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Theodore E. Cadell
University of Massachusetts Amherst

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by

Theodore E. Cadell

B.A., University of British Columbia

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University of Massachusetts, Amherst

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Maier (1949) found that when rats trained on a Lashley jumping apparatus were presented with an insoluble problem (random reward and punishment), they would soon refuse to jump. If the animals were then forced to respond by applying shock, or air blast, or by prodding with a stick, they would quickly adopt a consistent position or discrimination response. These responses Maier termed position or symbol stereotypes to be distinguished from similar responses obtained by consistent reward. If the animals were subsequently given a soluble problem in which the dark window was correct, approximately 10 to 20 percent of the animals would solve the problem. Those animals which did not solve were said to have "abnormal fixations," and although these animals did not practice the new response they did discriminate between the consistently rewarded and the consistently punished windows by responding faster to the rewarded window.

Maier (1949, p. 77) states that abnormal fixations are responses characterized "...(a) by the tendency to be repeated over and over without variation and (b) by the property of possessing a degree of resistance to change that is not found in a learned response."

Thus far the only means which have been successful in reducing the numbers of fixations is manual guidance, whereby the animal is systematically forced to make a response to the non-preferred position or symbol. Also, ECS applied immediately

after the insoluble problem trials reduces the tendency to form fixations in subsequent problems (Feldman and Neet, 1960; Liberson, et al, 1958).

Attempts have been made to account for abnormal fixations in terms of anxiety reduction (Farber, 1948; Mowrer, 1950). However, Maier and Ellen (1951) reject this hypothesis on the grounds that it fails to explain all the data. On the other hand, Maier (1949) acknowledged the importance of anxiety in the situation.

This study was an attempt to evaluate the effects of dextroamphetamine sulfate (Dexedrine) on abnormal fixations and to manipulate fear and anxiety which are assumed to accompany the insoluble problem and contribute to the formation of fixations.

Dexedrine

Studying the effects of tranquilizing drugs on abnormal fixations, Liberson, Feldman, and Ellen (1958) have found it possible to evaluate the drugs with respect to: 1) motor behavior, 2) perception, 3) learning, 4) avoidance reactions and 5) escape reactions in addition to evaluating the drugs in terms of their ability to alter fixations or reduce them in number. Thus far they report that there has been no success in preventing or modifying fixated behavior with either Chlorpromazine, Reserpine, Meprobamate, or Phenobarbital.

Clinically, much work has been done on substances

closely related to Dexedrine such as Benzedrine and the barbiturates. For example, Myerson (1947) postulated the existence of sleeping and waking mechanisms, the impairment of which accounts for depressive states. When he administered sodium barbiturate in conjunction with some of the bromides, some patients seemed to get relief from these depressive states.

Wilbur et al (1937) administered Benzedrine orally to 100 patients who were diagnosed into three categories: chronic exhaustion, depression, and psycho-neurosis. The drug gave relief from the symptoms in approximately 80, 70, and 46 percent of the cases respectively. Continued administration of the drug was found to be less favorable in that only about 50 percent of the chronic exhaustion and 25 percent of the depressive patients continued to find relief.

In a study by Prinzmetal and Bloomberg (1935), nine patients who had narcolepsy were studied, seven of whom also had cataplexy. Drugs were administered orally in aqueous solution and at a dosage of 10 to 40 mgm. per day. A record was kept of the number and duration of sleep attacks as well as attacks of cataplexy. Each patient was given physiological saline for three to seven days to establish a level of number and duration of sleep attacks and then started on the drugs. First the patients underwent "several days" of treatment at various dosages of Benzedrine. This was followed by "several days" of ephedrine and then more Benzedrine. When ephedrine was administered there was only diminution of sleep attacks,

but in all instances, when Benzedrine was given in sufficient dosages, there was complete relief from the attacks of sleep, and complete relief from cataplexy. There was no noticeable diminution of effectiveness over long periods of time.

Several studies have also been carried out to determine the effect of Benzedrine on learning. Andrews (1940) gave Benzedrine to 20 naive volunteers who subsequently underwent a test of syllogistic reasoning. He found no significant differences between drug and control conditions in terms of accuracy, time, or power scores. There was, however, a small consistent difference in favor of the drug. He felt that had he given a greater dosage (he gave 10 mgm.) and allowed a greater length of time for the drug to take effect (he allowed 1/2 hour), he might have obtained significant results.

Minkowsky (1939) found the reverse to be the case when rats were given Benzedrine. In learning to traverse a Stone maze, drugged animals made significantly more errors than their controls. When the experimental animals were injected with saline instead of the drug, the number of errors decreased, when given Benzedrine again the errors increased. Methodologically, these results are difficult to interpret since only the experimental animals received an injection, which was administered subcutaneously at the back of the neck, just 15 minutes before the animals were given the one daily trial. It is possible, for the type of injection given, that the experimental animals were run too soon after the injection, thus

giving the drug an inadequate time to take effect.

Brady (1956) (1957) reports a study of the effects of amphetamine on the CER (conditioned emotional response) superimposed on a stable bar pressing response. In control animals (saline injections) there is an inflection (decrease in rate) in the cumulative record when the CS for the CER is presented. In animals given amphetamine there is a greater inflection, due mainly to a marked increase in bar pressing (greater than 100 percent for a dose of 2 mg/kg) during the CS-off period while there was only slight reduction (as compared to controls) in the CS-on period.

In the studies cited above, Benzedrine was the principal drug used and not Dexedrine, which is the drug used in this study. However, as is noted in a manual on Dexedrine prepared by the Smith, Kline and French Laboratories (1959), "A comparison (of Dexedrine) with closely related 'Benzedrine' showed that, while the peripheral effects of the two agents remain equal, milligram for milligram, the central nervous system activity of 'Dexedrine' is 1-1/2 to 2 times as pronounced." Then the manual suggests that if the dosage is halved to obtain the same effect centrally, the peripheral effects will be halved. This indicates that Dexedrine should give comparable results to those obtained in the Benzedrine studies cited, but reduce peripheral effects.

Orderly Punishment

In a study by Maier and Klee (1943) one of the variables in the frustration situation found to be of great importance was punishment. To avoid describing a lengthy and involved procedure, it may suffice to state that the amount and pattern of punishment was found to be important to the number of fixations produced. However, in their experiment, comparisons were made between groups subjected not only to different patterns of punishment, but also to different percentages of trials on which punishment occurred.

One of the purposes of this study was to investigate the effect of the pattern of punishment with amount of punishment controlled. This could be done simply by unlocking both doors on odd-numbered trials and locking both on even-numbered trials. Thus, as in the random condition, any response that the rat makes will be rewarded half the time and punished half the time. But, in this condition if the animal learns to discriminate between punished and non-punished trials, anxiety or frustration during the insoluble problem would be reduced since punishment would not be anticipated on the non-punished trials. If this is the case one would expect fewer fixations for the orderly punishment group when compared to a group which has been given 50 percent random punishment. Data which appear to support the hypothesis are to be found in an experiment by Maier and Feldman (1948), in which animals were subjected to either 8, 16, or 24 days of insoluble problem. It was found

in the soluble problem which followed that there were fewer and weaker fixations in the 8 day group than in either the 16 or 24 day groups. There were no significant differences between the 16 and 24 day groups. These results suggest that fixations would become fewer and weaker as the frustration and anxiety were reduced.

The foregoing observations led to the following suggestions: In the studies cited above, Benzedrine was found to be successful in relieving the symptoms of depressions and schizophrenic-like states, and other studies (Ivy and Krasno, 1941) report that Dexedrine produces a state of euphoria in the subject. If this euphoric state were to counteract the frustration or anxiety produced in the insoluble problem and in the initial phases of the soluble problem, then it would be expected to lead to a reduction in the strength and number of fixations. Working on this hypothesis, it was necessary to give the drug throughout the insoluble and soluble problems.

Orderly punishment as compared to random punishment was expected to give rise to fewer and weaker fixations, owing to a hypothesized reduction in fear and anxiety.

Specifically the hypotheses were these:

1. If the feeling of euphoria produced by the drug does reduce anxiety produced in the frustration situation, and if the orderly punishment also reduces this anxiety, it may be expected that the four groups of animals would order themselves in the following way

in terms of numbers of fixations:

Orderly-drug $<$ Orderly-saline $\lessgtr$ Random-drug $<$ Random-saline.

2. If anxiety is reduced by the drug and by orderly punishment, then there may be expected an impairment of the avoidance response to grid shock as shown by increased latencies to the negative (bright) window during learning.
3. For the orderly punishment groups, if discrimination between punished and non-punished trials reduces anxiety or frustration in the insoluble problem then there should be fewer fixations among those animals that do make the discrimination.

Two experiments will be reported, the second a replication of the first with the exception of one minor change. This replication was felt desirable in view of the fact that in the first experiment many of the animals developed discrimination stereotypes, thus eliminating them from most of the comparisons and reducing the cell N.

Experiment I

Method

Subjects. Forty male albino rats of the Sprague-Dawley strain, 60 to 75 days old at the start of the experiment, were used. They were housed in individual cages and allowed free access to water. Upon finishing the daily trials, the animals were

returned to the home cage and given approximately 45 grams of food. The food cups were withdrawn from the animals three hours after the last animal in the group was run and returned to its home cage.

Apparatus. The apparatus used was a semi-automatically controlled modified Lashley jumping stand similar to that described by Feldman (1948). The principal features of this device are: translucent windows which can be lock or unlocked and can be differentially illuminated, bright or dark; an electrifiable grid from which the animal jumps, placed directly in front of the two windows, and a food platform on which the animal received food reward following a jump to the unlocked window. A response to a window which was locked caused the rat to bump against the window and fall to a net 39 inches below. The grid shock was supplied by an Applegate #228 stimulator and scrambled with a Foringer #1155 scrambler. The initial shock intensity was .350 ma. and after 60 seconds was .700 ma. A 60 watt bulb directly in front of the jumping stand was the sole illumination, other than that provided by the bright window.

Procedure

Preliminary Training. Subjects received their daily ration on the feeding platform for three days thus allowing them to become familiar with the apparatus. Following this, they were given 10 trials per day of jumping from the grid to the windows. The grid was first placed at a distance of 3-1/2

inches from the windows and then moved back one inch per day until the animals were jumping 8-1/2 inches to fully closed but unlocked windows. In order to minimize position preferences a clear plastic barrier was used to guide the animals to alternate sides on successive trials. The bright and dark windows were also alternated in a balanced order to minimize symbol preferences.

Preference Trials. On completion of the above training, animals were given 10 trials per day for four days to assess the preferences they might have before starting the first problem. The bright and dark windows, neither of which was locked, appeared on either side an equal number of times in a preset random order. If the rat failed to respond within the allotted 30 seconds, grid shock was applied to force a response. If a consistent response to a position or window occurred on three successive trials, the animal was guided to the opposite position or window on the following trial. Latencies were recorded for each trial. The animals were then divided into four groups which were equated in terms of preference and latency: Random-Saline (R-S), Orderly-Drug (O-D), Random-Drug (R-D), and Orderly-Saline (O-S). The groups were run in the stated order since it was balanced for the drug-saline condition.

Insoluble Problem. With the beginning of the insoluble problem injections of drug or saline were begun and continued for the remainder of the experiment. One half-hour before being run, the experimental subjects were injected

intraperitoneally with 1.75 mg/kg of Dexedrine. Since the concentration of drug was 1.75 mg/cc, each experimental subject was given some fraction of a cc. according to body weight and control subjects were given an equivalent volume of saline.

In the random insoluble problem bright and dark windows were alternated from side to side in a set random order and locked in a set random order, thus any consistent response was punished 50 percent of the time and rewarded 50 percent of the time. In the orderly insoluble problem the bright and dark windows were alternated from side to side in the same preset random order, but both windows were unlocked on odd-numbered trials and locked on even-numbered trials. Thus any given response was punished 50 percent of the time and rewarded 50 percent of the time but in an orderly sequence.

In both of these cases, as in the preference trials, if a response did not occur before 30 seconds, grid shock was applied to force a response.

Soluble Problem. Following the insoluble problem, all groups were presented with a soluble one in which the dark window was rewarded (unlocked) 100 percent of the time and the bright window was punished (locked) 100 percent of the time (except for rats with dark stereotypes, in which case the reward-punishment contingencies were reversed). As before the bright and dark windows were alternated in a preset random order and the grid charged at the end of 30 seconds. The criterion for solving the problem was 3 days (10 trials per day) with not more than

one error.

Results

Insoluble Problem. Of the 34 animals that completed the experiment, 19 formed position stereotypes and 15 formed discrimination stereotypes. Since animals which develop a discrimination stereotype receive 100 percent punishment when introduced to the soluble problem, they are not comparable to the position animals (Maier and Klee, 1943) and this difference must be treated as another variable in analysis.

It was expected that animals that discriminated between open and closed windows in the insoluble problem would subsequently solve the soluble problem. A test of this hypothesis comparing the insoluble problem latency data of solvers and nonsolvers, using analysis of variance techniques, seemed ill-advised since the number of animals solving the soluble problem was small (4 out of 15).

It was decided, rather, that this analysis should be done on the combined data of the two experiments since the second experiment was a replication of the first with the exception of only a change in room illumination. Also, there was no reason to expect that the decreased contrast between bright and dark windows in the second experiment would influence the number of solutions of the soluble problem following discrimination between open and closed windows in the insoluble problem phase. Thus, only the figure for the combined results will be

presented following the results of Experiment II.

Soluble Problem. Table 1 shows the number of solutions that appeared in the various groups as well as the distribution of solutions among position and discrimination stereotypes. It will be noted that the numbers solving are fairly evenly distributed among the groups and using Myers' exact probability technique (1958), comparisons made in terms of the number of fixations did not reveal any significant differences between drug and saline or orderly and random conditions. In fact, in terms of the dependent variable considered, none of the effects tested were significant. Not only were the differences between groups insignificant, but also the ordering of the groups predicted in terms of a hypothesis of reduction in anxiety was not upheld. The percent of fixations for each group showed the ordering to be

$$OD < RS < OS \overset{<}{=} RD$$

instead of

$$OD < OS \overset{\leq}{=} RD < RS.$$

Next are the results of latency analysis. The reason for this type of analysis is that it shows not only the response time under different conditions (e.g., drug vs. saline injection), but it also reveals the rate of acquisition of the differential response to positive and negative windows and hence reveals a learning rate.

Presented in Figures 1 and 2 are the latency data of responses to positive and negative windows for drug and

Table 1

Number of Animals Solving or Not Solving, and the Distribution of Position and Discrimination Stereotypes within each Group

	Drug				Saline			
	Orderly		Random		Orderly		Random	
	Disc.	Posn.	Disc.	Posn.	Disc.	Posn.	Disc.	Posn.
Solved	1	2	1	0	1	0	0	2
Did not solve	1	4	3	5	4	2	4	4

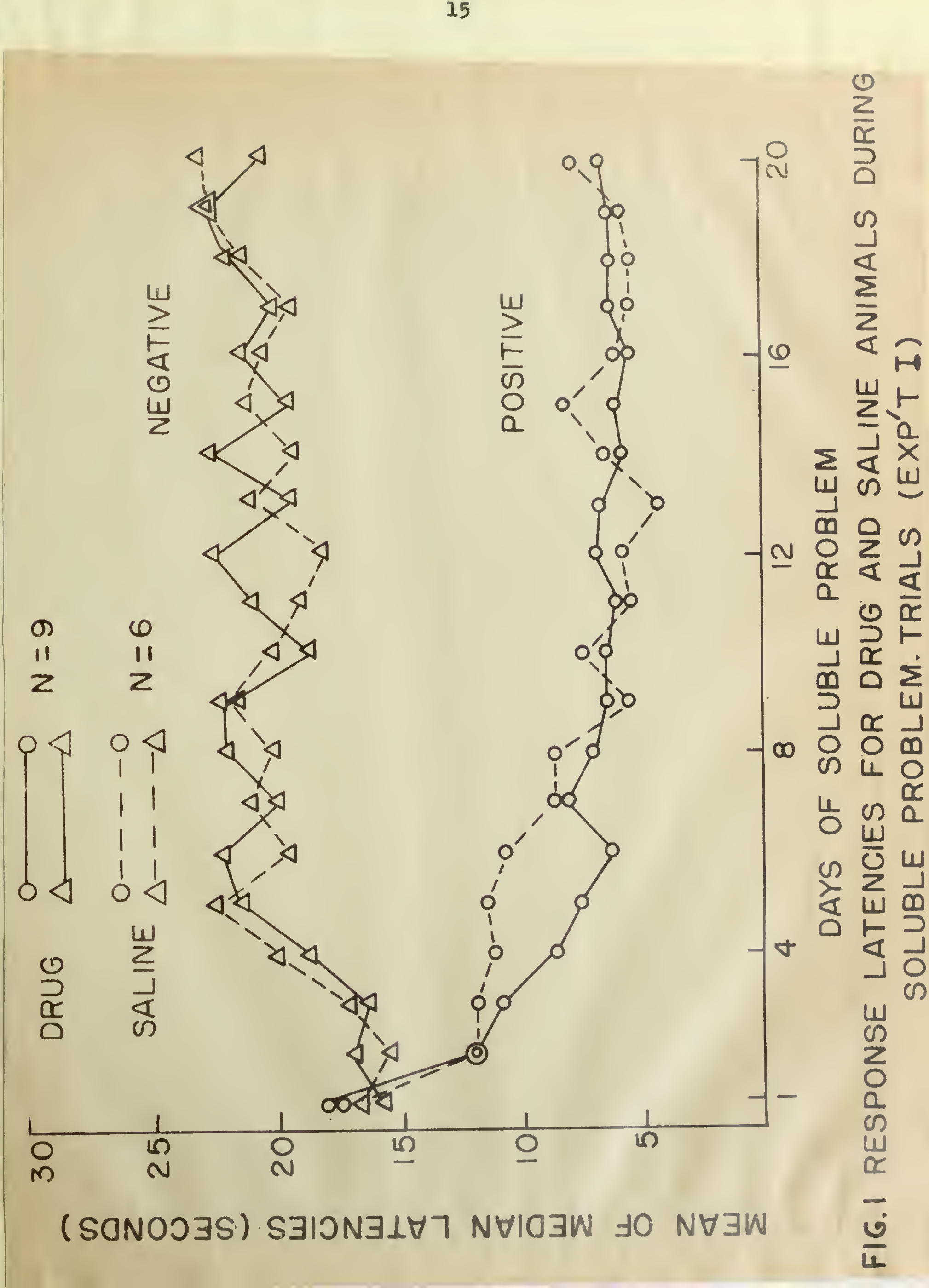

FIG. 1 RESPONSE LATENCIES FOR DRUG AND SALINE ANIMALS DURING SOLUBLE PROBLEM-TRIALS (EXP'T I)

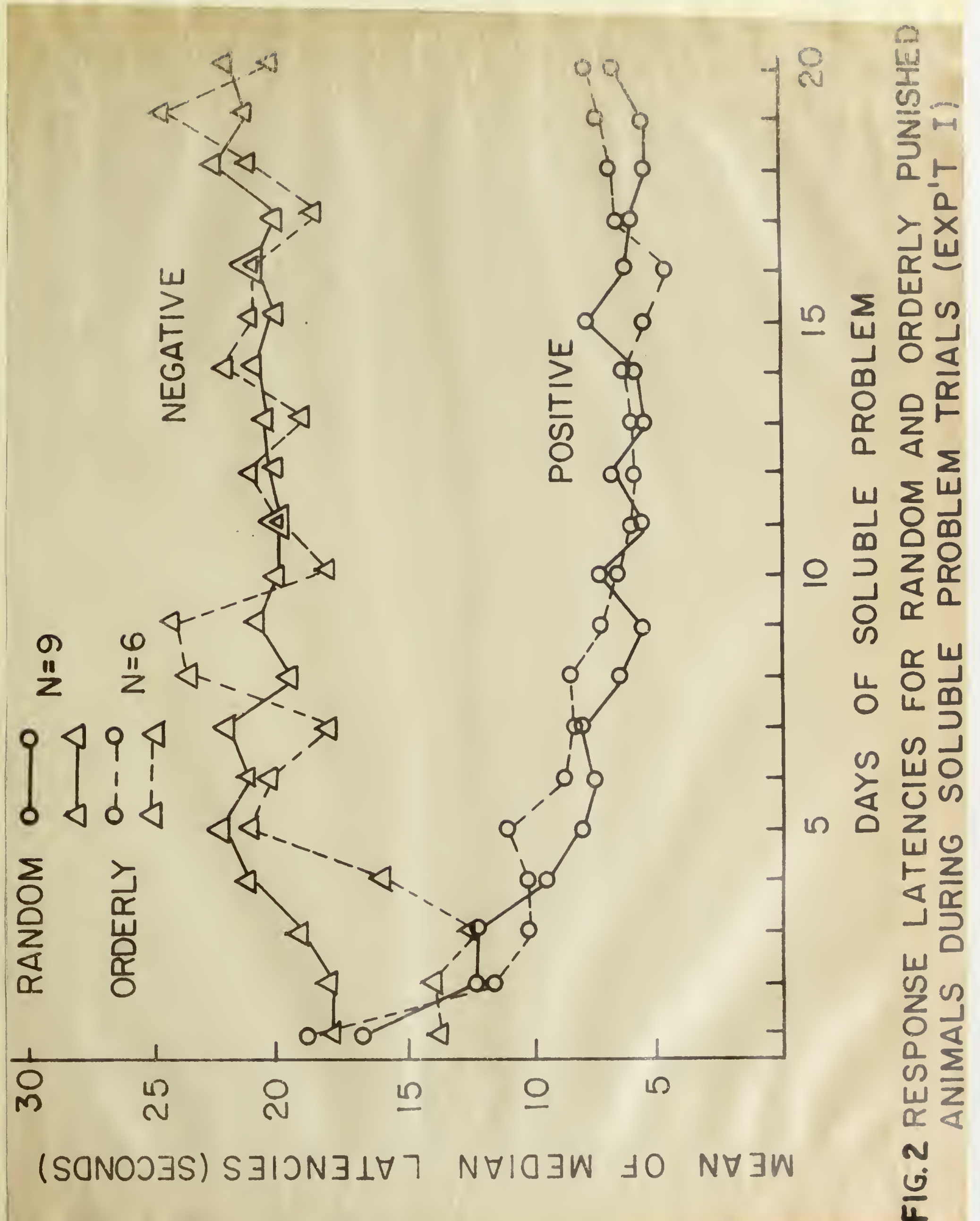

FIG. 2 RESPONSE LATENCIES FOR RANDOM AND ORDERLY PUNISHED ANIMALS DURING SOLUBLE PROBLEM TRIALS (EXP'T I)

punishment conditions respectively. In order to make statements about the significance of such results it would be desirable to do an analysis of variance on the data. However, such an analysis was not done since the small number of position stereotypes destroyed the proportionality of cell N. Even if the disproportionality were corrected for, the cell N would be decreased to such an extent that the reliability of an analysis of variance of the latency measures would be placed very much in doubt. However, even if statements of significance cannot be made, visual inspection of Figures 1 and 2 indicate that the prior drug or punishment conditions yielded virtually no differences in differential latency.

Experiment II

Method

Subjects. Thirty male albino rats of the Sprague-Dawley strain, 60 to 75 days old at the start of the experiment were used. They were housed and maintained in the same way as described in Experiment I.

Apparatus and Procedure. The apparatus and procedure were the same as described in Experiment I with the exception that a 100 watt light bulb was substituted for the 60 watt one illuminating the front of the jumping stand. This was done to reduce the contrast between the "bright" and "dark" windows in the hope of reducing the number of discrimination stereotypes which occur in the insoluble problem stage.

Results

Insoluble Problem. Increasing the room illumination proved successful since the percentage of discrimination stereotypes was reduced from 44 percent in the first experiment to 10 percent in the second.

As in the first experiment, the number of orderly punished animals that subsequently solved the soluble problem in Experiment II was so small (3 out of 15) as to again cast doubt on the efficacy of an analysis of variance for this experiment alone. The pooled data of both experiments are shown in Figure 3 and the analysis of variance results presented in Table 2. The results show that the animals did learn to discriminate between open and closed windows ($p < .001$) and in particular the animals that solved the soluble problem showed greater differential latency to the windows than did those that did not subsequently solve ($p < .001$).

The above analysis does not however indicate whether or not the animals which subsequently solved the soluble problem discriminated between open and closed windows sooner than did those that did not solve. To ascertain this, the last day on which an animal had a median latency to the open window equal to, or greater than the median latency to the closed window was used as a score, and a t-test indicated that animals that solved the soluble problem discriminated between open and closed windows sooner than those that did not solve ($p < .01$).

One may raise the question about how Dexedrine affects

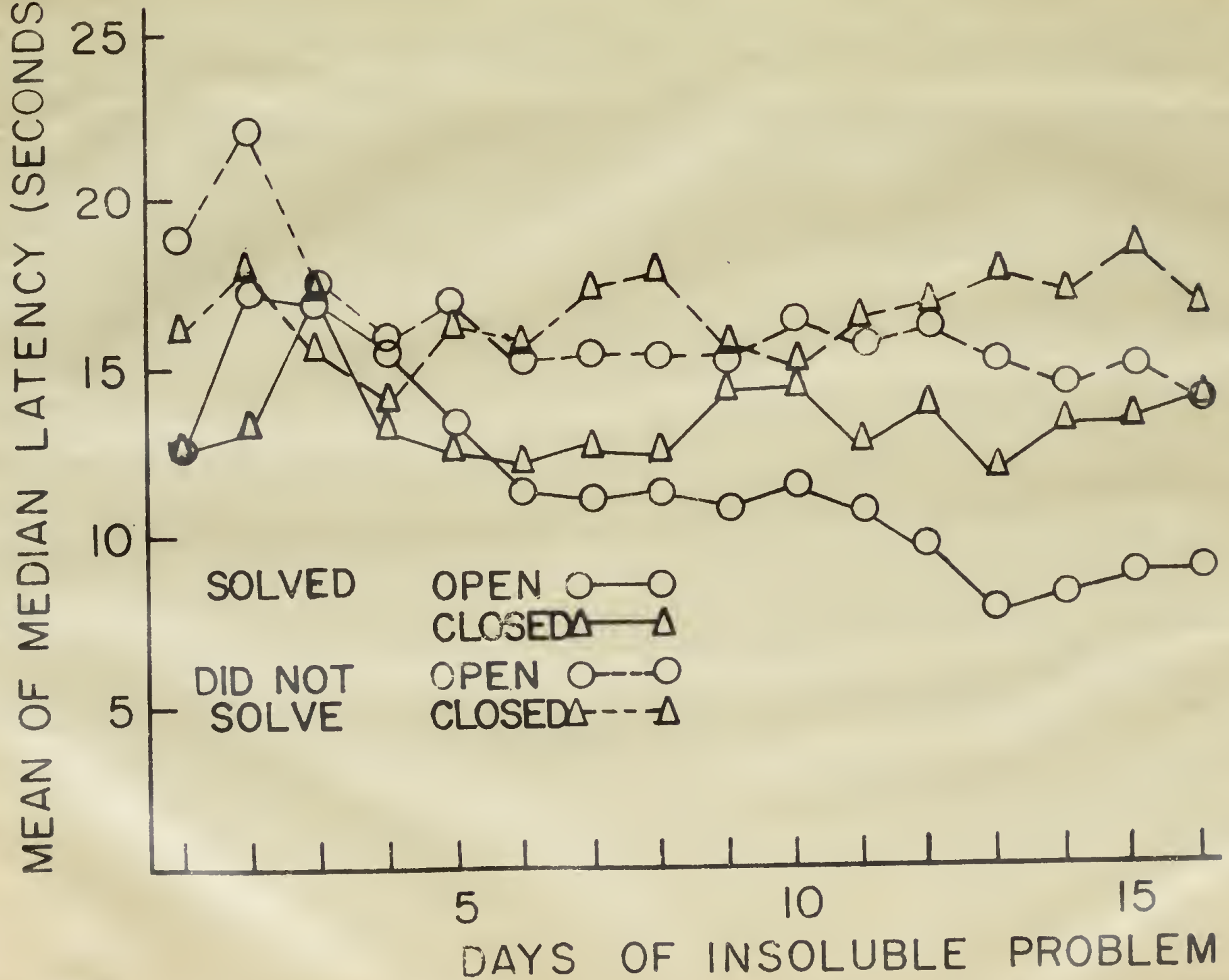

FIG. 3 DATA FROM BOTH EXPERIMENTS SHOWING LATENCY OF RESPONSE FOR ORDERLY PUNISHED ANIMALS TO OPEN AND CLOSED WINDOWS

Table 2

Analysis of Variance for Pooled Data of Insoluble Problem

SV	df	SS	MS	F
Between S's	28	896,227.31		
S (solution)	1	72,462.14	72,462.14	2.375*
error	27	823,765.17	30,509.82	
Within S's	899	941,484.97		
W (O or C)	1	20,985.53	20,985.53	18.966***
T (days)	15	44,872.64	2,991.51	2.238**
WT	15	45,857.55	3,057.17	6.193***
SW	1	15,920.24	15,920.24	14.388***
ST	15	32,042.84	2,136.19	1.598
SWT	15	10,582.68	705.51	1.429
S's x W/S	27	29,874.63	1,105.47	
S's x T/S	405	541,436.99	1,336.88	
S's x WT/S	405	199,911.87	493.61	

* $p > .10$

** $p < .01$

*** $p < .001$

activity. If the drug were to increase activity, then it might be expected that the drugged animals overall latency in the insoluble problem would be decreased compared to that of saline animals. Figure 4 shows the mean of median latencies for randomly punished drug and saline animals. Comparing the mean latency of drugged animals during the 16 days of insoluble problem with that of the saline animals, a t-test showed that the difference was insignificant ($p = .10$).

Soluble Problem. Table 3 shows the number of solutions that occurred in each group and as in the previous experiment, comparisons made in terms of Myers' exact probability technique were not significant although the ordering of groups for this experiment in terms of fixations was as predicted, except for the equality of orderly-drug and random-drug conditions:

$$OD = RD < OS < RS.$$

Analyzing the response latencies, an analysis of variance was done using the reciprocal of daily median latency for each of the animals and the results are presented in Table 4. The analysis showed the following:

The overall latency for drugged animals was lower than that for their saline controls (see Figure 5). In addition, the differential latencies to bright and dark windows was greater for the drugged animals. A Tukey-gap test was done in order to determine the significant gaps between the means for differential reciprocal latencies. This test showed that all

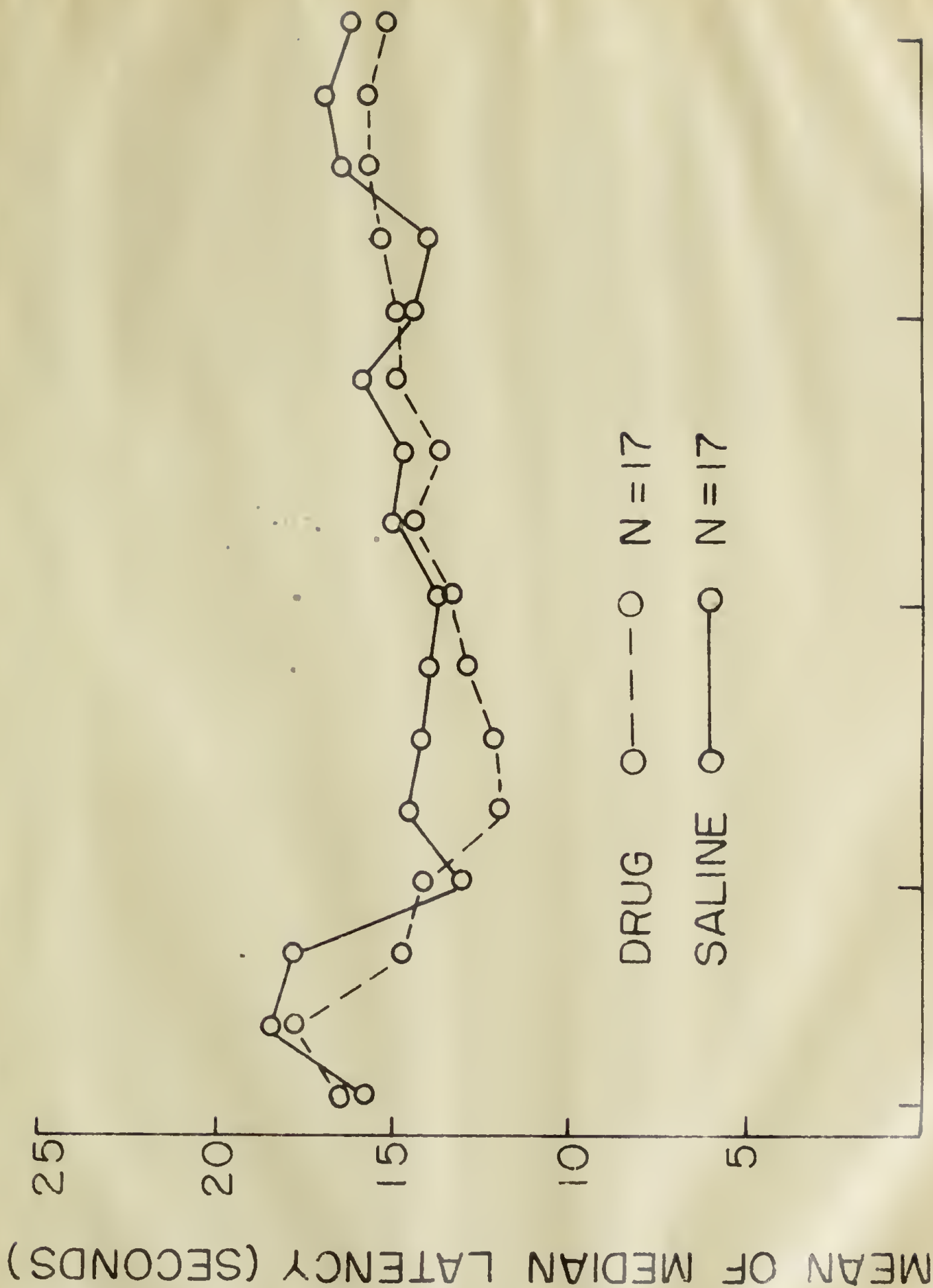

FIG. 4 RESPONSE LATENCIES FOR RANDOMLY PUNISHED DRUG AND SALINE ANIMALS DURING THE INSOLUBLE PROBLEM

Table 3

Number of Animals Solving or Not Solving, and the Distribution of Position and Discrimination Stereotypes within each Group

	Drug				Saline			
	Orderly		Random		Orderly		Random	
	Disc.	Posn.	Disc.	Posn.	Disc.	Posn.	Disc.	Posn.
Solved	0	2	0	2	0	1	0	0
Did not solve	0	6	0	6	1	5	2	5

Table 4

Analysis of Variance for Soluble Problem: Experiment II

Source	df	SS	MS	F
Between S's	21	1,042,780.74		
D (Drugs)	1	205,160.00	205,160.00	4.740*
P (Punish.)	1	1,182.27	1,182.27	-
DP	1	57,327.41	57,327.41	-
error	18	779,111.06	43,283.95	
Within S's	858	2,514,472.70		
W (Windows)	1	733,947.04	733,947.04	72.060***
T (Days)	19	143,293.66	7,541.77	5.000***
WT	19	304,238.74	16,012.57	15.601***
DW	1	91,119.26	91,119.26	8.946**
DT	19	56,376.55	2,967.19	1.968*
PW	1	2,019.95	2,019.55	-
PT	19	22,274.69	1,172.35	-
DWT	19	60,314.81	3,174.46	3.094***
PWT	19	13,624.54	717.08	-
DPW	1	6,974.37	6,974.37	-
DPT	19	18,446.68	970.88	-
DPWT	19	11,898.90	626.26	-
S's x W/DP	18	183,344.68	10,185.82	
S's x T/DP	342	515,664.82	1,507.79	
S's x WT/DP	342	350,934.01	1,026.12	

* $p < .05$

** $p < .01$

*** $p < .001$

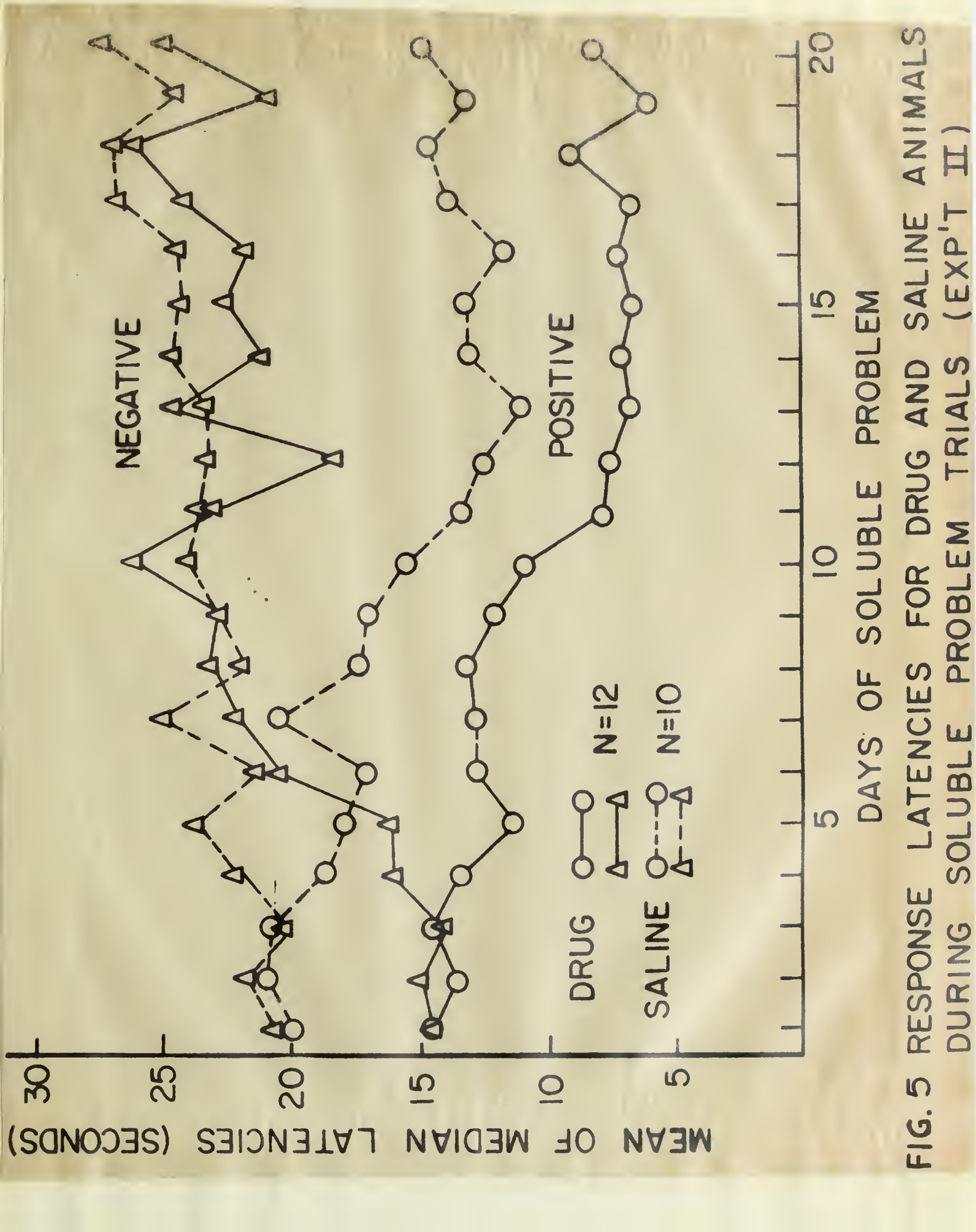

FIG. 5 RESPONSE LATENCIES FOR DRUG AND SALINE ANIMALS DURING SOLUBLE PROBLEM TRIALS (EXP'T II)

gaps were significant with the exception of the one between the means for response to the negative window for both groups.

The significant DWT interaction ($p < .001$) (see Table 4) indicates that the drugged animals learn to discriminate between the positive and negative windows more quickly than do the saline controls.

As in the first experiment, there were no effects upon response latency which might be ascribed to orderly punishment (see Figure 6). Apparently the random and orderly patterns of punishment are equivalent in their effects on the subsequent learning situation.

To complete the analysis the soluble problem data of the two experiments were combined, disproportionality corrected for, and another analysis of variance done. The results indicated that the only effects which proved significant were windows (positive or negative), trials, and the interaction of windows and trials. All other effects due to the drug condition which were significant in the second experiment, were "cancelled out" when the data of the first were added, evidently due to the increased variability in response latency of saline animals when the two sets of data were pooled.

It should be noted that the increased room illumination in Experiment II resulted in an increase in the number of trials needed for the subjects of the second experiment to discriminate between positive and negative windows. Using the last day, plus 1, on which a subject's median latency to the

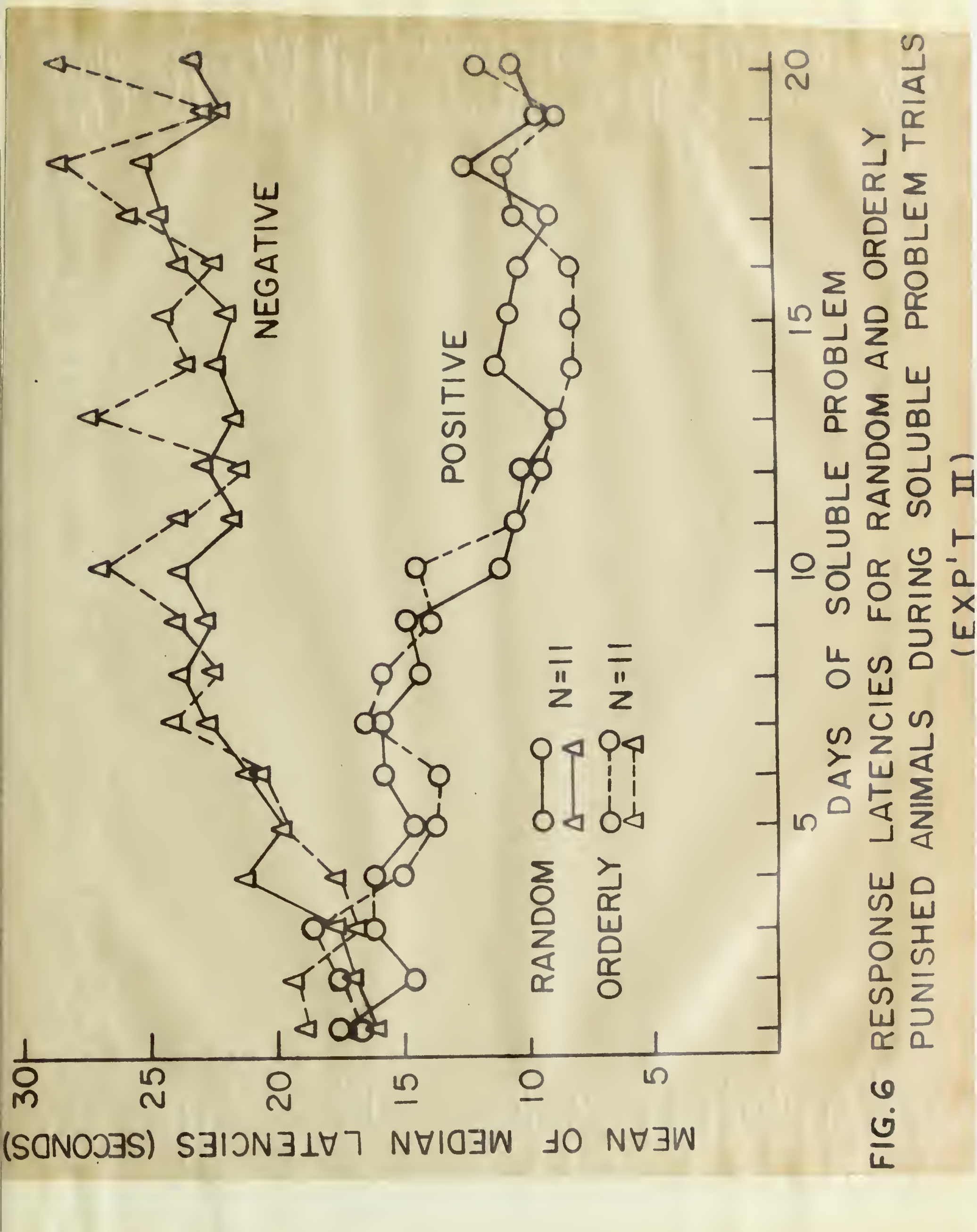

FIG. 6 RESPONSE LATENCIES FOR PUNISHED ANIMALS DURING

positive stimulus was equal to or greater than that to the negative stimulus as a score, a t-test showed that this difference was significant ($p < .01$). This indicates that the increase in room illumination in the second experiment did make the positive and negative stimuli less discriminable.

Discussion

The question arises as to how adequately the anxiety reduction hypothesis, put forward at the beginning of this paper, accounts for the results of these experiments. Apart from an insignificantly greater number of solutions in the soluble problem phase for drugged animals, there is no evidence to suggest that Dexedrine reduced the anxiety produced by the insoluble problem. If there were such a reduction in anxiety, one might also expect a greater latency to the negative window for drugged animals that failed to solve than for saline controls. The reason for this expectation is that animals which do not respond before 30 seconds are shocked on the jumping stand, thus responses which do occur before this interval may be looked upon as avoidance responses (Liberson et al, 1958). Avoidance responses in turn may be thought of as mediated by anxiety, so that any reduction in anxiety would result in a greater latency. Although there was a tendency for drugged animals to respond sooner to the negative window than the saline controls, this difference was insignificant.

Orderly punishment, as compared to random punishment,

did not decrease the numbers of fixations nor alter the latency of response to positive or negative windows in the soluble problem. The only data which appear on the surface to support the hypothesis of anxiety reduction are those which showed that subjects which discriminated between open and closed windows early in the insoluble problem subsequently solved the soluble problem. That there is no decrease in the number of fixations for the orderly punished animals indicates that those animals which make the discrimination between open and closed windows come from the same population as those that would solve the soluble problem in any case. Possibly the early discrimination occurs because the latter subjects enter the insoluble problem with a lower level of anxiety or are less prone to anxiety than those which do not subsequently solve the soluble problem. Although the predicted differences between solvers and non-solvers did occur, the fact that there were not significantly fewer fixations for orderly punishment is an argument against the anxiety reduction hypothesis.

An experiment by Wenzel (1959) has shown that the drug Reserpine has a selective action on responses to negative stimuli. The latency of a bar pressing response to a tone associated with shock in avoidance conditioning became significantly slower than that of a bar pressing response for food reward (CS used was a tone of different frequency) in a series of post-injection testing sessions. If, in Brady's experiment (1956), the condition of CS-off is considered comparable to a positive

stimulus and CS-on comparable to a negative stimulus, then his results would indicate a selective action of the drug Amphetamine on responses to positive stimuli. This conclusion is drawn from the observation that Amphetamine-injected animals, when compared to saline-injected animals, showed an increase in rate of responding during CS-off and only a slight decrease in rate during the CS presentation. However, one of the difficulties of this argument is that during CS-off there is no stimulus presentation, let alone presentation of a reward for responding.

In the experiments reported here, fixated animals when they respond to the positive window are rewarded with food for jumping toward it and at the same time are avoiding shock from the grid. When the subjects respond to the negative window they are punished at the window and are also avoiding grid shock. Although this situation is not the same as that employed by Wenzel, it is comparable in that the important determiners of response to the positive and negative stimuli are the food reward and avoidance of the grid shock respectively. Wenzel stresses the point that in order to compare the positive and negative situations they must share the same responses, stimulus characteristics, post-injection test times, and response measures. In the frustration procedure used here all these requirements are met.

In Experiment II the apparent effect of the drug Dexedrine is to decrease the latency to the positive stimulus.

However, a closer inspection of the data, comparing latencies over the last 5 days of soluble problem (see Figure 3), shows that this is not the whole story. The mean of median latency to the negative stimulus for the last five days of Experiment I and Experiment II was 21.3 seconds and 23.3 seconds respectively for drugged animals and 21.5 and 25.8 seconds respectively for saline animals. It is unlikely that any of these means are significantly different since the Tukey-gap test done on Experiment II data did not show a significant gap between mean reciprocal latencies to the negative window for drugged and saline animals. The data for mean latencies to the positive window for Experiment I showed that drugged and saline animals responded equally as quickly, the means being 6.3 and 6.0 seconds respectively. In the second experiment the drugged animals also responded at much the same latency (mean = 7.3 seconds), while the saline animals were slower (13.6 seconds).

These data indicate that when the contrast between positive and negative stimuli is reduced (i.e., stimuli less discriminable) the drug <u>maintains</u> the asymptotic latency to the positive window at the same level as that under conditions of greater contrast. Saline animals, on the other hand, show an increase in latency when the contrast between positive and negative stimuli is reduced.

The question now arises as to whether or not these results can be explained simply in terms of increased activity on the part of the drugged subjects. An experiment by

Teitelbaum and Derks (1958), using rate of responding in a forced drinking situation (to avoid shock) as a measure would certainly seem to indicate this. They found that regardless of the schedule which would produce the greater delay in shock onset, the rats, after having been injected with amphetamine, responded with an extremely high rate of licking. However, the authors reject the hypothesis of increase in activity and postulate that the effects of amphetamines are due to increased emotionality. To support their hypothesis they cite experiments in which the effects of the amphetamines were counteracted by Chlorpromazine, assuming that Chlorpromazine acts to reduce emotionality.

If the amphetamines do increase emotionality, then one would expect that the avoidance latencies to the negative window would be decreased. This is not the case for the experiments reported here nor does such an effect occur in Brady's (1956) experiment. With respect to the activity hypothesis it must be remembered that such a hypothesis must <u>also</u> account for the failure of drugged animals to respond more quickly to the negative window than do the saline controls. In addition, the combined data for the insoluble problem indicate that drugged animals do not respond with a lower latency than saline injected animals.

The results of these experiments confirm the hypothesis put forward by Andrews (1940) that the drug would be effective in increasing performance. Although Andrews' results were not

significant he suggested that had he given a greater dosage of the drug, significant results might have been obtained (as mentioned earlier, p. 4). However, the results of the experiments reported here indicate that difficulty of task may have been the important variable rather than, or in addition to, the dosage. Difficulty of task in the frustration situation may be defined in terms of the degree of contrast between positive and negative stimuli, i.e., low contrast would produce a difficult task relative to a higher degree of contrast. It was seen in Experiment II where contrast was low (with respect to Experiment I), that drugged animals discriminated between positive and negative windows more quickly than saline animals.

This evidence suggests that if Andrews had used more difficult problems, more difficult to the degree that the performance of non-drugged subjects was decreased below that on less difficult problems, then the drug would have had a significant effect. The assumption is that decrease in performance with increased difficulty is nonlinear and that at a certain point of difficulty performance falls off very rapidly. It is at just this point that the drug very likely has its most pronounced effect in increasing the speed of discrimination.

In Minkowsky's experiment (1939) the measure of learning was the number of errors. Although a measure of learning in the experiments reported here was not errors but latencies, one may infer from the failure of the drug to produce significantly fewer fixations, that Dexedrine does not, under the

conditions used here, increase errors. If errors were increased by the drug then it should produce variability in the drugged animals during the insoluble problem and hence increase the likelihood of solving the soluble problem. Also, in Andrews' experiment accuracy scores indicated a tendency for the drugged subjects to be more accurate than the placebo group. Inferences and indicated tendencies, however, are not equivalent to results and until further research is done these seemingly disparate results must remain unexplained.

Summary

A total of 72 rats in two experiments were run through the Maier frustration procedure. The difference between the two experiments was a change of room illumination which in the second experiment reduced the contrast between "bright" and "dark" windows.

Two other variables were manipulated: punishment in the insoluble problem, random or orderly, and injections throughout both the insoluble problem and the soluble problem, Dexedrine or saline. Thus in each experiment there were four groups of animals: random-drug, orderly-drug, random-saline, and orderly-saline.

It was hypothesized that under both conditions (drug administration and orderly punishment) there would be a reduction in the anxiety provoked by the insoluble problem and as a consequence there would be fewer fixations in both conditions

as well as a reduction in avoidance reactions for the drug.

These hypotheses were not upheld since there were no differences in numbers of fixations. Nor was there any difference in avoidance latencies between experimental groups and controls.

The reduction in contrast in the second experiment did produce a more difficult problem. As a result of this increased difficulty saline-injected animals showed a reduction in differential latency (as compared to the same group in the first experiment) while drugged animals performed at about the same level as those in the less difficult problem.

A further effect of the drug was to produce, in the more difficult discrimination problem, a quicker discrimination between the positive and negative windows.

Another hypothesis based on anxiety reduction predicted that animals that discriminated between open and closed windows in orderly punishment would most likely solve the soluble problem. This difference was significant, but since there were not significantly more solutions for orderly punishment it could only be concluded that the effect was not due to anxiety reduction intrinsic to orderly presentation of punishment. It was concluded that animals that made the discrimination came from the same population of animals as those which solved the soluble problem under conditions of random punishment.

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Approved by:

Robert S. Feldman per Claude C. Neet

Claude C. Neet

Jerome L. Myers

David A. Feigh

John G Moner

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