relevant variables it allows and the emphasis it places on the behaviour of the individual animal, both factors which have been up to now largely overlooked in work done in this area.

EXPERIMENTAL DESIGN

Rationale for the experimental design used and an outline

In planning our design, we kept relatively closely to the original one used by Radloff (1970, 1971) since one of our aims was a replication of his findings. However, in view of the fact that he consistently found no differences between his yoked and control groups, it was decided to have only one control condition, that of a yoked group. The choice of this method of control ensured that control Ss were provided with food and water in the same quantities and at the same times as the experimental Ss but had no control over their supply which was entirely governed by the behaviour of the experimental Ss. This technique, coupled with matching of experimental and control Ss' weights, allowed for later meaningful comparison of weight gains between Ss in the two conditions.

With regard to time spent in the experimental situation, we originally decided on five different periods -- 10, 20, 30, 40 and 50 days -- since we were interested in seeing whether there was any relationship between the time spent in the experimental situation and later differences in emotionality and problem-solving ability. However, because of difficulties experienced in obtaining enough suitable subjects, the 10 day group was left out of the final design.

The number of Ss in each condition posed some problems, since we did not wish to introduce any form of social deprivation into the situation but at the same time, feared that a large number in each condition might cause difficulties with regard to overcrowding during lever-pressing and feeding, a factor which could lead to non-reward of appropriate behaviour (One rat may press a lever, while another eats the pellet. This can occur in smaller groups as well, but the probability increases with size of group). After running a pilot group using five Ss per condition, we decided that this number was too large, and chose to limit numbers to three per condition, a move which was perhaps unfortunate with regard to later statistical analysis but could not be avoided.

Our design thus consisted of four groups -

| | |
|-----------|-----------|
| group I | (20 days) |
| group II | (30 days) |
| group III | (40 days) |
| group IV | (50 days) |

with six Ss in each group, three per condition giving a total of 24 Ss.

Since all the groups were placed in the experimental situation at the same age (approximately 26 days), each group differed in age from any other by at least 10 days during subsequent testing. But as each group consisted of experimental and control Ss, comparison within and between groups was possible.

We were interested in the effects on emotionality and "intelligence" (problem-solving) of different periods in the experimental environment. This necessitated an emotionality test and a test of intelligence. The choice of the open field test satisfied the first requirement. A modified form of Hall's (1934) test was used. This allowed for comparison of results with those obtained by Radloff (1970; 1971) who used the same test, and also with results obtained by other investigators in the field of early environmental programming most of whom have tested for emotionality using some form of the open field test.

The choice of a test of intelligence or problem-solving ability required that lever-pressing or similar responses were not part of the testing situation, in view of our design which involved lever-pressing in the experimental cages. The Hebb-Williams closed field test met these requirements. Two versions of this test are available -- a floor test and a water test -- and, although more work has been done in standardizing the former, and this version has most often been used by investigators testing for differences in problem-solving ability following early environmental manipulation, the water version was considered for practical reasons, more appropriate for the present

study. First, it involves motivation in the form of water escape rather than hunger (as in the floor test) and thus does not necessitate depriving animals of food, a procedure which would have involved considerable difficulty since our groups differed in age during testing. Thus, both the deprivation schedule and the amount of food given as reward would have to be modified for each group. Second, the water test has the practical advantage of not needing cleaning after every trial, a procedure most necessary in the floor version where olfactory traces can confound results rather badly.

EXPERIMENTAL PROCEDURE

Subject selection and maintenance.

The subjects used were 24 male hooded rats divided into 4 groups, each comprising 3 experimental and 3 control animals. The subjects were specially bred for this research using animals from the rat colony at the Department of Psychology, University of Cape Town. Breeding was done at different times for each of the groups since groups were run consecutively and not simultaneously.

Randomly selected females were mated and then placed individually in cages made of transparent plastic and measuring 17 x 28 x 12 cms. with wiremesh tops and wood-shavings covering the floors. The cages were housed in the temperature (22°C) and humidity controlled rat colony room with a natural light-dark cycle. Food in the form of Epol rat pellets (Formula 4100) and water were provided ad libitum. The wiremesh tops were shaped in such a way as to provide a container for the pellets, which the animals could easily reach. The water was held in glass bottles with rubber tubes at one end, the bottles being placed through the wiremesh at an angle.

Birth date of each of the litters was recorded. Litters were undisturbed until weaning. At weaning (23 to 25 days after birth depending on the size of the pups), each litter was placed in a cage similar to the one described above but with larger dimensions (24 x 45 x 16 cms.) also housed in the rat colony room. The animals were then sexed and ear-marked. The males were weighed using a Mettler P2000 scale with weights being recorded to the nearest gramme, and assigned to either experimental or control conditions in such a way that any differences in weight, either of the means or of the Standard Deviations were not significant between experimental and control Ss. When it was not possible to form groups with equal mean weights, even though differences were not significant, the heavier group was assigned to the control condition. The Ss

were then placed in the experimental cages for the prearranged time, i.e., either 20, 30, 40 or 50 days (the approximate age being then 26 days.)

The procedure outlined above was repeated for each of the 4 groups. The choice of Ss was limited by the date of birth, and sex. The Ss for each group came from two litters which were born either on the same day or within one day of each other. Litters with larger discrepancies in birth dates were not used since control for age was considered important in the present design. Weight allowing, animals from the two litters were distributed equally between experimental and control situations in each of the 4 groups.

Unfortunately, because of the limited number of suitable Ss, the same rigour could not be applied with regard to litter size although it had initially been hoped to limit selection to litters of 6 to 8. Taking all 4 groups together, litter size varied from 3 to 12.

Apparatus for the "meaningful" environment and procedure.

The cages used to provide a "meaningful" environment were 70 x 70 x 70 cms. in size, built of aluminium with stainless steel wiremesh floors. The tops were uncovered. The cages rested on short legs, 8 cms. off the ground so that a shallow tray 70 cms square could slide underneath. This enabled cleaning of cages to take place without undue disturbance of the Ss.

On one of the inside walls of each cage were affixed two containers, one for food and one for water 43 cms. apart and $5\frac{1}{2}$ cms. from the floor of the cage. Each container was made of aluminium and measured $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{4}$ cms. 2 cms. above and $1\frac{1}{2}$ cms. to the right and to the left of the food and water containers respectively and at right angles to the floor were situated the

levers which measured $1\frac{3}{4}$ cms. in length and were $\frac{1}{2}$ cm. wide. These were attached to micro-switches in such a way that a lever-depression would result in the dispensing of a single pellet of food or 0,7 secs. of water flow (this amount just filled the water container).

Pellets were deposited into the food container from the food dispenser attached to the outside of the cages via a plastic tube running into a chute. The dispensers were obtained from the Ralph Gerbrands Co., Arlington, Massachusetts. Two models were used; D 1 for groups III and IV and G 51000 for groups I and II. The mechanisms of these were essentially the same except that the latter model was less noisy and slightly more reliable with regard to freeflow of pellets.

Water was pumped into the water containers by means of a rubber tube attached to an aquarium pump which was suspended in a beaker of water placed outside the cage. (See Appendix III for a diagram.)

The control cages were identical to the experimental ones except that the two levers in each cage were not linked to a food and water supply. Instead, the control cage was yoked to the experimental cage, so that the control Ss obtained food and water only when one of the experimental Ss pressed the appropriate lever. This system ensured that both sets of Ss would receive the same quantity of food and water at the same time. (Thus any differences in weight at the end of an experimental session could not be attributed to consumption of differential amounts of food and/or water).

The cages were housed singly in two rooms (3,50 x 2,15 meters in size) separated by a corridor. The rooms were air-conditioned and the temperature was kept at approximately 22°C. A 12 hour light-dark cycle (6 to 6) was maintained by means of time-switches. Light was provided by fluorescent lighting.

While in the experimental situation, the Ss were fed with Noyes Precision Food pellets each weighing 45 mgs. The ingredients of the pellets were: animal feed, bleached flour, dry milk solids, gelatin and calcium phosphate. Experimental Ss' responses were shaped for the first day or so and control Ss were provided with approximately the same amounts of food and water during this period.

The apparatus and animals were inspected at least twice a day and the food and water supplies replenished. Lever pressings for both groups were recorded by means of automatic cumulative recorders. The cages were cleaned approximately once a week by sliding out the trays beneath the cages and replacing the woodshavings in them.

At the end of the experimental session, the Ss were removed from the cages by hand, weighed, and returned to the home cages they had occupied at weaning (24 x 45 x 16 cms. in size). For every group, the Ss were assigned to cages in such a way that there were 3 Ss per cage, (2 experimental, 1 control; 2 control, 1 experimental). The cages were randomly numbered 1 and 2, and were placed in the rat colony room. Throughout testing, the Ss remained housed here, being provided with food and water ad libitum as well as with vegetables once a week. They were not isolated from the rest of the colony.

Starting on the day after removal from the experimental situation, the Ss were run for six days on the Open Field Test, rested for a day and then run on the Hebb-Williams Closed Field Test for a total of 11 days. The Ss were weighed after the third and after the final Open Field trial, as well as at the start and end of the testing on the 12 closed field test problems. Together with the weights recorded at the beginning and end of the experimental sessions, this gave a total of six weight recordings for each S., which served to provide a clear picture of possible differences in weight gains between experimental and control Ss in any of the four groups.

TESTING -- THE OPEN FIELD TESTIntroduction

The term "emotionality" is a blanket one used rather loosely to describe certain states of affect or "feeling" in a variety of situations. These subjective reactions are usually equated with changes in the Autonomic Nervous System which are manifested in behavioural responses of a certain kind of which accelerated breathing, increased heart-rate, change in pupil size and increased rate of elimination are examples.

In research using animals, this last type of response (elimination) has been most widely used as a measure of emotionality. Individual differences in emotionality are assessed by placing the animal in (what is considered by the investigator to be) a fear-provoking situation. This usually takes the form of a large, unfamiliar open space. The number of times defaecation and urination takes place during a specified time period gives an indication of the emotionality of the animal.

Hall (1934; 1936a; 1936b), in a series of studies developed a standardized open field test of emotionality using defaecation and activity as two inversely related measures of emotionality or "adjustment". The kind of elimination exhibited by the Ss, Hall (1934) called "emotional elimination". The validity of these measures has been confirmed by a number of later studies eg. Evans and Hunt (1942), Broadhurst (1957; 1958) and Isvinskis (1966).

More recently, other open field measures have been investigated as possibly useful indicants of emotionality. Among these have been urination, rearing, grooming, "freezing" and inner circle activity. (Doyle and Pratt Yule, 1959; Isvinskis, 1966; 1968; 1970; Pare, 1964). Apart from confirming on the whole Hall's initial results, these later studies also suggest that

rearing is a valid and reliable measure of emotionality, i.e., the less emotional animal, when placed in a novel situation will rear more. This finding can be explained in terms of the inverse relationship between exploratory behaviour (of which rearing is a form) and timidity or fearfulness (Montgomery, 1955; Hayes, 1960).

Urination and inner circle activity (ambulation in the centre of the open field) both appear to be valid measures of emotionality, the former being associated with increased, and the latter with decreased, emotionality. However, their reliability as indicated by test-retest and odd-even day correlations, has been found to be poor (Isvinskis, 1968). "Freezing" behaviour also appears to be a valid measure of emotionality (Doyle and Pratt Yule, 1959) but little is known about its reliability. Grooming is neither a valid nor a reliable measure of emotionality. Rather, it seems to occur as part of a pattern or sequence of behaviour and may follow any of a number of activities such as eating, drinking or exploratory behaviour (Bolles, 1960).

It would thus seem that in an open field test, the best measures of emotionality are defaecation, activity (in terms of ambulation) and rearing. Inner circle activity, "freezing" and urination are valid but possibly not reliable measures and there is some difficulty with the recording of the latter two. With regard to "freezing", both the number of times this response occurs and the length of time it lasts are probably important factors, and need to be measured. Urination poses a more difficult problem since it is not clear whether frequency or volume of urination is the differentiating factor (Isvinskis, 1966).

Description

The OFT consisted of a circular field 84 cms. in diameter surrounded by a 61 cms. high wall. The floor was made of white formica, divided by thin black lines into an inner circle with a diameter of $31\frac{1}{2}$ cms. and 6 radial segments to facilitate recording of Ss' ambulation. The walls were of aluminium sheeting painted black. Light was provided by a single unshaded 100 watt frosted bulb suspended 52 cms. above the centre of the field. Surface illumination was 100 candles at the centre of the field. Since the room in which the OFT was situated was not soundproof, "white noise" was used to screen any possible outside noise. The "white noise" was provided by a Grason-Stadler Noise Generator (model 901 B), set at 75 decibels, and attached to a Uni-Pex loudspeaker positioned approximately $1\frac{3}{4}$ meters from the centre of the field. Microphones attached to the top of the OFT wall and connected to an Alton Motion Detector were used to record activity in the field. The Detector was set at $2\frac{1}{2}$ sensitivity level (range was from 0 to 10). This was sensitive enough to pick up quite small body movements. The Detector was connected to a cumulative recorder which allowed activity to be quantified.

The room was air-conditioned and the temperature maintained at approximately 22° C.

Procedure

A day after removal of Ss from the experimental situation, testing was started on the OFT. The Ss were brought to the testing room in their home cages and placed outside in the corridor (which was heated). Each S was removed from the cage by hand and placed in a smaller cage (17 x 28 x 12 cms.) in which it was brought in to the testing room. The S was placed by hand in the Open Field in the centre of one of the radial segments and facing clock-wise (all Ss were introduced into the Open Field in the same manner). The Motion Detector and the stop-watch were switched on. The path of the S was traced on a scale diagram of the OFT and appropriate marks were made as the different activities being recorded, occurred. The variables and symbols used were as follows:

Defaecation (D) (Number of faecal boluses)
 Rearing (R) (Each time animal stood on its hind legs, supported by its tail)
 Grooming (G) (Face-washing, fur-licking and scratching)
 Other (O) ("Eating" behaviour and sniffing at the sides of the open field).

In addition, later analysis of the S's path gave a measure of:

General Ambulation (G. Am.) (Number of times animal entered each of the six radial segments marked on the floor of the open field - an animal was regarded as having entered a particular segment if all four of its feet crossed the dividing line between segments), and

Inner Circle Ambulation (I. Am.) (Number of times animal entered inner circle).

Cumulative recordings were made of:

Activity (A) (Movements of the animal picked up by the Motion Detector and recorded by the cumulative recorder).

Each trial lasted for 4 min.

The A score was noted after the first 2 min. and at the end of the trial. Different coloured pens were used to record the other variables mentioned above for the first and second two minute periods so that any differences over time could be detected.

At the end of the trial, the S was removed from the open field by hand and returned to the home cage in the smaller cage. Faecal boluses were removed from the field and the floor and sides were cleaned with Tepol detergent diluted in water in order to obscure any olfactory traces.

Each S was given one trial a day for six consecutive days. Ss were rotated in such a way that each rat in a particular cage was tested first, second or last, twice during the testing period of six days. The sequence of cages (randomly numbered 1 and 2) were not changed throughout the running of a particular group. Testing was done each day between 6 p.m. and 9 p.m. The time of testing was kept constant because there appear to be differences in performance on the OFT due to an animal's general activity level which varies as a function of its normal sleep-wakefulness cycle (Henderson, 1963).

TESTING -- HEBB-WILLIAMS CLOSED FIELD TEST.Introduction

In 1946 Hebb and Williams outlined what they considered to be a qualitative test of animal "intelligence" as opposed to the usual quantitative measures which employed learning scores as an index of intelligence. The test was in the form of a maze with start and goal box (the latter containing food) diagonally opposite each other. Various combinations of movable upright wooden barriers allowed the presentation of a number of different Umweg situations. The number of "error zones" entered and the time taken to reach the goal box were used as measures of intelligence, lower scores designating higher intelligence and vice versa. Hebb and Williams compared this closed field test to a homogeneous performance test such as the Porteous Maze used with humans and pointed out its main advantage as being a minimization of variations in motivation, emotion and exploratory behaviour as a result of long pre-test adaptation sessions, a constant setting for the presentation of the problems, and a fixed goal.

The original test was subsequently modified and standardized by Rabinovitch and Rosvold (1951) whose form has a high test-retest reliability (.84) and compares favourably with older measures of rat intelligence. (The reliability of this form has been questioned by Das and Broadhurst (1959) for whose argument see Discussion of Hebb-Williams results). This version of the test has been employed by a number of investigators and appears to be useful in discriminating for example, between brain-injured rats, rats subjected to electroconvulsive shock, and normal controls, and between rats reared in restricted and enriched environments. The test has also been modified for use with other laboratory animals in cross-species studies (e.g., Pollard, 1963).

Rabinovitch and Rosvold's form of the test has also been adapted for water use by Rosvold and Mirsky (1954). In this form (the water test as opposed to the floor test) escape from water rather than hunger is used as motivation and the difficulties associated with possible decrease in motivation to run to food as well as satiation, are thus avoided. Test-retest reliability obtained by Rosvold and Peters (1954) suggests that this form of the test is reliable with respect to both the time and error measures. However, the studies of both Rosvold and Mirsky and Rosvold and Peters indicate that "considerable practice" on the test is required to achieve reliability on the error score measure.

The ability of the water test to discriminate between brain-injured and normal rats is comparable to that of the Rabinovitch-Rosvold floor test.

This is the form of the Hebb-Williams closed field test used in the present study. The reasons for the choice of this version have been outlined in the section on experimental design.

Description

The closed field test consisted of a 30 in. square tank, 12 ins. deep,⁺ built of galvanized iron with a start and goal box at diagonally opposite corners. The goal box consisted of a wooden platform, 6 by 4 ins. in size, which could be reached by a short wiremesh ladder elevated at an angle of approximately 55° from the floor of the tank. The floor of the tank was divided into 36 5 in. squares by means of thin black lines to facilitate the placement of the barriers and recording of a S's path during testing. The top of the tank was left uncovered throughout testing. Barriers were made of galvanized iron sheeting and were the same height (12 ins.) as the walls of the tank. For a full description of the number of barriers used and for diagrams of the 6 practice and 12 test problems, see Rosvold and Mirsky (1954).

The tank was filled with water by means of a rubber tube attached to a nearby tap, to a height of 8 ins. The water was heated to 23° C with an immersion heater. The tank was emptied with the aid of a pump. The water was changed daily.

The apparatus was housed in a small room (3,50 x 2,15 meters), lighted by natural light coming from a single window and fluorescent lighting. Room temperature was maintained at approximately 22° C throughout testing. The test room was unfortunately not soundproof. It was, however, relatively isolated being at the end of a passage. During testing, the window was kept closed.

⁺ The measurements of the closed field test are given in inches so as to make comparison with the Rosvold and Mirsky (1954) version, easier.

Procedure

The running of Ss on the test closely followed the procedure outlined by Rosvold and Mirsky (1954) but some changes were made for practical reasons. These involved the presentation of two problems a day instead of one, the standardization of the number of trials given during the adaptation sessions, and during the presentation of the practice and test problems, to 8 instead of 10, 9 and 8 as in the case of Rosvold and Mirsky (1954), and a modification of the scoring procedure (discussed below). It was felt that the presentation of 2 problems a day would not jeopardize the validity or reliability of the test. With regard to the decreased number of trials during the adaptation sessions and the practice problems, it was felt that if Ss were capable of reaching the stricter time criterion set (60 seconds rather than 75 seconds) then there would be little need for additional trials.

One day after the final Open Field Test trial, the adaptation sessions on the water test were begun. Ss were given two afternoon sessions of 8 trials each, running being done between 2 and 5 p.m. Ss were brought to the testing room in their home cages and kept there until the end of each session when they were again returned to the rat colony room. The adaptation trials consisted of placing a S by hand in the start box tail first and facing the goal box, and releasing it. The S was removed from the test when it reached and climbed the wooden platform in the goal box, and placed in a small restraining cage to dry. Ss in each group were run in random order, with at least three minutes between trials for any one S. An S was considered to have adapted to the testing situation when it swam from the start to the goal box without circling or retracing its path. All Ss easily reached this criterion during the two afternoon sessions.

Ss were then presented with the six practice problems, two a day, with running being done in the mornings between 9.a.m. and 12 noon and in the afternoons between 2 and 5 p.m. Ss were run in a randomly selected order which was retained throughout testing for any one group. Each S's trial was separated by that of the five other Ss in the group (i.e., each S in a group was given the first trial, then the second and so on, until all eight trials for any one problem were given). The time in seconds taken by a S to reach the goalbox was recorded by a manually operated stop-watch, time being measured from the moment the S left the start box until its front feet touched the ladder in the goalbox. All Ss reached the set criterion of completing eight trials in 60 seconds or less on two consecutive problems, by the end of the six practice problems.

Ss were run on the 12 test problems, in the same way as described above, their paths for each trial being traced onto a scale diagram of the test with the squares outlined and the position of the barriers for each test marked. The score for each trial was given as the number of squares entered by a S in its swim from start to goal box. Following the reasoning of Pollard and Sampson (1961) we assumed that the best performance on any one trial would be in terms of the shortest path between start and goal box. Thus, the lower the score (the fewer the squares entered) the better the performance. This scoring method was found to be more practical than the marking and recording of "error zones" for each problem as was done by Rosvold and Mirsky (1954). Each S had two measures for each of the 12 problems; the time taken to reach the goal box ladder (mean of eight trials) and the number of squares entered (mean of eight trials).

The procedure outlined above was followed for each of the four groups of Ss used in the present study. All Ss seemed to adapt relatively easily to the testing situation.

Every attempt was made to ensure that running was done blindly, but since most of the adaptation sessions and all of the experimental sessions were conducted by the writer who was also involved in the selection, marking and weighing of Ss, the identity of some of the Ss was inevitably revealed. However, the fact that the identification numbers of Ss tended to be repeated from group to group assisted in keeping the experimenter on the whole in the dark as to whether a particular rat was an experimental or control S.

RESULTS

Weight

The weights of each group of Ss were recorded on six different occasions. (See Procedure and also Appendix IV for individual weights). Two (experimental and control conditions) by four (groups I, II, III, and IV) analyses of variance were computed for each set of weights with the exception of weights recorded at weaning (where there were no differences between experimental and control animals) in order to see whether there were any significant differences in weight gain. Since it had not been possible to control for weight differences between the four groups at the start of each experimental session, Scott's (1955) method of percentage weight gain was used, all later gains being taken as a percentage of the initial weight measure recorded at weaning. This procedure allowed for comparison of weights between groups.

The only significant difference found between experimental and control Ss was in percentage weight gain as measured on removal from the experimental situation ($F_{1-16} = 5,52$ $p < ,05$). The experimental Ss weighed significantly more than the control Ss although there had been no such differences at the start of the experimental sessions. These initial differences did not however, persist.

With regard to differences between groups in weight gain these yielded as expected, remembering the age differences between groups, significant Fs for gains at the end of experimental sessions, and after the third OFT trial ($F_{3-16} = 6,63$ $p < ,005$ and $F_{3-16} = 5,35$ $p < ,01$, respectively), and Fs approaching significance at the end of the OFT trials, and at the start and end of testing on the closed field. ($F_{3-16} = 3,04$ $p < ,10$; $F_{3-16} = 2,54$ $p < ,10$; and $F_{3-16} = 2,46$ $p < ,10$).

No significant interaction effects were found. (See Appendix I for statistical tables).

The Open Field Test

Taking each of the four groups separately, two (experimental and control conditions) by six (trials on the OFT) analyses of variance were computed for every variable recorded on the OFT (D, R, G, O, G. A., I. A., and A). for the first and second two minute periods as well as for the total four minutes. The following results were obtained (See Appendix I for statistical tables). Results for each group are summarized separately because of large variations between groups for the different variables.

Group I (20 days)

Defaecation between experimental and control Ss differed significantly for the second two minutes as well as for the total four minute period, ($F_{1-24} = 5,57$ $p < ,05$ and $F_{1-24} = 6,61$ $p < ,025$) the control Ss defaecating more than the experimental Ss. Differences in defaecation between trials were significant for the first two minute period only ($F_{5-24} = 3,31$ $p < ,025$).

There were no significant interaction effects.

Rearing was found to be significantly different for all three periods, experimental Ss rearing more than control Ss in each case ($F_{1-24} = 6,44$ $p < ,025$; $F_{1-24} = 7,17$ $p < ,025$; and $F_{1-24} = 8,79$ $p < ,01$). There were no significant differences between trials although the difference during the first two minute period approached significance ($F_{5-24} = 2,50$ $p < ,10$). Interaction effects were not significant.

Grooming differences between experimental and control Ss were not significant although they approached significance during the first two minute period and the total four minutes ($F_{1-24} = 3,63$ $p < ,10$ and $F_{1-24} = 3,07$, $p < ,10$) the control Ss grooming more than the experimental Ss. Differences in grooming between trials were not significant although they approached significance for the first two minute period ($F_{5-24} = 2,27$ $p < ,10$). There were no significant interaction effects.

The differences between experimental and control Ss in general ambulation were not significant. Differences between trials were, however, significant especially for the first two minute period ($F_{5-24} = 8,00$ $p < ,0005$) but also for the total four minutes ($F_{5-24} = 6,26$ $p < ,001$). Differences for the second two minute period approached significance ($F_{5-24} = 2,49$ $p < ,10$). There were no significant interaction effects.

Noting the large differences between trials especially during the first two minute period and also the finding of Whimby and Denenberg (1967) that activity (ambulation) in the open field was positively related to emotionality for the first trial on the test and only negatively related on subsequent trials, it was decided to do an analysis of variance on the scores obtained for trials two to six, leaving out the first trial. The results obtained were interesting and could be regarded as tentatively supporting those mentioned above. Differences between experimental and control Ss were significant for the first two minutes ($F_{1-20} = 5,62$ $p < ,05$) and approached significance for the total four minutes ($F_{1-20} = 3,98$ $p < ,10$). At the same time, the difference between trials failed to reach significance although it

Group II (30 days)

There were no significant differences in defaecation between experimental and control Ss nor did the differences (although they were in the direction predicted) approach significance. The only significant F was that between trials for the first two minute period ($F_{5-24} = 3,66$ $p < .025$). There were no significant interaction effects.

There were clear significant differences in the rearing scores for all three time periods ($F_{1-24} = 4,69$ $p < .005$; $F_{1-24} = 5,27$ $p < .05$; $F_{1-24} = 6,48$ $p < .025$). But, unlike those for Group I and opposite to what would be predicted from our initial hypothesis, the control Ss reared more than the experimental Ss. Differences between trials were also significant for all three periods ($F_{5-24} = 6.62$ $p < .001$; $F_{5-24} = 2,91$ $p < .05$; and $F_{5-24} = 5,73$ $p < .0005$). There were no significant interaction effects.

Differences between experimental and control Ss in grooming proved nonsignificant although they approached significance for the first two minute period and the total four minutes. ($F_{5-24} = 3,13$ $p < .10$; $F_{5-24} = 4,10$ $p < .10$) Control Ss grooming more than experimental Ss. There were significant differences between trials for all three periods ($F_{5-24} = 5,90$ $p < .005$; $F_{5-24} = 3,79$ $p < .025$; and $F_{5-24} = 4,67$ $p < .005$). There were no significant interaction effects.

With regard to general ambulation, there were no significant differences between experimental and control Ss although differences approached significance for the second two minute period and for the total four minutes ($F_{1-24} = 3,95$ $p < .10$ and $F_{1-24} = 3,94$ $p < .10$), Control Ss ambulating more than experimental Ss. Differences between trials were markedly

significant for all three periods ($F_{5-24} = 5,47$ $p < ,005$; $F_{5-24} = 7,61$ $p < ,0005$; and $F_{5-24} = 8,14$ $p < ,0005$). There were no significant interaction effects.

Analyses of variables as for group I were computed for trials 2 to 6. No significant Fs were found but differences between experimental and control Ss approached significance for the first two minute period and the total four minutes. ($F_{1-20} = 3,44$ $p < ,10$; and $F_{1-20} = 3,73$ $p < ,10$).

Inner circle ambulation differences were significant for the total four minutes only ($F_{1-24} = 5,00$ $p < ,05$) Control Ss entering the inner circle more than experimental Ss. Differences between trials were significant for the total four minutes ($F_{5-24} = 2,74$ $p < ,05$) and approached significance for the first two minute period ($F_{5-24} = 2,24$ $p < ,10$). There were no significant interaction effects.

Differences between experimental and control Ss on the "other" variable were not significant. Differences between trials were significant, however, for the first two minute period only ($F_{5-24} = 3,14$ $p < ,05$). There were no significant interaction effects.

Differences between experimental and control Ss for activity were not significant although they approached significance for the second two minute period. ($F_{1-24} = 3,45$ $p < ,10$). There were no other significant differences.

It can be seen from the statistical analysis presented above that differences in emotionality for the 30 day group were completely opposite to what had been predicted, the control Ss showing less emotionality than the experimental Ss as measured by rearing and inner circle ambulation. The possible reasons for these findings will be outlined in the Discussion.

Group III (40 days)

There were no significant differences in defaecation between experimental and control Ss, nor were there any significant differences between trials for this variable. There were no significant interaction effects.

There were no significant differences between experimental and control Ss in the amount of rearing. Differences between trials were significant for the first two minute period and the total four minutes ($F_{5-24} = 2,96$ $p < ,05$ and $F_{5-24} = 2,74$ $p < ,05$). There were no significant interaction effects.

There were no significant differences between experimental and control Ss with regard to amount of grooming. Differences between trials were not significant but approached significance for the first two minute period ($F_{5-24} = 2,20$ $p < ,10$). There were no significant interaction effects.

General ambulation yielded no significant differences between experimental and control Ss but the difference between trials was significant for all three periods ($F_{5-24} = 3,44$ $p < ,025$; $F_{5-24} = 3,87$ $p < ,025$; and $F_{5-24} = 4,77$ $p < ,005$). There were no significant interaction effects. Analyses of variance for trials two to six also yielded no significant Fs.

Differences between experimental and control Ss with respect to inner circle ambulation were nonsignificant. Differences between trials were significant for the first two minute period ($F_{5-24} = 3,54$ $p < ,025$) and approached significance for the total four minutes ($F_{5-24} = 2,35$ $p < ,10$). There were no significant interaction effects.

There were no significant differences between experimental and control Ss for the "other" variable. Nor were there any significant differences between trials although these approached significance for the first two minute period ($F_{5-24} = 2,17$ $p < ,10$). There were no significant interaction effects.

There were no significant differences between experimental and control Ss in activity. Differences between trials were however, significant for all three periods ($F_{5-24} = 7,17$ $p < ,001$; $F_{5-24} = 2,86$ $p < ,05$ and $F_{25-24} = 4,92$ $p < ,005$). Interaction effects were significant for the second two minute period ($F_{5-24} = 2,84$ $p < ,05$) and approached significance for the total four minutes ($F_{5-24} = 2,34$ $p < ,10$).

It is clear from the above results that there were no apparent differences in emotionality between experimental and control Ss for the 40 day group. The possible reasons for these findings will be outlined in the Discussion.

Group IV (50 days)

Defaecation scores yielded no significant differences either between experimental and control Ss, or between trials. In addition, there were no significant interaction effects.

Rearing scores were significantly different between experimental and control Ss for the first two minute period and the total four minute period, experimental Ss rearing more than control Ss ($F_{1-24} = 9,47$ $p < ,01$; $F_{1-24} = 8.08$ $p < ,01$). There were no significant differences between trials and no significant interaction effects.

Differences in grooming behaviour were not significant between experimental and control Ss. Differences between trials were, however, significant for the first two minute period and the total four minutes ($F_{5-24} = 6,63$ $p < .005$ and $F_{5-24} = 4,88$ $p < .005$). There were no significant interaction effects.

General ambulation differences between experimental and control Ss were not significant taking all six trials but they did approach significance for the second two minute period when trial I was discarded ($F_{1-20} = 3,79$ $p < .10$). There were no significant differences between trials. Interaction effects proved significant for the second two minute period and the total four minutes ($F_{5-24} = 2,88$ $p < .05$ and $F_{5-24} = 2,82$ $p < .05$).

Inner circle ambulation yielded very marked significant differences between experimental and control Ss for all three periods ($F_{1-24} = 14,40$ $p < .001$; $F_{1-24} = 5,56$ $p < .05$; and $F_{1-24} = 16,51$ $p < .0005$), experimental Ss entering the inner circle more often than control Ss. There were no significant differences between trials. Interaction effects were significant for all three periods ($F_{5-24} = 5,28$ $p < .005$; $F_{5-24} p < .05$; and $F_{5-24} = 5,03$ $p < .005$).

There were no differences for either "Other" behaviour or activity.

Although defaecation differences were not found to be significant, this group did differ in terms of rearing and inner circle ambulation, experimental Ss rearing and entering the inner circle more often than control Ss. Since all three variables (defaecation, rearing, and inner circle ambulation) are considered to be reliable measures of emotionality, it is rather difficult to interpret the present findings.

Since we wished to see whether there were differences between groups on the seven OFT variables recorded, and also whether some common trends with respect to emotionality could be traced for experimental and control Ss irrespective of age differences and differences in length of exposure to the experimental situation, two (experimental and control conditions) by four (groups I, II, III, and IV) analyses of variance were computed for each variable for the first two minutes and the second two minute periods and the total four minutes in the OFT. The scores for each variable consisted of the mean of six trials for the first two minutes, the second two minutes, and the total four minute period. The results obtained are summarised below. (For full tables, see Appendix I).

Differences between experimental and control Ss were not significant for any of the seven variables recorded (D, R, G, O, G. A., I. A., and A) during either the first and second two minute periods or the total four minutes in the OFT. The difference for grooming did however, approach significance ($F_{1-16} = 3,17$ $p < ,10$) for the total four minutes, control Ss indulging in more grooming activity.

Differences between groups were, on the other hand, quite marked for all the variables recorded. These differences were especially notable for the first two minute period in each case. The following were the significant Fs obtained:

| | |
|-------------|--|
| Defaecation | $F_{3-16} = 11,21$ $p < ,001$ (First two minutes) |
| | $F_{3-16} = 6,35$ $p < ,01$ (Total four minutes) |
| Rearing | $F_{3-16} = 3,30$ $p < ,05$ (First two minutes) |
| | $F_{3-16} = 3,47$ $p < ,05$ (Second two minutes) |
| | $F_{3-16} = 3,80$ $p < ,05$ (Total four minutes) |
| Grooming | $F_{3-16} = 3,43$ $p < ,05$ (First two minutes) |
| | $F_{3-16} = 2,58$ ($p < ,10$) (Second two minutes) |
| | $F_{3-16} = 5,95$ $p < ,01$ (Total four minutes) |

General ambulation

$$F_{3-16} = 3,73 \quad p < ,05 \quad (\text{First two minutes})$$

General ambulation(trials 3 - 16 two to six)

$$F_{3-16} = 4,07 \quad p < ,05 \quad (\text{First two minutes})$$

Inner circle ambulation

$$F_{3-16} = 4,13 \quad p < ,05 \quad (\text{First two minutes})$$

$$F_{3-16} = 3,46 \quad p < ,05 \quad (\text{Second two minutes})$$

$$F_{3-16} = 4,77 \quad p < ,05 \quad (\text{Total four minutes})$$

Other

$$F_{3-16} = 7,45 \quad p < ,005 \quad (\text{First two minutes})$$

$$F_{3-16} = 4,44 \quad p < ,025 \quad (\text{Total four minutes})$$

Activity

$$F_{3-16} = 6,97 \quad p < ,005 \quad (\text{First two minutes})$$

$$F_{3-26} = 5,06 \quad p < ,025 \quad (\text{Second two minutes})$$

$$F_{3-26} = 6,72 \quad p < ,005 \quad (\text{Total four minutes}).$$

Graphs plotted of the means of three Ss in each cell for the variables analysed above, indicate that defaecation and rearing tend to increase with age whereas instances of the "other" behaviours-(sniffing at the sides of the field, "eating" behaviour) appear to decrease with age. Differences on the other variables do not seem to reflect any consistent trends. (See Appendix II for graphs).

Interaction effects between condition and group were found to be significant for inner circle ambulation for both the first two minute period and the total four minutes ($F_{3-16} = 4,23 \quad p < ,05$ and $F_{3-16} = 4,33 \quad p < ,025$ respectively) and to approach significance for the second two minute period ($F_{3-16} = 2,51 \quad p < ,10$). Interaction effects for rearing approached significance for the total four minute period ($F_{3-16} = 2,67 \quad p < ,10$).

It would seem then, that there are marked differences between the four graphs with respect to the frequency of occurrence of the 7 variables recorded on the OFT, these differences being most probably due to the age differences between groups during testing. (The age ranges for each group during the six days of testing on the OFT were as follows:

| | | |
|-----------|---------|--------|
| Group I | 46 - 52 | days |
| Group II | 56 - 62 | days |
| Group III | 66 - 72 | days |
| Group IV | 76 - 82 | days) |

Hebb-Williams closed field test

Two (experimental and control conditions) by four (groups I, II, III, and IV) analyses of variance were computed for the scores and the time measures on the closed field test. Scores and time measures were obtained by calculating the respective means for these on the 12 test problems, thus giving each S a single score and time measure indicating performance level on the test.

There were no significant differences between experimental and control Ss for either scores or time measures. There were, however, marked differences between groups for both ($F_{3-16} = 8,38$ $p < ,005$ and $F_{3-16} = 6,31$ $p < ,005$ respectively). Graphs plotted of the means of scores and time measures in each cell, revealed that group III (40 days) performed significantly better than any of the other three groups as reflected by both measures. Moreover, there was a slight trend towards improvement in performance with age as reflected by both scores and time measures which were closely related to each other. (See Appendix I for statistical tables and Appendix II for graphs).

There were no significant interaction effects for either the score or the time variables.

DISCUSSION

Interpretation of the results obtained

Weight:

The significant differences between experimental and control Ss with respect to percentage weight gain, at removal from the experimental situation support the findings of the second experiment carried out by Radloff (1970). They indicate that experimental Ss weigh more than control Ss although no such differences in weight existed at the start of the experimental sessions, and the amounts of food and water available during experimental sessions were identical for the two conditions. This suggests that experimental Ss utilized their food intake better than did the control Ss and supports previous findings of weight gain as a result of increased stimulation in the form of handling or "gentling" (Bernstein, 1952; Weininger, 1956; Weininger et al, 1954).

This initial weight difference was however, not found with later analyses of percentage weight gain and suggests that this effect is only a short-term one.

Another possibility is that these weight differences were due to differential activity in the experimental cages, control Ss being more active and thus keeping their body weights lower than those of the experimental Ss. But, since no systematic observation or recordings were made of Ss' behaviour in the experimental situation, this explanation must remain speculative.

The Open Field Test

The very clear differences in emotionality between experimental and control Ss in groups I and IV (20 and 50 days, respectively) support the original findings of Radloff (1970), and confirm our own prediction that experimental Ss will be less emotional than control Ss.

The results obtained in group III (40 days), on the other hand, reflect no differences at all between experimental and control Ss with regard to any of the OFT variables measured. The reasons for this are not clear and the only explanation that can be offered is in terms of uncontrolled variables. This group was exposed to some unavoidable extra stimulation in the form of banging noise and increased activity around the cages while certain installations were being carried out in the rooms housing the experimental cages. This occurred during the first third of the 40 day session and involved a period of about three days. It is possible that this experience, coming as it did during the period when Ss were relatively young (about 30 to 35 days), thus presumably especially susceptible to stimulation, may have caused uniform increases or decreases in emotionality of both sets of Ss which overrode any differences due to the differential rearing conditions.

The results with respect to group II (30 days) are even more puzzling, since they indicate that the control Ss were less emotional than the experimental Ss as reflected by rearing and inner circle ambulation, a finding quite contrary to our initial prediction. These results may be due to some kind of critical period phenomenon whereby stimulation during one age period or for one particular length of time results in completely different effects than stimulation during another age period or for a different length of time, or both. We are not inclined to accept such an explanation since at present, there is little evidence to support it.

Rather, part of the answer may lie in the Ss' initial experiences in the experimental cages. Unlike the other three groups which were housed in experimental cages previously occupied by other Ss and not scrubbed clean (it must be remembered that groups were run consecutively) this group was placed in unused cages which thus had no olfactory traces or other markings around the sides and near the levers and food and water containers. We may have completely overlooked this difference but for the fact that a pilot group (N = 10) which had been exposed to an identical environment for 50 days showed similar differences when tested on the OFT, control Ss being less emotional in terms of rearing and "other" behaviours, as well as with regard to general ambulation during the first two minute period of testing (See Appendix I for statistical tables). The only similarity between this group and group II was that both had been placed in previously unused experimental cages. Although it is far from clear why and how this fact could lead to the differences in emotionality that were found in these animals, it is nevertheless, important to keep in mind that such a possibility may exist and thus to investigate it or at least control for it in future studies.

Returning to the two groups (groups I and IV) where differences in emotionality were found, it is interesting to note that the amount of general ambulation or, as is usually termed, exploratory behaviour which is considered to be a valid and relatively reliable measure and widely used in open field studies, did not differ for experimental and control Ss. This lack of difference may be due to the similarity in area between the open field and the experimental cages (5544,25 sq. cms. versus 4900 sq. cms). The open field did not thus offer much novelty in terms of size for either experimental or control Ss and would therefore not be expected to elicit differential general ambulation on the part of these animals. Such an interpretation supports the idea expressed by Bindra (1959(b)) that the amount of novelty any situation holds for an animal can only be understood in terms of its past experiences. No situation is

"novel" in and of itself alone. Support for the suggestion that previous experience with respect to cage size, will modify behaviour in the open field, comes from a study done by Patrick & Lauchlin (1934) who found that rats reared in large cages tend to exhibit more exploratory behaviour (as measured by amount of ambulation) in an open-alley maze than controls reared in ordinary laboratory cages.

It is rather interesting to note that differences between experimental and control Ss for open field variables tend to be most pronounced during the first two minute period of testing. Indeed, it is this initial difference which often resulted in significant Fs for the total four minutes. This finding suggests that it is initial reaction to the open field which is the important factor in differentiating between emotional and non-emotional animals, and may be seen as supporting our original tentative explanation as to why any differences in responding in the open field between experimental and control Ss should occur. Control Ss are confronted with a relatively more novel situation than experimental Ss, this novelty having most impact initially at each presentation (i.e., the first two minutes of each trial) in terms of emotional reactivity and/or absence of non-emotional responses.

Comparison of scores obtained during the first two minute and second two minute periods show, in addition, that all the responses measured tended to decline in frequency of occurrence over time. Similar results have been reported by Glickman and Hartz (1964) who found that exploration (in terms of amount of ambulation) in the open field decreased between the first and second two minutes of a 10 minute trial. In a number of species including the albino rat Hughes (1968a; 1968b) found similar trends, during a 15 minute trial in the novelty half of an exploration box, with regard to exploratory behaviour (rearing and sniffing) and ambulation. Radloff (1959) also noted this pattern between the first and second two minutes of four minute trials, with respect to the number of feet traversed in the open field.

Turning now to general results with respect to emotionality in experimental and control Ss in the four groups taken as a whole, we cannot be surprised at the lack of significant differences in view of the very diverse results obtained in each group. (The graphs plotted using these results clearly show the lack of uniform trends. See Appendix II).

Differences between groups however, show some trends which are in line with previous findings regarding changes in open field behaviour as a function of age. Increases with age in exploratory behaviour and ambulation have been found by Broadhurst (1958a), Candland (1959), Candland & Campbell (1962), Hughes (1968a; 1968b) and Williams, Carr and Peterson (1966). Furchgott, Wechkin, and Dees (1961) and Werboff & Havlena (1962) reported decreases in exploratory behaviour with age but, since their youngest rats were over 100 days old, and it has been suggested (Williams et al., 1966) that activity in the open field increases up to a certain age, and then begins to decline, these findings are not inconsistent with those mentioned above. (Williams et al. found increases in exploratory behaviour up to 78 days of age and our oldest group was between 76 and 82 days during testing on the open field).

Increases in defaecation with age have been noted by Candland (1959) and also by Denenberg & Smith (1963), who found that avoidance training resulted in increasing amounts of defaecation in the open field in 50, 100, 150 and 200 day-old animals.

From our interpretation of the results on the OFT, we can conclude that the prediction with regard to differences in emotionality between experimental and control Ss was supported for groups I and II, our results being in line with those obtained by Radloff (1970) as well as with numerous other studies which have found differences in emotionality following various forms of extra stimulation during early development. (See Denenberg, 1966, for a review).

The findings with respect to age differences in behaviour in the open field are interesting and on the whole, similar to results of other studies dealing with this variable. They suggest that the age factor plays an important part in the way an animal will respond to novelty, and needs to be controlled in studies using the OFT or indeed, any other test of emotional reactivity.

Hebb-Williams closed field test

From the statistical analyses done, it appears that there are no differences in performance on the closed field test between Ss reared in the "meaningful" environment and control Ss for any of the four groups. There are at least two possible interpretations of these results.

Firstly, we might assume that the differences between the "meaningful" and control environments used in the present study were not large enough to result in measurable differences in maze performance as reflected by the Hebb-Williams closed field test. Some indirect support for this assumption comes from the interpretation of the superior performances on this test by rats reared in "free" as opposed to "restricted" environments. It has been suggested that a "free" or "enriched" environment provides greater opportunity for perceptual learning or experience than does the "restricted" environment thus resulting in the better performance on a problem-solving task like the closed field test (Forgays & Forgays, 1952; Forgays & Read, 1962; and Hymovitch, 1952). The critical variables in the "enriched" environments are usually the large size of the living area coupled with the presence of various "playthings" with which the S can interact. In the present study, the size variable was kept constant since experimental and control cages were identical with regard to physical appearance. Therefore, the only difference was in terms of the kind of interaction which was possible with the two levers provided. It is obvious that the experimental Ss experienced a more "meaningful" interaction with the levers, an interaction which can be viewed in terms of increased motor and tactile stimulation. (It is important to remember that the control Ss had the same opportunity to interact with the two levers in their cage, but, as the cumulative recordings of lever-pressing show, they did so with decreasing frequency as the experimental session progressed and then only usually accidentally while eating or drinking. The experimental Ss on the other hand, showed regular and consistent lever-pressing behaviour). This very clear and obvious difference with regard

to interaction with the levers probably resulted in wider perceptual experience on the part of the experimental groups but possibly experience of a kind which might not be critical for performance on the Hebb-Williams closed field test.

The second interpretation leaves our original hypothesis (that experimental Ss would perform better in a problem-solving situation than would control Ss) intact and focuses rather, on some problems of standardization and administration of the closed field test used which throw some doubt as to its reliability and which might have contributed to the lack of significant differences. With regard to standardization, Das and Broadhurst (1959) have pointed out some difficulties associated with order effects due to practice as well as questioning the validity of the present order of the 12 test problems in terms of difficulty level. There seems to be a need for changing the order of the problems and/or introducing new combinations of barriers in order to overcome these drawbacks which undermine the reliability of the test. A related problem is the exact relationship between the floor test (which has been used in all the studies mentioned above) and the water version used in the present study. Rosvold and Mirsky (1954) have shown that both these tests can discriminate between brain-injured and intact rats, the correlation between scores on the two tests being .736. However, this finding may not apply in the case of differences between animals reared in various kinds of environments, the variable under investigation in the present study. In other words, the water version of the Hebb-Williams closed field test may not be a useful tool for discriminating between rats reared in a "meaningful" environment and those reared in a control setting with regard to problem-solving ability.

The difficulty with regard to administration stems from the method already described in the procedure of running Ss on the practice and test problems which involves giving a trial to all the Ss in a testing group, one after the other, instead of running any one S on all eight trials consecutively with fixed time intervals between trials. The method used was that outlined by Rosvold and

Mirsky (1954) whose procedure was followed in the use of the water version of the closed field test. Rosvold and Mirsky give no explanation as to why this method should be used instead of the more usual one used in the floor version of the test. The problem with Rosvold & Mirsky's method is that it does not allow for control of the time interval between trials for any S since this interval will be a function of the time taken by the intervening Ss to run their trials. This is a drawback which throws further doubt on the reliability of the measure used in the present study.

The significant differences between groups found in the analysis of scores and time measures may also be interpreted in two ways. Firstly, following on from the points made above with regard to the reliability of the test used, these differences could be merely reflecting this feature, the fluctuations between groups being due to uncontrolled factors arising from test administration, the level of difficulty of the various problems and practice effects. On the other hand, if our criticism of the reliability of the test is too harsh, and reliability is in fact, adequate, then these differences would seem to suggest that age is an important factor in determining performance on the test, the older Ss performing better. Hebb and Williams (1946) in the original version of the closed field test found similar age differences but these were not clear-cut. (Their findings suggest that three-month-old Ss perform better than two-month-olds). There do not seem to have been any other investigations of this variable using either the floor or the water version of the test, and thus our findings will need to be replicated before we can accept that age is an important variable in performance on the closed field test. It is interesting to note that the group which performed best on the closed field test was the one in which no differences in emotionality between experimental and control Ss were found. We can offer no adequate explanation for this fact apart from suggesting that this is only a coincidental relationship. If there is some relationship between emotionality and performance on the closed field test, this would presumably have been reflected in differences in performance between experimental and control Ss

in groups I and IV where significant differences in emotionality were found. But from the statistical data already presented, it is clear that these did not occur. This finding is not really surprising in view of the long adaptation sessions on this test which attempt to eliminate emotionality differences between Ss and also of the finding of Thompson and Bindra (1952) that rats differentiated as "bright" or "dull" by performance on the Hebb-Williams closed field test, showed no differences in emotionality as measured by defaecation and urination. Thompson and Bindra conclude that the relationship between emotionality and problem-solving ability as measured by the Hebb-Williams is an orthogonal one. Denenberg and Morton (1962b) came to a similar conclusion since they found no differences in performance on the Hebb-Williams between rats which differed in emotionality as a result of exposure or non-exposure to preweaning stimulation in the form of handling and shock. What little evidence there is for a relationship between emotionality and performance on a test of the kind used in the present study, suggests that more emotional animals will take less time to swim a water maze (O'Kelly, 1940). It is also interesting in this connection to note the finding of Searle (1949) that rats bred for brightness show low motivation to escape from water as compared with "dull" animals.

We can conclude that no differences between experimental and control Ss in performance on the closed field test for any of the groups tested were found, but these negative results may be attributed to unreliability of the test used. The differences between groups may be explained in this way too, or they may be regarded as reflecting genuine differences in performance as a function of age. However, the shape of the graphs obtained for these differences, would suggest that there is in fact, no clear relationship between age and performance, and that the significant Fs obtained were due to the superior performance of one group only, group III, the reason for this not being very clear. There appears to be little or no relationship between emotionality and problem-solving ability, as measured by the Hebb-Williams closed field test.

Shortcomings of the present study

The discussion of results has revealed a number of shortcomings in the design used which may have contributed to limiting the usefulness of the present study. Below are outlined what we consider to be the most important ones.

- (i) Not enough control was exercised in the selection of females bred to provide the Ss for our research. It has been shown that the past history of a female rat will affect the emotionality of her offspring. (Denenberg & Rosenberg, 1967; Denenberg & Whimbey, 1963). For practical reasons, we were not able to control the past history of our animals and were, instead forced to assume that, since they all came from the same colony, they had all presumably been exposed to similar environments. However, some of the rats were older than others, and had had litters previously, while others were bred for the first time. This factor probably contributed to differences in maternal behaviour and thus possibly the emotionality of offspring as well.
- (ii) The size of litters could not be kept constant because of the scarcity of potential Ss. Litter size has been found to affect emotionality of animals, those coming from larger litters being more emotional than smaller litter animals (Denenberg, 1963; Seitz, 1954). Our litters ranged from 3 to 12 in size and although within-group differences were usually small, differences in litter size across our four groups were quite marked.
- (iii) The rooms housing the experimental cages were not soundproof which was rather unfortunate since building operations which proved at times rather noisy, were in progress during most of the time that this research was being conducted.

(iv) There was no objective way of ascertaining during experimental sessions that all the experimental Ss actually pressed levers to obtain food and water, or that the particular S which did was appropriately reinforced. It is possible that one of the other Ss obtained the food or water reward, since more than one animal had access to the containers at any one time. This difficulty could be overcome by building barriers on either side of a container to form a passage wide enough for only one animal. (the passage could be gradually widened as the Ss increased in size.)

(v) During testing on both the OFT and the closed field test, animals had to be transported from the rat colony room to the testing rooms two floors up. This resulted in exposure of Ss to uncontrolled temperature changes. It has been suggested (Hutchings, 1963; Schaefer, Weingarten, & Towne, 1962) that temperature is a critical variable which may possibly account for the behavioural differences found in a number of studies between handled and non-handled animals. It is possible that the drop in temperature which rats were exposed to during transportation may have had similar or other effects on behaviour during testing. Moreover, it should be remembered that the Ss were exposed to this change in stimulation at different ages, the younger animals (following the critical period hypotheses) being possibly more strongly influenced.

(vi) The two tests used - the Open Field Test and the Hebb-Williams closed field test - have certain limitations with regard to validity and reliability which require further investigation before these can be usefully employed in testing early environmental manipulation effects. At present, we can only put forward some suggestions as to modifications in procedure which may lead to greater reliability.

Efforts should be made to minimize handling of Ss during testing since it is known that this treatment may result in differences in performance irrespective of previous treatment Ss have been exposed to.

For the OFT, this may be achieved by providing access to the open field through a passage the other end of which is attached to the opening of the S's home cage. Such a procedure would also allow the measurement of time taken to emerge from the home cage, a variable which has been found to be a good indicant of fearfulness and probably emotionality as well. Ss could be removed from the field at the end of a trial by means of some sort of "scooping" device such as a small wire cage with a sliding side door which could be manipulated by the experimenter by means of a long stick attached to its top. In the closed field test, the addition of a return alley in the floor test as described by Radloff (1964) could possibly be modified for use in the water version as well.

The scoring of the tests can be improved. A one-way mirror covering the top of the open field would allow the experimenter to watch the S's behaviour more closely without disturbing it and thus make possible more accurate recordings of responses during trials. Covering the top of the open field would also assist in keeping extraneous noise to a minimum. The use of a multi-channel magnetic tape event recorder to record behaviour in the open field would allow for accurate assessment of the time a particular variable occurred during a trial, as well as providing easily analysed patterns of responses which might well prove useful in differentiating between emotional and non-emotional Ss. Automatic timing devices would assist in obtaining accurate assessments of time taken to swim a trial in the closed field test.

An additional factor with regard to the closed field test, is the choice of water temperature. Rosvold and Mirsky (1954) gave no rationale for their use of a temperature of 23° C and it is interesting to note that Hack (1933) found that water temperature of 15° C resulted in fastest learning of a simple water maze. It would be interesting to see whether such a relationship holds for the more complex maze situations found in the Hebb-Williams. If it does, then the present temperature probably does not produce

the optimum amount of motivation to escape and is thus not really as valid a motivator as hunger which is used as incentive in the floor test.

Suggestions for future research

In view of the present findings, a number of possible topics for future research can be suggested.

- (i) The behaviour of Ss while in the experimental situation should be observed both in order to ensure that all the Ss are responding in the required manner and receiving the appropriate reinforcement, and to investigate the possible changes in behaviour (especially that involving interactions with other Ss) over time, as well as any differences in activity between experimental and control groups. This might involve either systematic observation during specific periods of the day or preferably, filming behaviour. This latter could be done continuously (which would involve a great deal of later analyses), or, probably better, only at times when significant behaviour is occurring. Such recordings would require connecting the camera either to the levers or to a motion detector, so that lever-pressing or increased activity, respectively would trigger off a short filming sequence.
- (ii) The possible long-term effects of exposure to a meaningful environment should be investigated, perhaps by repeated testing but controlling for habituation and any other variables considered important.
- (iii) The factor of reversibility of effect could also prove interesting. One way of tackling this question is to expose Ss to the two experimental conditions for a set period of time, test for any differences in behaviour, return Ss for a similar period to their cages, this time placing the experimental group in the control cages and vice versa. Subsequent testing could reveal any changes from the original findings. (Control of factors such as age, and repeated running on the same tests is, of course, necessary).

(iv) The effects of a meaningful environment on variables not analysed in the present study should be considered. Such variables might include heart-rate, blood-pressure, and endocrine functioning. In addition, possible anatomical and physiological changes in the brain need investigation.

(v) Finally, because of the limitations of most available tests, it is necessary to repeat the kind of study which was undertaken here, using alternative tests of emotionality and intelligence.

CONCLUSIONS

CONCLUSIONS

Although our hypothesis with regard to differences in problem-solving ability was not confirmed, and our hypothesis with regard to emotionality differences, only partially confirmed, the positive findings which were obtained, suggest that the type of approach used in the present study is a fruitful one for understanding developmental processes.

Its main advantage lies in the possibility of very clear and well-defined manipulation of environmental variables, which can lead to meaningful interpretation of subsequent findings. It also offers a framework in which the behaviour of the individual animal can be studied and analyzed with ease.

The present research has, hopefully, offered a useful example of how techniques allowing for control of stimulus and response variables, can be used to provide a framework for an alternative approach to the analysis of early determinants of behaviour.

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APPENDIX I

PERCENTAGE WEIGHT GAINS

Two (experimental and control conditions) by
four (groups I, II, III, and IV) analyses of
variance.

TABLE 1
ANALYSIS OF VARIANCE: PERCENTAGE WEIGHT GAIN
AT END OF EXPERIMENTAL SESSION

| Source | df | Ms | F | p |
|---------------|----|----------|------|------|
| CONDITION (A) | 1 | 21639,02 | 5,52 | ,05 |
| GROUP (B) | 3 | 25967,28 | 6,63 | ,005 |
| A X B | 3 | 5044,12 | 1,29 | |
| ERROR | 16 | 3919,10 | | |

TABLE 2
ANALYSIS OF VARIANCE: PERCENTAGE WEIGHT GAIN
AFTER THIRD OFT TRIAL

| Source | df | Ms | F | p |
|---------------|----|----------|------|-----|
| CONDITION (A) | 1 | 11498,82 | 2,24 | |
| GROUP (B) | 3 | 28501,17 | 5,55 | ,01 |
| A X B | 3 | 4704,74 | 0,92 | |
| ERROR | 16 | 5133,79 | | |

TABLE 3
ANALYSIS OF VARIANCE: PERCENTAGE WEIGHT GAIN
AT END OF OFT TESTING

| Source | df | Ms | F | p |
|---------------|----|----------|------|-------|
| CONDITION (A) | 1 | 24,36 | 0,00 | |
| GROUP (B) | 3 | 50298,36 | 3,04 | (,10) |
| A X B | 3 | 14749,60 | 0,89 | |
| ERROR | 16 | 16528,59 | | |

TABLE 4

ANALYSIS OF VARIANCE: PERCENTAGE WEIGHT GAIN
AT START OF HEBB-WILLIAMS PROBLEM TESTING

| Source | df | Ms | F | p |
|---------------|----|----------|------|-------|
| CONDITION (A) | 1 | 3752,50 | 0,57 | (,10) |
| GROUP (B) | 3 | 16677,89 | 2,54 | |
| A X B | 3 | 3561,32 | 0,54 | |
| ERROR | 16 | 6556,22 | | |

TABLE 5

ANALYSIS OF VARIANCE: PERCENTAGE WEIGHT GAIN
AT END OF HEBB-WILLIAMS PROBLEM TESTING

| Source | df | Ms | F | p |
|---------------|----|----------|------|-------|
| CONDITION (A) | 1 | 3346,01 | 0,35 | (,10) |
| GROUP (B) | 3 | 23184,36 | 2,46 | |
| A X B | 3 | 4619,79 | 0,49 | |
| ERROR | 16 | 9434,81 | | |

OPEN FIELD TEST OF EMOTIONALITY

Two (experimental and control conditions)
by six (trials) analyses of variance.

GROUP I (20 days)

TABLE 1(a)

ANALYSIS OF VARIANCE: DEFAECATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|------|
| CONDITION (A) | 1 | 2,25 | 1,50 | |
| TRIAL (B) | 5 | 4,96 | 3,31 | ,025 |
| A X B | 5 | 1,05 | 0,70 | |
| ERROR | 24 | 1,50 | | |

TABLE 1(b)

ANALYSIS OF VARIANCE: DEFAECATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 14,69 | 5,57 | ,05 |
| TRIAL (B) | 5 | 0,69 | 0,26 | |
| A X B | 5 | 2,29 | 0,87 | |
| ERROR | 24 | 2,64 | | |

TABLE 1(c)

ANALYSIS OF VARIANCE: DEFAECATION (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 28,44 | 6,61 | ,025 |
| TRIAL (B) | 5 | 5,18 | 1,20 | |
| A X B | 5 | 5,18 | 1,20 | |
| ERROR | 24 | 4,31 | | |

TABLE 2(a)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 66,69 | 6,44 | ,025 |
| TRIAL (B) | 5 | 25,89 | 2,50 | (,10) |
| A X B | 5 | 18,96 | 1,83 | |
| ERROR | 24 | 10,36 | | |

TABLE 2(b)
ANALYSIS OF VARIANCE: REARING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 72,25 | 7,17 | ,025 |
| TRIAL (B) | 5 | 16,98 | 1,68 | |
| A X B | 5 | 25,52 | 2,53 | (,10) |
| ERROR | 24 | 10,08 | | |

TABLE 2(c)
ANALYSIS OF VARIANCE: REARING (total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 277,78 | 8,79 | ,01 |
| TRIAL (B) | 5 | 35,64 | 1,13 | |
| A X B | 5 | 54,98 | 1,74 | |
| ERROR | 24 | 31,61 | | |

TABLE 3(a)
ANALYSIS OF VARIANCE: GROOMING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 6,25 | 3,63 | (,10) |
| TRIAL (B) | 5 | 3,92 | 2,27 | (,10) |
| A X B | 5 | 0,72 | 0,42 | |
| ERROR | 24 | 1,72 | | |

TABLE 3(b)
ANALYSIS OF VARIANCE: GROOMING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,11 | 0,15 | |
| TRIAL (B) | 5 | 0,38 | 0,50 | |
| A X B | 5 | 1,38 | 1,84 | |
| ERROR | 24 | 0,75 | | |

TABLE 3(c)
ANALYSIS OF VARIANCE: GROOMING (total)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 8,03 | 3,07 | (,10) |
| TRIAL (B) | 5 | 4,56 | 1,75 | |
| A X B | 5 | 2,29 | 3,07 | |
| ERROR | 24 | 2,61 | | |

TABLE 4(a)

ANALYSIS OF VARIANCE: GENERAL AMBULATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 44,44 | 1,27 | |
| TRIAL (B) | 5 | 279,78 | 8,00 | ,0005 |
| A X B | 5 | 77,44 | 2,21 | (,10) |
| ERROR | 24 | 34,97 | | |

TABLE 4(b)

ANALYSIS OF VARIANCE: GENERAL AMBULATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 53,78 | 1,12 | |
| TRIAL (B) | 5 | 119,91 | 2,49 | (,10) |
| A X B | 5 | 73,44 | 1,52 | |
| ERROR | 24 | 48,22 | | |

TABLE 4(c)

ANALYSIS OF VARIANCE: GENERAL AMBULATION (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 152,11 | 1,31 | |
| TRIAL (B) | 5 | 729,31 | 6,26 | ,001 |
| A X B | 5 | 195,44 | 1,68 | |
| ERROR | 24 | 116,44 | | |

TABLE 5(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 182,53 | 5,62 | ,05 |
| TRIAL (B) | 4 | 88,12 | 2,71 | (,10) |
| A X B | 4 | 14,12 | 0,43 | |
| ERROR | 20 | 32,50 | | |

TABLE 5(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 58,80 | 1,41 | |
| TRIAL (B) | 4 | 27,05 | 0,65 | |
| A X B | 4 | 66,22 | 1,59 | |
| ERROR | 20 | 41,70 | | |

TABLE 5(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 448,53 | 3,98 | (,10) |
| TRIAL (B) | 4 | 138,70 | 1,29 | |
| A X B | 4 | 96,70 | 0,86 | |
| ERROR | 20 | 112,77 | | |

TABLE 6(a)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 1,36 | 3,77 | (,10) |
| TRIAL (B) | 5 | 0,23 | 0,63 | |
| A X B | 5 | 0,23 | 0,63 | |
| ERROR | 24 | 0,36 | | |

TABLE 6(b)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,27 | 1,72 | |
| TRIAL (B) | 5 | 0,13 | 0,80 | |
| A X B | 5 | 0,13 | 0,80 | |
| ERROR | 24 | 0,16 | | |

TABLE 6(c)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(total)

| Source | df | Ms | F | p |
|---------------|----|------|------|-----|
| CONDITION (A) | 1 | 2,78 | 5,26 | ,05 |
| TRIAL (B) | 5 | 0,44 | 0,84 | |
| A X B | 5 | 0,64 | 1,22 | |
| ERROR | 24 | 0,53 | | |

TABLE 7 (a)
ANALYSIS OF VARIANCE: OTHER (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 25,00 | 1,85 | |
| TRIAL (B) | 5 | 50,44 | 3,73 | ,025 |
| A X B | 5 | 33,93 | 1,51 | |
| ERROR | 24 | 13,53 | | |

TABLE 7 (b)
ANALYSIS OF VARIANCE: OTHER (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 51,36 | 3,61 | (,10) |
| TRIAL (B) | 5 | 7,96 | 0,56 | |
| A X B | 5 | 33,16 | 2,33 | (,10) |
| ERROR | 24 | 14,22 | | |

TABLE 7 (c)
ANALYSIS OF VARIANCE: OTHER (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 191,36 | 4,61 | ,05 |
| TRIAL (B) | 5 | 49,92 | 1,20 | |
| A X B | 5 | 75,29 | 1,82 | |
| ERROR | 24 | 41,47 | | |

TABLE 8(a)
ANALYSIS OF VARIANCE: ACTIVITY (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 205,44 | 0,03 | |
| TRIAL (B) | 5 | 14319,91 | 2,01 | |
| A X B | 5 | 2798,84 | 0,40 | |
| ERROR | 24 | 7022,50 | | |

TABLE 8(b)
ANALYSIS OF VARIANCE: ACTIVITY (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|---------|------|---|
| CONDITION (A) | 1 | 1167,36 | 0,29 | |
| TRIAL (B) | 5 | 4644,72 | 1,14 | |
| A X B | 5 | 8120,76 | 1,99 | |
| ERROR | 24 | 4077,25 | | |

TABLE 8(c)
ANALYSIS OF VARIANCE: ACTIVITY (total)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 393,36 | 0,02 | |
| TRIAL (B) | 5 | 31439,29 | 1,85 | |
| A X B | 5 | 19421,43 | 1,14 | |
| ERROR | 24 | 16991,39 | | |

GROUP II (30 days)

TABLE 1(a)

ANALYSIS OF VARIANCE: DEFAECATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|------|
| CONDITION (A) | 1 | 1,36 | 0,52 | |
| TRIAL (B) | 5 | 9,56 | 3,66 | ,025 |
| A X B | 5 | 0,76 | 0,29 | |
| ERROR | 24 | 2,61 | | |

TABLE 1(b)

ANALYSIS OF VARIANCE: DEFAECATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,11 | 0,03 | |
| TRIAL (B) | 5 | 2,20 | 0,68 | |
| A X B | 5 | 1,38 | 0,42 | |
| ERROR | 24 | 3,25 | | |

TABLE 1(c)

ANALYSIS OF VARIANCE: DEFAECATION (Total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 2,25 | 0,32 | |
| TRIAL (B) | 5 | 12,76 | 1,82 | |
| A X B | 5 | 0,98 | 0,14 | |
| ERROR | 24 | 7,00 | | |

TABLE 2(a)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 72,25 | 4,69 | ,005 |
| TRIAL (B) | 5 | 101,92 | 6,62 | ,001 |
| A X B | 5 | 3,12 | 0,20 | |
| ERROR | 24 | 15,39 | | |

TABLE 2(b)
ANALYSIS OF VARIANCE: REARING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 103,36 | 5,27 | ,05 |
| TRIAL (B) | 5 | 57,09 | 2,91 | ,05 |
| A X B | 5 | 19,23 | 0,98 | |
| ERROR | 24 | 19,61 | | |

TABLE 2(c)
ANALYSIS OF VARIANCE: REARING (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 348,44 | 6,48 | ,025 |
| TRIAL (B) | 5 | 308,51 | 5,73 | ,005 |
| A X B | 5 | 25,84 | 0,48 | |
| ERROR | 24 | 53,81 | | |

TABLE 3(a)
ANALYSIS OF VARIANCE: GROOMING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 4,00 | 3,13 | (,10) |
| TRIAL (B) | 5 | 7,53 | 5,90 | ,005 |
| A X B | 5 | 2,93 | 2,30 | (,10) |
| ERROR | 24 | 1,28 | | |

TABLE 3(b)
ANALYSIS OF VARIANCE: GROOMING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 1,00 | 1,33 | |
| TRIAL (B) | 5 | 2,84 | 3,79 | ,025 |
| A X B | 5 | 1,73 | 2,31 | (,10) |
| ERROR | 24 | 0,75 | | |

TABLE 3(c)
ANALYSIS OF VARIANCE: GROOMING (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 9,00 | 4,10 | (,10) |
| TRIAL (B) | 5 | 10,24 | 4,67 | ,005 |
| A X B | 5 | 3,20 | 1,46 | |
| ERROR | 24 | 2,19 | | |

TABLE 4(a)

ANALYSIS OF VARIANCE: GENERAL AMBULATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 117,36 | 2,38 | ,005 |
| TRIAL (B) | 5 | 270,03 | 5,47 | |
| A X B | 5 | 55,63 | 1,13 | |
| ERROR | 24 | 49,36 | | |

TABLE 4(b)

ANALYSIS OF VARIANCE: GENERAL AMBULATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 169,00 | 3,95 | (,10) |
| TRIAL (B) | 5 | 325,78 | 7,61 | ,0005 |
| A X B | 5 | 52,80 | 1,23 | |
| ERROR | 24 | 42,83 | | |

TABLE 4(c)

ANALYSIS OF VARIANCE: GENERAL AMBULATION (Total)

| Source | df | Ms | F | p |
|---------------|----|---------|------|-------|
| CONDITION (A) | 1 | 568,03 | 3,94 | (,10) |
| TRIAL (B) | 5 | 1173,12 | 8,14 | ,0005 |
| A X B | 5 | 126,76 | 0,88 | |
| ERROR | 24 | 144,06 | | |

TABLE 5(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 187,50 | 3,44 | (,10) |
| TRIAL (B) | 4 | 96,47 | 1,77 | |
| A X B | 4 | 42,17 | 0,77 | |
| ERROR | 20 | 54,57 | | |

TABLE 5(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 93,63 | 2,24 | |
| TRIAL (B) | 4 | 60,00 | 1,44 | |
| A X B | 4 | 58,80 | 1,41 | |
| ERROR | 20 | 41,77 | | |

TABLE 5(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (TOTAL)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 563,33 | 3,73 | (,10) |
| TRIAL (B) | 4 | 288,28 | 1,91 | |
| A X B | 4 | 152,58 | 1,01 | |
| ERROR | 20 | 151,13 | | |

TABLE 6(a)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 1,78 | 1,83 | |
| TRIAL (B) | 5 | 2,18 | 2,24 | (,10) |
| A X B | 5 | 0,11 | 0,11 | |
| ERROR | 24 | 0,97 | | |

TABLE 6(b)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 1,36 | 2,72 | |
| TRIAL (B) | 5 | 0,49 | 0,99 | |
| A X B | 5 | 0,09 | 0,19 | |
| ERROR | 24 | 0,50 | | |

TABLE 6(c)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|------|------|-----|
| CONDITION (A) | 1 | 6,25 | 5,00 | ,05 |
| TRIAL (B) | 5 | 3,43 | 2,74 | ,05 |
| A X B | 5 | 0,32 | 0,25 | |
| ERROR | 24 | 1,25 | | |

TABLE 7(a)
ANALYSIS OF VARIANCE: OTHER (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 6,25 | 0,43 | |
| TRIAL (B) | 5 | 46,09 | 3,14 | ,05 |
| A X B | 5 | 4,72 | 0,32 | |
| ERROR | 24 | 14,67 | | |

TABLE 7(b)
ANALYSIS OF VARIANCE: OTHER (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 36,00 | 2,58 | |
| TRIAL (B) | 5 | 6,07 | 0,43 | |
| A X B | 5 | 18,27 | 1,31 | |
| ERROR | 24 | 13,97 | | |

TABLE 7(c)
ANALYSIS OF VARIANCE: OTHER (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 12,25 | 0,29 | |
| TRIAL (B) | 5 | 63,09 | 1,47 | |
| A X B | 5 | 36,12 | 0,84 | |
| ERROR | 24 | 42,94 | | |

TABLE 8(a)
ANALYSIS OF VARIANCE: ACTIVITY (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|---------|------|---|
| CONDITION (A) | 1 | 5801,36 | 0,88 | |
| TRIAL (B) | 5 | 5768,09 | 0,87 | |
| A X B | 5 | 3258,36 | 0,49 | |
| ERROR | 24 | 6622,94 | | |

TABLE 8(b)
ANALYSIS OF VARIANCE: ACTIVITY (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|-------|
| CONDITION (A) | 1 | 22101,78 | 3,45 | (,10) |
| TRIAL (B) | 5 | 1673,67 | 0,26 | |
| A X B | 5 | 3003,71 | 0,47 | |
| ERROR | 24 | 6409,06 | | |

TABLE 8(c)
ANALYSIS OF VARIANCE: ACTIVITY (Total)

| Source | df | Ms | F | p |
|---------------|----|-----------|------|---|
| CONDITION (A) | 1 | 508850,25 | 2,38 | |
| TRIAL (B) | 5 | 11150,12 | 0,52 | |
| A X B | 5 | 7613,32 | 0,36 | |
| ERROR | 24 | 21331,31 | | |

GROUP III (40 days)

TABLE 1(a)

ANALYSIS OF VARIANCE: DEFAECATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 1,00 | 0,25 | |
| TRIAL (B) | 5 | 6,98 | 1,77 | |
| A X B | 5 | 4,20 | 0,25 | |
| ERROR | 24 | 3,94 | | |

TABLE 1(b)

ANALYSIS OF VARIANCE: DEFAECATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 2,25 | 0,74 | |
| TRIAL (B) | 5 | 0,78 | 0,26 | |
| A X B | 5 | 1,18 | 0,39 | |
| ERROR | 24 | 3,03 | | |

TABLE 1(c)

ANALYSIS OF VARIANCE: DEFAECATION (total)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,25 | 0,04 | |
| TRIAL (B) | 5 | 8,23 | 1,43 | |
| A X B | 5 | 3,12 | 0,54 | |
| ERROR | 24 | 5,75 | | |

Table 2(a)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 23,36 | 1,21 | |
| TRIAL (B) | 5 | 57,12 | 2,96 | ,05 |
| A X B | 5 | 12,49 | 0,65 | |
| ERROR | 24 | 19,31 | | |

Table 2(b)
ANALYSIS OF VARIANCE: REARING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 20,25 | 1,19 | |
| TRIAL (B) | 5 | 31,65 | 1,86 | |
| A X B | 5 | 9,38 | 0,55 | |
| ERROR | 24 | 17,06 | | |

Table 2(c)
ANALYSIS OF VARIANCE: REARING (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 87,11 | 1,53 | |
| TRIAL (B) | 5 | 156,73 | 2,74 | ,05 |
| A X B | 5 | 35,91 | 0,63 | |
| ERROR | 24 | 57,11 | | |

Table 3(a)
ANALYSIS OF VARIANCE: GROOMING (1st 2 min)

| Source | df | Ms | F | P |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 0,44 | 1,00 | (,10) |
| TRIAL (B) | 5 | 0,98 | 2,20 | |
| A X B | 5 | 0,51 | 1,15 | |
| ERROR | 24 | 0,44 | | |

Table 3(b)
ANALYSIS OF VARIANCE: GROOMING (2nd 2 min)

| Source | df | Ms | F | P |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,25 | 0,43 | |
| TRIAL (B) | 5 | 0,45 | 0,77 | |
| A X B | 5 | 0,85 | 1,46 | |
| ERROR | 24 | 0,58 | | |

Table 3(c)
ANALYSIS OF VARIANCE: GROOMING (total)

| Source | df | Ms | F | P |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,03 | 0,03 | |
| TRIAL (B) | 5 | 2,03 | 1,87 | |
| A X B | 5 | 0,29 | 0,27 | |
| ERROR | 24 | 1,08 | | |

TABLE 4(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 40,11 | 0,65 | ,025 |
| TRIAL (B) | 5 | 212,71 | 3,44 | |
| A X B | 5 | 13,38 | 0,22 | |
| ERROR | 24 | 61,89 | | |

TABLE 4(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 42,25 | 0,82 | ,025 |
| TRIAL (B) | 5 | 199,76 | 3,87 | |
| A X B | 5 | 61,98 | 1,20 | |
| ERROR | 24 | 51,61 | | |

TABLE 4(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 164,69 | 0,96 | ,005 |
| TRIAL (B) | 5 | 821,52 | 4,77 | |
| A X B | 5 | 113,56 | 0,66 | |
| ERROR | 24 | 172,28 | | |

TABLE 5(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 28,03 | 0,53 | |
| TRIAL (B) | 4 | 69,53 | 1,31 | |
| A X B | 4 | 16,37 | 0,31 | |
| ERROR | 20 | 53,27 | | |

TABLE 5(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 13,33 | 0,26 | |
| TRIAL (B) | 4 | 82,47 | 1,64 | |
| A X B | 4 | 69,67 | 1,38 | |
| ERROR | 20 | 50,40 | | |

TABLE 5(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|---|
| CONDITION (A) | 1 | 80,03 | 0,55 | |
| TRIAL (B) | 4 | 300,88 | 2,08 | |
| A X B | 4 | 130,45 | 0,90 | |
| ERROR | 20 | 144,40 | | |

TABLE 6(a)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|------|
| CONDITION (A) | 1 | 0,44 | 0,48 | |
| TRIAL (B) | 5 | 3,24 | 3,54 | ,025 |
| A X B | 5 | 0,38 | 0,41 | |
| ERROR | 24 | 0,92 | | |

TABLE 6(b)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,69 | 0,61 | |
| TRIAL (B) | 5 | 1,03 | 0,90 | |
| A X B | 5 | 0,76 | 0,67 | |
| ERROR | 24 | 1,14 | | |

TABLE 6(c)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|------|-------|-------|
| CONDITION (A) | 1 | 0,03 | -,001 | |
| TRIAL (B) | 5 | 7,36 | 2,35 | (,10) |
| A X B | 5 | 2,03 | 0,65 | |
| ERROR | 24 | 3,14 | | |

TABLE 7(a)
ANALYSIS OF VARIANCE: OTHER (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 16,00 | 2,13 | |
| TRIAL (B) | 5 | 16,24 | 2,17 | (,10) |
| A X B | 5 | 7,67 | 1,02 | |
| ERROR | 24 | 7,50 | | |

TABLE 7(b)
ANALYSIS OF VARIANCE: OTHER (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 0,25 | 0,02 | |
| TRIAL (B) | 5 | 14,89 | 0,91 | |
| A X B | 5 | 10,98 | 0,67 | |
| ERROR | 24 | 16,31 | | |

TABLE 7(c)
ANALYSIS OF VARIANCE: OTHER (Total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 12,25 | 0,34 | |
| TRIAL (B) | 5 | 53,52 | 1,52 | |
| A X B | 5 | 22,72 | 0,64 | |
| ERROR | 24 | 35,22 | | |

TABLE 8(a)
ANALYSIS OF VARIANCE: ACTIVITY (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|------|
| CONDITION (A) | 1 | 1332,25 | 0,83 | |
| TRIAL (B) | 5 | 11530,52 | 7,17 | ,001 |
| A X B | 5 | 3195,72 | 1,99 | |
| ERROR | 24 | 1608,22 | | |

TABLE 8(b)
ANALYSIS OF VARIANCE: ACTIVITY (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|---------|------|-----|
| CONDITION (A) | 1 | 30,25 | 0,04 | |
| TRIAL (B) | 5 | 2240,09 | 2,86 | ,05 |
| A X B | 5 | 2223,12 | 2,84 | ,05 |
| ERROR | 24 | 783,08 | | |

TABLE 8(c)
ANALYSIS OF VARIANCE: ACTIVITY (Total)

| Source | df | Ms | F | p |
|---------------|----|----------|------|-------|
| CONDITION (A) | 1 | 641,78 | 0,15 | |
| TRIAL (B) | 5 | 21334,84 | 4,92 | ,005 |
| A X B | 5 | 10134,91 | 2,34 | (,10) |
| ERROR | 24 | 4334,36 | | |

GROUP IV (50 DAYS)

TABLE 1(a)

ANALYSIS OF VARIANCE: DEFAECATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 0,11 | 0,02 | |
| TRIAL (B) | 5 | 10,87 | 1,92 | |
| A X B | 5 | 3,11 | 0,55 | |
| ERROR | 24 | 5,67 | | |

TABLE 1(b)

ANALYSIS OF VARIANCE: DEFAECATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,25 | 0,05 | |
| TRIAL (B) | 5 | 1,78 | 0,38 | |
| A X B | 5 | 3,12 | 0,67 | |
| ERROR | 24 | 4,67 | | |

TABLE 1(c)

ANALYSIS OF VARIANCE: DEFAECATION (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 0,69 | 0,05 | |
| TRIAL (B) | 5 | 5,58 | 0,43 | |
| A X B | 5 | 2,03 | 0,16 | |
| ERROR | 24 | 13,00 | | |

TABLE 2(a)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 261,36 | 9,47 | ,01 |
| TRIAL (B) | 5 | 25,18 | 0,91 | |
| A X B | 5 | 21,76 | 0,79 | |
| ERROR | 24 | 27,61 | | |

TABLE 2(b)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 40,11 | 2,31 | |
| TRIAL (B) | 5 | 27,58 | 1,59 | |
| A X B | 5 | 22,51 | 1,29 | |
| ERROR | 24 | 17,39 | | |

TABLE 2(c)
ANALYSIS OF VARIANCE: REARING (total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 506,25 | 8,08 | ,01 |
| TRIAL (B) | 5 | 83,09 | 1,33 | |
| A X B | 5 | 68,12 | 1,09 | |
| ERROR | 24 | 62,67 | | |

TABLE 3(a)
ANALYSIS OF VARIANCE: GROOMING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|------|
| CONDITION (A) | 1 | 0,03 | 0,05 | |
| TRIAL (B) | 5 | 4,05 | 6,63 | ,005 |
| A X B | 5 | 1,56 | 2,55 | |
| ERROR | 24 | 0,61 | | |

TABLE 3(b)
ANALYSIS OF VARIANCE: GROOMING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,0 | 0,0 | |
| TRIAL (B) | 5 | 1,27 | 1,11 | |
| A X B | 5 | 0,47 | 0,41 | |
| ERROR | 24 | 1,14 | | |

TABLE 3(c)
ANALYSIS OF VARIANCE: GROOMING (total)

| Source | df | Ms | F | p |
|---------------|----|------|------|------|
| CONDITION (A) | 1 | 0,03 | 0,02 | |
| TRIAL (B) | 5 | 7,32 | 4,88 | ,005 |
| A X B | 5 | 1,23 | 0,82 | |
| ERROR | 24 | 1,50 | | |

TABLE 4(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 10,03 | 0,30 | |
| TRIAL (B) | 5 | 57,29 | 1,72 | |
| A X B | 5 | 50,23 | 1,51 | |
| ERROR | 24 | 33,25 | | |

TABLE 4(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 20,25 | 0,63 | |
| TRIAL (B) | 5 | 32,69 | 1,01 | |
| A X B | 5 | 93,18 | 2,88 | ,05 |
| ERROR | 24 | 32,33 | | |

TABLE 4(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 1,78 | 0,02 | |
| TRIAL (B) | 5 | 164,58 | 1,86 | |
| A X B | 5 | 249,04 | 2,82 | ,05 |
| ERROR | 24 | 88,36 | | |

TABLE 5(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 0,03 | 0,00 | |
| TRIAL (B) | 4 | 16,62 | 0,49 | |
| A X B | 4 | 51,78 | 1,54 | |
| ERROR | 20 | 33,63 | | |

TABLE 5(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 124,03 | 3,79 | (,10) |
| TRIAL (B) | 4 | 14,03 | 0,43 | |
| A X B | 4 | 42,37 | 1,29 | |
| ERROR | 20 | 32,77 | | |

TABLE 5(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
TRIALS 2 - 6 (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|---|
| CONDITION (A) | 1 | 128,13 | 1,48 | |
| TRIAL (B) | 4 | 50,58 | 0,59 | |
| A X B | 4 | 164,55 | 1,91 | |
| ERROR | 20 | 86,30 | | |

TABLE 6(a)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|-------|------|
| CONDITION (A) | 1 | 16,00 | 14,40 | ,001 |
| TRIAL (B) | 5 | 1,44 | 1,30 | |
| A X B | 5 | 5,87 | 5,28 | ,005 |
| ERROR | 24 | 1,11 | | |

TABLE 6(b)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-----|
| CONDITION (A) | 1 | 2,78 | 5,56 | ,05 |
| TRIAL (B) | 5 | 0,24 | 0,49 | |
| A X B | 5 | 1,31 | 2,62 | ,05 |
| ERROR | 24 | 0,50 | | |

TABLE 6(c)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|-------|-------|-------|
| CONDITION (A) | 1 | 32,11 | 16,51 | ,0005 |
| TRIAL (B) | 5 | 1,58 | 0,81 | |
| A X B | 5 | 9,78 | 5,03 | ,005 |
| ERROR | 24 | 1,94 | | |

TABLE 7(a)
ANALYSIS OF VARIANCE: OTHER (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 9,00 | 0,99 | |
| TRIAL (B) | 5 | 10,51 | 1,16 | |
| A X B | 5 | 4,67 | 0,52 | |
| ERROR | 24 | 9,06 | | |

TABLE 7(b)
ANALYSIS OF VARIANCE: OTHER (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 9,00 | 0,66 | |
| TRIAL (B) | 5 | 1,40 | 0,10 | |
| A X B | 5 | 11,40 | 0,81 | |
| ERROR | 24 | 13,58 | | |

TABLE 7(c)
ANALYSIS OF VARIANCE: OTHER (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 46,69 | 1,90 | |
| TRIAL (B) | 5 | 9,72 | 0,50 | |
| A X B | 5 | 24,03 | 0,98 | |
| ERROR | 24 | 24,56 | | |

TABLE 8(a)
ANALYSIS OF VARIANCE: ACTIVITY (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 3325,44 | 0,19 | |
| TRIAL (B) | 5 | 26031,51 | 1,48 | |
| A X B | 5 | 21012,51 | 1,19 | |
| ERROR | 24 | 17641,92 | | |

TABLE 8(b)
ANALYSIS OF VARIANCE: ACTIVITY (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 177,78 | 0,02 | |
| TRIAL (B) | 5 | 11352,98 | 1,29 | |
| A X B | 5 | 7847,38 | 0,89 | |
| ERROR | 24 | 8827,00 | | |

TABLE 8(c)
ANALYSIS OF VARIANCE: ACTIVITY (total)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 765,44 | 0,02 | |
| TRIAL (B) | 5 | 55866,58 | 1,30 | |
| A X B | 5 | 55923,04 | 1,30 | |
| ERROR | 24 | 42059,36 | | |

OPEN FIELD TEST OF EMOTIONALITY

Two (experimental and control conditions)
by four (groups I, II, III, and IV)
analyses of variance.

TABLE 1(a)
ANALYSIS OF VARIANCE: DEFAECATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|-------|------|
| CONDITION (A) | 1 | 0,17 | 0,09 | |
| GROUP (B) | 3 | 20,01 | 11,21 | ,001 |
| A X B | 3 | 0,21 | 0,12 | |
| ERROR | 16 | 1,79 | | |

TABLE 1(b)
ANALYSIS OF VARIANCE: DEFAECATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 1,76 | 1,30 | |
| GROUP (B) | 3 | 0,51 | 0,38 | |
| A X B | 3 | 0,41 | 0,31 | |
| ERROR | 16 | 1,34 | | |

TABLE 1(c)
ANALYSIS OF VARIANCE: DEFAECATION (Total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 2,65 | 0,62 | |
| GROUP (B) | 3 | 27,03 | 6,35 | ,01 |
| A X B | 3 | 0,84 | 0,20 | |
| ERROR | 16 | 4,25 | | |

TABLE 2(a)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 17,82 | 2,34 | |
| GROUP (B) | 3 | 25,06 | 3,30 | ,05 |
| A X B | 3 | 17,60 | 2,31 | |
| ERROR | 16 | 7,60 | | |

TABLE 2(b)
ANALYSIS OF VARIANCE: REARING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 3,52 | 0,81 | |
| GROUP (B) | 3 | 15,13 | 3,47 | ,05 |
| A X B | 3 | 11,94 | 1,74 | (,10) |
| ERROR | 16 | 4,36 | | |

TABLE 2(c)
ANALYSIS OF VARIANCE: REARING (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 37,18 | 1,79 | |
| GROUP (B) | 3 | 78,88 | 3,80 | ,05 |
| A X B | 3 | 55,38 | 2,67 | (,10) |
| ERROR | 16 | 20,75 | | |

TABLE 3(a)
ANALYSIS OF VARIANCE: GROOMING (1st 2 min)

| Source | df | Ms | F | P |
|---------------|----|------|------|-----|
| CONDITION (A) | 1 | 0,73 | 1,89 | |
| GROUP (B) | 3 | 1,32 | 3,43 | ,05 |
| A X B | 3 | 0,39 | 1,02 | |
| ERROR | 16 | 0,39 | | |

TABLE 3(b)
ANALYSIS OF VARIANCE: GROOMING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 0,14 | 1,00 | |
| GROUP (B) | 3 | 0,36 | 2,58 | (,10) |
| A X B | 3 | 0,03 | 0,21 | |
| ERROR | 16 | 0,14 | | |

TABLE 3(c)
ANALYSIS OF VARIANCE: GROOMING (total)

| Source | df | Ms | F | P |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 1,50 | 3,17 | (,10) |
| GROUP (B) | 3 | 2,82 | 5,95 | ,01 |
| A X B | 3 | 0,51 | 1,08 | |
| ERROR | 16 | 0,47 | | |

TABLE 4(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 29,26 | 1,89 | |
| GROUP (B) | 3 | 57,79 | 3,73 | ,05 |
| A X B | 3 | 25,34 | 1,63 | |
| ERROR | 16 | 15,51 | | |

TABLE 4(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 5,19 | 0,46 | |
| GROUP (B) | 3 | 19,45 | 1,73 | |
| A X B | 3 | 15,67 | 1,39 | |
| ERROR | 16 | 11,23 | | |

TABLE 4(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION (total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 56,00 | 1,58 | |
| GROUP (B) | 3 | 81,31 | 2,29 | |
| A X B | 3 | 77,36 | 2,18 | |
| ERROR | 16 | 35,44 | | |

TABLE 5(a)

ANALYSIS OF VARIANCE: GENERAL AMBULATION TRIALS
2 - 6 (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|-------|
| CONDITION (A) | 1 | 13,80 | 0,89 | |
| GROUP (B) | 3 | 63,10 | 4,07 | ,05 |
| A X B | 3 | 49,94 | 3,22 | (,10) |
| ERROR | 16 | 15,51 | | |

TABLE 5(b)

ANALYSIS OF VARIANCE: GENERAL AMBULATION TRIALS
2 - 6 (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|---|
| CONDITION (A) | 1 | 1,50 | 0,14 | |
| GROUP (B) | 3 | 20,53 | 1,90 | |
| A X B | 3 | 18,80 | 0,14 | |
| ERROR | 16 | 10,78 | | |

TABLE 5(c)

ANALYSIS OF VARIANCE: GENERAL AMBULATION TRIALS
2 - 6 (Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 0,03 | 0,0 | |
| GROUP (B) | 3 | 131,97 | 3,16 | (,10) |
| A X B | 3 | 81,65 | 1,95 | |
| ERROR | 16 | 41,81 | | |

TABLE 6(a)

ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|--------|-----|
| CONDITION (A) | 1 | 0,42 | (1,90) | |
| GROUP (B) | 3 | 0,92 | (4,13) | ,05 |
| A X B | 3 | 0,95 | 4,23 | ,05 |
| ERROR | 16 | 0,22 | | |

TABLE 6(b)

ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| Condition (A) | 1 | 0,14 | 1,47 | |
| GROUP (B) | 3 | 0,32 | 3,46 | ,05 |
| A X B | 3 | 0,24 | 2,51 | (,10) |
| ERROR | 16 | 0,09 | | |

TABLE 6(c)

ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|------|------|------|
| CONDITION (A) | 1 | 1,05 | 2,34 | |
| GROUP (B) | 3 | 2,13 | 4,77 | ,025 |
| A X B | 3 | 1,94 | 4,33 | ,025 |
| ERROR | 16 | 0,45 | | |

TABLE 7(a)
ANALYSIS OF VARIANCE: OTHER (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 4,32 | 2,17 | |
| GROUP (B) | 3 | 14,81 | 7,45 | ,005 |
| A X B | 3 | 3,59 | 1,80 | |
| ERROR | 16 | 1,99 | | |

TABLE 7(b)
ANALYSIS OF VARIANCE: OTHER (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,61 | 0,20 | |
| GROUP (B) | 3 | 5,94 | 1,92 | |
| A X B | 3 | 4,93 | 1,59 | |
| ERROR | 16 | 3,09 | | |

TABLE 7(c)
ANALYSIS OF VARIANCE: OTHER (Total)

| Source | df | Ms | F | p |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 2,45 | 0,28 | |
| GROUP (B) | 3 | 39,24 | 4,44 | ,025 |
| A X B | 3 | 8,22 | 0,93 | |
| ERROR | 16 | 8,85 | | |

TABLE 8(a)
ANALYSIS OF VARIANCE: ACTIVITY (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|------|
| CONDITION (A) | 1 | 200,16 | 0,08 | |
| GROUP (B) | 3 | 18483,57 | 6,97 | ,005 |
| A X B | 3 | 525,78 | 0,20 | |
| ERROR | 16 | 2652,13 | | |

TABLE 8(b)
ANALYSIS OF VARIANCE: ACTIVITY (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|---------|------|------|
| CONDITION (A) | 1 | 898,42 | 0,79 | |
| GROUP (B) | 3 | 5776,79 | 5,06 | ,025 |
| A X B | 3 | 871,36 | 0,76 | |
| ERROR | 16 | 1142,55 | | |

TABLE 8(c)
ANALYSIS OF VARIANCE: ACTIVITY (total)

| Source | df | Ms | F | p |
|---------------|----|----------|------|------|
| CONDITION (A) | 1 | 1946,70 | 0,30 | |
| GROUP (B) | 3 | 44003,19 | 6,72 | ,005 |
| A X B | 3 | 1956,38 | 0,60 | |
| ERROR | 16 | 6646,66 | | |

PILOT STUDY (50 days)

OPEN FIELD TEST OF EMOTIONALITY

Two (experimental and control conditions) by
six (trials) analyses of variance.

TABLE 1(a)
ANALYSIS OF VARIANCE: DEFAECATION (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|-------|-------|-------|
| CONDITION (A) | 1 | 43,35 | 14,78 | ,001 |
| TRIAL (B) | 5 | 6,78 | 2,31 | (,10) |
| A X B | 5 | 2,19 | 0,75 | |
| ERROR | 48 | 2,93 | | |

TABLE 1(b)
ANALYSIS OF VARIANCE: DEFAECATION (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,82 | 0,44 | |
| TRIAL (B) | 5 | 2,02 | 1,09 | |
| A X B | 5 | 2,82 | 1,52 | |
| ERROR | 48 | 1,86 | | |

TABLE 1(c)
ANALYSIS OF VARIANCE: DEFAECATION (Total)

| Source | df | Mf | F | p |
|---------------|----|-------|------|-----|
| CONDITION (A) | 1 | 28,02 | 7,17 | ,01 |
| TRIAL (B) | 5 | 5,31 | 1,36 | |
| A X B | 5 | 3,82 | 0,98 | |
| ERROR | 48 | 3,91 | | |

TABLE 2(a)
ANALYSIS OF VARIANCE: REARING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 52,27 | 1,39 | |
| TRIAL (B) | 5 | 207,32 | 5,51 | ,025 |
| A X B | 5 | 25,79 | 0,69 | |
| ERROR | 48 | 37,60 | | |

TABLE 2(b)
ANALYSIS OF VARIANCE: REARING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|-------|------|
| CONDITION (A) | 1 | 400,42 | 11,63 | ,005 |
| TRIAL (B) | 5 | 34,55 | 1,00 | |
| A X B | 5 | 46,34 | 1,35 | |
| ERROR | 48 | 34,42 | | |

TABLE 2(c)
ANALYSIS OF VARIANCE: REARING (total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 742,02 | 8,64 | ,005 |
| TRIAL (B) | 5 | 359,07 | 4,18 | ,005 |
| A X B | 5 | 88,70 | 1,03 | |
| ERROR | 48 | 85,89 | | |

TABLE 3(a)
ANALYSIS OF VARIANCE: GROOMING (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,82 | 0,43 | |
| TRIAL (B) | 5 | 1,87 | 0,99 | |
| A X B | 5 | 0,86 | 0,45 | |
| ERROR | 48 | 1,88 | | |

TABLE 3(b)
ANALYSIS OF VARIANCE: GROOMING (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,27 | 0,27 | |
| TRIAL (B) | 5 | 0,43 | 0,44 | |
| A X B | 5 | 0,71 | 0,72 | |
| ERROR | 48 | 0,98 | | |

TABLE 3(c)
ANALYSIS OF VARIANCE: GROOMING (Total)

| Source | df | Ms | F | p |
|---------------|----|------|------|-------|
| CONDITION (A) | 1 | 0,15 | 0,09 | |
| TRIAL (B) | 5 | 3,46 | 2,01 | (,10) |
| A X B | 5 | 1,83 | 1,07 | |
| ERROR | 48 | 1,72 | | |

TABLE 4(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 56,07 | 0,80 | |
| TRIAL (B) | 5 | 216,63 | 3,08 | ,025 |
| A X B | 5 | 58,91 | 0,84 | |
| ERROR | 48 | 70,40 | | |

TABLE 4(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|------|
| CONDITION (A) | 1 | 355,27 | 6,87 | ,025 |
| TRIAL (B) | 5 | 36,52 | 0,71 | |
| A X B | 5 | 16,11 | 0,31 | |
| ERROR | 48 | 51,74 | | |

TABLE 4(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 686,82 | 4,29 | ,05 |
| TRIAL (B) | 5 | 368,95 | 2,31 | (,10) |
| A X B | 5 | 101,38 | 0,63 | |
| ERROR | 48 | 159,93 | | |

TABLE 5(a)
ANALYSIS OF VARIANCE: GENERAL AMBULATION TRIALS
2 - 6 (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-----|
| CONDITION (A) | 1 | 42,32 | 0,60 | |
| TRIAL (B) | 4 | 193,77 | 2,73 | ,05 |
| A X B | 4 | 73,47 | 1,04 | |
| ERROR | 40 | 70,93 | | |

TABLE 5(b)
ANALYSIS OF VARIANCE: GENERAL AMBULATION TRIALS
2 - 6 (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 212,18 | 3,90 | (,10) |
| TRIAL (B) | 4 | 44,90 | 0,82 | |
| A X B | 4 | 9,68 | 0,18 | |
| ERROR | 40 | 54,45 | | |

TABLE 5(c)
ANALYSIS OF VARIANCE: GENERAL AMBULATION TRIALS
(Total)

| Source | df | Ms | F | p |
|---------------|----|--------|------|-------|
| CONDITION (A) | 1 | 444,02 | 2,61 | (,10) |
| TRIAL (B) | 4 | 366,97 | 2,16 | (,10) |
| A X B | 4 | 112,57 | 0,66 | |
| ERROR | 40 | 170,05 | | |

TABLE 6(a)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 0,27 | 0,34 | |
| TRIAL (B) | 5 | 0,48 | 0,61 | |
| A X B | 5 | 1,15 | 1,45 | |
| ERROR | 48 | 0,79 | | |

TABLE 6(b)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 4,27 | 2,64 | |
| TRIAL (B) | 5 | 1,07 | 0,66 | |
| A X B | 5 | 2,35 | 1,45 | |
| ERROR | 48 | 1,62 | | |

TABLE 6(c)
ANALYSIS OF VARIANCE: INNER CIRCLE AMBULATION
(Total)

| Source | df | Ms | F | p |
|---------------|----|------|------|---|
| CONDITION (A) | 1 | 6,67 | 2,35 | |
| TRIAL (B) | 5 | 1,43 | 0,50 | |
| A X B | 5 | 5,51 | 1,94 | |
| ERROR | 48 | 2,84 | | |

TABLE 7(a)
ANALYSIS OF VARIANCE: OTHER (1st 2 min)

| Source | df | Ms | F | P |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 0,02 | 0,00 | |
| TRIAL (B) | 5 | 24,19 | 6,38 | ,001 |
| A X B | 5 | 1,98 | 0,52 | |
| ERROR | 48 | 3,79 | | |

TABLE 7(b)
ANALYSIS OF VARIANCE: OTHER (2nd 2 min)

| Source | df | Ms | F | P |
|---------------|----|-------|-------|------|
| CONDITION (A) | 1 | 68,27 | 13,88 | ,001 |
| TRIAL (B) | 5 | 7,39 | 1,50 | |
| A X B | 5 | 7,23 | 1,47 | |
| ERROR | 48 | 4,92 | | |

TABLE 7(c)
ANALYSIS OF VARIANCE: OTHER (Total)

| Source | df | Ms | F | P |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 70,42 | 8,16 | ,01 |
| TRIAL (B) | 5 | 51,78 | 6,00 | ,001 |
| A X B | 5 | 11,38 | 1,32 | |
| ERROR | 48 | 8,63 | | |

TABLE 8(a)
ANALYSIS OF VARIANCE: ACTIVITY (1st 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 5264,07 | 0,39 | |
| TRIAL (B) | 5 | 24993,95 | 1,86 | |
| A X B | 5 | 12328,43 | 0,92 | |
| ERROR | 48 | 13442,56 | | |

TABLE 8(b)
ANALYSIS OF VARIANCE: ACTIVITY (2nd 2 min)

| Source | df | Ms | F | p |
|---------------|----|----------|------|-------|
| CONDITION (A) | 1 | 53282,40 | 3,98 | (,10) |
| TRIAL (B) | 5 | 16945,67 | 1,27 | |
| A X B | 5 | 18211,48 | 1,36 | |
| ERROR | 48 | 13371,52 | | |

TABLE 8(c)
ANALYSIS OF VARIANCE: ACTIVITY (Total)

| Source | df | Ms | F | p |
|---------------|----|----------|------|---|
| CONDITION (A) | 1 | 92041,67 | 2,12 | |
| TRIAL (B) | 5 | 76404,11 | 1,76 | |
| A X B | 5 | 56292,43 | 1,30 | |
| ERROR | 48 | 43330,12 | | |

HEBB-WILLIAMS CLOSED FIELD TEST OF INTELLIGENCE

Two (experimental and control conditions) by
four (groups I, II, III and IV) analyses of
variance.

TABLE 1

ANALYSIS OF VARIANCE: SCORES ON THE
HEBB-WILLIAMS TEST PROBLEMS

| Source | df | Ms | F | p |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 0,44 | 0,17 | ,005 |
| GROUP (B) | 3 | 22,05 | 8,38 | |
| A X B | 3 | 4,52 | 1,72 | |
| ERROR | 16 | 2,63 | | |

TABLE 2

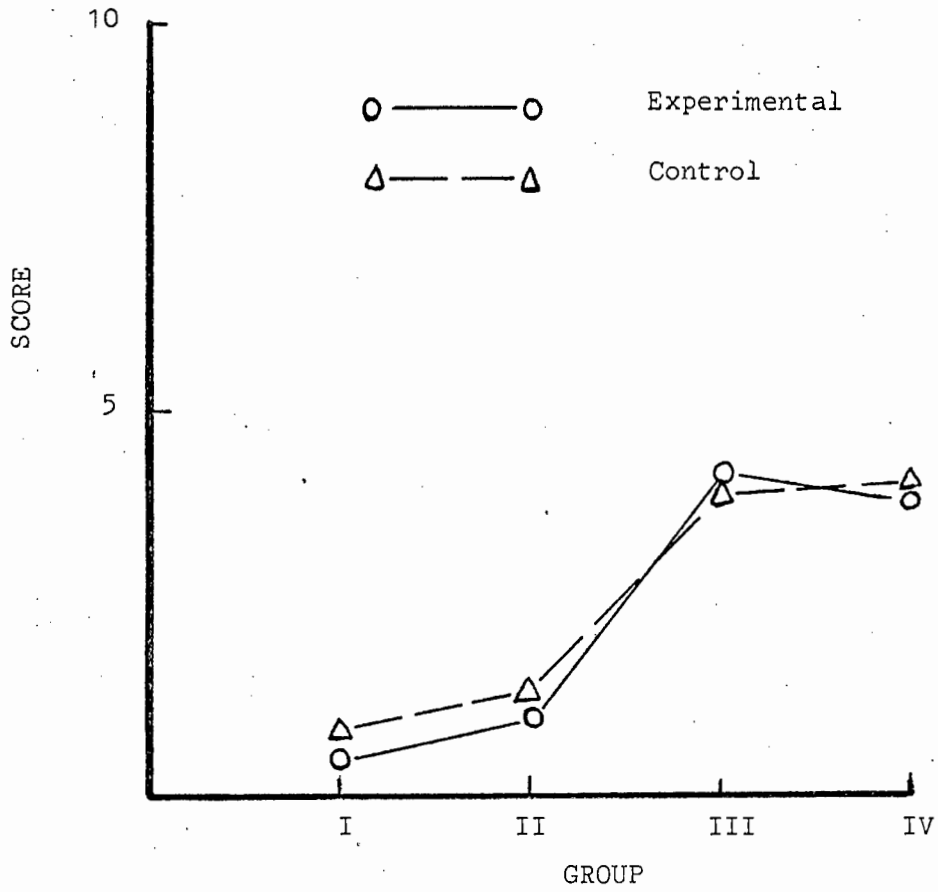
ANALYSIS OF VARIANCE: TIME ON THE
HEBB-WILLIAMS TEST PROBLEMS

| Source | df | Ms | F | p |
|---------------|----|-------|------|------|
| CONDITION (A) | 1 | 13,70 | 2,72 | ,005 |
| GROUP (B) | 3 | 31,81 | 6,31 | |
| A X B | 3 | 7,23 | 1,44 | |
| ERROR | 16 | 5,04 | | |

APPENDIX II

OPEN FIELD TEST
(Graphs 1 - 21)

GRAPH 1
 MEAN DEFAECATION SCORES
 (FIRST TWO MINUTES)

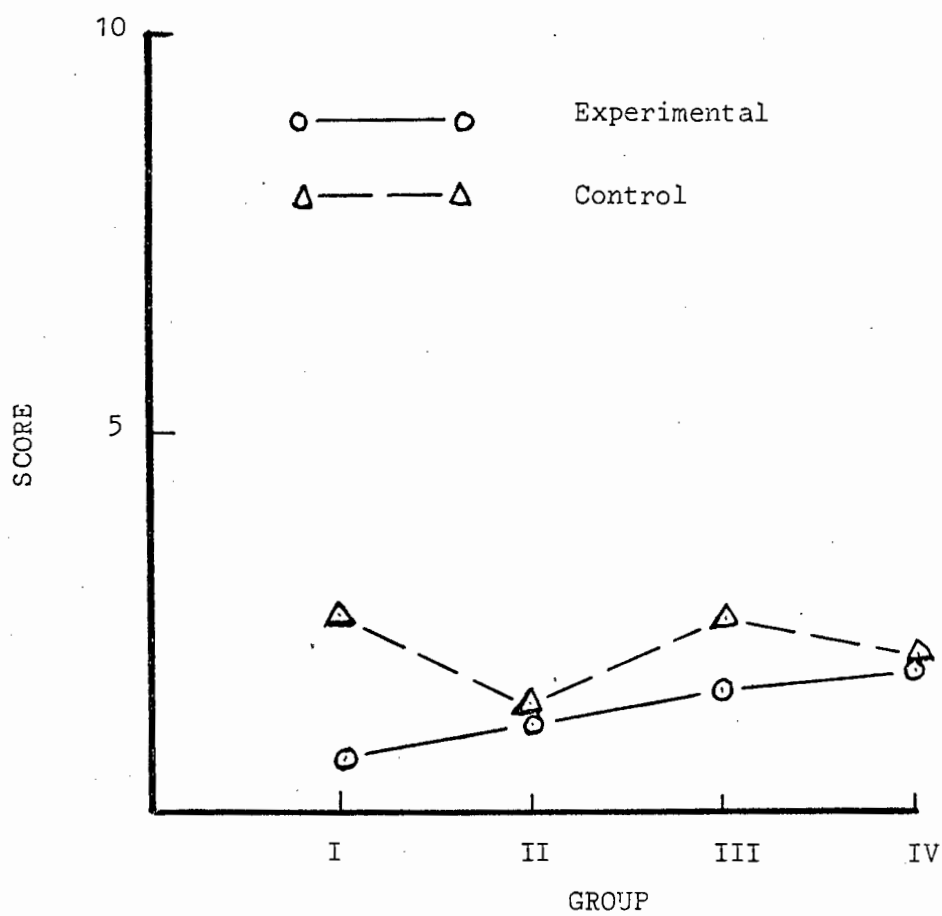


(GROUP) $F_{3-16} = 11,21 \quad p < ,001$

(CONDITION) $F_{1-16} = 0,09 \quad NS$

GRAPH 2

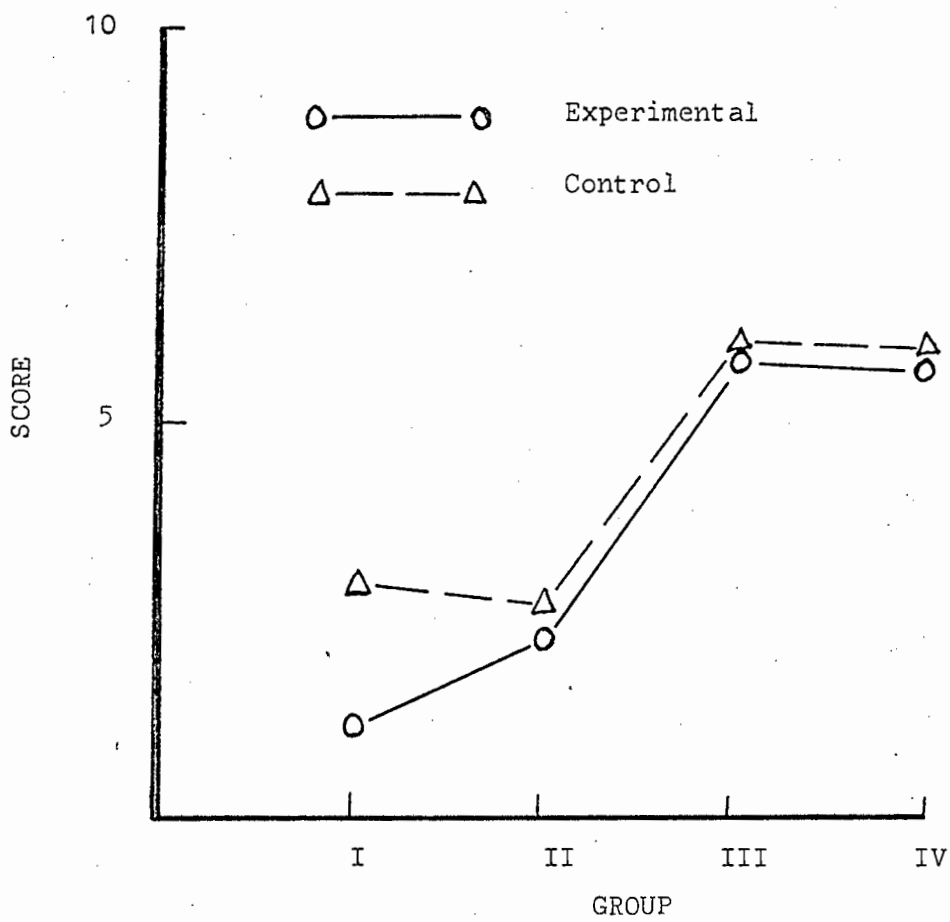
MEAN DEFAECATION SCORES
(SECOND TWO MINUTES)



(GROUP) $F_{3-16} = 0,38$ NS

(CONDITION) $F_{1-16} = 1,30$ NS

GRAPH 3
 MEAN DEFAECATION SCORES
 (TOTAL FOUR MINUTES)

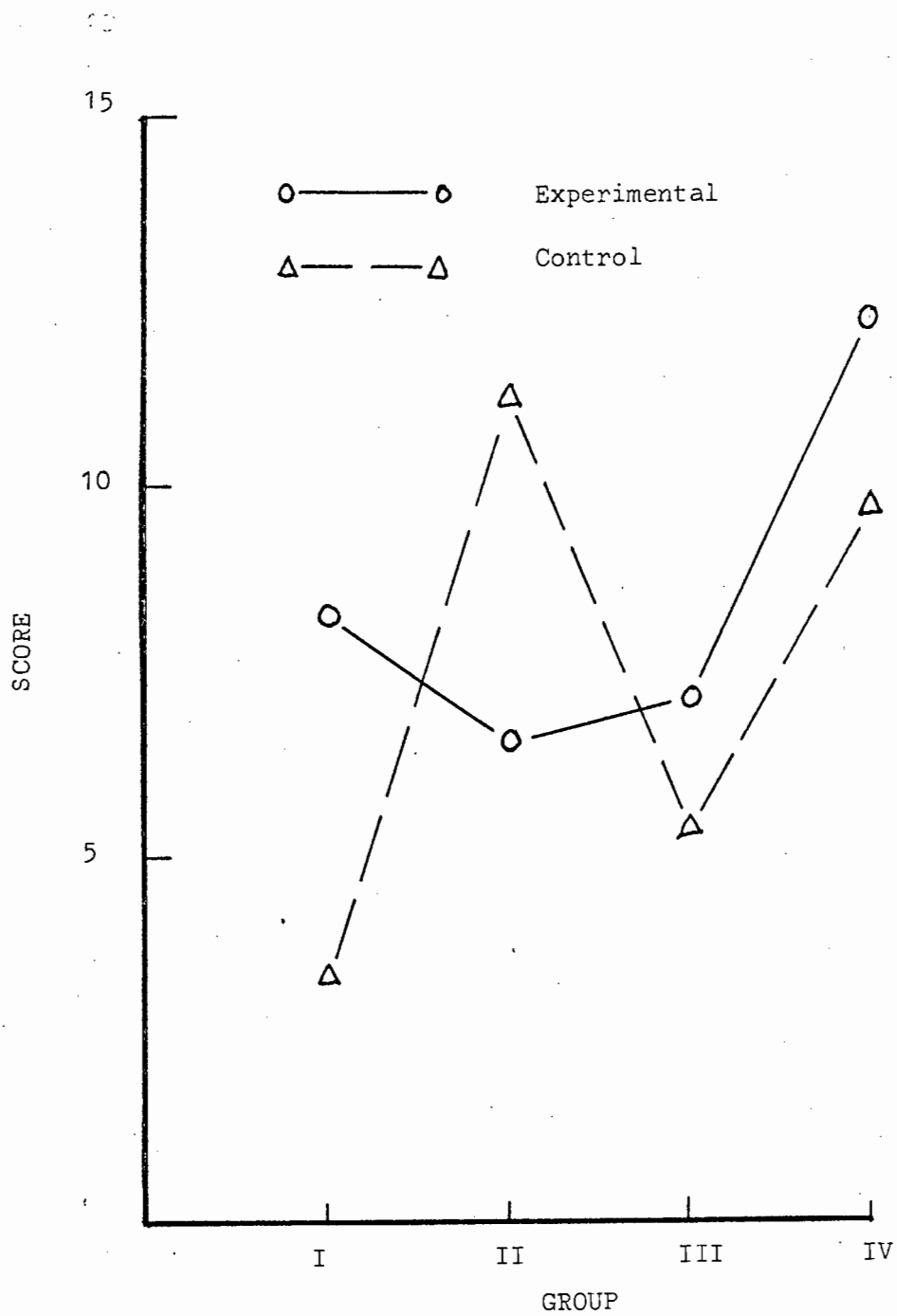


(GROUP) $F_{3-16} = 6,35$ $p < ,01$

(CONDITION) $F_{1-16} = 0,62$ NS

GRAPH 4

MEAN REARING SCORES
(FIRST TWO MINUTES)

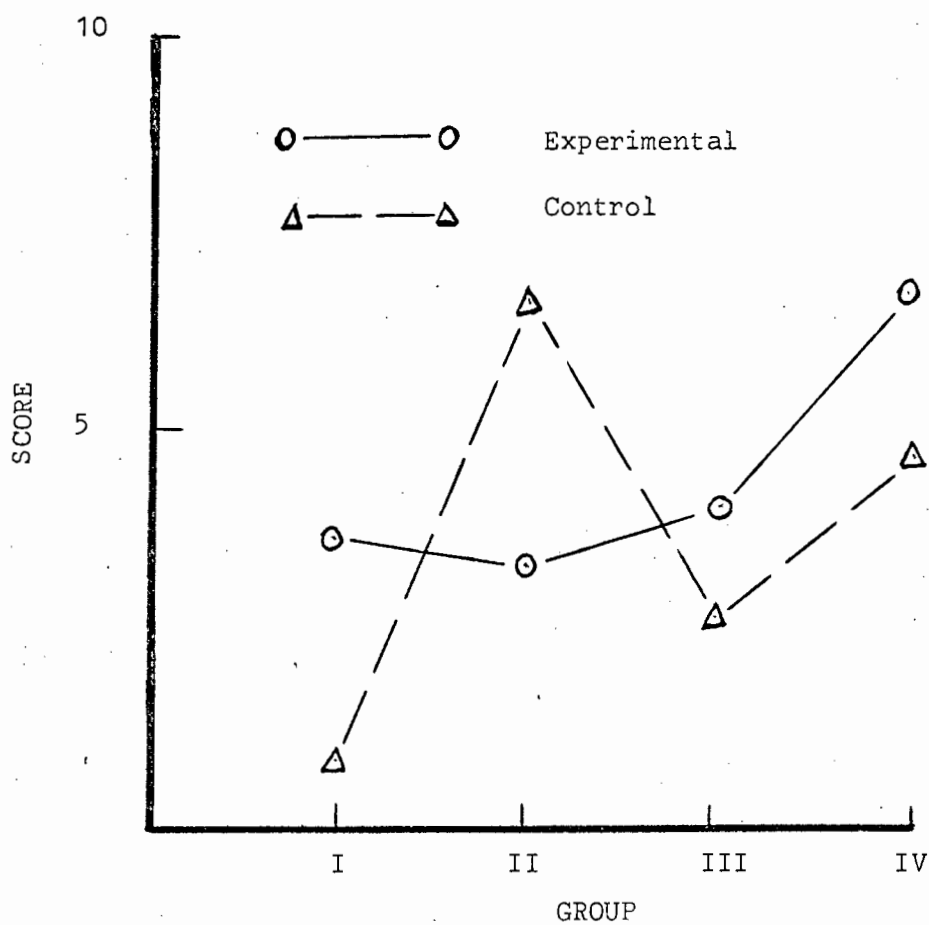


(GROUP) $F_{3-16} = 3,30$ $p < ,05$

(CONDITION) $F_{1-16} = 2,34$ NS

GRAPH 5

MEAN REARING SCORES
(SECOND TWO MINUTES)

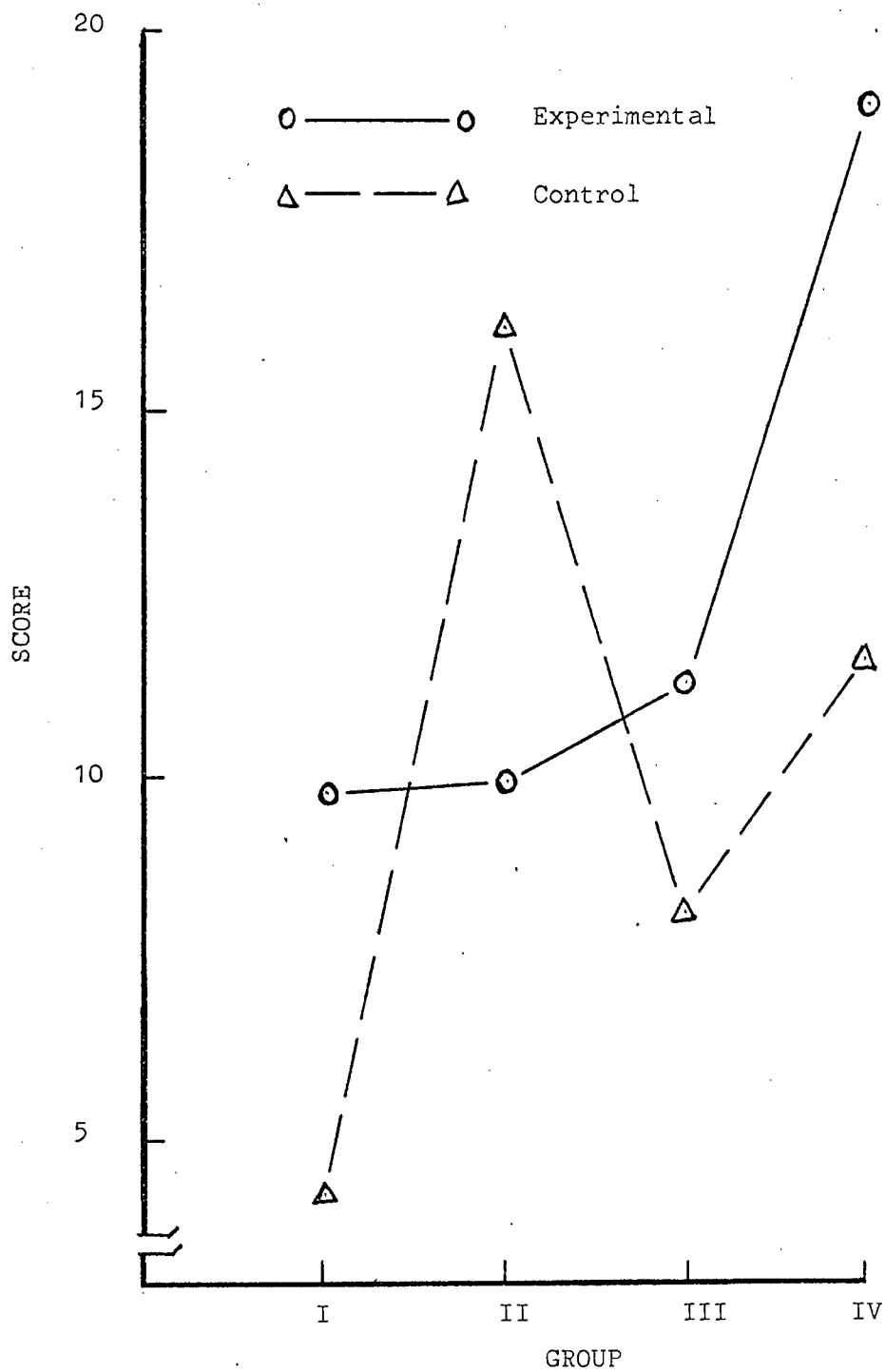


(GROUP) $F_{3-16} = 3,47$ $p < ,05$

(CONDITION) $F_{1-16} = 0,81$ NS

GRAPH 6

MEAN REARING SCORES
(TOTAL FOUR MINUTES)

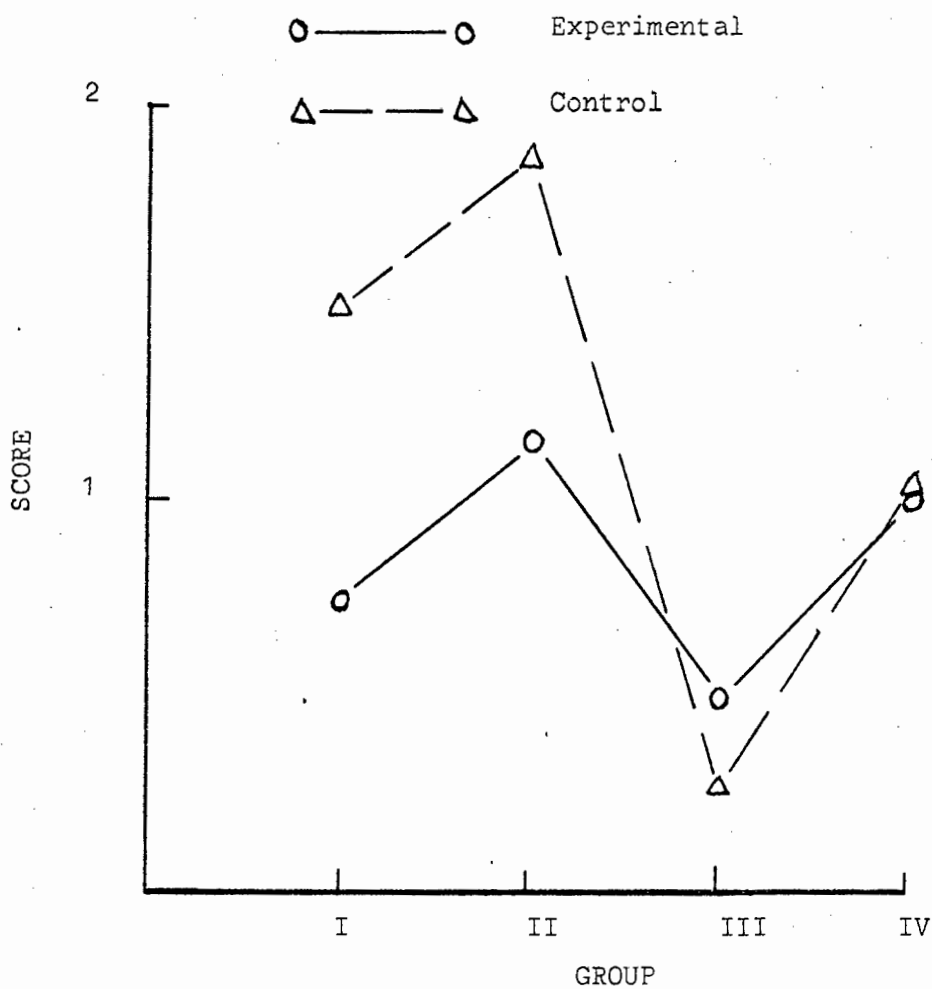


(GROUP) $F_{3-16} = 3,80$ $p < ,05$

(CONDITION) $F_{1-16} = 1,79$ NS

GRAPH 7

MEAN GROOMING SCORES
(FIRST TWO MINUTES)

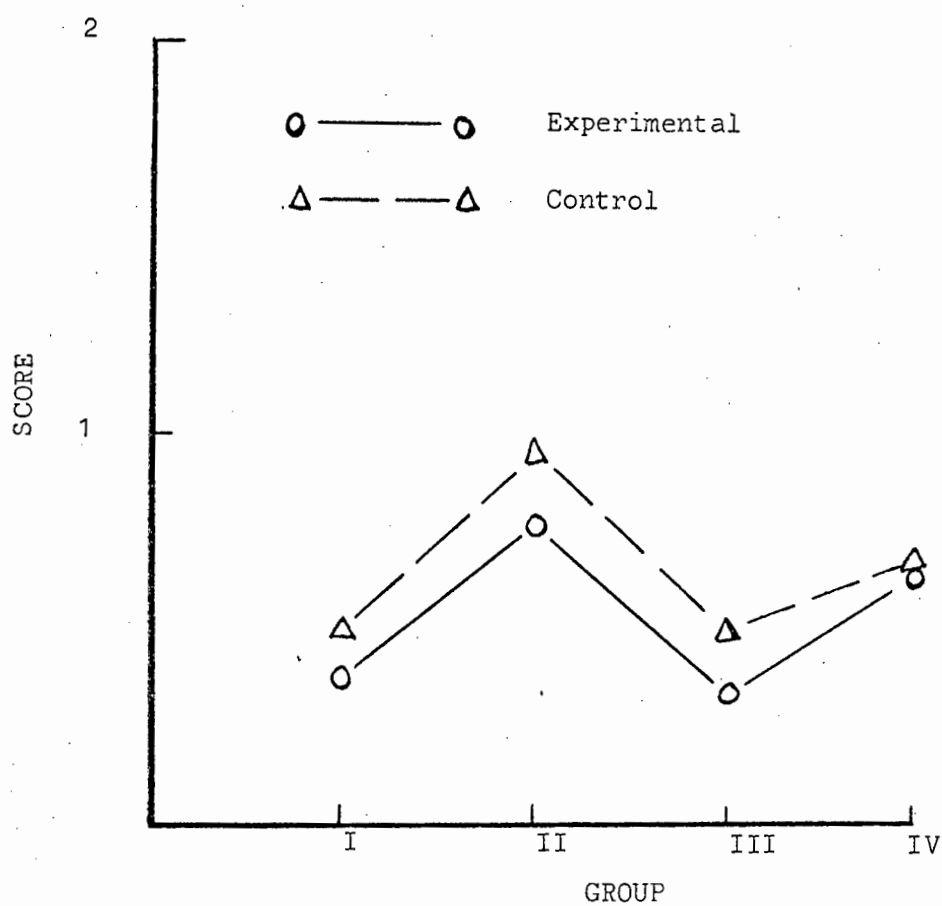


(GROUP) $F_{3-16} = 3,43$ $p < ,05$

(CONDITION) $F_{1-16} = 1,89$ NS

GRAPH 8

MEAN GROOMING SCORES
(SECOND TWO MINUTES)

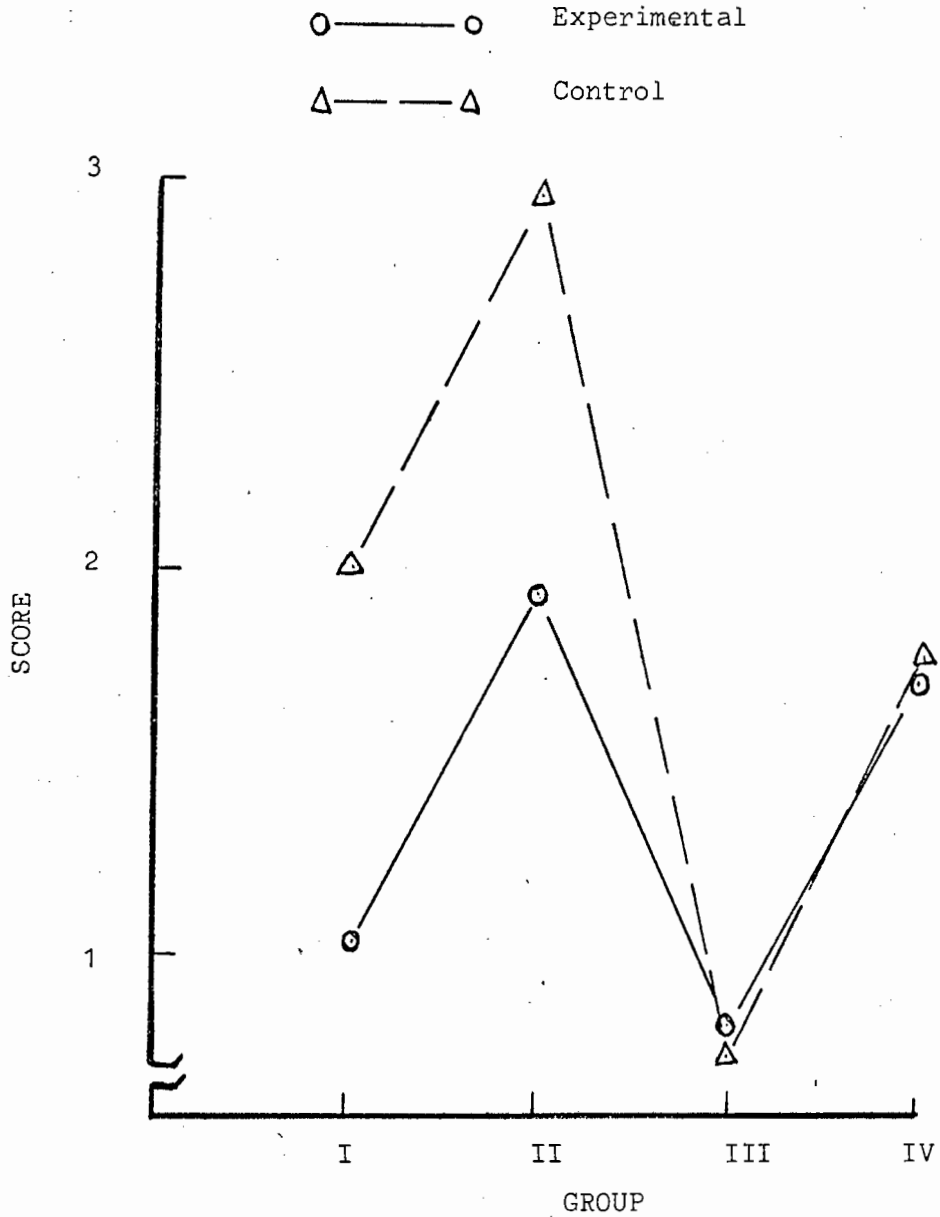


(GROUP) $F_{3-16} = 2,58$ ($p < ,10$)

(CONDITION) $F_{1-16} = 1,00$ NS

GRAPH 9

MEAN GROOMING SCORES
(TOTAL FOUR MINUTES)

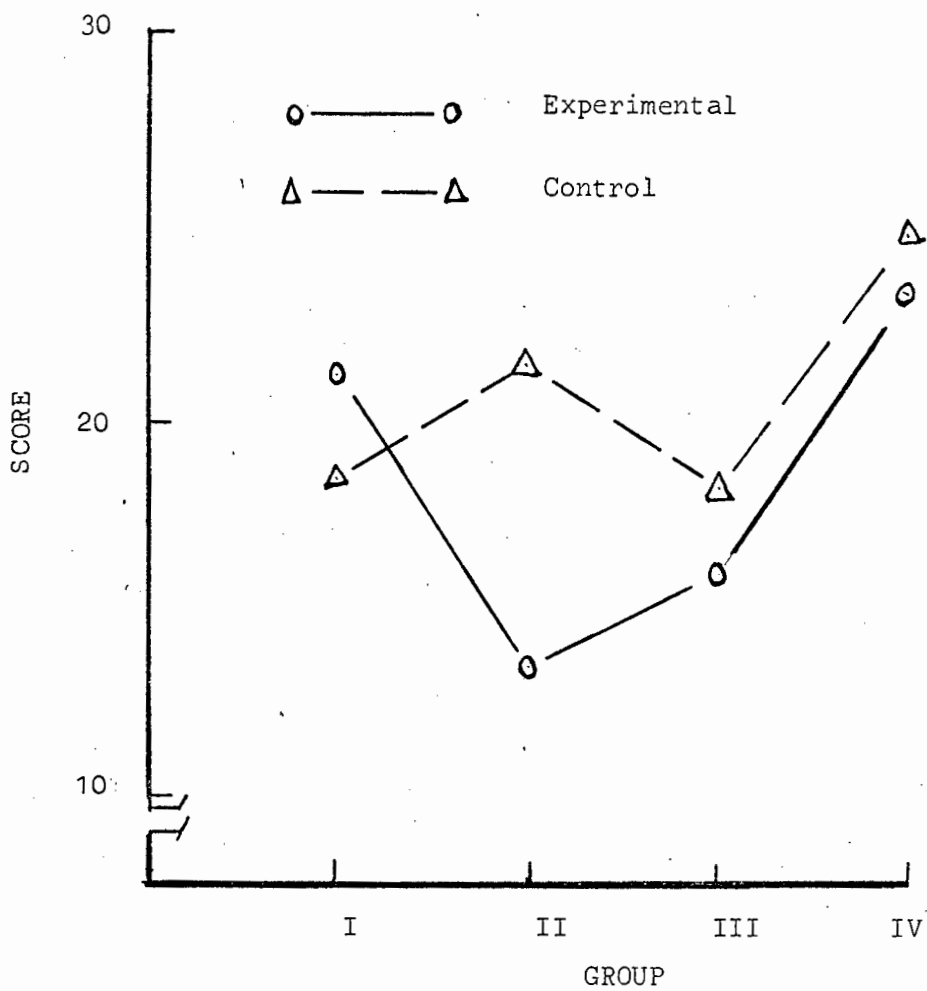


(GROUP) $F_{3-16} = 5,95$ $p < ,01$

(CONDITION) $F_{1-16} = 3,17$ ($p < ,10$)

GRAPH 10

MEAN GENERAL AMBULATION SCORES
(FIRST TWO MINUTES)

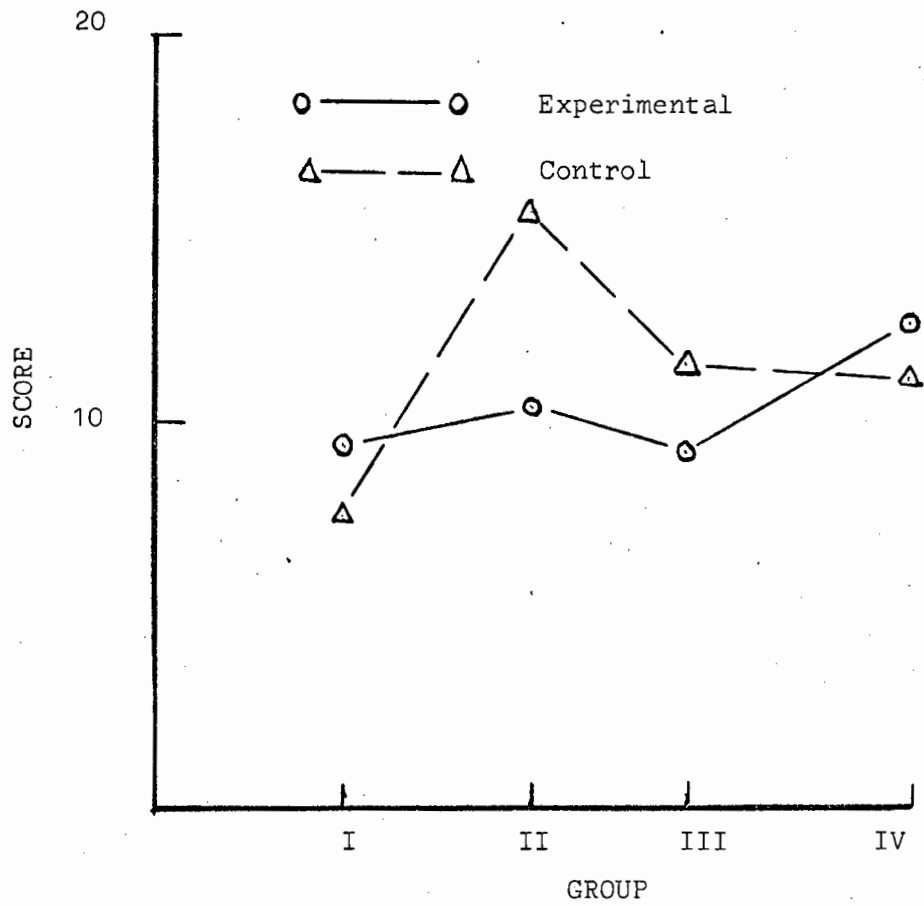


(GROUP) $F_{3-16} = 3,73$ $p < ,05$

(CONDITION) $F_{1-16} = 1,89$ NS

GRAPH 11

MEAN GENERAL AMBULATION SCORES
(SECOND TWO MINUTES)

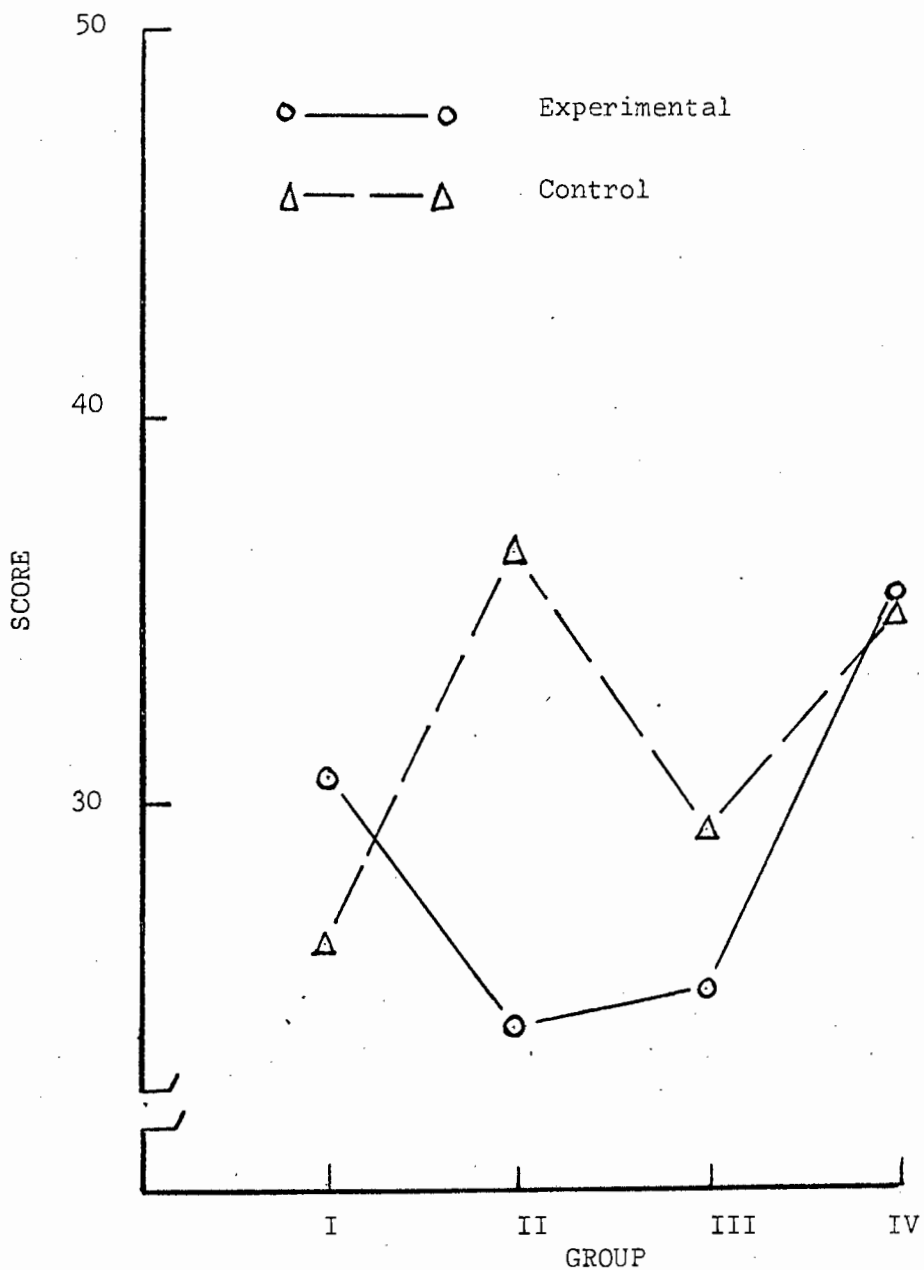


(GROUP) $F_{3-16} = 1,73$ NS

(CONDITION) $F_{1-16} = 0,46$ NS

GRAPH 12

MEAN GENERAL AMBULATION SCORES
(TOTAL FOUR MINUTES)

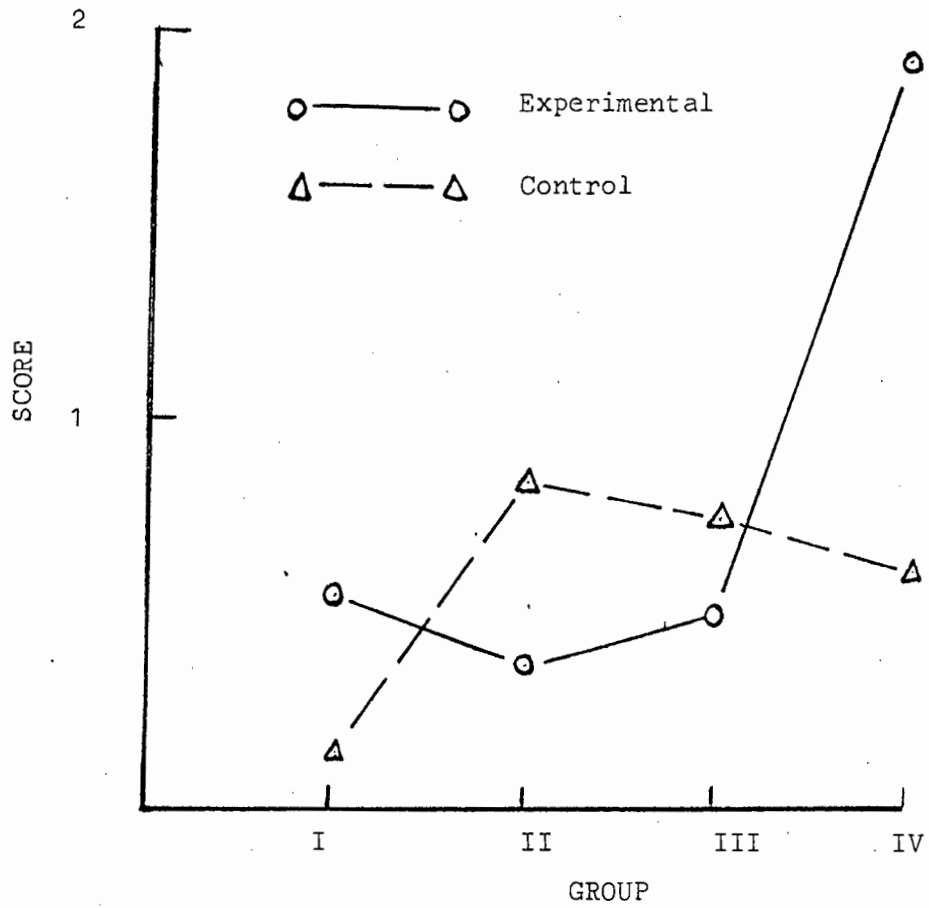


(GROUP) $F_{3-16} = 2,29$ NS

(CONDITION) $F_{1-16} = 1,58$ NS

GRAPH 13

MEAN INNER CIRCLE AMBULATION SCORES
(FIRST TWO MINUTES)

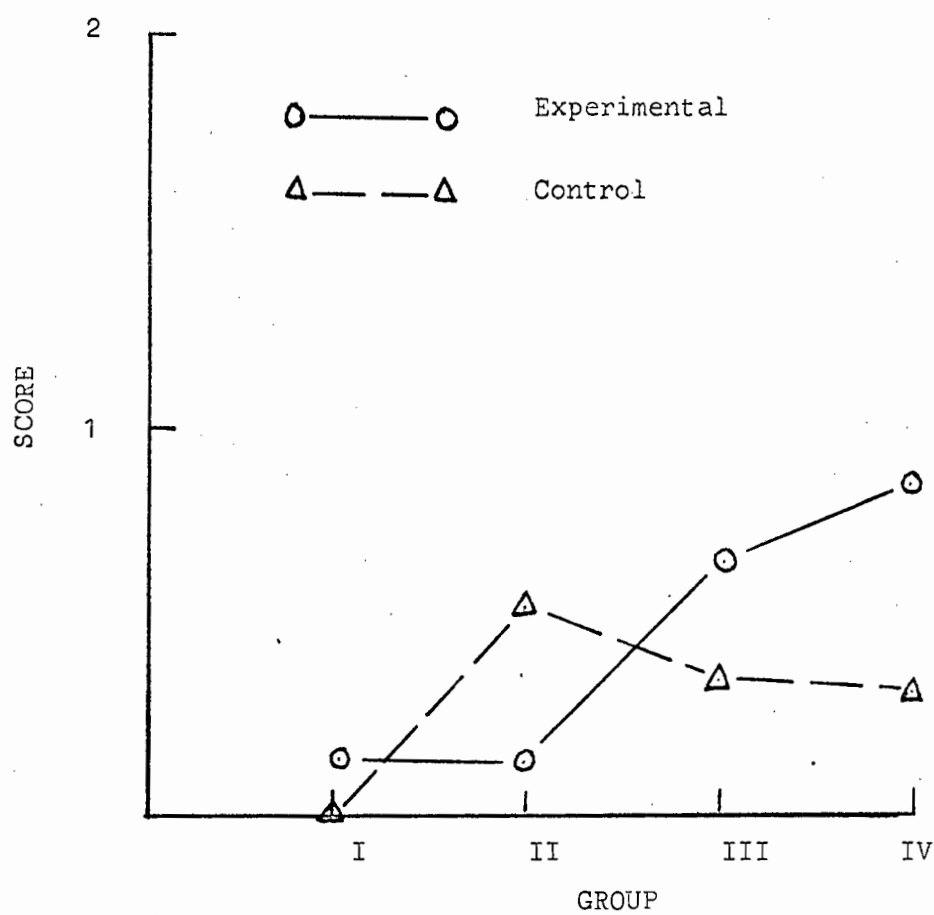


(GROUP) $F_{3-16} = 4,13$ $p. < ,05$

(CONDITION) $F_{1-16} = 1,90$ NS

GRAPH 14

MEAN INNER CIRCLE AMBULATION SCORES
(SECOND TWO MINUTES)

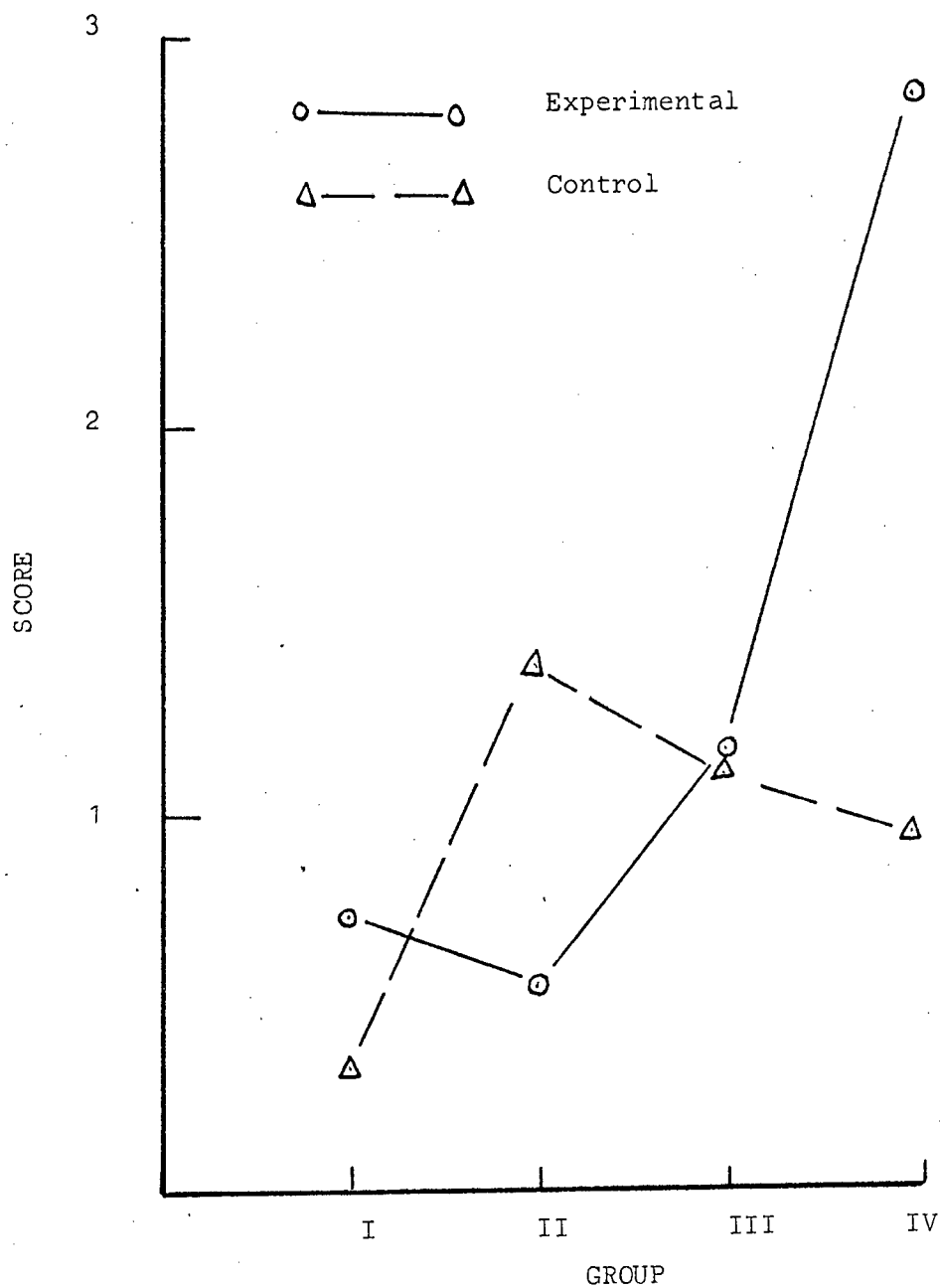


(GROUP) $F_{3-16} = 3,46$ $p < ,05$

(CONDITION) $F_{1-16} = 1,47$ NS

GRAPH 15

MEAN INNER CIRCLE AMBULATION SCORES
(TOTAL FOUR MINUTES)

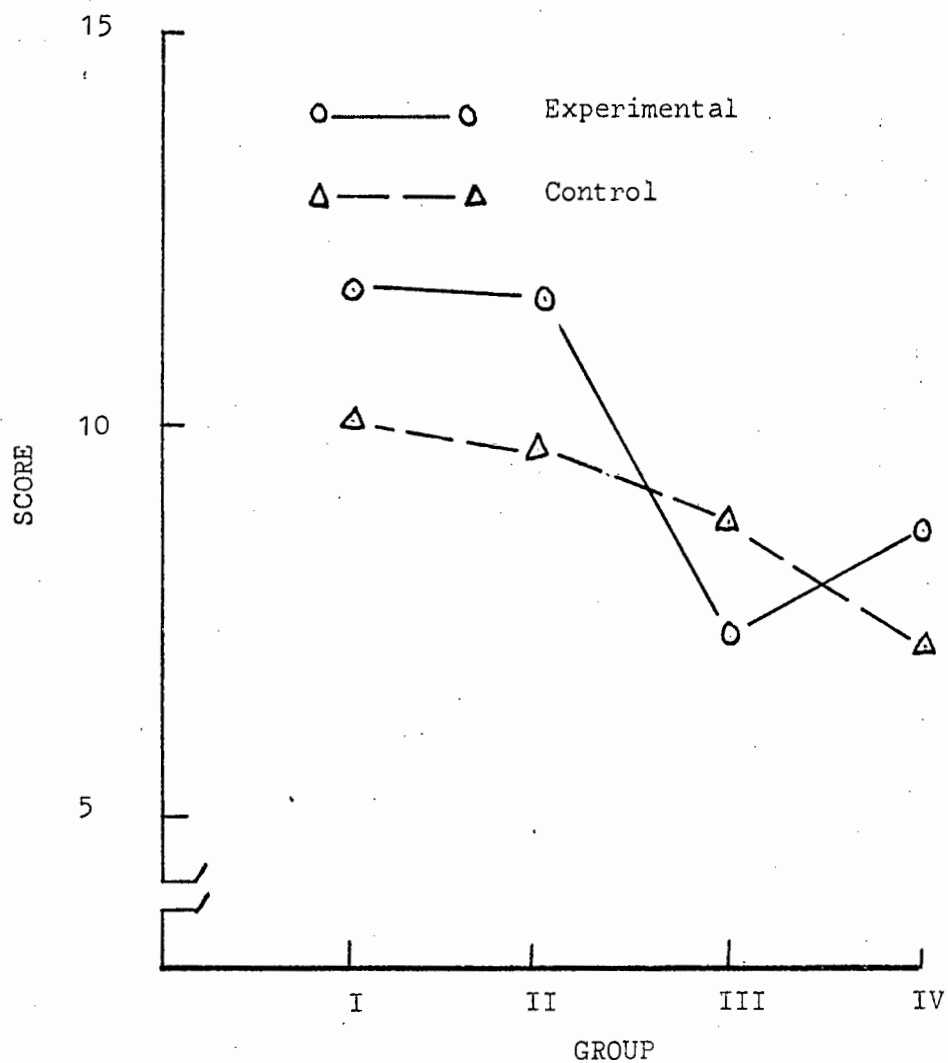


(GROUP) $F_{3-16} = 4,77$ $P < ,025$

(CONDITION) $F_{1-16} = 2,34$ NS

GRAPH 16

MEAN "OTHER" SCORES
(FIRST TWO MINUTES)

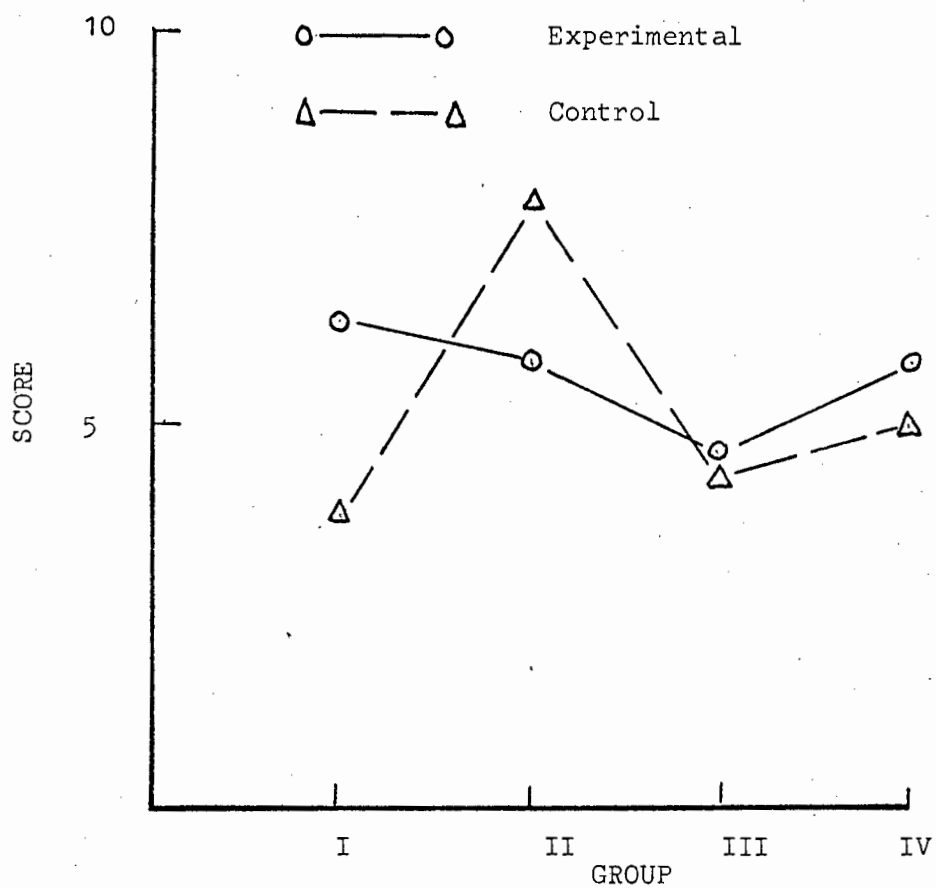


(GROUP) $F_{3-16} = 7,45$ $p < ,005$

(CONDITION) $F_{1-16} = 2,17$ NS

GRAPH 17

MEAN "OTHER" SCORES
(SECOND TWO MINUTES)

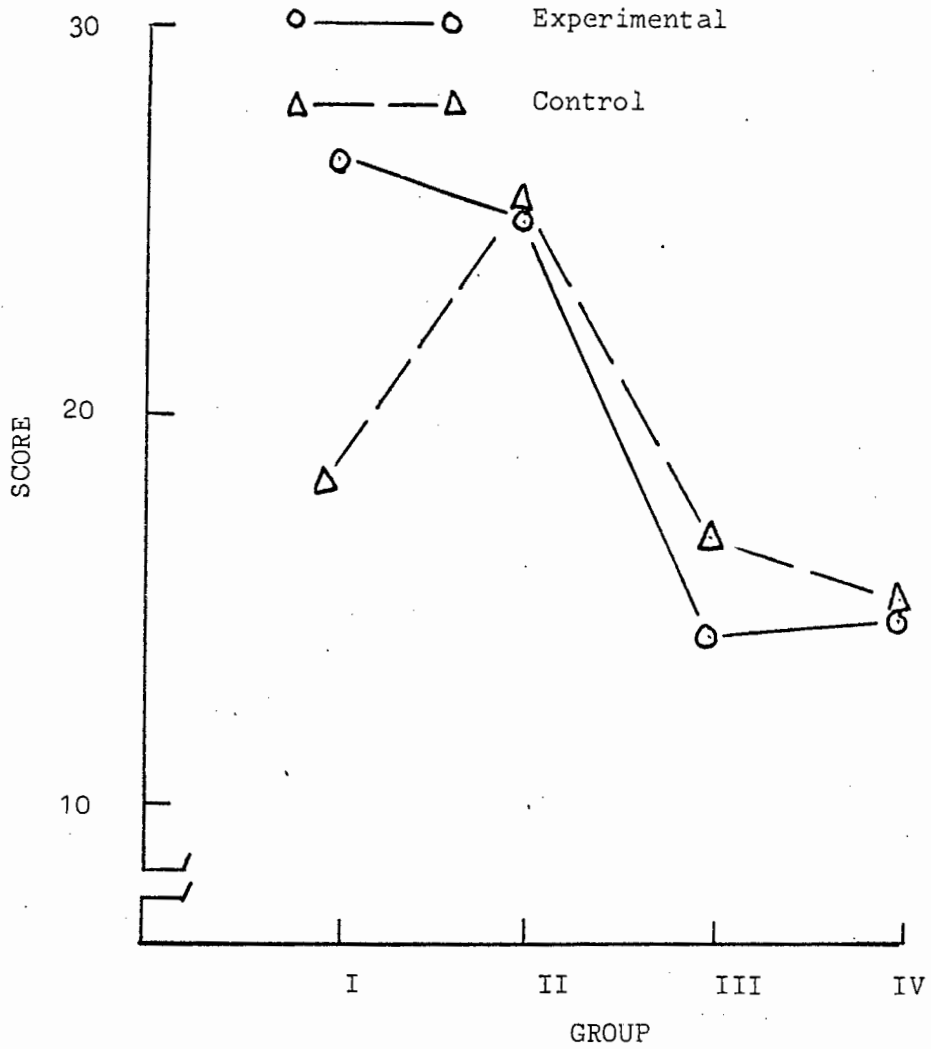


(GROUP) $F_{3-16} = 1,92$ NS

(CONDITION) $F_{1-16} = 0,20$ NS

GRAPH 18

MEAN "OTHER" SCORES
(TOTAL FOUR MINUTES)

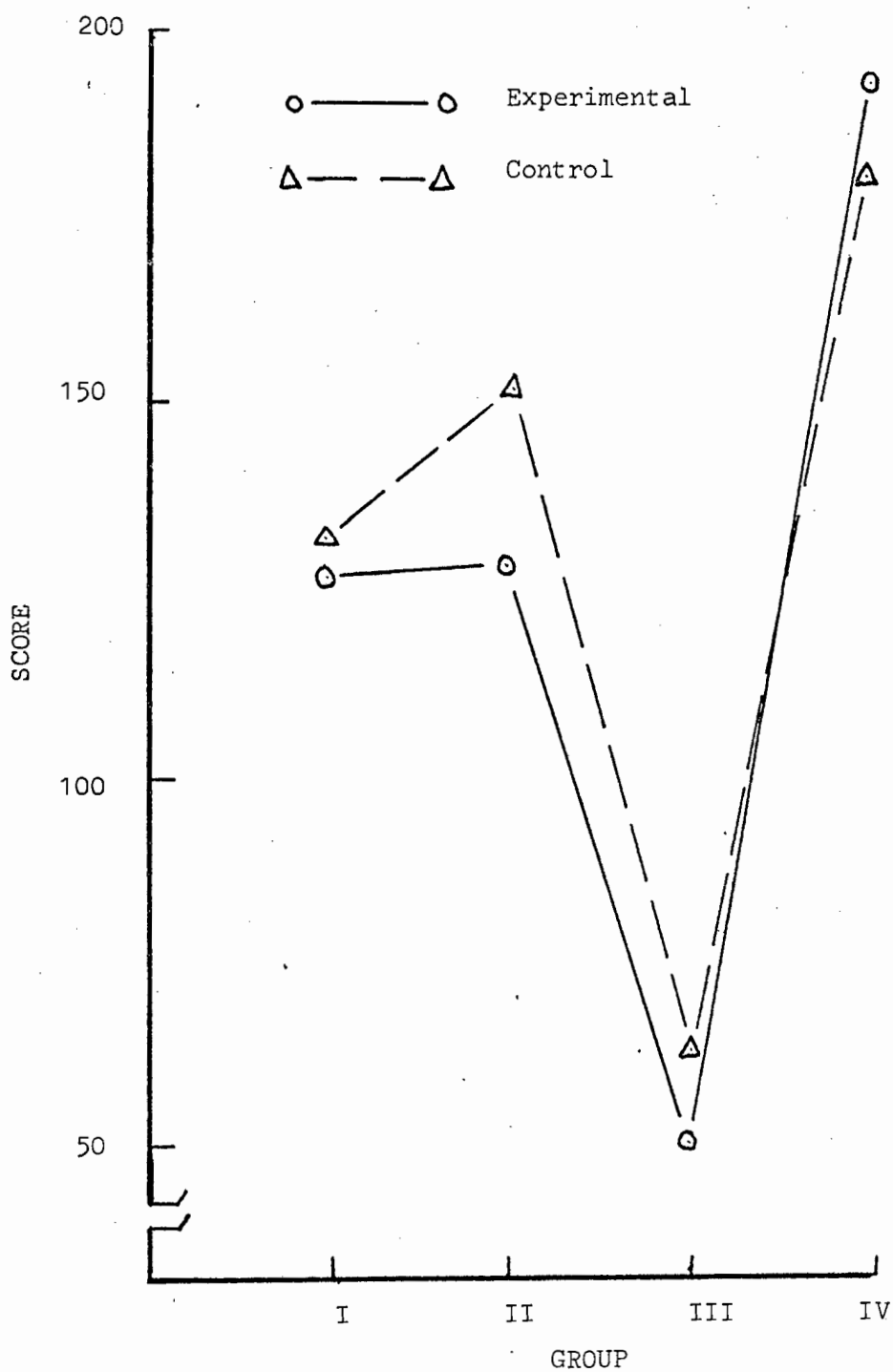


(GROUP) $F_{3-16} = 4,44$ $P < ,025$

(CONDITION) $F_{1-16} = 0,28$ NS

GRAPH 19

MEAN ACTIVITY SCORES
(FIRST TWO MINUTES)

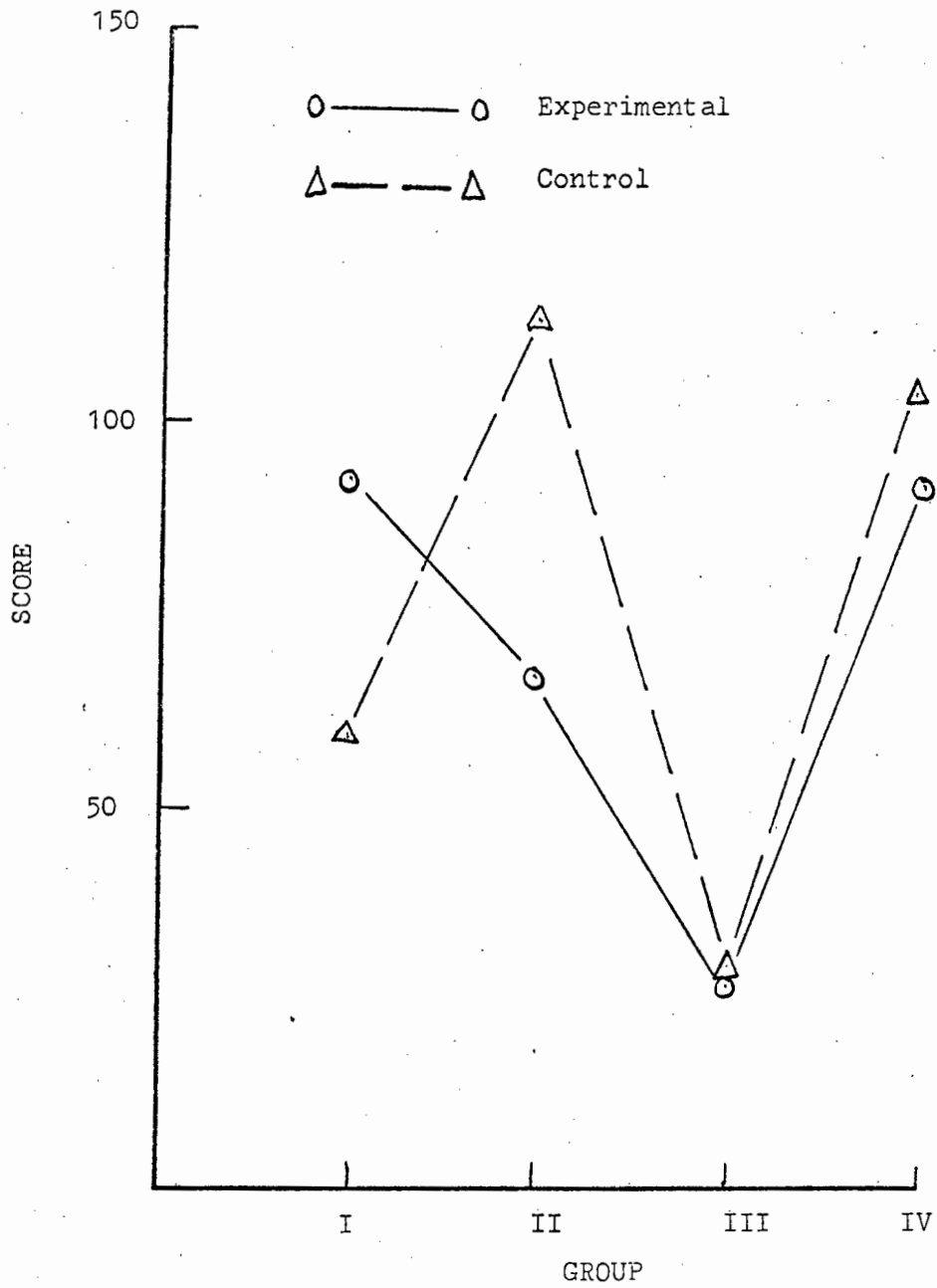


(GROUP) $F_{3-16} = 6,97$ $P < ,005$

(CONDITION) $F_{1-16} = 0,08$ NS

GRAPH 20

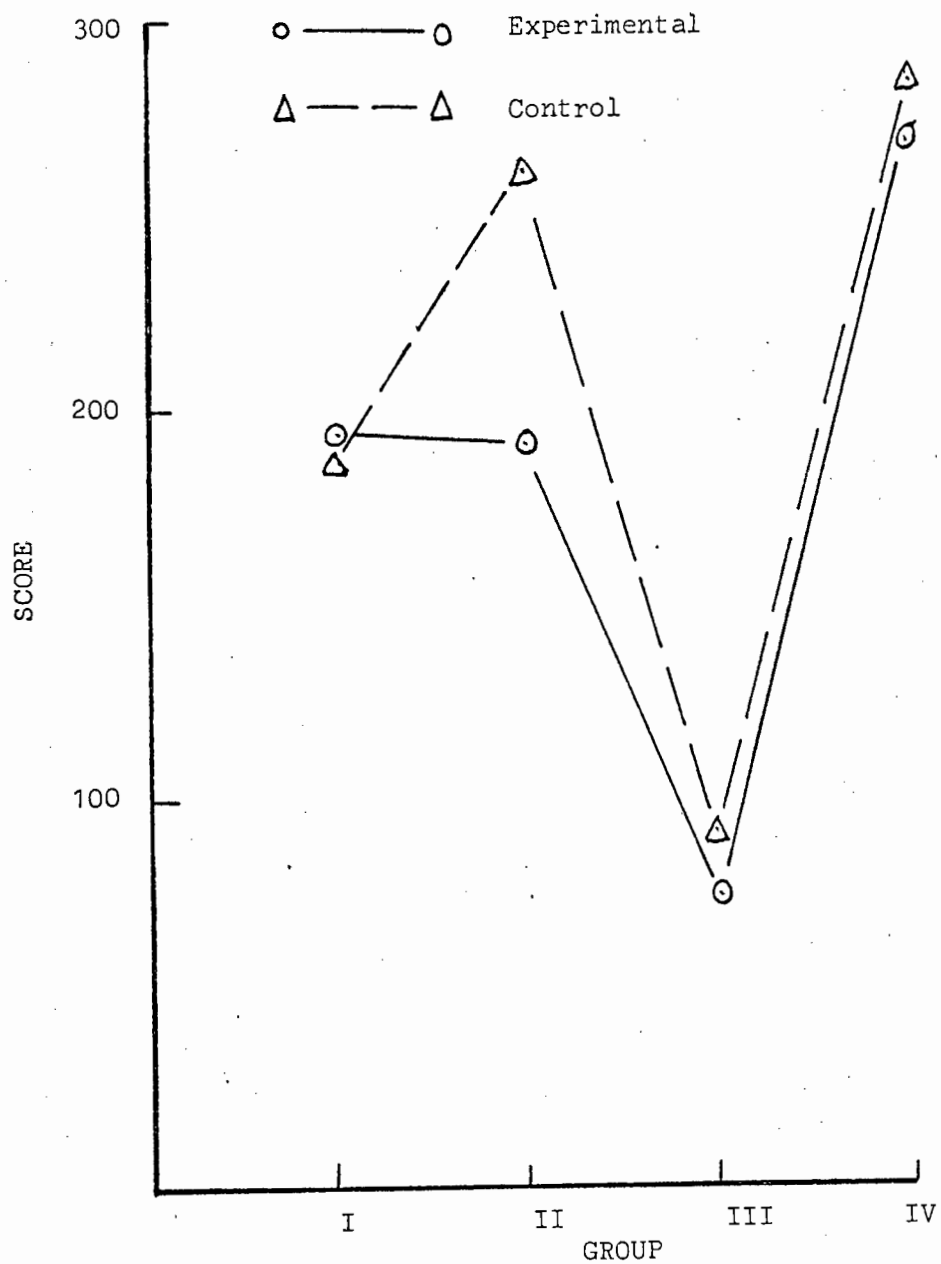
MEAN ACTIVITY SCORES
(SECOND TWO MINUTES)



(GROUP) $F_{3-16} = 5,06$ $p < ,025$

(CONDITION) $F_{1-16} = 0,79$ NS

GRAPH 21
 MEAN ACTIVITY SCORES
 (TOTAL FOUR MINUTES)



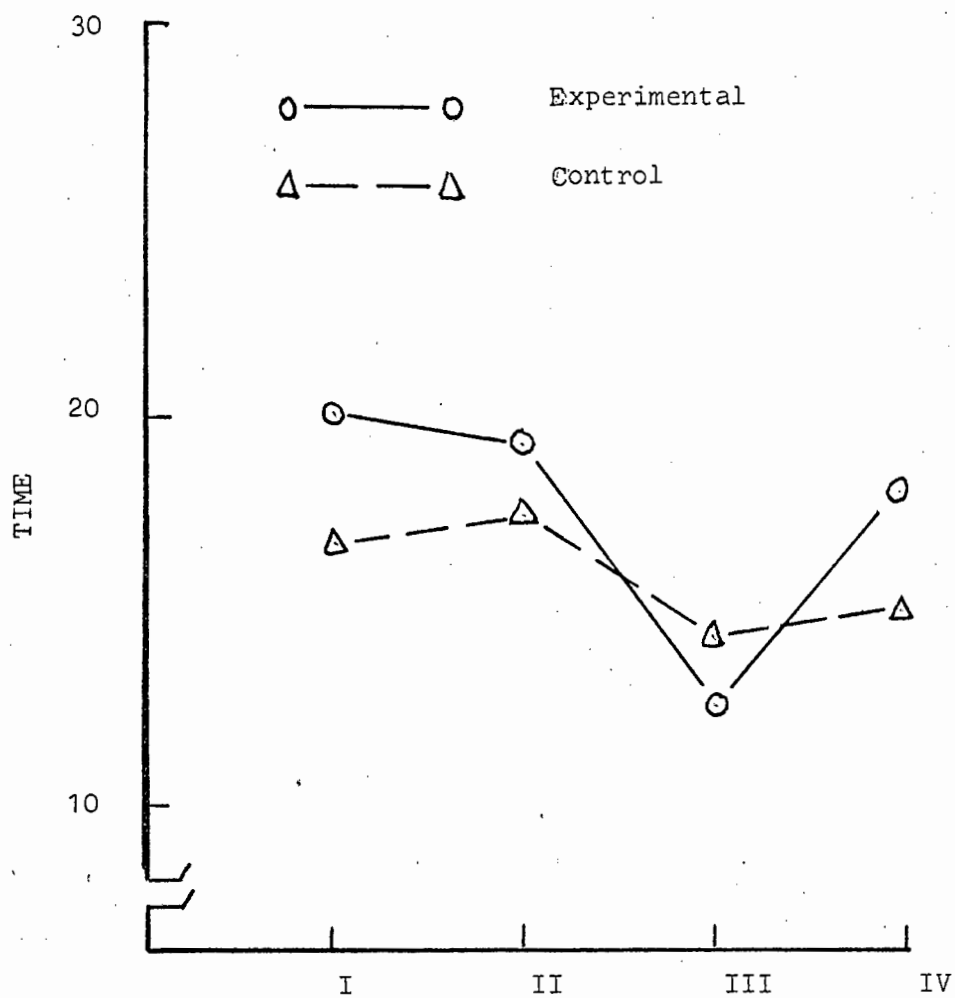
(GROUP) $F_{3-26} = 6,72 < ,005$

(CONDITION) $F_{1-16} = 0,30$ NS

HEBB-WILLIAMS
CLOSED FIELD TEST

(1 and 2)

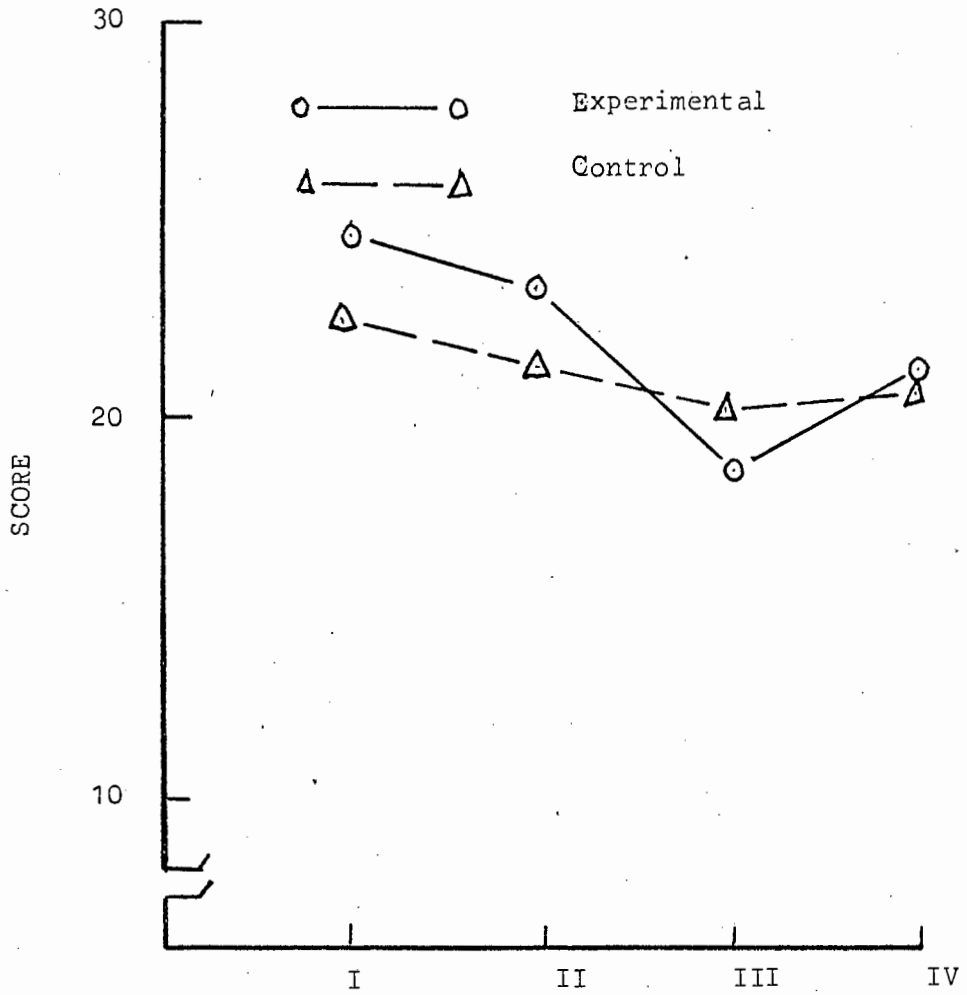
GRAPH 1
MEAN TIMES



(GROUP) $F_{3-16} = 6,31$ $p < ,005$

(CONDITION) $F_{1-16} = 2,72$ NS

GRAPH 2
MEAN SCORES

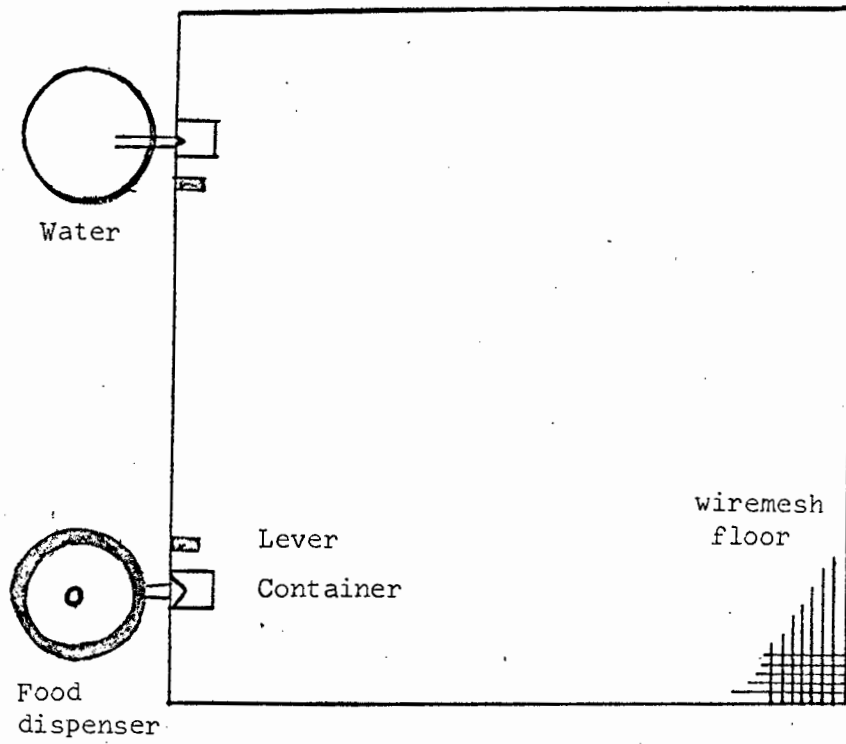


(GROUP) $F_{3-16} = 8,38$ $p < ,005$

(CONDITION) $F_{1-16} = 0,16$ NS

APPENDIX III

DIAGRAM OF THE EXPERIMENTAL CAGES

DIAGRAM OF EXPERIMENTAL CAGE

70 cms.³ (Made of aluminium)

APPENDIX IV

| GROUP | CONDITION | RAT NO. + | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | |
|-------|-----------|---------------|-------------|-------------|--------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | |
| I | EXP | 1 2 7 | 0 0 6 | 0 0 2 | 0 0 8 | 0 0 0 | 0 0 0 | 0 0 0 | 1 0 0 | 0 0 3 | 1 0 3 | 0 0 0 | 0 0 3 | 0 0 3 | 0 0 0 | 0 0 4 | 0 0 4 | 0 0 4 | 0 0 0 | 0 0 3 | 0 0 3 |
| | CON | 3 4 6 | 4 2 2 | 1 2 3 | 5 4 5 | 0 3 3 | 5 2 3 | 5 5 6 | 0 0 0 | 4 1 4 | 4 1 4 | 0 0 2 | 0 1 2 | 0 1 4 | 0 0 4 | 0 0 4 | 0 1 4 | 0 1 4 | 0 0 4 | 0 1 0 | 4 1 0 |
| II | EXP | 1 5 6 | 3 1 0 | 1 1 4 | 4 2 4 | 3 0 4 | 1 0 2 | 4 0 6 | 4 0 2 | 2 0 3 | 6 0 5 | 1 0 0 | 3 0 1 | 4 0 1 | 0 0 0 | 3 0 0 | 3 0 0 | 0 0 0 | 0 0 0 | 2 0 0 | 2 0 0 |
| | CON | 2 3 4 | 3 6 0 | 0 2 2 | 3 8 2 | 4 5 0 | 3 1 0 | 7 6 0 | 3 4 0 | 2 1 0 | 5 5 0 | 0 0 0 | 2 7 0 | 2 7 0 | 0 0 0 | 5 0 0 | 5 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 |
| III | EXP | 2 4 6 | 5 4 8 | 1 2 3 | 6 6 11 | 3 4 6 | 2 1 0 | 5 5 6 | 1 5 4 | 4 2 0 | 5 7 4 | 6 5 6 | 2 0 1 | 8 5 7 | 3 3 2 | 2 4 0 | 5 7 2 | 4 4 4 | 1 3 2 | 5 7 6 | |
| | CON | 1 3 7 | 4 6 6 | 5 3 0 | 9 9 6 | 6 6 6 | 1 4 0 | 7 10 6 | 0 6 7 | 4 3 0 | 4 9 7 | 0 4 4 | 5 1 3 | 5 5 7 | 0 6 2 | 0 2 2 | 0 8 4 | 0 4 4 | 0 4 4 | 0 4 2 | 0 8 6 |
| IV | EXP | 7 10 11 | 8 5 8 | 0 0 1 | 8 5 9 | 7 0 5 | 3 0 5 | 10 0 10 | 5 4 3 | 1 0 1 | 6 4 4 | 5 0 2 | 2 0 5 | 7 0 7 | 5 0 3 | 3 0 6 | 8 0 9 | 8 0 3 | 0 0 6 | 8 0 9 | |
| | CON | 1 8 9 | 6 4 6 | 0 1 4 | 6 5 10 | 6 6 6 | 3 1 0 | 9 7 6 | 3 5 4 | 3 2 4 | 6 7 8 | 3 4 4 | 0 2 2 | 3 6 6 | 0 3 6 | 0 5 8 | 0 8 8 | 0 1 6 | 0 5 2 | 0 6 8 | |

1
DEFAECATION SCORES

2

3

TRIAL

4

5

6

+ Each group was numbered separately from number 1, thus similar numbers do not signify the same subject.

| GROUP | CONDITION | RAF NO. | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | |
|-------|-----------|---------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total |
| I | EXP | 1 | 4 | 0 | 4 | 7 | 0 | 7 | 2 | 2 | 4 | 5 | 6 | 11 | 0 | 0 | 0 | 4 | 12 | 16 |
| | | 2 | 3 | 4 | 7 | 9 | 1 | 10 | 10 | 2 | 12 | 2 | 0 | 2 | 5 | 5 | 10 | 13 | 18 | 31 |
| | | 7 | 15 | 2 | 17 | 6 | 0 | 6 | 11 | 8 | 19 | 4 | 1 | 5 | 6 | 6 | 12 | 3 | 2 | 5 |
| II | CON | 3 | 8 | 0 | 8 | 1 | 3 | 4 | 2 | 0 | 2 | 3 | 0 | 3 | 3 | 0 | 3 | 2 | 0 | 2 |
| | | 4 | 11 | 0 | 11 | 1 | 0 | 1 | 1 | 0 | 1 | 2 | 0 | 2 | 1 | 0 | 1 | 1 | 3 | 4 |
| | | 6 | 11 | 4 | 15 | 2 | 6 | 8 | 3 | 0 | 3 | 6 | 2 | 8 | 1 | 0 | 1 | 1 | 0 | 1 |
| III | EXP | 1 | 10 | 10 | 20 | 4 | 1 | 5 | 1 | 0 | 1 | 7 | 8 | 15 | 6 | 0 | 6 | 7 | 4 | 11 |
| | | 5 | 14 | 7 | 21 | 3 | 1 | 4 | 6 | 2 | 8 | 7 | 1 | 8 | 9 | 2 | 11 | 10 | 2 | 2 |
| | | 6 | 13 | 3 | 16 | 1 | 1 | 2 | 1 | 0 | 1 | 3 | 2 | 5 | 6 | 5 | 11 | 9 | 14 | 23 |
| IV | CON | 2 | 15 | 15 | 30 | 6 | 2 | 8 | 11 | 5 | 16 | 6 | 0 | 6 | 2 | 0 | 2 | 4 | 1 | 5 |
| | | 3 | 19 | 12 | 31 | 3 | 2 | 5 | 4 | 7 | 11 | 6 | 8 | 14 | 13 | 10 | 23 | 14 | 5 | 19 |
| | | 4 | 14 | 15 | 29 | 4 | 5 | 9 | 3 | 2 | 5 | 7 | 3 | 10 | 15 | 20 | 35 | 22 | 12 | 34 |
| I | EXP | 2 | 8 | 5 | 13 | 1 | 0 | 1 | 1 | 3 | 4 | 3 | 3 | 6 | 3 | 5 | 8 | 4 | 5 | 9 |
| | | 4 | 6 | 1 | 7 | 2 | 2 | 4 | 9 | 0 | 9 | 3 | 0 | 3 | 8 | 0 | 8 | 7 | 8 | 15 |
| | | 6 | 18 | 16 | 34 | 8 | 15 | 23 | 6 | 2 | 8 | 11 | 0 | 11 | 17 | 12 | 29 | 12 | 1 | 13 |
| II | CON | 1 | 5 | 4 | 9 | 1 | 0 | 1 | 8 | 4 | 12 | 1 | 0 | 1 | 2 | 2 | 4 | 4 | 4 | 8 |
| | | 3 | 19 | 11 | 30 | 0 | 0 | 0 | 3 | 0 | 3 | 5 | 0 | 5 | 3 | 0 | 3 | 6 | 4 | 10 |
| | | 7 | 15 | 7 | 22 | 3 | 1 | 4 | 7 | 5 | 12 | 6 | 0 | 6 | 5 | 4 | 9 | 5 | 5 | 10 |
| III | EXP | 7 | 16 | 15 | 31 | 20 | 7 | 27 | 23 | 11 | 34 | 15 | 6 | 21 | 18 | 8 | 26 | 9 | 17 | 26 |
| | | 10 | 9 | 3 | 12 | 3 | 0 | 3 | 6 | 1 | 7 | 8 | 5 | 13 | 5 | 4 | 9 | 15 | 12 | 27 |
| | | 11 | 15 | 1 | 16 | 7 | 7 | 14 | 18 | 5 | 23 | 11 | 6 | 17 | 5 | 9 | 14 | 15 | 9 | 24 |
| IV | CON | 1 | 16 | 16 | 32 | 1 | 5 | 6 | 3 | 0 | 3 | 9 | 7 | 16 | 4 | 0 | 13 | 5 | 2 | 7 |
| | | 8 | 13 | 7 | 20 | 12 | 1 | 13 | 8 | 17 | 15 | 8 | 8 | 16 | 7 | 3 | 10 | 9 | 6 | 15 |
| | | 9 | 9 | 8 | 17 | 7 | 0 | 7 | 0 | 2 | 2 | 3 | 0 | 3 | 2 | 1 | 3 | 5 | 6 | 11 |

REARING SCORES

TRIAL

| GROUP | CONDITION | RAT NO. | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | |
|-------|-----------|---------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|---|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | |
| I | EXP | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 2 | 0 | 1 | 1 | 3 | 1 | 2 | 3 | 5 | 2 | 7 |
| | | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| I | CON | 3 | 0 | 0 | 0 | 1 | 2 | 3 | 2 | 0 | 2 | 0 | 3 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | |
| | | 4 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 2 | 4 | 2 | 4 | 3 | 0 | 3 | 5 | 0 | 5 | |
| | | 6 | 0 | 1 | 1 | 2 | 3 | 5 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 1 | 3 | 0 | 3 | |
| II | EXP | 1 | 1 | 0 | 1 | 3 | 1 | 4 | 1 | 0 | 1 | 3 | 0 | 3 | 2 | 1 | 3 | 1 | 3 | 4 | |
| | | 5 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 1 | 3 | 4 | |
| | | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 2 | 3 | 5 | |
| II | CON | 2 | 0 | 1 | 1 | 2 | 0 | 2 | 2 | 3 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 2 | 2 | 4 | |
| | | 3 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 6 | 2 | 8 | 3 | 1 | 4 | 1 | 3 | 4 | |
| | | 4 | 0 | 1 | 1 | 0 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 2 | 3 | 1 | 4 | 2 | 0 | 2 | |
| III | EXP | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | | |
| | | 4 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 2 | 0 | 2 | 2 | 0 | 2 | |
| | | 6 | 0 | 3 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| III | CON | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 3 | |
| | | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | |
| | | 7 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | |
| IV | EXP | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 2 | 1 | 3 | 4 | 1 | 1 | 2 | |
| | | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 3 | 6 | 2 | 0 | 2 | 2 | 0 | 2 | |
| | | 11 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 2 | 2 | 2 | 0 | 2 | 1 | 0 | 1 | 1 | 1 | 2 | |
| IV | CON | 1 | 2 | 0 | 2 | 0 | 1 | 1 | 0 | 4 | 4 | 1 | 1 | 2 | 1 | 1 | 2 | 4 | 1 | 5 | |
| | | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 2 | 2 | 0 | 2 | 3 | 1 | 4 | |
| | | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 2 | 0 | 2 | 2 | 0 | 2 | |

GROOMING SCORES

2

3

TRIAL

4

5

6

| GROUP | CONDITION | RAT NO. | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | |
|-------|-----------|---------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total |
| I | EXP | 1 | 21 | 10 | 31 | 33 | 1 | 34 | 12 | 7 | 19 | 3 | 12 | 43 | 19 | 4 | 23 | 25 | 30 | 55 |
| | | 2 | 25 | 10 | 35 | 24 | 10 | 34 | 21 | 3 | 24 | 11 | 1 | 12 | 20 | 14 | 34 | 22 | 10 | 32 |
| | | 7 | 33 | 28 | 61 | 22 | 4 | 26 | 19 | 17 | 36 | 14 | 1 | 15 | 16 | 8 | 24 | 11 | 3 | 14 |
| | CON | 3 | 41 | 13 | 54 | 23 | 15 | 38 | 22 | 4 | 26 | 15 | 5 | 20 | 8 | 1 | 9 | 13 | 5 | 18 |
| | | 4 | 43 | 14 | 57 | 17 | 6 | 23 | 12 | 1 | 13 | 9 | 2 | 11 | 11 | 4 | 15 | 9 | 11 | 20 |
| | | 6 | 29 | 29 | 58 | 26 | 14 | 40 | 16 | 1 | 17 | 20 | 12 | 32 | 15 | 1 | 16 | 10 | 1 | 11 |
| II | EXP | 1 | 27 | 26 | 53 | 15 | 6 | 21 | 13 | 2 | 15 | 6 | 9 | 15 | 19 | 7 | 26 | 21 | 9 | 30 |
| | | 5 | 33 | 15 | 48 | 10 | 9 | 19 | 16 | 4 | 20 | 12 | 1 | 13 | 17 | 11 | 28 | 19 | 8 | 27 |
| | | 6 | 40 | 27 | 67 | 11 | 6 | 17 | 5 | 5 | 10 | 7 | 10 | 17 | 18 | 16 | 34 | 32 | 23 | 55 |
| | CON | 2 | 32 | 37 | 69 | 35 | 21 | 56 | 22 | 12 | 34 | 12 | 1 | 13 | 7 | 1 | 8 | 8 | 1 | 9 |
| | | 3 | 25 | 23 | 48 | 13 | 16 | 29 | 18 | 15 | 33 | 22 | 9 | 31 | 27 | 5 | 32 | 24 | 37 | 51 |
| | | 4 | 31 | 33 | 64 | 20 | 12 | 32 | 17 | 16 | 33 | 15 | 6 | 21 | 26 | 18 | 44 | 32 | 19 | 51 |
| III | EXP | 2 | 28 | 19 | 47 | 8 | 1 | 9 | 5 | 9 | 14 | 11 | 5 | 16 | 10 | 14 | 24 | 12 | 11 | 23 |
| | | 4 | 13 | 6 | 19 | 11 | 5 | 16 | 20 | 1 | 21 | 6 | 1 | 7 | 17 | 2 | 19 | 16 | 12 | 28 |
| | | 6 | 37 | 25 | 62 | 19 | 27 | 46 | 18 | 2 | 20 | 15 | 3 | 18 | 23 | 19 | 42 | 19 | 2 | 21 |
| | CON | 1 | 20 | 19 | 39 | 28 | 4 | 32 | 22 | 21 | 43 | 5 | 2 | 7 | 20 | 10 | 30 | 23 | 17 | 40 |
| | | 3 | 32 | 22 | 54 | 6 | 1 | 7 | 4 | 1 | 5 | 7 | 1 | 8 | 10 | 1 | 11 | 17 | 15 | 32 |
| | | 7 | 35 | 28 | 63 | 10 | 9 | 19 | 25 | 16 | 41 | 16 | 3 | 19 | 18 | 15 | 33 | 28 | 18 | 46 |
| IV | EXP | 7 | 28 | 5 | 33 | 17 | 5 | 22 | 31 | 20 | 51 | 22 | 10 | 32 | 19 | 8 | 27 | 21 | 18 | 39 |
| | | 10 | 27 | 13 | 40 | 21 | 4 | 25 | 22 | 9 | 31 | 21 | 12 | 33 | 17 | 13 | 30 | 30 | 21 | 51 |
| | | 11 | 24 | 12 | 36 | 20 | 16 | 36 | 29 | 17 | 46 | 27 | 15 | 42 | 19 | 14 | 33 | 24 | 14 | 38 |
| | CON | 1 | 34 | 24 | 58 | 11 | 15 | 26 | 20 | 1 | 21 | 24 | 18 | 42 | 23 | 15 | 38 | 16 | 2 | 18 |
| | | 8 | 39 | 26 | 65 | 26 | 9 | 45 | 24 | 15 | 39 | 26 | 13 | 39 | 23 | 13 | 36 | 30 | 14 | 44 |
| | | 9 | 24 | 14 | 38 | 25 | 3 | 28 | 9 | 1 | 10 | 23 | 2 | 25 | 23 | 7 | 30 | 28 | 7 | 35 |

1
GENERAL AMBULATION SCORE

2

3

TRIAL

4

5

6

| GROUP | CONDITION | RAT NO. | 1st 2 min | | | 2nd 2 min | | | 1st 2 min | | | 2nd 2 min | | | 1st 2 min | | | 2nd 2 min | | |
|-------|-----------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | | | |
| I | EXP | 1 2 7 | 0 0 2 | 0 0 0 | 0 0 2 | 0 0 1 | 0 0 0 | 0 0 1 | 1 0 1 | 0 0 1 | 1 0 2 | 1 0 0 | 0 0 0 | 1 0 0 | 1 0 0 | 0 0 0 | 1 0 0 | 1 1 1 | 2 0 0 | 3 1 1 |
| | CON | 3 4 6 | 0 2 0 | 0 0 0 | 0 2 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 | 1 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 |
| II | EXP | 1 5 6 | 0 0 3 | 2 0 0 | 2 0 3 | 0 0 0 | 0 0 0 | 0 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 1 | 0 0 1 | 1 0 3 | 0 0 0 | 1 0 3 |
| | CON | 2 3 4 | 1 2 0 | 2 0 1 | 3 2 1 | 2 0 0 | 2 0 0 | 4 0 0 | 1 1 0 | 0 0 1 | 1 1 1 | 0 0 1 | 0 0 0 | 0 0 1 | 0 1 1 | 0 1 1 | 0 1 2 | 1 1 4 | 0 2 0 | 1 3 4 |
| III | EXP | 2 4 6 | 1 0 5 | 1 0 4 | 2 0 9 | 0 0 0 | 0 0 2 | 0 0 2 | 0 0 0 | 0 0 0 | 0 0 0 | 0 1 0 | 0 0 0 | 0 1 0 | 0 0 3 | 0 0 4 | 0 0 1 | 0 0 1 | 2 0 0 | 2 0 1 |
| | CON | 1 3 7 | 2 1 3 | 0 2 0 | 2 3 3 | 0 0 0 | 0 0 0 | 0 0 0 | 2 0 0 | 2 0 0 | 4 0 0 | 1 0 0 | 0 0 0 | 1 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 1 1 2 | 2 0 1 | 3 1 3 |
| IV | EXP | 7 10 11 | 1 0 0 | 0 0 0 | 1 0 0 | 2 0 2 | 0 0 3 | 2 0 5 | 6 1 4 | 2 0 0 | 8 1 4 | 1 1 1 | 1 2 1 | 2 3 2 | 3 0 1 | 0 2 1 | 3 2 2 | 4 4 3 | 2 1 2 | 6 5 5 |
| | CON | 1 8 9 | 2 1 1 | 1 1 1 | 3 2 2 | 0 2 1 | 0 0 0 | 0 2 1 | 0 0 0 | 0 1 0 | 0 1 0 | 1 2 1 | 0 0 0 | 1 2 1 | 0 0 0 | 2 0 0 | 2 0 0 | 0 0 0 | 0 0 0 | 0 0 0 |
| | | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | |

INNER CIRCLE AMBULATION SCORES

TRIAL

| GROUP | CONDITION | RAT NO. | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | |
|-------|-----------|---------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total |
| I | EXP | 1 | 9 | 6 | 15 | 15 | 0 | 15 | 5 | 4 | 9 | 12 | 6 | 18 | 7 | 1 | 8 | 14 | 14 | 28 |
| | | 2 | 12 | 6 | 18 | 11 | 8 | 19 | 14 | 5 | 19 | 8 | 2 | 10 | 12 | 9 | 21 | 12 | 11 | 23 |
| | | 7 | 17 | 10 | 27 | 14 | 2 | 16 | 18 | 15 | 33 | 14 | 4 | 18 | 10 | 9 | 19 | 7 | 2 | 9 |
| | CON | 3 | 15 | 0 | 15 | 11 | 7 | 18 | 5 | 0 | 5 | 18 | 6 | 24 | 6 | 1 | 7 | 7 | 3 | 10 |
| | | 4 | 18 | 5 | 23 | 7 | 1 | 14 | 5 | 0 | 5 | 9 | 1 | 10 | 3 | 2 | 5 | 7 | 7 | 14 |
| | | 6 | 22 | 9 | 31 | 11 | 12 | 23 | 9 | 1 | 10 | 15 | 7 | 22 | 11 | 1 | 12 | 2 | 2 | 4 |
| II | EXP | 1 | 12 | 9 | 21 | 10 | 4 | 14 | 16 | 2 | 18 | 13 | 13 | 26 | 10 | 9 | 19 | 13 | 6 | 19 |
| | | 5 | 11 | 5 | 16 | 9 | 8 | 17 | 7 | 4 | 11 | 7 | 0 | 7 | 15 | 6 | 21 | 12 | 3 | 15 |
| | | 6 | 9 | 1 | 10 | 7 | 0 | 7 | 4 | 6 | 10 | 12 | 4 | 16 | 17 | 13 | 30 | 24 | 12 | 36 |
| | CON | 2 | 7 | 5 | 12 | 11 | 12 | 23 | 8 | 9 | 17 | 7 | 6 | 13 | 8 | 1 | 9 | 9 | 4 | 13 |
| | | 3 | 7 | 10 | 17 | 10 | 12 | 22 | 9 | 7 | 16 | 13 | 5 | 18 | 10 | 7 | 17 | 21 | 10 | 31 |
| | | 4 | 11 | 8 | 19 | 10 | 11 | 21 | 8 | 7 | 15 | 12 | 7 | 19 | 14 | 13 | 27 | 18 | 7 | 25 |
| III | EXP | 2 | 8 | 6 | 14 | 6 | 0 | 6 | 6 | 8 | 14 | 6 | 3 | 9 | 8 | 4 | 12 | 6 | 4 | 10 |
| | | 4 | 6 | 2 | 8 | 6 | 4 | 10 | 10 | 0 | 10 | 5 | 0 | 5 | 9 | 2 | 11 | 6 | 6 | 12 |
| | | 6 | 11 | 10 | 21 | 8 | 15 | 23 | 7 | 2 | 9 | 7 | 2 | 9 | 12 | 11 | 23 | 7 | 3 | 10 |
| | CON | 1 | 6 | 8 | 6 | 10 | 3 | 13 | 10 | 9 | 19 | 6 | 0 | 6 | 11 | 2 | 13 | 11 | 6 | 17 |
| | | 3 | 13 | 7 | 20 | 6 | 0 | 6 | 1 | 0 | 1 | 4 | 1 | 5 | 8 | 0 | 8 | 9 | 6 | 15 |
| | | 7 | 10 | 3 | 23 | 5 | 3 | 8 | 10 | 11 | 21 | 8 | 3 | 11 | 14 | 10 | 24 | 16 | 7 | 23 |
| IV | EXP | 7 | 4 | 5 | 9 | 5 | 6 | 11 | 12 | 10 | 22 | 8 | 5 | 13 | 8 | 4 | 12 | 8 | 10 | 18 |
| | | 10 | 8 | 2 | 10 | 9 | 1 | 10 | 8 | 2 | 10 | 9 | 4 | 13 | 4 | 6 | 10 | 13 | 7 | 20 |
| | | 11 | 8 | 4 | 12 | 12 | 8 | 20 | 10 | 10 | 20 | 9 | 10 | 19 | 9 | 10 | 19 | 10 | 4 | 14 |
| | CON | 1 | 4 | 8 | 12 | 2 | 12 | 14 | 8 | 2 | 10 | 8 | 8 | 16 | 10 | 8 | 18 | 8 | 5 | 13 |
| | | 8 | 12 | 5 | 17 | 12 | 4 | 16 | 10 | 12 | 22 | 5 | 2 | 7 | 5 | 4 | 9 | 9 | 4 | 13 |
| | | 9 | 9 | 9 | 18 | 5 | 2 | 7 | 4 | 2 | 6 | 6 | 0 | 6 | 4 | 1 | 5 | 10 | 2 | 12 |

"OTHER" SCORES

TRIAL

| GROUP | CONDITION | RAT NO. | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | |
|-------|-----------|---------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|-----------|-----------|-------|
| | | | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total | 1st 2 min | 2nd 2 min | Total |
| I | EXP | 1 | 105 | 114 | 219 | 101 | 2 | 103 | 64 | 50 | 114 | 111 | 6 | 117 | 100 | 34 | 134 | 157 | 196 | 353 |
| | | 2 | 169 | 83 | 252 | 163 | 33 | 196 | 30 | 14 | 44 | 54 | 38 | 92 | 21 | 66 | 87 | 110 | 75 | 185 |
| | | 7 | 367 | 229 | 596 | 157 | 15 | 172 | 239 | 231 | 470 | 142 | 32 | 174 | 121 | 34 | 155 | 63 | 19 | 82 |
| | CON | 3 | 199 | 31 | 230 | 180 | 107 | 287 | 64 | 9 | 73 | 235 | 242 | 377 | 73 | 4 | 77 | 63 | 16 | 79 |
| | | 4 | 326 | 76 | 402 | 194 | 53 | 247 | 43 | 0 | 43 | 14 | 10 | 151 | 102 | 22 | 124 | 294 | 184 | 478 |
| | | 6 | 53 | 109 | 162 | 186 | 99 | 285 | 38 | 5 | 43 | 63 | 183 | 246 | 41 | 6 | 47 | 65 | 10 | 75 |
| II | EXP | 1 | 131 | 37 | 168 | 43 | 9 | 52 | 231 | 22 | 253 | 305 | 215 | 520 | 110 | 78 | 88 | 123 | 25 | 148 |
| | | 5 | 218 | 111 | 329 | 67 | 52 | 119 | 33 | 39 | 72 | 119 | 1 | 120 | 65 | 18 | 83 | 57 | 26 | 83 |
| | | 6 | 205 | 76 | 283 | 90 | 19 | 109 | 43 | 55 | 98 | 155 | 90 | 245 | 95 | 122 | 217 | 199 | 125 | 324 |
| | CON | 2 | 198 | 309 | 507 | 300 | 239 | 539 | 218 | 150 | 368 | 234 | 57 | 291 | 7 | 1 | 8 | 161 | 28 | 189 |
| | | 3 | 179 | 100 | 279 | 59 | 20 | 70 | 85 | 114 | 199 | 91 | 76 | 167 | 194 | 29 | 223 | 149 | 132 | 181 |
| | | 4 | 63 | 63 | 126 | 122 | 67 | 189 | 99 | 138 | 237 | 234 | 106 | 340 | 240 | 270 | 510 | 113 | 119 | 232 |
| III | EXP | 2 | 184 | 113 | 297 | 3 | 0 | 3 | 53 | 52 | 105 | 26 | 14 | 40 | 90 | 65 | 155 | 28 | 28 | 56 |
| | | 4 | 37 | 7 | 44 | 3 | 0 | 3 | 34 | 1 | 35 | 40 | 0 | 40 | 43 | 5 | 48 | 66 | 2 | 68 |
| | | 6 | 20 | 18 | 38 | 14 | 33 | 47 | 9 | 4 | 13 | 9 | 15 | 24 | 78 | 119 | 197 | 154 | 18 | 172 |
| | CON | 1 | 38 | 42 | 18 | 97 | 18 | 115 | 22 | 45 | 67 | 5 | 1 | 6 | 91 | 12 | 103 | 156 | 102 | 258 |
| | | 3 | 40 | 52 | 92 | 11 | 2 | 13 | 2 | 0 | 2 | 3 | 0 | 3 | 35 | 1 | 36 | 188 | 90 | 278 |
| | | 7 | 97 | 60 | 157 | 2 | 0 | 2 | 24 | 26 | 51 | 24 | 3 | 37 | 65 | 16 | 81 | 200 | 56 | 256 |
| IV | EXP | 7 | 254 | 62 | 316 | 220 | 98 | 318 | 257 | 168 | 425 | 76 | 11 | 87 | 162 | 102 | 264 | 67 | 28 | 95 |
| | | 10 | 286 | 59 | 345 | 29 | 15 | 44 | 190 | 93 | 283 | 18 | 11 | 29 | 8 | 18 | 26 | 91 | 51 | 142 |
| | | 11 | 241 | 111 | 352 | 544 | 141 | 685 | 350 | 61 | 411 | 100 | 99 | 199 | 442 | 511 | 953 | 260 | 155 | 415 |
| | CON | 1 | 369 | 128 | 597 | 53 | 126 | 179 | 159 | 35 | 194 | 84 | 114 | 194 | 68 | 110 | 178 | 139 | 42 | 181 |
| | | 8 | 427 | 291 | 718 | 118 | 19 | 137 | 135 | 115 | 250 | 385 | 181 | 565 | 154 | 138 | 284 | 10 | 38 | 57 |
| | | 9 | 298 | 137 | 435 | 243 | 43 | 286 | 7 | 4 | 11 | 82 | 67 | 149 | 207 | 195 | 402 | 302 | 100 | 402 |

1
ACTIVITY SCORES

2

3

TRIAL

4

5

6

GROUP

| | CONDITION | RAT NO. | TRIAL | | | | | | | | | | | |
|-----|-----------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| I | EXP | 1 | 13,13 | 12,38 | 10,88 | 22,38 | 27,13 | 25,38 | 19,50 | 15,13 | 25,88 | 14,00 | 11,63 | 83,13 |
| | | 2 | 12,25 | 18,63 | 11,75 | 21,75 | 32,13 | 33,75 | 16,00 | 13,08 | 51,38 | 19,13 | 12,88 | 44,25 |
| | | 7 | 22,13 | 18,88 | 13,75 | 26,63 | 27,38 | 37,25 | 23,00 | 21,38 | 28,88 | 21,35 | 21,13 | 56,25 |
| | CON | 3 | 20,50 | 21,88 | 12,25 | 22,63 | 33,25 | 30,00 | 19,13 | 16,13 | 28,13 | 16,50 | 14,50 | 52,00 |
| | | 6 | 20,00 | 14,00 | 11,63 | 18,88 | 15,25 | 22,38 | 14,13 | 40,50 | 23,75 | 18,88 | 12,63 | 40,50 |
| | | 4 | 18,13 | 31,13 | 11,38 | 17,00 | 22,50 | 39,88 | 14,00 | 10,00 | 25,88 | 17,00 | 13,63 | 48,75 |
| II | EXP | 1 | 22,25 | 17,25 | 13,63 | 24,38 | 26,75 | 34,00 | 22,63 | 32,25 | 29,75 | 21,38 | 16,38 | 51,13 |
| | | 5 | 13,13 | 17,13 | 14,75 | 20,50 | 22,00 | 45,63 | 15,38 | 29,75 | 28,88 | 14,75 | 14,52 | 37,38 |
| | | 6 | 13,25 | 15,00 | 18,00 | 17,50 | 15,38 | 31,63 | 12,25 | 37,00 | 24,63 | 19,75 | 13,50 | 30,50 |
| | CON | 2 | 11,38 | 21,13 | 19,25 | 27,50 | 23,13 | 42,25 | 15,00 | 25,25 | 21,50 | 14,75 | 15,50 | 42,63 |
| | | 3 | 13,63 | 17,63 | 15,63 | 25,00 | 23,50 | 28,38 | 14,74 | 33,13 | 24,38 | 19,50 | 13,25 | 37,50 |
| | | 4 | 14,63 | 13,13 | 14,00 | 23,63 | 30,38 | 23,63 | 20,88 | 35,00 | 38,38 | 26,38 | 12,25 | 26,25 |
| III | EXP | 2 | 11,88 | 11,75 | 12,00 | 19,88 | 23,38 | 29,50 | 13,50 | 17,50 | 20,13 | 15,38 | 12,88 | 16,63 |
| | | 4 | 13,63 | 16,88 | 13,88 | 15,88 | 23,63 | 26,88 | 26,75 | 18,25 | 24,50 | 15,00 | 17,50 | 34,50 |
| | | 6 | 11,63 | 14,25 | 12,50 | 18,50 | 19,63 | 23,75 | 13,38 | 18,80 | 25,00 | 14,25 | 11,00 | 37,00 |
| | CON | 1 | 9,00 | 13,88 | 23,63 | 15,25 | 27,50 | 18,75 | 13,63 | 16,63 | 23,13 | 24,88 | 13,88 | 41,63 |
| | | 3 | 10,88 | 15,88 | 12,13 | 25,00 | 22,50 | 29,50 | 12,63 | 18,38 | 21,25 | 21,13 | 14,38 | 25,38 |
| | | 7 | 12,63 | 16,75 | 11,75 | 18,75 | 27,00 | 27,63 | 19,38 | 20,00 | 30,38 | 14,38 | 11,88 | 54,00 |
| IV | EXP | 7 | 11,50 | 11,25 | 11,65 | 15,63 | 28,00 | 24,00 | 27,25 | 38,63 | 21,00 | 13,00 | 13,88 | 50,63 |
| | | 10 | 11,50 | 14,75 | 12,50 | 24,00 | 21,25 | 24,50 | 17,38 | 17,00 | 19,25 | 13,38 | 15,50 | 65,88 |
| | | 11 | 10,25 | 14,00 | 13,00 | 21,63 | 32,13 | 13,75 | 20,00 | 17,30 | 19,25 | 13,00 | 10,88 | 58,00 |
| | CON | 1 | 10,00 | 16,50 | 12,00 | 20,00 | 43,13 | 25,13 | 16,50 | 25,38 | 19,38 | 13,50 | 11,13 | 44,88 |
| | | 8 | 16,00 | 14,75 | 12,13 | 21,95 | 20,50 | 28,88 | 19,00 | 26,38 | 20,88 | 15,63 | 12,00 | 36,38 |
| | | 9 | 13,50 | 23,75 | 14,75 | 25,50 | 34,50 | 23,13 | 14,15 | 23,38 | 21,63 | 16,13 | 17,88 | 44,38 |

SCORE FOR EACH PROBLEM (MEAN OF EIGHT TRIALS)

| GROUP | CONDITION | RAT NO. | TRIAL | | | | | | | | | | | |
|-------|-----------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| I | EXP | 1 | 6,13 | 16,00 | 6,38 | 12,25 | 18,88 | 15,25 | 13,50 | 9,13 | 16,00 | 7,00 | 5,63 | 65,38 |
| | | 2 | 6,13 | 15,38 | 8,50 | 19,25 | 29,00 | 35,25 | 16,00 | 19,25 | 44,88 | 44,88 | 10,63 | 30,50 |
| | | 7 | 21,00 | 18,88 | 11,25 | 24,38 | 22,50 | 35,63 | 19,38 | 21,63 | 24,25 | 20,13 | 16,88 | 45,75 |
| | CON | 3 | 15,50 | 15,50 | 5,38 | 15,88 | 24,63 | 25,75 | 13,38 | 12,88 | 19,38 | 11,50 | 9,88 | 36,75 |
| | | 4 | 13,13 | 36,63 | 7,50 | 9,63 | 19,25 | 25,63 | 7,75 | 10,25 | 17,50 | 13,88 | 9,38 | 36,88 |
| | | 6 | 11,00 | 10,88 | 7,63 | 11,88 | 10,38 | 17,38 | 11,63 | 37,00 | 19,88 | 12,50 | 7,50 | 29,13 |
| II | EXP | 1 | 15,00 | 15,75 | 11,00 | 25,13 | 25,50 | 28,38 | 20,00 | 28,88 | 25,88 | 17,75 | 13,88 | 39,63 |
| | | 5 | 8,50 | 14,63 | 10,00 | 16,88 | 17,50 | 45,13 | 12,50 | 26,25 | 23,50 | 9,75 | 7,38 | 31,25 |
| | | 6 | 9,13 | 13,88 | 10,63 | 14,13 | 11,00 | 31,00 | 11,38 | 30,38 | 20,38 | 17,50 | 11,63 | 20,75 |
| | CON | 2 | 5,88 | 18,38 | 14,38 | 23,25 | 17,65 | 41,25 | 12,88 | 16,88 | 15,13 | 12,75 | 11,63 | 30,13 |
| | | 3 | 7,88 | 14,00 | 12,13 | 22,25 | 19,88 | 22,38 | 12,50 | 24,50 | 16,25 | 12,88 | 8,75 | 27,63 |
| | | 4 | 8,75 | 7,13 | 10,88 | 16,75 | 21,00 | 18,38 | 15,25 | 34,38 | 33,25 | 19,50 | 6,38 | 26,38 |
| III | EXP | 2 | 9,00 | 9,25 | 6,38 | 11,50 | 15,00 | 22,88 | 8,75 | 10,50 | 17,00 | 9,25 | 7,88 | 9,38 |
| | | 4 | 9,13 | 11,88 | 8,75 | 11,13 | 16,88 | 22,88 | 21,00 | 12,13 | 19,25 | 9,75 | 15,75 | 27,38 |
| | | 6 | 7,63 | 10,38 | 6,13 | 9,88 | 12,38 | 16,75 | 7,50 | 14,00 | 16,25 | 7,63 | 5,88 | 24,63 |
| | CON | 1 | 6,25 | 10,75 | 5,00 | 8,63 | 18,00 | 11,63 | 9,38 | 10,38 | 16,00 | 19,00 | 9,75 | 29,00 |
| | | 3 | 6,13 | 12,00 | 7,63 | 15,75 | 16,25 | 22,63 | 10,50 | 13,38 | 16,50 | 15,13 | 14,13 | 22,25 |
| | | 7 | 8,88 | 18,88 | 5,00 | 12,25 | 21,50 | 20,88 | 12,63 | 12,88 | 27,63 | 7,75 | 6,38 | 54,00 |
| IV | EXP | 7 | 8,63 | 8,75 | 5,88 | 9,35 | 23,25 | 18,00 | 20,25 | 17,00 | 12,63 | 6,88 | 9,13 | 46,50 |
| | | 10 | 6,88 | 10,13 | 7,13 | 19,63 | 17,25 | 17,38 | 12,25 | 13,13 | 11,38 | 7,75 | 13,50 | 59,75 |
| | | 11 | 8,50 | 12,88 | 8,38 | 16,25 | 30,63 | 34,25 | 15,38 | 12,50 | 12,63 | 9,38 | 8,88 | 50,38 |
| | CON | 1 | 4,38 | 10,63 | 5,88 | 10,00 | 42,63 | 20,00 | 9,50 | 19,50 | 10,75 | 6,50 | 6,00 | 34,88 |
| | | 8 | 10,00 | 10,38 | 6,75 | 14,25 | 12,50 | 20,25 | 12,50 | 18,50 | 13,13 | 10,75 | 8,00 | 26,00 |
| | | 9 | 9,13 | 18,63 | 12,38 | 22,00 | 22,75 | 16,50 | 13,75 | 17,63 | 15,63 | 13,38 | 16,13 | 34,75 |

TIME IN SECONDS FOR EACH PROBLEM (MEAN OF EIGHT TRIALS)

WEIGHTS AND AGES

| GROUP | CONDITION | AT WEANING | | | AT END OF EXPERIMENTAL SESSION | | | AFTER THIRD OFT TRIAL | | | AT END OF OFT TESTING | | | AT START OF HEBB-WILLIAMS PROBLEMS | | AT END OF HEBB-WILLIAMS PROBLEMS | |
|-------|-------------|------------|------|-----|--------------------------------|-----|-----|-----------------------|-----|-----|-----------------------|-----|-----|------------------------------------|-----|----------------------------------|--|
| | | RAT NO. | AGE* | AGE | AGE | AGE | AGE | AGE | AGE | AGE | AGE | AGE | AGE | AGE | AGE | AGE | |
| I | E X P | 1 | 24 | 37 | 46 | 109 | 50 | 127 | 53 | 132 | 60 | 170 | 65 | 184 | | | |
| | | 2 | " | 37 | " | 101 | " | 122 | " | 128 | " | 158 | " | 189 | | | |
| | | 7 | " | 40 | " | 118 | " | 122 | " | 139 | " | 178 | " | 204 | | | |
| II | C O N | 3 | 24 | 34 | 46 | 96 | 50 | 114 | 53 | 123 | 60 | 154 | 65 | 178 | | | |
| | | 4 | " | 35 | " | 98 | " | 113 | " | 117 | " | 143 | " | 171 | | | |
| | | 6 | " | 30 | " | 111 | " | 124 | " | 130 | " | 173 | " | 194 | | | |
| III | E X P | 1 | 24 | 36 | 56 | 161 | 60 | 176 | 63 | 189 | 70 | 164 | 75 | 230 | | | |
| | | 5 | " | 33 | " | 157 | " | 173 | " | 186 | " | 163 | " | 221 | | | |
| | | 6 | " | 49 | " | 165 | " | 181 | " | 192 | " | 164 | " | 217 | | | |
| IV | C O N | 2 | 24 | 43 | 56 | 122 | 60 | 152 | 63 | 174 | 70 | 162 | 75 | 213 | | | |
| | | 3 | " | 43 | " | 163 | " | 194 | " | 200 | " | 170 | " | 246 | | | |
| | | 4 | " | 32 | " | 128 | " | 153 | " | 162 | " | 157 | " | 207 | | | |
| V | E X P | 2 | 24 | 37 | 66 | 197 | 70 | 216 | 73 | 223 | 80 | 229 | 85 | 261 | | | |
| | | 4 | " | 33 | " | 192 | " | 210 | " | 213 | " | 221 | " | 254 | | | |
| | | 6 | " | 53 | " | 213 | " | 230 | " | 227 | " | 241 | " | 252 | | | |
| VI | C O N | 1 | 24 | 34 | 66 | 163 | 70 | 188 | 73 | 194 | 80 | 208 | 85 | 225 | | | |
| | | 3 | " | 37 | " | 164 | " | 182 | " | 185 | " | 204 | " | 228 | | | |
| | | 7 | " | 52 | " | 165 | " | 176 | " | 184 | " | 193 | " | 221 | | | |
| VII | E X P | 7 | 24 | 50 | 76 | 234 | 80 | 246 | 83 | 231 | 90 | 258 | 95 | 257 | | | |
| | | 10 | " | 56 | " | 222 | " | 237 | " | 223 | " | 253 | " | 256 | | | |
| | | 11 | " | 60 | " | 242 | " | 258 | " | 278 | " | 283 | " | 301 | | | |
| VIII | C O N | 1 | 24 | 76 | 76 | 207 | 80 | 235 | 83 | 221 | 90 | 263 | 95 | 267 | | | |
| | | 8 | " | 53 | " | 169 | " | 199 | " | 215 | " | 233 | " | 249 | | | |
| | | 9 | " | 49 | " | 176 | " | 202 | " | 210 | " | 234 | " | 248 | | | |

WEIGHT IN GRAMMES

* Approximate.