Emotionality ratings and open-field behavior¹

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A correlational analysis of presurgery data from the study of Corman, Meyer, & Meyer (1967) reveals the independence of emotionality rating scores and open-field behaviors in intact Ss.

In a recent publication, Corman, Meyer, & Meyer (1967) found changes in both emotionality ratings and open-field activity as a result of limbic lesions in rats. It was found that with longer recovery periods the changes in emotionality produced by septal lesions attenuated while changes in activity persisted. The question of the relationship between emotionality ratings and open-field behavior in the intact animal was ignored. The present article presents product-moment correlations between measures taken prior to surgery in that study.

SUBJECTS

The Ss were 90 male rats of the Long-Evans strain. Twelve additional animals which subsequently failed to survive surgery or showed signs of illness were excluded from the analysis.

APPARATUS

The apparatus was an open-field, 45-in. square. The walls, which were 24 in. high, were painted flat grey, and the floor consisted of 9-in. squares of black linoleum tile. A removable start box (9 x 9 x 12 in.) had two sides and was placed in one corner of the open-field so that the walls of the field completed the box. A hinged lid permitted insertion of S into the start box, and a long handle was used to lift the box from the field at the beginning of the trial. The field was illuminated by a single 15-W fluorescent light suspended 20 in. above the center of the field. The room was darkened, permitting the E to observe S without distracting it. Hand switches connected to a remotely located Esterline-Angus recorder permitted the recording of latency in leaving the starting square, locomotion, and time-in-center.

PROCEDURE

After Ss were gentled by handling for five days, they were then rated for emotionality for six days, using the scale and procedure described by King (1958) and by Yutzey et al (1964, 1967). On the fourth rating day, S was placed in the

start box within the field. Thirty seconds later the box was gently lifted from the open-field, and S was observed for 3 min. Three behavioral measures were recorded: (1) latency in leaving the starting square; (2) locomotion (number of squares entered during the test period); and (3) time-in-center (total time, in seconds, during which S was in contact with squares other than those adjacent to the walls of the apparatus).

Subjects received one trial per day, and the field was sponged clean and dried after testing each S.

Subjects were rated for emotionality approximately 1 h before testing in the open-field.

RESULTS AND DISCUSSION

Product-moment correlation coefficients (r) are presented in Table 1.

The interpretation of correlations between open-field measures must be tempered by the lack of independence between the measures resulting from aspects of the procedure. Locomotion and time-in-center are influenced by latency since the longer the latency, the shorter the time available to the S to move around the apparatus. Time-in-center is not independent of locomotion in that the S must make at least one movement between squares in order to enter the "center" area. Since only rarely did an animal fail to make a locomotion response on a given trial and since the mean locomotion scores ranged from 44-51, with mean latencies ranging from 1.4-10 sec, it is improbable that these potential relationships contribute appreciably to the correlations.

Of major interest is the lack of correlation between emotionality ratings and any of the open-field measures. Within the limits of the procedures employed, no prediction of Ss' open-field behavior on the basis of emotionality rating could be made.

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Table 1
Product Moment Correlations (r)

Measure		Emotionality Rating						Latency			Locomotion			Time-in-Center		
	Day	1	2	3	4	5	6	4	5	6	4	5	6	4	5	6
I	1	—														
	2	.67	—													
	3	.71	.76	—												
	4	.35	.53	.53	—											
	5	.44	.57	.62	.58	—										
	6	.23	.30	.32	.61	.61	—									
II	4	.05	.12	.12	.07	.20	.07	—								
	5	-.13	.02	.01	-.04	.02	-.01	.37	—							
	6	-.16	-.04	.00	-.08	-.07	-.05	.26	.71	—						
III	4	.01	.03	.05	.14	.06	.11	-.47	-.36	-.19	—					
	5	-.02	-.06	-.06	-.02	-.07	-.07	-.55	-.51	-.43	.71	—				
	6	-.02	-.09	-.08	-.03	-.01	-.04	-.49	-.48	-.53	.58	.80	—			
IV	4	.03	-.05	-.07	-.14	-.08	-.05	-.24	-.26	-.26	.43	.36	.25	—		
	5	-.12	-.07	-.11	-.17	-.19	-.09	-.25	-.25	-.23	.47	.64	.44	.37	—	
	6	.04	.10	.13	.09	.09	-.08	-.08	-.27	-.27	.39	.52	.56	.13	.39	—

$r = .21, p = .05$ (two-tailed)

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Fig. 2. Mean total body weight changes as a function of deprivation and postdeprivation time.

During the post-deprivation experiment, both the water and the food-deprivation groups show abrupt increments in HR at 10 min postdeprivation. The HRs for both groups gradually decreased down to the levels of ad lib conditions. An analysis of variance shows that the HR changes over the postdeprivation sessions are significant beyond the .01 level, $F = 4.18$, $df = 7/112$, and the group difference is significant beyond the .001 level, $F = 23.11$, $df = 1/112$.

The total body weight changes as a function of the hours of both deprivation and postdeprivation are summarized in Fig. 2. Both groups show very similar trends, except that the body weight loss of the water-deprivation group is slightly more severe than that of the food-deprivation group during the deprivation period. During the postdeprivation period, the water-deprivation group shows a slightly faster body weight gain than that of the food-deprivation group. However, these differences were not statistically significant.

DISCUSSION

The results of the first part of this experiment, i.e., the deprivation experiment, clearly agree with our previous findings (1968) in which the water-deprivation group showed a positive monotonic function, and the food-deprivation group an inverse U-shaped function. The results of the postdeprivation experiment show that both groups show distinct increments in their HR during a 10-min recording period, then the HRs gradually decreased to the ad lib basal levels. From the results of both experiments it appears (1) that HR is influenced by deprivation (either food or water) and (2) that consummatory activities definitely increase HR.

The nature of the inverse U-shaped function obtained from the food-deprivation group requires further consideration. First, consider the total body weight loss of the food-deprivation group. The trend of the weight loss is almost identical with that of the water-deprivation group. And note that water was available to the food-deprivation group during the deprivation experiment.

The total body weight loss of the food-deprivation group during deprivation is influenced not only by a loss of food

stores, but also by a loss of water, or dehydration. During the deprivation of food, electrolytes are first lost continually through the kidneys. As these electrolytes are lost, the kidneys excrete equivalent quantities of water in order to maintain osmotic equilibria in the body. At the same time, an additional quantity of water is lost as the cellular stores of foods are depleted, because the proteins of the cells absorb considerable water. In short, the deprivation of food increases the degree of dehydration in rats. From these physiological facts it was expected that deprivation of food should increase HR. But our data show an inverse U-shaped function suggesting that these food-deprived rats adjusted themselves by reduction in basal metabolism during the deprivation experiment (see also Quimby et al, 1948).

In the case of the water-deprivation group, the degree of dehydration is much greater than that of the food-deprivation group. This is well demonstrated by (1) the total body weight changes during the deprivation experiment, (2) the amount of water intake, and (3) the HR changes during both the deprivation and the postdeprivation experiments. Cessation of water intake increases the degree of dehydration which is, of course, much greater for the water-deprivation group than for the food-deprivation group. Thus, it is expected that HR will increase monotonically only up to a critical period—a critical period evidently occurring sometime after 96 h of water deprivation.

These experimental findings suggest (1) that physiological characteristics measured by the HR change suggest that the deprivation processes of the food-deprived rats are quite different from those of the water-deprived rats; (2) that the rats' HR may be influenced by both dehydration and metabolic changes; (3) that since deprivation itself changes the basal HR level, the HR can be used as a measurement of arousal level as suggested by Malmo (1962); (4) that since consummatory activities definitely increase HR, the HR can be used as a sensitive measurement of conditioning. However, substantial experimental data are required, especially for the reward conditioning, before a suitable general behavioral law can be formulated.

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NOTE

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