Discriminative control by dl-amphetamine and saline of lever choice and response patterning [1]

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Discriminative control of lever choice and response patterning by internal states was demonstrated in rats trained on a two lever mult FR DRL schedule of food reinforcement. Saline was administered on days when the FR component was programmed and amphetamine when DRL was in effect. On subsequent extinction sessions, the animals responded on the lever and at rates which were appropriate to the compound administered.

It has been demonstrated that drug induced internal effects are able to function as discriminative stimuli (SD) by the alcohol controlled choice of direction in a maze (Conger, 1951), chlorpromazine controlled avoidance responding (Otis, 1964) and control of lever choice by atropine, alcohol and harmaline (Barry & Kubena, 1967). The present study utilized amphetamine and saline as discriminative stimuli to control lever choice and response patterning in a two lever, multiple fixed ratio-differential reinforcement of low rate schedule (mult FR DRL). It was anticipated that performance in extinction would be determined by the internal state of the animal.

Subjects

The Ss were three 150 day old experimentally naive female Sprague-Dawley rats. Throughout the study a 22 h food deprivation schedule maintained Ss at 85 per cent of their normal ad lib body weight.

Apparatus

Three standard two lever boxes served as apparatus. Food reinforcement consisted of 45 mg Noyes pellets. Electronic equipment was used for programming and recording functions.

Procedure

Initially, Ss were shaped to a mult FR DRL schedule in which one lever was associated with the DRL component and another with the FR component. On FR every 50th lever press was reinforced and on DRL, presses which followed previous ones by 20 sec or more were reinforced. To prevent chaining of responses between the two levers, a response on the incorrect lever during the FR component did not step the counter. During the DRL component an incorrect response reset the interval. The FR and DRL components were programmed randomly from day to day and appeared equally over the training period. Experimental sessions were 1 h duration.

After eight days of training on each schedule component the compounds were administered prior to each session. A dose of 1.0 mg/kg of dl-amphetamine, dissolved in 0.3 ml saline, was administered intraperitoneally 15 min prior to DRL sessions. An equal volume of physiological saline was administered 15 min prior to FR sessions. The Ss were given eight additional days of training on each schedule component paired with its appropriate compound.

Tests for discriminative control of responding were carried out in extinction. Each animal was placed on extinction for 1 h under saline and 1 h under amphetamine. Four days of retraining on each schedule component paired with its appropriate injection intervened between the two extinction sessions. On the first extinction session two Ss were administered amphetamine and one saline. On the second extinction session the drug conditions were reversed.

Following the second extinction session, one animal was transferred to a one lever chamber and maintained on the training procedure previously in effect. After five training sessions on each schedule component paired with its appropriate injection, an extinction session under saline, four retraining sessions with each compound, and an extinction session under amphetamine were programmed.

Results and Discussion

Figure 1 provides cumulative record comparisons of responding during reinforcement and extinction with saline and amphetamine for the three Ss. During reinforcement, correct responses and reinforcements were recorded in the usual manner. Incorrect lever presses were recorded on the event marker. During extinction, responses on the lever appropriate to the injection given were recorded cumulatively, while inappropriate presses were recorded on the event marker.

An inspection of these records demonstrates that the internal state in effect during extinction controlled the performance of the animals. When amphetamine was administered prior to extinction, responding on the amphetamine-associated lever predominated. Similarly, during saline extinction sessions, responding on the saline-associated lever predominated. The amphetamine records reveal that the incidence of inappropriate responding was not appreciably greater during extinction than during reinforcement. On the other hand, the saline records show several short bursts of inappropriate responding during extinction. Since the bursts appeared during pauses in responding on the appropriate lever, they probably represent probing as a function of extinction.

Response patterning in extinction also appeared to be under the control of the internal state of the animal. The sequence of bursts and pauses shown on the saline records and the paced rate shown in the amphetamine records are characteristic of responding in extinction following training on FR and DRL, respectively.

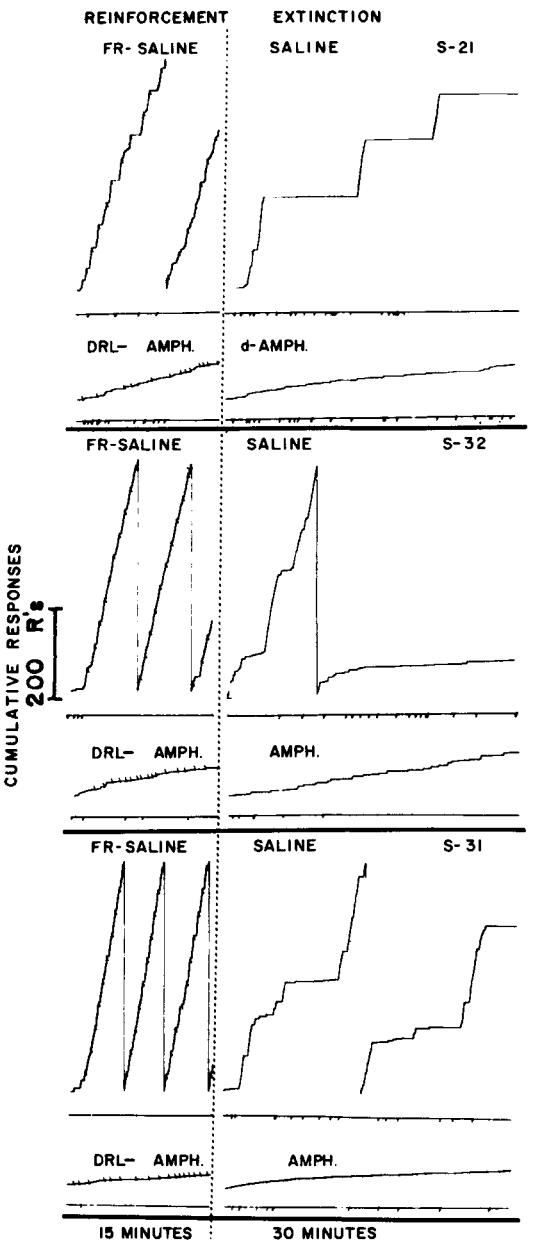

Fig. 1. Left Panel: Cumulative records of the initial 15 min of the last pre-extinction session for each schedule component for the three Ss. Right Panel: Cumulative records of initial 30 min of extinction sessions.

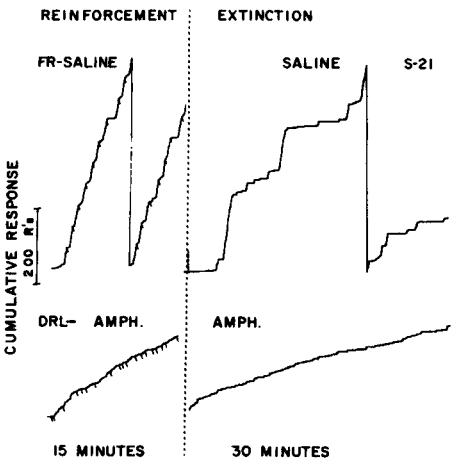

Fig. 2. Left Panel: Cumulative record of initial 15 min of the last pre-extinction session for each schedule component. Right Panel: Cumulative record of initial 30 min of extinction sessions.

It is not clear from these data whether the injected solutions per se controlled response patterning or whether they functioned as SDs for a lever which then controlled the rate of responding. Figure 2 presents extinction records for S-21 which was transferred to a one lever box. Responding in extinction under both saline and amphetamine corresponded to the patterns in the two tests. This demonstrates that the internal state of the animal controlled response patterning.

Using this technique of assessing the discriminability of internal states, further tests are being undertaken to determine if a generalization gradient can be obtained with successively lower doses of amphetamine or with other psychomotor stimulants. This study demonstrates that a more complete understanding of drug behavior interactions can be achieved by considering the stimulus properties of drugs in addition to their traditionally emphasized pharmacological effects.

References

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Notes

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