# The effect of chlorpromazine on survival motivated escape response

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*The purpose of the study was to determine whether the escape response in a survival situation might not be modified in some way by moderate dosages of CPZ. The procedure used provided two measures, swimming time and success or failure in escaping from a submerged linear runway whose exit was blocked by an oncoming opponent. Three drug levels were selected: 1.0, 2.5, and 4.0 mg/kg CPZ. Measured on the variable of success in the escape situation, the escape response was altered by the administration of CPZ. Measured on the variable of swimming time, the escape response was not altered by the administration of CPZ.*

Courvoisier, Fournel, Ducrot, Kolsky, & Koetschet (1953) first described the differential effect of chlorpromazine (CPZ) on the conditioned avoidance response (CAR). In general, at moderate dose levels, the phenothiazine derivatives have been shown to suppress the conditioned avoidance response while leaving the escape response (ER) intact (Gollub & Brady, 1965). For example, Verhave, Owen, & Slater (1958) using CPZ, 1.5 mg/kg SC, found a 65% loss of avoidance responses with 0% loss of escape responses. At 2.5 mg/kg SC, the losses were 84% and 1%, respectively, and at 4 mg/kg SC, the losses were 97% and 8%. Hughes & Kopman (1960) found unimpaired escape responses but significantly suppressed avoidance responses subsequent to the administration of 1 and 2 mg/kg IP of CPZ while nearly total suppression of all responses occurred at 5 mg/kg IP. It should be noted that this effect has been demonstrated over a variety of escape behaviors including fence-jumping and wheel-turning (Verhave et al, 1958), pole-climbing (Cook & Weidley, 1957), leg-flexion (Domino, Karoly, & Walker, 1963), and lever-pressing (Heise & Boff, 1962).

There appear to be several interpretations of the differential effect of CPZ on CARs and ERs. Some authors suggest that the tranquillizers in question reduce fear or anxiety (CARs) without reducing pain-motivated responses (ERs) (Gollub & Brady, 1965). Dews & Morse (1960) suggest that CPZ weakens the stimulus control of behavior. If stimuli are on a "continuum of peremptoriness," and if the administration of CPZ weakens the power of all stimuli to occasion a response, then those stimuli lowest on the continuum would become ineffective first. The conditioned avoidance stimulus would be lower on the continuum than the unconditioned avoidance stimulus and consequently would drop out first.

The present study was designed to further explore the effects of CPZ upon the escape response. More specifically, its purpose was to determine whether the ER might not be modified in some way by those moderate dosages of CPZ which appear to leave it intact. CPZ was chosen rather than any of the other phenothiazine derivatives because a larger number of studies show CPZ to leave the ER intact while inhibiting the CAR.

The procedure used was a modification of the procedure established by Uyeno & White (1967) to study the effects of social isolation on dominance in a survival situation. In that study, rats were pretrained to swim through a fully submerged tube. During the experimental trial, members of a pair of Ss (pairing was done on the basis of weight) entered opposite ends of the submerged tube simultaneously. Because of the narrowness of the tube, Ss were unable to pass each other or turn around; one rat had to back down before either could escape. The rat which backed down was scored submissive.

Uyeno and White defined their dependent variable as dominance/submission. In the usual dominance study, dominance is measured after the animals have been interacting over a period of time. In fact, there is evidence that the stability of dominance hierarchies is positively correlated with the length of time of this interaction (Schumsky & Jones, 1966). However, Uyeno and White did not consider dominance in this context. They examined only the initial encounter between two animals. It seems that their dependent variable might have been more accurately defined as success or failure in the conflict situation. The advantages of their procedure were that motivation was maintained at such a high level there could be little interference from competing stimuli and that motivation was assumed to be constant for all animals since motivation was survival.

Independent variables in the present study were drug level and sex. Three drug levels were selected: 1.0, 2.5, and 4.0 mg/kg CPZ. On the basis of the known effects of CPZ, it was felt that doses beyond 4 mg/kg would markedly inhibit the escape response and that doses less than 1.0 had not been adequately documented as suppressing avoidance behavior.

The sex variable was not expected to be significant but because of the limited information regarding CPZ under survival motivation it was considered necessary to establish whether or not it was relevant.

The hypothesis tested was that the escape response would be significantly modified by the administration of CPZ inasmuch as success in the conflict situation would decrease in frequency ($p < .05$) while the escape response as measured by swimming time would not be altered by the administration of CPZ.

## METHOD

### Subjects

The Ss were 78 six-month-old hooded rats, 38 males and 40 females, obtained from the Washington State University animal colony.

### Apparatus

For the male Ss, the apparatus consisted of a 4-ft long clear plastic tube 2½ in. inside diameter with a frame at either end into which a clear plastic start box, 7 x 4½ x 3½ in., with a sliding gate, could be fitted. Ss could be placed in the start box and then lowered into the submerged apparatus. Small holes were drilled at intervals over the entire apparatus to maintain constant water pressure and to allow air bubbles to escape. Because of the narrowness of the tube, rats were unable to turn around in it or to pass each other, although they were able to swim through it without difficulty. Apparatus for female Ss was identical except that the inside diameter of the tube was 2¼ in. since female Ss weighed less and were able to pass each other in the larger tube.

### Pretraining

On Days 1 and 2, one end of the apparatus was submerged in 1 ft of 70 deg F water. Water was maintained at this temperature throughout the experiment. The start box at the other end of the tube was completely out of the

water. Ss were placed, one at a time, into a start box and lowered into the submerged end of the apparatus; they emerged into the dry start box, were lifted out, and returned to their home cages. Two trials were given each day, separated by at least a 1-h interval. Ss were never allowed to escape from the starting point; however, no animal was submerged more than 30 sec. In cases of freezing or prolonged vacillation, the tube was raised and slanted so that the S slid the full length of the tube into the dry start box.

On Days 3 through 6, the apparatus was horizontally and completely submerged. Two trials separated by a 1-h interval were given each day. On Days 5 and 6, swimming time through the first 1 ft of the tube was measured by an electric timer, manually operated. Animals were weighed at the end of Day 5. At the end of Day 6, animals were paired on the basis of swimming time and then weight; however, animals from the same home cage were not paired with one another.

Experimental Trial

On Day 7, pairs of female rats were randomly assigned to each of three experimental groups, dose levels 1.0, 2.5, and 4.0 mg/kg. Within each level the member of the pair not receiving CPZ received a comparable volume of saline. Pairs of male rats were randomly assigned to each of three similar groups. CPZ and saline were administered intraperitoneally 1 h prior to the experimental trial. Pairs of Ss were put into the two start boxes and simultaneously submerged into the apparatus. The S that forced the other pair member back into his own start box was scored successful in the conflict situation. Swimming time was recorded for each S from entry into the tube until a point 1 ft from the entry was reached.

## RESULTS

Successful or unsuccessful responses—the S which backed down the tube to escape was defined as unsuccessful; the S which did not back down was defined as successful—were tabulated for each S receiving CPZ at each dose level. In two instances, one rat of a pair refused to leave the start box. One had received CPZ; one had received saline; both were male. No scores were tabulated for these two pair; consequently, the number of Ss receiving CPZ at levels of 4.0 and 1.0 mg/kg was reduced by one each.

Since sex differences were not significant, the data were collapsed for purposes of statistical analysis. The total of successful responses at each level of CPZ was compared with the probable total had chance been the only operating factor by the one-tailed probabilities associated with the binomial test for small samples (Siegel, 1956). Probability at each drug level was: 1.0 mg/kg, $p = .073$; 2.5 mg/kg, $p = .194$; 4.0 mg/kg, $p = .011$, CPZ Ss predominantly unsuccessful.

Differences in swimming time among female Ss were assessed by a multiple classification analysis of variance. No significance was found for Levels, Drugs, or Interaction. Swimming times for male Ss were analyzed similarly. Drugs and Interaction were not significant. F for Level was significant, $p < .05$. Swimming data were not analyzed for sex differences, since mean weight of female Ss compared to the diameter of the tube was not necessarily the same as the mean weight of male Ss compared to the diameter of the tube.

## DISCUSSION

Since this procedure is relatively new, it may be useful to discuss the difficulties encountered with it. Two major problems were discovered during an earlier pilot study and the present study was altered accordingly.

First, it is not feasible to use repeated trials for the variable of success or failure in the conflict situation, since the unsuccessful animals appear to learn to make the response of backing down on the first trial. Repeated trials could be used if only animals scored successful on the preceding trial were used to make up pair members for the subsequent trial. This, of course, would reduce N by ½ on every trial.

Second, pretraining trials may not be given successively without a substantial time interval between each one. It appeared that an avoidance-avoidance situation built up when animals swam the length of the tube, were removed from the goal box, and returned immediately to the escape situation. This was inferred from increasing vacillation within the tube over a series of consecutive trials. A time interval of 1 h between trials was adequate to reduce this.

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