FACILITATORY EFFECT OF DARKNESS UPON SPATIAL REVERSAL LEARNING IN SEPTAL RATS

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Many investigations have shown that septal lesions in rats impair their performance in successive reversals of spatial discriminations (3, 4, 6, 7, 9, 11, 12). As there is no apparent deficit following the same lesions in reversals of the visual tasks (8) it has been suggested that septal ablations may impair the ability to use response-produced (proprioceptive) cues (2).

Recently, when reversal performance of septal rats was analysed in spatial tasks with different visual cues (1, 8), it appeared that the degree of impairment in spatial reversal performance depends on the relevance and discriminability of the visual cues provided in the experimental conditions. Those results suggested that spatial reversal deficit may be due to a sensitization of septal rats to all exteroceptive stimuli present in the experimental situation, and that responding to these stimuli may interfere with correct utilization of interoceptive cues (i.e., proprioceptive or kinaesthetic). The present experiment investigated the performance of rats with septal lesions in the acquisition and two successive reversals of spatial discrimination when visual cues were eliminated from the experimental situation by testing all animals in the darkness.

Twenty male hooded rats 75 days old were used. They were kept in separate cages with constant supply of water. The apparatus was a modified Thompson's double choice alley (10). The experiment was conducted in an almost complete darkness, the only source of light consisted of an infrared lamp. Observations were made with help of infrared sensitive glasses. All animals received preliminary training during which they
established approach to either of the two goal boxes and learned to pass through the doors in front of the goal boxes. A piece of cookie served as a reward. The initial training lasted 2 to 5 days (maximum 10 trials per day) and it was terminated when the rat reached goal boxes in less than 10 s. Surgery was performed on 11 randomly selected animals, the remaining 9 served as unoperated control group. Bilateral septal lesions were made by passing anodal current (2 mA for 15 s through a tungsten electrode (0.2 mm in diameter). Fourteen days after surgery the training was resumed. During the acquisition of the initial discrimination all animals were required to approach the right goal box. The door on the left side was blocked and an attempt to open it was scored as an error. An approach to either of the door without touching it was scored as a vicarious response. During reversal training the previously correct door was blocked and the reward was available in the other (left) goal box. During rereversal training (2nd reversal) all animals were required to reestablish their initial approach to the right goal box. Ten daily trials were given throughout all training with an intertrial interval of 60 s. The criterion for the acquisition and both reversals was 10 consecutive trials without an error and vicarious responses.

At the end of the experiment animals with septal lesions were sacrificed, their brains removed and subjected to a routine histological

Fig. 1. Extent of the largest and smallest lesion (hatched area) on three frontal planes of the septal nuclei in the rat.
procedure for lesion verification. Figure 1 shows the extent of the largest and the smallest lesion. Generally, all lesions were found to be large and they involved bilaterally dorsal, medial and lateral septal nuclei. Upper levels of the diagonal band nucleus as well as the precommissural fornix were partially damaged. Behaviorally, all operated animals showed "septal rage", were resistant to handling and reacted strongly to the tap at the rump. Most of these reactions were attenuated at the start of discrimination training.

### Table I

<table>
<thead>
<tr>
<th></th>
<th>Acquisition</th>
<th>Reversal</th>
<th>Rereversal</th>
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<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Septal</td>
<td>Control</td>
</tr>
<tr>
<td>Trials</td>
<td>45.4</td>
<td>28.9</td>
<td>47.5</td>
</tr>
<tr>
<td>Errors</td>
<td>8.4</td>
<td>5.6</td>
<td>12.2</td>
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<tr>
<td>Vicarious responses</td>
<td>11.8</td>
<td>11.7</td>
<td>14.4</td>
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</table>

Table I presents summary of the behavioral results. There were no significant differences between the septal and control animals on any of the measures obtained in the acquisition or in the two reversals of spatial discrimination. A two-way analysis of variance (Type II, mixed design (5)) for the number of errors, trials to criterion and vicarious responses did not show any significant treatment effects (all F-values < 1.70). None of the interaction effects reached a statistically reliable level. Similarly, when the additional measures, such as the number of errors to the first correct response and perseverative errors, were analysed there was no difference between the two experimental groups.

These results are clearly at variance with the numerous reports of an impaired ability to reverse spatial discriminations in rats with septal lesions. However, the present results support our previous suggestion (1) that the deficit in ability to use proprioceptive or kinaesthetic cues following septal ablations is probably task dependent. Such impairment appears to be absent or grossly attenuated when the experimental situation does not contain irrelevant visual cues interfering with correct responding. It is suggested, therefore, that septal deficit in the reversal of the spatial discrimination is probably due to a disruptive interference of irrelevant visual cues that had acquired incentive value in the course of the initial approach training. When the experimental conditions facilitate development of a selective attention
to the relevant cues (like darkness in the present experiment) no deficit would be expected following septal lesions. The present results confirmed this prediction.

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