Escape behavior in neonatal rats:

Methodological and psychometric considerations*

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To determine factors conducive to shock-escape behavior, and which of several measures reflects a learning capability, 5- and 9-day-old rats were given 25 shock-escape training trials in a straight alley in which the grids that comprised the floor ran either vertically or horizontally. Performance was evaluated in terms of speed and competing response measures. Vertically arranged grids were found to facilitate performance in terms of an increased tendency to move in a forward direction. An intrasession decrease in competing responses proved to be the most reliable indicator of learning.

The present research was prompted by a recent study (Misanin, Nagy, & Weiss, 1970) on shock-escape behavior in 5- to 11-day-old rats. In that study, a straight alley was used, the floor of which consisted of steel rods which ran parallel with the length of the alley, i.e., vertically. This floor feature was thought to have facilitated forward movement in the neonatal rat. The nature of the facilitation was, however, not specified. Since facilitation of forward movement may be in the form of an increased tendency to move in a forward direction, an increased speed of locomotion, or both, it is possible that the facilitation provided by the vertical-grid arrangement shows up in only one characteristic of the response, i.e., speed or direction. It is also possible that improvement on one aspect of performance occurs at the expense of another, e.g., an increased tendency to move in a forward direction but a decreased or limited locomotor ability in terms of speed. Thus, the purpose of the present study was to determine the nature of the facilitation provided by the vertical-grid arrangement on shock-escape behavior in the neonatal rat, and to determine which of several measures best reflects a learning capability.

METHOD

The Ss were 20 5-day-old and 20 9-day-old male Wistar rats. The apparatus consisted of a 25 x 6 x 10 cm aluminum alley and a separate 30 x 39 cm grid floor with 1-mm steel grids spaced 2 mm apart. Half of the Ss of each age were given escape training on a vertical-grid floor; for the others, the grids ran perpendicularly to the sides of the alley, i.e., horizontally. A removable door, 5 cm from one end of the alley,

formed the startbox. Fifteen seconds before a trial, S was placed in the startbox facing the goal. A trial began with the removal of the door and the application of .1-mA 60-Hz scrambled ac shock to the grids. Shock and the trial ended when S touched the goal end of the alley. If S failed to do this within 3 min, it was gently forced to the goal (forced trial). At the end of the trial, S was removed from the alley and held in E's hand for 30 sec. This procedure was followed for 25 trials.

Response latency to the nearest .1 sec, and the number of competing responses (180-deg turn in a direction away from the goal) were recorded for each trial. A 180-sec latency was recorded on forced trials.

RESULTS AND DISCUSSION

Performance on the escape task was evaluated in terms of speed (reciprocal latency), number of forced trials, number of competing responses (CRs), and number of trials without CRs.

A 2 by 2 by 5 factorial analysis of variance was performed on the speed data, with age, grid direction, and five-trial block being the factors under consideration. Only the main effects of age and trial block, and their interaction effect, were significant ($p < .001$). The slope of the curve relating speed to trial block was steeper for 9- than for 5-day Ss, but both age groups increased speed over session ($p < .001$). To determine if shorter latencies over trial blocks were due to faster movement or a decrease in CRs, speeds on trials without CRs were averaged for Trials 1-12 and 14-25 and analyzed. No reliable effects of grid direction or trial block were obtained. Thus, grid direction has, apparently, no effect on speed of response, and the intrasession increase in speed seems merely to reflect a decrease in competing responses.

A 2 by 2 by 5 factorial analysis of variance performed on CRs, on the other hand, showed the main effects

of age, grid direction, and trial block, and the Age by Trial Block interaction, to be significant ($p < .005$). In general, animals trained on vertical grids made fewer CRs than those trained on horizontal grids, and 9-day Ss made fewer CRs than 5-day Ss. Only on Trial Block 1 did the number of CRs of the 9- and 5-day Ss fail to differ. All groups showed an intrasession decrease in CRs ($p < .001$). Thus, vertical grids appear to increase the rat's forward-going tendency over and above that of rats trained on horizontal grids. This directional cue value of vertical grids was, to a lesser degree, also made manifest in the number of trials without CRs. An analysis of these trials showed significant main effects of age, grid direction, and trial blocks, and a significant interaction of these variables ($p < .05$). Subsequent individual comparisons showed the 9-day vertical group to be superior to the 9-day horizontal group on Trial Blocks 3-5; no significant difference was obtained between the 5-day groups on any trial block. Apparently, trials without CRs are less sensitive to intrasession changes in behavior than are number of CRs.

Since an intrasession increase in overall speed seems to reflect a decrease in CRs, and since trials without CRs are less sensitive to intrasession changes in escape behavior than the CR measure, the CR measure appears to be the most appropriate measure of escape performance in the neonatal rat. However, to say that it is a learning measure and, hence, that grid direction affects learning, it is necessary to provide evidence that the decrease in CRs is not simply the result of a temporary state of the organism, e.g., fatigue or a change in sensitivity to footshock (FS) (Nagy, Misanin, & Newman, 1970). It is unlikely that the decrease in CRs over the session was due to fatigue. If it were, forced trials should have increased over the session. The number of forced trials was small, however, averaging 4.3 and 3.2 per session for the 5- and 9-day Ss, respectively, and, in general, these trials decreased for all over the session. The distribution of percentages of these trials over Trial Blocks 1-5 were, respectively, 36, 27-1/3, 12, 17-1/3, and 7-1/3. It is also unlikely that the decrease in CRs resulted from a change in sensitivity to FS. If this were so, the change should also have been evident in the speed

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measure. Speed on trials without CRs, however, remained constant over the session.

If, as suggested, an intrasession decrease in competing responses is indicative of shock-escape learning in the neonatal rat, then the advantage of

the vertical-grid arrangement in an escape task with neonates is that a higher level of learning can be attained in fewer trials. This reduces the possibility of obtaining confounding effects of other factors such as fatigue, habituation or sensitization to FS.

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