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BRIEF COMMUNICATION

Effects of Amphetamine and Nembutal on Social Exploration in the Mongolian Gerbil

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MARTINDALE, C. AND D. HINES. *Effects of amphetamine and nembutal on social exploration in the mongolian gerbil.* PHARMAC. BIOCHEM. BEHAV. 7(6) 573–574, 1977. – Male Mongolian gerbils were injected intraperitoneally with amphetamine, nembutal, or saline and placed in a preference chamber one side of which contained a female gerbil. Amphetamine significantly decreased amount of time in contact with the female. Although the amphetamine effect held for both novel and familiar females, it was more marked for novel than for familiar females.

Social exploration Amphetamine Nembutal

ACCORDING to Eysenck, extraverts have low levels of cortical arousal [2]. Because of this, they seek novelty and stimulation and, consequently, association with other people. Introverts theoretically manifest high levels of cortical arousal and hence avoid stimulation, novelty, and other people. Drugs that increase cortical arousal should have an introverting effect and drugs that decrease cortical arousal should have an extraverting effect. That is, drugs that increase cortical arousal should make organisms behave more like introverts and drugs that decrease cortical arousal should make them behave more like extraverts. The latter hypothesis has been tested indirectly with non-social behaviors such as sensory thresholds that differentiate introverts and extraverts [2], but drug effects on socialization have not been systematically studied. Further, there has been no direct investigation of whether the theory applies to socialization in other than human organisms.

On the basis of a number of studies of social exploration in rodents, Latané has hypothesized that animal social attraction is not the result of static stimulus qualities but rather of preferences for an optimal level of stimulation and unpredictability [6]. This conclusion is clearly similar to Eysenck's notions concerning the proximal cause of social attraction, although Latané does not go on to explain this preference in terms of level of cortical arousal. Also consistent with Eysenck's theory is the finding that gerbils reared in isolation show higher levels of social exploration than do gerbils reared in groups [5,9]. Social stimuli would be more novel for isolated than for non-isolated animals. Based on Eysenck's and Latané's theories, we predicted that increased arousal induced by d-amphetamine should decrease social exploration in Mongolian gerbils while lowered arousal induced by sodium nembutal should increase social exploration. Further, it was predicted that effects should be most marked for novel social stimuli, since the theory explains socialization in terms of seeking or avoiding stimulation and novelty is a potent source of stimulation. There is evidence that d-amphetamine inhibits exploration of novel non-social stimuli [7,8]. Thus, it might be expected that amphetamine would decrease preference for novel as compared with familiar social stimuli, while nembutal should have a reverse effect.

METHOD

Animals

Animals were eighteen experimentally naive male Mongolian gerbils aged 24 to 50 weeks. They were housed with female mates and offspring, if present, in separate cages. Animals were maintained on a 12 hr off light-dark cycle with food and water available ad lib.

Apparatus

The test apparatus was a Lafayette Instruments two-sided preference chamber modified to accommodate gerbils. Each side of the chamber was fitted with a small wire mesh cage in which a stimulus gerbil could be placed. An animal was allowed freedom of movement in the preference chamber. A running wheel with automatic counter was used to assess activity levels before each preference chamber observation.

Experimental Procedure

The measure of social exploration was the amount of time out of a 15 min test trial during which the animal was in contact with the wire cage holding the stimulus gerbil. Contact was timely by the second author with a stopwatch.

Reliability was assessed by having a second observer time contact times of 10 gerbils for two min each along with the second author. The correlation between contact times as assessed by the two observers was 0.99. Before the experiment began, all of the male gerbils were injected with saline and run through the experimental procedure with no stimulus present until preference for the two sides of the chamber stabilized at about 50%. For the 13 days before the experiment, mean time on the right side was 7.33 min and on the left 7.67 min.

The measure of activity level was the number of revolutions of the running wheel during the 15 min observation period.

A 2 × 3 completely repeated design was employed: Novelty (novel vs. familiar stimulus gerbil) × Drug (amphetamine vs. nembutal vs. saline). The familiar stimulus gerbil was the animal's mate. The novel one was another female chosen at random from the 18 pairs. d-Amphetamine dosage was 1.5 mg/kg; nembutal dosage was 22.5 mg/kg. Injection volume for animals weighing up to 80 g was .01 ml/g. For animals above 80 g it was .008 ml/g. Saline volume was 0.5 ml for all animals. Animals received each of the six treatments in random order every other day over twelve days. Order of treatments was randomized in order to counteract any habituation effects. Each animal was always run at the same time of the day. They were always injected intraperitoneally, placed in a waiting cage for 15 min, placed in a running wheel for 15 min, and then placed in the preference chamber for 15 min. On non-test days, subjects received saline injections and were run through the procedure with no stimulus gerbil present. The side on which the stimulus gerbil was placed and the side into which the animal was introduced were randomized.

RESULTS

Drug treatments had an effect on running wheel activity, $F(2,85) = 21.27$, $p<0.01$. This effect was due to a depression of activity under sodium nembutal. Mean number of running wheel revolutions was 282.6 for d-amphetamine trials, 279.4 for saline trials, and 150.2 for nembutal trials. There were no obvious carry-over or order effects on activity level. In any case, social exploration was not correlated with running wheel activity under any of the conditions.

An analysis of variance of log-transformed contact times revealed a significant drug effect, $F(2,85) = 4.31$, $p<0.05$. This was due to lowered contact times in the d-amphetamine conditions. Mean contact time during d-amphetamine trials was 2.32 min while it was 2.49 min with saline and 2.45 with nembutal. The d-amphetamine contact time is significantly less than either saline ($p<0.05$) or nembutal ($p<0.05$) using Duncan's multiple-range test. The drug effect is primarily due to amphetamine decreasing contact with novel stimulus gerbils, however the interaction between stimulus familiarity and drug did not reach significance. Mean contact time for the d-amphetamine-novel condition (2.26 min) was significantly ($p< 0.01$) less than that for the saline-novel condition (2.51 min) with Duncan's multiple-range test. However, mean contact time under the d-amphetamine-familiar condition (2.39 min) was not significantly different from that under the saline-familiar condition (2.48 min). Contact times in the nembutal conditions did not differ significantly from those in the saline conditions for either novel or familiar stimuli.

DISCUSSION

The effects of d-amphetamine are grossly consistent with predictions from Eysenck's theory. It seems unlikely that the effects of d-amphetamine on gerbil socialization are artifactual. Since d-amphetamine did not increase activity level, an explanation in terms of increased locomotor activity seems unlikely. This conclusion is reinforced by the lack of correlations between running wheel activity and social exploration in any of the conditions. It is possible that d-amphetamine had its effect in some indirect manner. Thus, it is conceivable that it rendered the gerbils less sensitive to olfactory cues emanating from the female stimulus gerbils. It is known that female sexual odors increase sexual exploration by male rodents [1], but it is not clear how amphetamine affects olfactory sensitivity in the gerbil. Furthermore, it has been shown that rendering rats completely anosmic does not lower their rates of social exploration [6]. On the other hand, the influence of d-amphetamine on reticular system activity is well established [3,4]. It would seem most parsimonious to attribute our results to this action, especially in light of Eysenck's rationale connecting socialization and cortical activation. Lack of clear results for nembutal could be due to insufficient dosages.

The design of the present experiment wherein each animal received all treatments made it impractical to investigate multiple dosage levels. However, this would seem to be a fruitful approach in future research along these lines using another design. While a significant interaction between stimulus novelty and drug was not found, trends in the data concerning the effects of d-amphetamine were in the direction of such an interaction. Overall, the results are consonant enough with Eysenck's theory to suggest that animal and human socialization do not follow completely different laws.

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