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TEST FOR A LEARNED DRINKING RESPONSE:

SUPPORT FOR APPETITIVE PREPAREDNESS

BY

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TEST FOR A LEARNED DRINKING RESPONSE:
SUPPORT FOR APPETITIVE PREPAREDNESS

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ABSTRACT

Seligman, Ives, Ames and Mineka (1970a) have suggested that by the nature of the stimulus-response association in appetitive states a prepared mechanism using "mild" deprivation cues exists which will activate an appetitional resolution. Pairing of a neutral stimulus with this prepared mechanism results in a conditioned stimulus capable of eliciting the drinking response. Contrary to this hypothesis, Mowrer (1956) posited that a water deprived state induces an emotional reaction or "thirst fear." It is assumed that reduction of this stimulus may be accomplished by means of alleviating the deprived state. A conditioned external stimulus can therefore elicit the drinking response by the mediational stress stimulus.

Rats demonstrated increased water intake at zero hours water deprived in the presence of an external stimulus previously paired with an increasing motive state, one-half hour through 23 hours water deprivation. A "hi" motive state associated cue, 23 hours through 23-1/2 hours water deprived, failed to elicit a greater drinking response in zero hour deprived animals. Intake monitored at quarter hour segments for two hours revealed that "lo to hi" drive associated stimulus does not effect overall intake but induces differentiation in drinking patterns

causing a significant enhancement and then a reduction in intake amounts. These results are in agreement with Seligman *et al.* (1970a) suggesting that elicitation of the prepared mechanism will evoke a drinking response but that water regulation controls do not allow prolonged hyperdipsia.

Introduction

E. E. Anderson's (1941) "externalization of drive" concept, following Mowrer's (1939) proposed stimulus-response analysis of anxiety, created a major problem for motivational theorists. Mowrer's paper posited that anxiety was a learned source of motivation, the reduction of which reinforces new response learning. This was acceptable to both the reinforcement and drive reduction theorists. The accuracy of the anxiety analysis has been experimentally supported many times (Miller, 1948; May, 1948; Brown and Jacob, 1949) and will be discussed later. The drive externalization hypothesis was also congrous with these theorists although experimental evidence by the author appeared weak. According to Anderson, arousal of the drive mechanism by external cues was due to the satisfaction of an internal drive state "in a relatively constant external situation" (p. 207) over a period of time. Support for the acquired drive outcome of this idea has never materialized although Anderson's "externalization" has a striking similarity to appetite based secondary reinforcement.

This theoretically implied possibility of conditioning appetitive motives, however, has been subject to debate among psychologists. In part the disagreement has persisted because a clear definition of the acquired motivational construct has never been obtained. As an offshoot of the drive concept, one which has never been universally accepted or demonstrated, the ability to experimentally identify the internal variables in learned drives has almost always failed, rendering many explanations useless.

Cofer and Appley (1964) emphasized that the study of motivational processes has had to be "indirectly inferable" (p. 2) from observed events and therefore restrictive in the experimental arena. Bolles (1967) reiterates this view adding that in the absense of understanding 'internal agencies' to explain overt behavior, the "existance of an appropriate agency" (p. 8) must be hypothesized. This may offer an alibi for the retention of the thus far unsupported drive theories; but as Bolles (1967) points out, "the role of drive has in primary and secondary motivation become ever less clear" (p. 329) while the importance of stimuli and reinforcement has increased with investigation.

Brown (1961) stressed this same observation underscoring response, the product of the stimuli-reinforcement relationship, by stating that "an acquired drive is a new or altered response" (p. 139) that when evoked must result in an affected motivation. Criteria for the learned response, as a motivational character, derives from its ability to stimulate learning of a new response through the reduction of the drive. (Brown, 1961; Cofer and Appley, 1964). Thus the important issue should be demonstrating a conditional response.

Experiments designed to illustrate secondary motivation based on an aversive stimuli have been more often than not in compliance with these suggested guidelines of learned drives as indicated during the opening of this paper. The resulting acquirable drive has been labeled fear, or as in Mowrer's case, anxiety, and utilized in numerous motivational experiments.

Miller (1948) introduced electrical shock to rats in a white compartment and then allowed escape learning into an adjacent black compartment through an open doorway. With the shock terminated and the interconnecting door closed, the animals were placed back into the white box. In order to open the door and escape, the rats had to perform an instrumental response of rotating a wheel. This was successfully achieved by half of the subjects (the other half experienced freezing or crouching behavior). Miller claimed that fear was being elicited by the white compartment. He suggested that fear was a response, of the autonomic nervous system, and a stimulus because of its capabilities in evoking learning by means of "fear" reduction.

Subsequent studies by Brown and Jacobs (1949) and Brown, Kalish and Farber (1951) substantiated Miller's claims although fear reduction has been assumed and not directly substantiated.

As previously remarked, the possibility of conditioning appetitive states would appear quite good, especially in view of the success of Miller and Brown et al. Remarkably this has not become a reality, leaving one author "leadened with despair" and grateful for the editorially merciful small page allottment he received when reviewing the area (D'Amato, 1974) (p. 83). Other authors have been equally wary of the conditioned appetitive drive (Cofer and Appley, 1964; Bolles, 1967; Brown and Farber, 1968; and Deese and Hulse, 1967), independently agreeing that no experimental attempt to date can unequivocally comply with the theoretical stipulations. These same authors (Cofer and Appley, 1964; Deese and Hulse, 1967; and Bolles,

1967) posit an additional requirement, to those previously delineated, by defining a conditioned appetitive drive as a CS based on a non-aversive UCS. The reason of course being that an aversive UCS would result in a mechanism no different than that of the fear oriented acquired drives already discussed.

Cofer and Appley (1964) continue, suggesting that by the nature of conditioning consummatory drives the CS must utilize an aversive or stress state (eg. hunger or thirst). Therefore, the stress factor mediates the CS acceptance of the UCS properties and in actuality becomes the stimulus which elicits the motivational response.

Bolles (1967) and Seligman (1970b) have signified that to manipulate or recall an appetional response by means of an external cue does not convinvingly suggest an acquired appetitive drive. Instead, the CS-UCS complex may mask the mediated paradigm of CS -aversive stimulus (i.e. fear) -response (i.e. learned drinking). Indeed, this end result may still provide satisfaction for Pavolovian conditioning.

Previous investigators have found it necessary to establish a deprived state by pairing an external CS with the non-availability of the natural resolution for a bodily need (i.e. drinking, eating). Calvin, Bicknell, and Sperling (1953a) paired a distinctive cage environment with two drive strengths, 22 and one-hour food deprivation, designated as hi and low drige groups respectively. Both groups of rats underwent 24 days of training receiving 30-minute daily pairings of the CS (cage) and the appropriate drive level without the food available. Water was always available and all animals were fed after 23 hours of deprivation. Two experimental days, immediately followed training, with four trials dispersed 12 hours apart were run. All subjects, 11½ hour food deprived, were placed in the cages with food available and intake amounts were monitored for the first five and fifteen minutes after which the animals were removed. The stronger drive groups consumed a significantly greater amount of food than the weaker drive group for the first five minutes of each trial.[1] The authors offer the explanation that "the conditioning of a hunger drive may be nothing more than the conditioning of these responses (eating) to new stimuli." The fact that reinforcement would not be necessary to establish learning underscores the major difference to Anderson's or Hull's assumptions that drive reduction must be present for learning to take place. Calvin et al. point out that no possible diminution of the hunger drive could have occurred in the experimental box although apparent learned responses resulted. The inability to connect drive reduction with stimulation of the learned response obviously violates the stipulations stated by Brown, Cofer and Appley and others.

Siegel and MacDonnell (1954) failed to confirm the Calvin et al. findings by replication. The authors could "offer no explanation for the disagreement" (p. 251).

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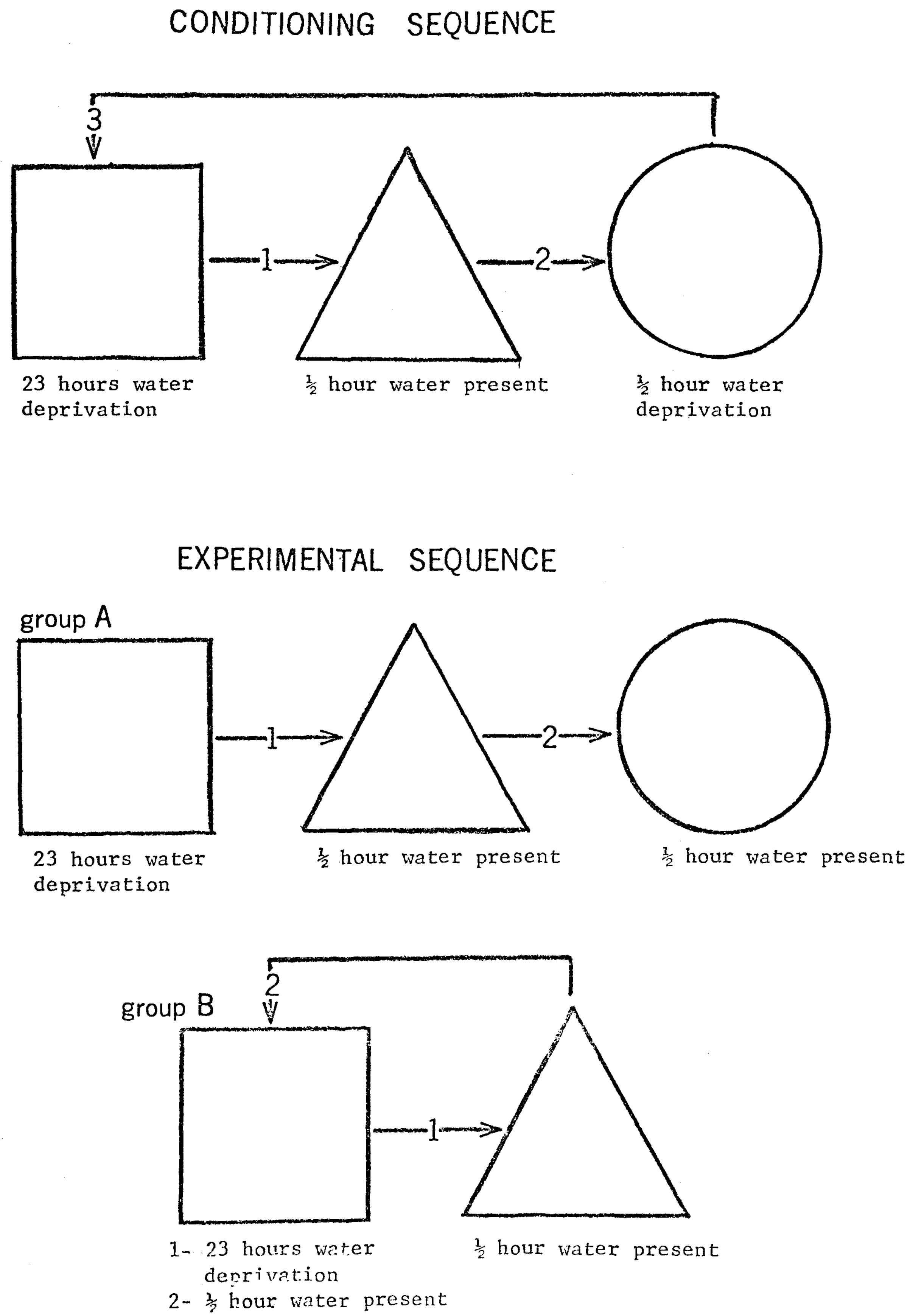
[1] It should be noted that Calvin et al. (1953b) revealed a "conditioned (p.4) satiation" (or intake suppression effect) by a group identical in procedural exposure as the controls. This may indicate an inappropriateness in that study comparisons biasing in favor of conditioned hunger.

More recently, Mowrer (1956) has cited an unpublished study by Solomon and Swanson that he claimed demonstrated "thirst fear." The drive shift analysis may best be related through the procedures and results of that investigation.

Three distinctively different cages were used each for one of the three phases of an appetitive state: high drive (deprivation), ongoing reduction (consumption) and the reduced state (satiation). Every animal experienced a 24-hour conditioning cycle spending 23 hours of water deprivation in one cage, one-half hour water availability in a second, and one-half hour of water deprivation in the final box (note figure 1). This training procedure was duplicated for 10 days. For the experimental trial, the eleventh day, all subjects were given free access to water in the appropriate cage for one-half hour after 23 hours of deprivation. One-half were then placed in the former deprivation chamber, the other half in the control or "satiation cage" and water was made available for the first time in these areas. Intake amounts were recorded for a one-half hour period. The group placed in the deprivation chamber drank significantly more than the controls. The author points out that the control group may be a biased comparison in light of the "conditioned satiation" effect eluded to by Calvin et al. (1953b). It should be noted that the results of Solomon and Swanson have been successfully replicated (Enscore, Monk, Kozub and Blick; in press). West and Kozub (1975) have also confirmed the findings using a non-biased neutral stimulus control group.

Figure 1. Conditioning and testing procedures commonly used in acquired appetitive motives (Enscore et al., in press; Solomon and Swanson, unpublished).

Figure 1


CONDITIONING SEQUENCE
3
1
2
23 hours water deprivation
½ hour water present
½ hour water deprivation
EXPERIMENTAL SEQUENCE
group A
1
2
23 hours water deprivation
½ hour water present
½ hour water present
group B
2
1
1- 23 hours water deprivation
2- ½ hour water present
½ hour water present

Mowrer explains the learning as utilization of a fear "of being thirsty," a mediating response, that relates the external cue with the internal state. It must be inferred that Mowrer intended a directive acquired drive which evokes the appropriate appetitive response.

The implication of elicited avoidance conditioning appears to solve the two questions raised by Calvin et al. First, that "thirst fear" by means of reduction, becomes a reinforcing agent for acquiring an altered respsone (drinking) that alleviates fear but is unrelated to thirst (therefore instrumental). Second, fear as conditioned to the CS and likewise associated with thirst, provides a means by which the observed CS and the drinking response can be paired.

Unfortunately, these answers promote more questions than have been solved. For instance, can the observed appetitive response be considered a conditioned response? Mowrer does not explicitly address this problem. It, therefore, remains unclear as to whether the "fear" evokes "thirst cues" which in turn stimulated an unconditioned drinking or, as has been suggested, fear of being thirsty causes a conditioned drinking response (avoidance). The latter alternative raises the question, can fear be associated with a specific stimulus, such as thirst, and if so, what reinforcement promotes this learning? Mowrer's attempt to clarify the paradigm raised the more difficult problem of identifying the nature of the learned response.

Myers and Miller (1954) emphasized the necessity of learned response to energize acquisition of new responses. An experiment which was essentially designed after Miller's previously discussed fear acquisition experiment was performed. The same compartmentalized box was used. Twenty-three hour deprived rats were placed in the white box and trained to run into the black chamber to obtain food. Four groups of rats were trained in this manner either with 0, 10, 30, or 70 trials set one per day. During the test phase, all animals were satiated and then returned to the white compartment. Now, escape could only be initiated by pressing a bar to open the door. The authors reported that learning, as measured by speed of response, was equal among all groups including the controls. They concluded that the motivation for acquiring the instrumental response could not be the result of an acquired appetitional drive but rather "exploration."

Mowrer (1956), Bolles (1967) and Cofer and Appley (1964) have stressed the methodological problems of pairing a physiological state with an external stimulus because of the gradual metabolic onset. The inconsistencies in past results may have occurred in part because of competing responses that have been conditioned to the stimulus (D'Amato, 1974).

Seligman, Ives, Ames, and Mineka (1970a) increased the rapidity of increasing thirst by injecting 15% hypertonic saline - 2% procaine into one-hour water deprived rats. Two control groups, isotonic saline - 2% procaine and isotonic saline, were also injected and trained in the same conditioning procedure. After injections, all three groups were immediately placed in distinctive cages (from home cage) without access to water. After 45 minutes, the animals were returned to their respective home cages where water was available. There was one trial per day for ten consecutive days. Water intake of one-hour deprived rats was measured while in the presence of the CS (cage) on day eleven. A one-hour trial, once per day, over 55 days, constituted the extinction period. Astoundingly, Seligman et al. reported an inability to extinguish increased drinking of the hypertonic NaCl procaine or the isotonic NaCl procaine groups although differential drinking occurred between hypertonic NaCl 2% and Isotonic NaCl 2%. The significantly enhanced drinking of both groups prompted the authors to suggest that possibly a stressful situation mediated in part the conditioned drinking.

Seligman et al. in a subsequent experiment within the same paper were able to extinguish the response by elimination of the one-hour deprivation that each animal experienced prior to the injection and CS exposure. They concluded that "rats are prepared to form a strong and persistent association between mild deprivation and strong thirst. When one-hour water deprivation is paired with sudden thirst the CS becomes capable of evoking enhanced drinking."

Explicit stimulus control over acquired drinking was also demonstrated by Seligman, Bravman and Radford (1970b). Using a classical conditioning paradigm of external stimulus paired with induced thirst was shown to significantly increase water intake when compared with a non-injection associated external cue.

In that experiment, one-hour water deprived rats were placed in either a white or black box with access to water and intake was recorded. This ten-day baseline was compared to drinking elicited by these same cages (CS+, CS-) after a 20-day conditioning period. The training procedure included placement of one-hour water deprived animals either in a black or white box (ten days in each) for 45 minutes. Water was not available and hypertonic NaCl - procaine induced thirst was paired with the designated cue or CS+ (black for half of the subjects and white for the remainder). During the 64-day extinction phase, the animals were presented daily with either CS+ or CS- randomly.

"Discriminatively conditioned drinking" gradually extinguished when each rat was repeatedly exposed to both CS+ and CS-. The authors state, "we have clearly conditioned drinking" (p. 64) but evidence for a conditioned appetitive drive cannot be deduced. Instead, the "differential conditioning of stress...to external cues...might differentially enhance drinking" (p. 64).

As D'Amato (1974) suggests, procaine, the common agent of the enhanced intake groups, may have caused distress which has been removed by water consumption thus conditioning drinking by mediational motivator (avoidance responding). Although labeled differently, Mowrer's "thirst fear" or D'Amato's "illness" or "stress" appear to be the same motivators of avoidance responding by appetitional means.

From this review, the author concludes that progress in determining the reinforcement element of enhanced consumption has not been advanced since Calvin et al.'s paper first proposed the problem. It would appear that two answers still remain viable; one, reduction of a mediating response (i.e. fear, stress, exploratory, etc.) stimulates new responses; or two, association of mild deprivation to severe thirst maintains a certain preparedness that recalls a drinking response by a prevention mechanism not initiated by stress.

The present study attempts to experimentally separate the two alternatives by purposely allowing the "mild deprivation" conditioned stimulus to be present with one but not a second environmental cue over ten pairings. By establishing a relatively constant stressful situation (deprivation) in both external Css and then presenting satiated animals with the discriminatory cue plus water, the potential learned response (drinking) can be demonstrated.

The first treatment (mild deprivation - external CS conditioning) would anticipate activation of a derived motive providing that conditioned drinking may be elicited by the preparedness mechanism. This can be explained as the nature of an organism's bodily need which establishes a directed and specific stimulus-response character for the resolution of that need. Thirst, or water deficiency, for example, can only be satisfied by drinking, resulting in tissue repletion. Prevention of such a severe deficeit would of course be of central importance to the animal's survival and, therefore, motivating. Development of cues (i.e. "mild" deprivation) to anticipate and prevent deprivation are, therefore, not arbitrarily set (like tones to electric shock) and may abide by different classical conditioning laws. By attaching an environmental cue (CS) to the US (i.e. thirst), these prepared internal cues can be externally elicited, evoking a learned appetitive response (i.e. drinking). This occurs providing the CS and internal CS have been previously conditioned (see figure 2).

Increased intake by satiated animals in the second treatment suggests an avoidance responding induced by an aversive situation. Whether labeled fear, exploratory or frustration (Wright, 1965), the implication of an emotional stress has been proposed many times to explain all acquired motives. The mechanism by which this occurs depends on the initial conditioning period. Thwarting of the natural appetitive response results in producing stress which may be defined as a learned response for the energizing of new or altered responses. Activation of the specific response reduces the motive by permitting completion of the natural US-UR complex. Later the presentation of the discriminatory cue recalls the stress, which in turn elicits the appropriate reaction of drinking, an operantly conditioned response (see figure 3).

Figure 2. Preparedness mechanism construct, as proposed by Seligman et al. (1970a,b), utilized in hypothetical explanation for the conditioning of appetitional responses to deprivation states. In the conditioning phase the naturally non-arbitrary association of an appetitional stimulus and the appropriate resolution mediates the two-step conditioning of an external cue to the appetitive response. In the recall phase the external cue elicits the internal stimulus which recalls the appropriate response.

Figure 2

CONDITIONING PHASE

1. Specific Natural Stimulus ($CS_{INTERNAL}$)

→ Natural Appetitive Resolution UCR

2. Specific Natural Stimulus (CS_I)

$$\begin{tikzcd} \text{Specific Natural Stimulus} \arrow[d, dash] \\ CS_{EXTERNAL} \end{tikzcd}$$

CS_I Paired with external cue (CS_E)

EXPERIMENTAL PHASE

1. External cue → internal natural stimulus

→ natural appetitive resolution

$CS_E \longrightarrow CS_I \longrightarrow CR$

Figure 3. Stress stimuli as a mediational cue for the association of an appetitive resolution with an external stimuli as evoked in experimental testing for a learned appetitional based drive (see Mower, 1956). The blocked resolution evokes stress which has been paired with the external cue and resolved by means of an appetitive response (step 3). The recall phase involves external cue elicitation of stress which in turn recalls the appetitive resolution, a conditioned response.

Figure 3

CONDITIONING PHASE

1. Deprivation ⇸ Resolution = Stress
   UCS → Blocked - UCR = CS
   Internal

2. CS_I paired with external cue (CS_E)

3. Deprivation + Stress → Resolution
   UCS + CS_I → UCR

RECALL PHASE

1. External cue → Internal stress → Appetitive Resolution
   CS_E → CS_I → CR

Methods

Subjects- 30 experimentally naive male Sherman rats were conditioned, fifteen during two independent experimental sessions conducted a week apart. Females were excluded to avoid water retention problems during the estrus cycle. All Ss were 150-180 grams at the onset of the experiment. Prior to the conditioning phase, all Ss were allowed 24-hour ad-lib water and food. The water intake was recorded during this five-day interval to assure water intake stability.

Apparatus- Fifteen sets of four distinctively different cages were used, two as discriminatory CSs tested in the experimental phase. A new cage was introduced on the experimental day, distinctive from the other four, and used as a neutral or "naive" CS. The home cage for all subjects (C_1) was 11x8x8 inches in size, the four wood sides and top were painted white with a wire mesh floor and front. A round entirely metal mesh cage (C_2) eight inches deep with a five-inch radius was used. This pre-water holding cage was surrounded with a black and white vertically striped piece of cardboard. The chamber where water was available (C_3) was a wood 16" equilateral triangle, painted grey with a wire mesh floor and top. A post drinking holding cage (C_4) was 11x8x8 inches with black painted wood sides and top and a wire mesh floor and front. The neutral or control box (C_5) was a four-sided metal chamber of 11x6x8 inches with a non-painted wood top and metal mesh floor. Drinking cylinders graduated in milliliters were attached to the sides of the triangle box with the spouts inserted through a hole in the wall. All other cages were equipped with holes although no drinking cylinders were attached except on the experimental day.

Procedure- The conditioning sequence employed resembles Solomon and Swanson's and Enscore et al.'s. All subjects received identical training. A daily 24-hour cycle consisted of 22½ hours of water deprivation in the home cage (C_1), then placed for one-half hour of water eprivation in the holding cage (C_2). Next, all Ss were placed for one-half hour of water availability in the triangle cage (C_3), and finally moved for one-half hour of water deprivation in the square holding cage (C_4). Food was available in all locations. Each subject then was weighed daily and the amount of food consumed per 24 hours was recorded. Subjects were returned to the home cage to begin another 24-hour cycle. Water intake in the triangle box was recorded for each subject and logged (see figure 4).

After ten days of conditioning, the subjects were randomly divided into three groups. On day eleven (experimental phase), every animal experienced water deprivation in the home cage and round holding cages (22½ and ½ hours, respectively) and one-half hour of available water in the triangle cage. Subjects were then placed into their respective experimental CS, either the home cage, round holding or neutral cage. For the first time water was present in these areas, and individual intake amounts were recorded every 15 minutes for two hours. Food was again available in all situations (see figure 5).

Figure 4. Design for conditioning procedures as used in the present study.

Figure 4

CONDITIONING PROCEDURE

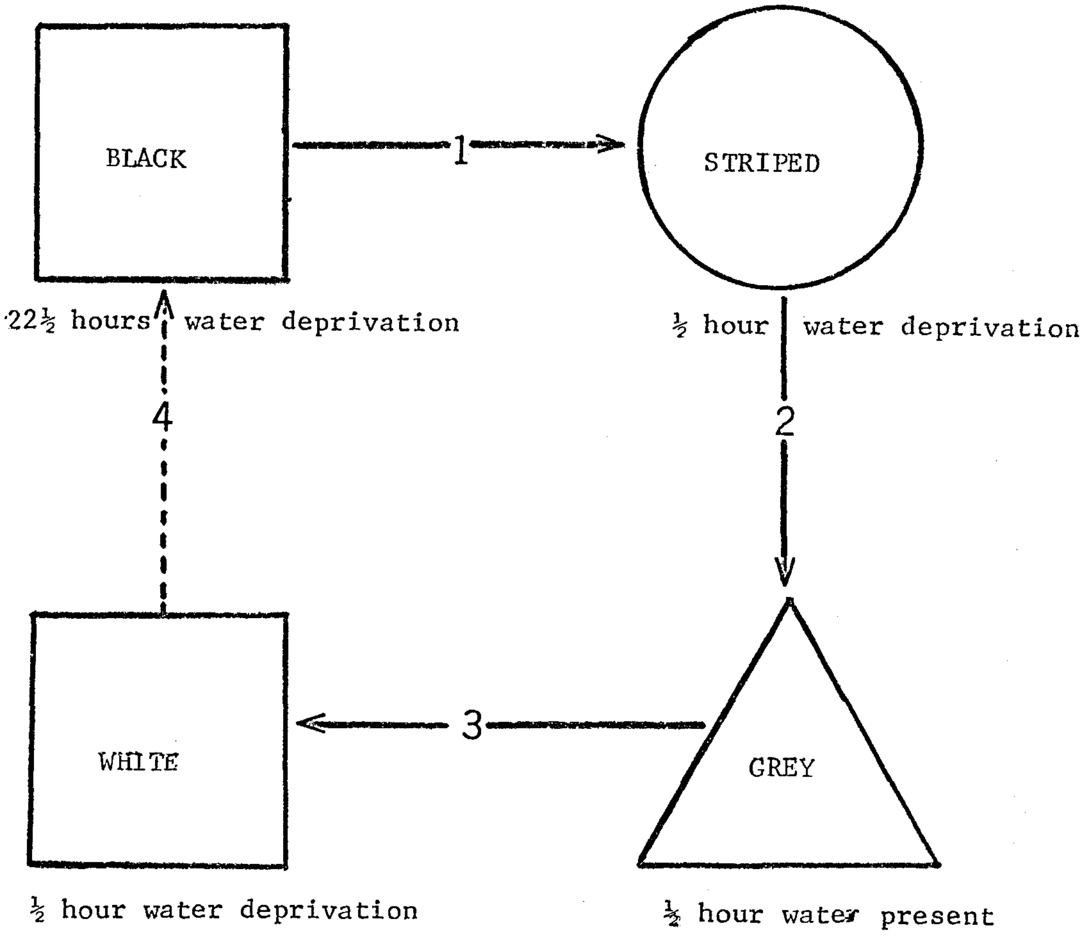
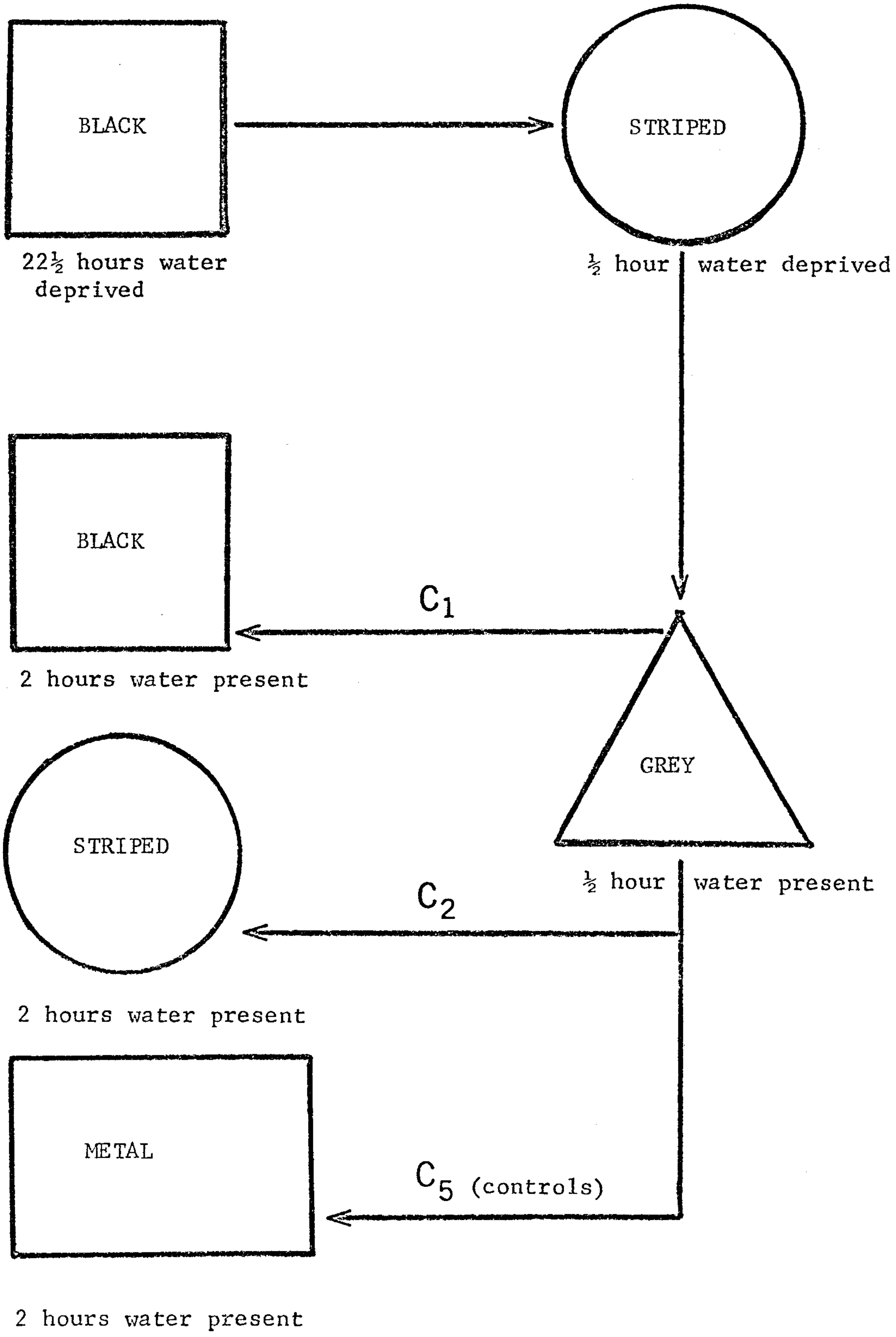


Figure 5. Design for testing procedures used in the present study.

Figure 5

EXPERIMENTAL PHASE



Results

Two split plot factorial designs were used, each having one between block treatment and one within block treatment. This later dimension was, in the first test a quarter hour, and the second analysis, a half-hour measure was repeated within subjects for two hours. Due to a death in the treatment one (C_1) group, an unweighted means analysis was performed to compensate for the unequal _n_ situation. Table 1 displays the statistical analysis for the quarter-hour intakes. Change in 15 minute consumption amounts significantly differed (F = 11.8, d.f. 7/182, p .01) over the two-hour period. Simple and interaction effects were not found to be significant.

The same statistical analysis using pooled 15-minute measures for four one-half-hour segments showed a time - treatment interaction significance (F = 2.88, d.f. 6/78, $p < .05$ and a linear (time) change significance (F = 23.59, d.f. 3/78, $p < .01$) (see Table 2).

A posteriori designated orthogonal comparisons were performed using a test for differences among means. Treatment one (C_1) was compared to a combined control (C_5) and second treatment (C_2) factor. Each set of comparisons was broken into individual time segments of one-half hour in order to evaluate the between-treatment dimension. The results are given in Table 3.

Treatment was found to be statistically significant during the first and third one-half hour segments. (F = 7.58, d.f. 1/26, $p < .05$ for both analyses).

Figure 6 demonstrates change in mean water intake of all three groups over the experimental two hours at one-half hour intervals. During the first one-half hour treatment one (C_1) group consumed a total of 56 cc at an average of 6.2 cc per animal. Treatment two (C_2) and the controls had an identical 43 cc, or 4.3 cc per animal intake. Significance found in the third half-hour reflected a decrease in treatment one (C_1) drinking to a total of 8 cc with a mean of 0.9 cc per animal. Treatment two (C_2) and controls (C_3) consumed a total of 26 and 23 cc respectively with means 2.6 and 2.3 cc per animal. Table 4 provides the quarter, half-hour, one-hour and two-hour intake total and means.

Table 1. Apriori factorial statistics of two-hour repeated intake measures over quarter-hour segments. The change in intake for the quarter hour are significantly different although not dependent on treatment exposure.

Table 1

Two-Hour Repeated Water Intake Measures Over Quarter-Hour Segments

Source	d.f.	SS	MS	F	p
Treatments	2	2.12	1.06	1.0	
Subjects within groups	26	36.84	1.42		
Time (linear)	7	99.97	14.28	11.8	.01
Treatments x Time	14	3.2	0.23	1.0	
Time x Subjects within groups	182	220.8	1.21		

Table 2. Apostriori factional statistics of two-hour repeated intake measures over half-hour segments. The change in intake was significantly different and dependent with treatment as seen in the interaction probability.

Table 2

Two-Hour Repeated Water Intake Measures Over Half-Hour Segments

Source	d.f.	SS	MS	F	p
Treatments	2	5.22	2.61	1.54	
Subjects within groups	26	43.95	1.69		
Time (linear)	3	188.26	62.75	23.59	.01
Treatments x Time	6	45.95	7.66	2.88	.05
Time x Subjects within groups	78	207.62	2.66		

Figure 6. Graph of differential drinking patterns in the "lo" to "hi" need state associated cue (C_1). Note that levels of intake for C_1 are both greater (at first half-hour) and smaller (at third half-hour) than either C_2 or C_5. C_2 ("hi" need trained) and C_5 (controls) are approximately equal throughout the two hours.

Figure 6

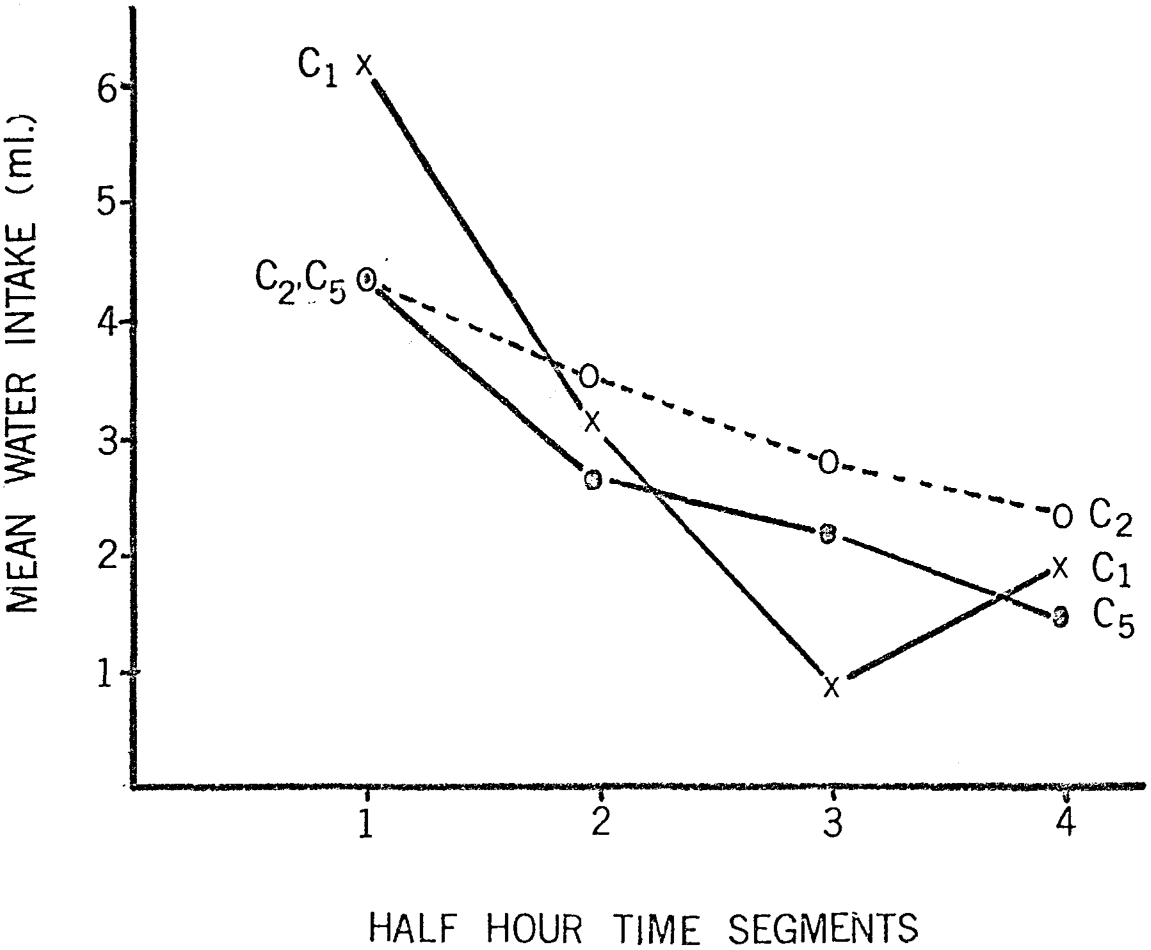

MEAN WATER INTAKE (ml.)
1
2
3
4
5
6
C1
C2,C5
C2
C1
C5
1
2
3
4
HALF HOUR TIME SEGMENTS

Table 3. Orthogonal comparisons of treatment effects for half-hour periods. Note that the first and third half hours are different. C_1 showed increased drinking in the first and decreased drinking in the third when compared to controls at the given time segment (see figure 6).

Table 3

Orthogonal Comparisons of Treatment Effects for Half-Hour Periods

Source of Comparisons	Probability (if significant)
First Half-Hour	
C_1 vs. $C_2 + C_5$	.05
C_2 vs. C_5	
Second Half-Hour	
C_1 vs. $C_2 + C_5$	
C_2 vs. C_5	
Third Half-Hour	
C_1 vs. $C_2 + C_5$	.05
C_2 vs. C_5	
Fourth Half-Hour	
C_1 vs. $C_2 + C_5$	
C_2 vs. C_5	

Table 4. Water intake measures for half-hour segments with totals and means. Note that two-hour totals and means are similar and statistically equal.

Table 4

Water Intake (in millileters)

Totaled for Half-Hour Segments / Means

Treatment	Time				
n	1	2	3	4	Total
C_5 (controls 10	43/4.3	27/2.7	23/2.3	15/1.5	108/10.8
C_2 10	43/4.3	32/3.2	26/2.6	20/2.0	121/12.1
C_1 9	56/6.2	31/3.4	8/0.9	18/2.0	113/12.6

Discussion

Although not the "robust effect" reported by Seligman, Ives, Ames and Mineka (1970a), the treatment one group (C_1) convincingly demonstrated a conditioned drinking response ($p < .05$). The strict interpretation of Seligman et al.'s preparedness hypothetical postulate as set forth in the introduction, places emphasis on a preventative internally conditioned stimulus - response complex (i.e. mild deprivation stimulates drinking). Stress or aversive stimulus involved in the conditioning were ruled out in that definition. The reader should be reminded that Seligman, Braveman, and Radford (1970b) suggested that the up to 1000% increase in CS elicited drinking in their rats may have been partially due to a "poisioning" of external cues. D'Amato's interesting conclusion pertaining to this procaine illness effect attributes the major portion of the enhanced consumption "to operant conditioning" and not "true thirst conditioning." The assumption was that appetitive avoidance responding have been conditioned to an alleviation of the distress.

The present study has successfully circumvented this problem by not including rapid thirst but still evoking enhanced responding. This, of course, is not unique since several authors using similar (Enscore, Monk, Kozub and Blick, in press; West and Kozub, 1975; Solomon and Swanson, unpublished) and dissimilar (Calvin, Bicknell and Sperling, 1953a; Wright, 1965) methods have also succeeded in demonstrating a "naturally" conditioned appetite. Additional support for the reported results above have been supplied by the consistency of the method used in this experiment. The author notes that mean volemic water intake in the Solomon and Swanson (see Mowrer, 1956, p. 147), Enscore et al.(in press) and West and Kozub (1975) studies were 5.8, 5.75, and 5.6 cc per animal respectively for one-half hour. 6.2 cc was recorded as a mean intake in the present study. Comparison of mean intake for the same control group in a past study (West and Kozub, 1975), 4.1 cc, and in the present report, 4.3 cc, is almost identical.

Second half-hour data also reveals consistencies when comparing past findings to the present results. An average mean intake of 2.1 cc to 3.3 cc have been previously reported for all experimental and control groups (Enscore et al., in press; West and Kozub, 1975) whereas presently a 2.7, 3.2 and 3.1 cc were recorded for the control, treatment two and treatment one groups respectively.

Seligman et al.'s (1970b) conclusion that preparedness on the part of non-arbitrarily paried stimulus appears well founded in accounting for the classically conditioned appetitive response. Suggestions that some form of stress has been responsible for the acquired motive, by means of a mediating agent, are weakened by the obvious failure to condition an increase response in treatment two (note: table 3 and 4).

Of course, other factors may have entered into the effect. It does appear unlikely that a stress agent, by means of stimulus mediation, could be held accountable for the observed effect in treatment one. If accepting this alternative (stress factor), a similar increase should have also been anticipated in treatment two. It may be that one-half hour of CS exposure per trial, even at a "high drive" (22½ hour deprived), is not adequate to establish the learned response. Calvin, Bicknell and Sperling (1953a) used one-half hour hi drive exposures (23 hours food deprived) and successfully achieved an acquired appetitive response. Wright (1965) employed a one-hour CS pairing with 22 hours food deprived rats and also achieved affirmative results. Any time limits for conditioning may be concluded as minor.

In treatment one (C_2), contiguity to the drinking chamber may have initiated an anticipation response which competed with any appetitive response and thus eliminated the effect. This would seem unlikely noting that Seligmen et al. (1970a, 1970b) placed water deprived animals directly from the CS chamber into their home cages where water was made available. Enscore et al. (in press); West and Kozub (1975) placed non-dipsogenic induced thirsty animals directly from the CS cage to the "drinking box with similar findings (5.75, 5.6 cc per animal in conditioned response groups; 6.2 cc in present findings). As Calvin et al. (1953) conclude, contiguity to the natureal response has no bearing on the effect.

A conceivable alternative still exists when combining partial elements of both stress and preparedness explanations. A recent study by Cott, Wayner and Millner (1972) demonstrated that hypertonic saline-procaine injections could be used to condition a "nonspecific increase in motor excitability" (p. 219). This may shed a new light on Seligman et al.'s proposed mechanism by introducing a general energizer caused by deprivation and which selects the "naturally" established preparedness stimulus-response because of its reduction property. This quite obviously changes the perspective conclusion from a "true" classically conditioned appetite based acquired motive to one derived by an aversive means. In the present experiment, treatment one provides an interconnection (suggested above) of both mechanisms where treatment two was purposely designed to initiate just one, stress.

This approach may explain Myers'and Millers' (1954) failure to achieve instrumental learning based on a supposed acquired appetitive motive. The authors reported that learning occurred in all groups (including controls) suggesting another motivator was responsible. By means of a second experiment, they concluded that a general "exploratory" activation had occurred facilitating learning. Running into the next chamber was a vital part of the animals' response reinforced by receiving food. Later, CS exposure recalled increased movement (within the confines of the chamber) and speed of response, the independent variable Myers and Miller used. This may have been a conditioned activity response or increased motor excitability response which heightened the amount of contact with the bar in a given time and/or quickened reaction time.

Significance of the elicited drinking effect on water regulation can be put into a proper perspective by examining the intake change over the two hours. The author emphasizes the gross result that the two-hour water intake for all three groups was similar ($p < .25$) (see Table 4). Mean two-hour fluid intake was 10.8 cc, 12.1 cc and 12.6 cc per animal for the controls (C_5), treatment two (C_2) and treatment one (C_1) respectively. The first half-hour increase observed in CS was negeted because of the third half-hour decrease in treatment one (C_1) consumption ($p \quad .05$). The linear time significance ($p < .01$) is a result of this extensive change (6.2 cc to 0.9 cc per animal for first and third one-half hours).

The conclusion can be drawn that the ephemeral effect can and will be corrected by the regulatory systems. However, as West and Kozub (1975) have implied, the extinction of the conditioned response is cyclic, fluctuating between CS stimulation of the learned response and presumably a water regulation inhibition each time the external CS is reintroduced.

The findings presented here indicate a quantitatively limited classically conditioned appetitive response as a result of a naturally paired internal stimulus-response. Basis for this learning may still include a general activator related to drinking only by its response capabilities to reduce the mediating stimulus, the preparedness agent. This experiment was not designed to investigate claims of instrumentally conditioned appetite, which as several authors have suggested

(D'Amato, 1974; Seligman et al., 1970a, 1970b), may produce a considerably greater quantitative effect. Experiments appreciating derived appetitive motives by successfully acquiring new "unrelated" responses run the risk of conditioning competing responses or multiple means for activating a general energizer. Either way, a "true operant paradigm" would be difficult to distinguish.

Reports acclaiming instrumental responding appear dependent on the availability of the specific resolution for the particular bodily need (Seligman et al., 1970a, 1970b; see D'Amato, 1974). This may be indicative of the non-random nature for appetitive stimulus-response relationships.

A proper operant demonstration should include a food or water acquiring bar press response during training which would be non-reinforced in the extinction phase. Time to extinction would be directly representative of the instrumental response strength under the control of the external CS.

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VITAE

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