AN ABSTRACT OF

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The purpose of the current study was to investigate the effects of nonassociative cues on taste aversion learning at different intervals of time. Specifically, novel and familiar environments were used to determine the effect of nonassociative cues on taste aversion. Thirty-two male Holtzman-derived albino rats served as participants. Conditioning consisted of a 15-min exposure to a .15% saccharin solution followed by an IP injection of .15M solution of LiCl. Test groups differed on conditioning/testing environment and the time between conditioning and testing. Results indicated that rats conditioned and tested in a novel environment consumed significantly less saccharin than all other groups. Implications for retention interval differences were discussed.

An Investigation of Retention Interval Differences

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A Thesis

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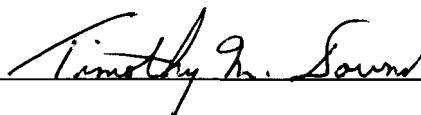of the Requirements for the Degree

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CHAPTER 1

INTRODUCTION

Overview

In traditional classical conditioning experiments the experimenter places a conditioned stimulus (CS) in temporal contiguity with an unconditioned stimulus (US). The CS is a stimulus that does not elicit a response under normal circumstances, whereas the US reflexively elicits a response. The reflexive response to a US is an unconditioned response (UR). After several pairings of a CS and a US, the participant may make a response to the CS when it is presented alone. The response to the CS is known as the conditioned response (CR) (Davis & Palladino, 1997).

Taste aversion (TA) learning is a form of classical conditioning in which a taste serves as the CS and a toxicosis-inducing element serves as the US. When a taste and a toxicosis-inducing element are paired, taste aversion occurs. Testing for TA learning involves presenting the conditioned taste to the test animal and observing the amount of fluid consumption. Stronger aversions result in strongly depressed fluid consumption, whereas weaker aversions result in greater fluid consumption. TA researchers have used a variety of USs: radiation (Garcia & Koelling, 1966, 1967), lithium chloride (LiCl) (Best, Meachum, Davis & Nash, 1987), rotation (Green & Rachlin, 1976), and apomorphine (Parker, 1986).

Logue (1979) determined that the main differences between TA research and classical conditioning are the amount of time needed between CS and US, number of trials necessary, and the ability to retain the learning. In each case TA learning was more efficient, allowed for long delays between CS and US, facilitated acquisition of the aversion in one trial, and maintained the conditioned response for a prolonged period of time. Based on a detailed analysis of various areas of classical conditioning and a wealth of TA research, Logue (1979) concluded that differences between classical conditioning and taste aversion learning were ones of quantity not quality.

TA learning is significant because, unlike other forms of classical conditioning, it occurs even when a long interval (i.e., 15 min or greater) separates the CS (presentation of the taste) and the US (toxicosis). For other types of classical conditioning, such as the eye blink in humans, .50 s was considered to be the optimal time needed to induce a CR (Davis & Pallidino, 1997).

Garcia, Kovner, and Green (1970) demonstrated that the propensity to associate particular CSs and illness was not indiscriminate. In other words, rats were able to associate taste and illness, but not tastes and nonillness aversive stimuli. More specifically, they placed the animals in a experimental apparatus with one drinking bottle at each end. The grid floor was capable of delivering a shock. In the first experiment they allowed one group of animals to

consume salty water (CS) before receiving a foot shock (US). At the other end of this experimental apparatus was another fluid dispenser containing saccharin (CS-). Consumption of saccharin was never followed by a shock. For the other group the exact same procedures were followed except saccharin (CS) was followed with a shock, and salty water (CS-) was the safe fluid. Testing occurred in the experimental apparatus and in the animals' home cages. Interestingly, the consumption of the fluid paired with an external shock was decreased in the experimental apparatus but not in the home cages. This result demonstrated that the shock was not associated with the illness, but rather the environment in which the shock was administered.

In the second experiment, Garcia et al (1970) trained rats to turn in one direction in a T-maze for a saccharin solution. After they mastered this task, the animals received saccharin (CS) in their home cages followed with an intraperitoneal (IP) injection of Lithium Chloride (LiCl). Testing was conducted in the T-maze and the animals' home cages; consumption was reduced in both areas. The experimenters concluded that taste was more readily associated with an internal US (illness) but served only as a cue for an external US (shock). These results are in accord with Seligman and Hager's (1972) proposal that rats are able to form taste aversions so effectively because they are biologically prepared to do so.

Also, Davis, Best, Richard, and Grover (1987) have
shown that TA learning is able to disrupt instrumental
performance. Davis et al. found that rats trained to run
down a runway would run at a slower rate when toxicosis was
induced contingent upon receiving a saccharin or water
reward for completing the runway. In addition to their
behavioral effects, researchers also noticed that exposing
the animal to the US prior to TA conditioning (i.e., US
preexposure) caused an attenuation of the subsequent taste
aversion (Domjan & Best, 1980).

US Preexposure

An investigation of US preexposure promotes helps
understanding the role of the US in TA learning. One
explanation for the US preexposure effect is that the
context in which the organism receives the US becomes
associated with the US. This association with the context
results in the blocking or attenuation of subsequent CS-US
pairings. Because the illness-context association exists, it
disrupts the subsequent taste-illness association (Batson &
Best, 1979). The association between the US and the context
extinguishes over time; that is, the longer the time between
the US preexposure and conditioning, the smaller the US
preexposure effect (Best, 1982).

Valliere, Misanin, and Hinderliter (1988) used weanling
(21-24 days), young adult (84-94 days), and old (674-695
days) rats to investigate differences in the US preexposure
effect as a function of age. After five preexposures to LiCl

or sodium chloride (NaCl), half of these groups were conditioned by pairing saccharin (CS) with an IP injection of LiCl (US), whereas the remaining animals received saccharin followed by an IP injection of .9% NaCl (injection control animals). Results indicated that the US preexposure was less likely to interfere with TA learning in the older animals compared to the younger animals. The groups receiving the NaCl injections failed to differ significantly.

Aguado, De Brugada, and Hall (1997) examined the effects of different intervals between the US preexposure and conditioning. In the initial experiment three groups of rats received three preexposures of LiCl, whereas the comparison (injection control) group received three injections of NaCl. These US preexposures occurred 2 days prior to conditioning for two of the LiCl groups and two of the NaCl groups, whereas one LiCl group and one NaCl group were given US preexposures 15 days prior to conditioning. All groups that received the US preexposure exhibited the US preexposure effect; however, this effect was attenuated in the group receiving preexposure 15 days before conditioning. Aguado et al. used a similar design in Experiment 2 to further test the effect of US preexposures. In this experiment two groups received a US preexposure, whereas two groups did not. These groups differed both on when they were given the preexposure, a long or short interval prior to conditioning. These groups also differed on when they were

tested, a long or short interval between conditioning and testing. All groups exhibited strong taste aversions except the group which had a short interval between preexposure and conditioning and a short interval between conditioning and testing. Because preexposure disrupted the short interval (preexposure-conditioning and conditioning-testing) group and not the group with the longer interval between conditioning and testing, the US preexposure appears to disrupt the acquisition of TA learning, not retrieval.

Cole, VanTilburg, Burch-Vernon, and Riccio (1996) gave US preexposures to six groups of rats. Two groups received .9% NaCl injections and served as comparison groups. The other four groups received a preexposure injection of LiCl. Two groups received this injection in a novel environment, and two groups received this injection in a familiar environment. One group that received a preexposure injection in the novel environment was tested in a novel environment, whereas the other group that received a preexposure injection in a novel environment was tested in a familiar environment. Likewise, the groups given a preexposure in a familiar environment were tested in a familiar or novel environment, thus creating four different conditions. Results indicated rats receiving a US preexposure in a novel environment exhibited a greater US preexposure effect than rats receiving a US preexposure in a familiar environment, which did not differ from controls. The researchers concluded that a stronger association was made between the

novel environment and the US preexposure compared to the familiar environment. One possible explanation for these results is that establishment of the subsequent CS-US association during conditioning was blocked by prior US-environment associations. This experiment suggests a need to further explain associations that are made outside the CS(taste)-US(illness) association.

Nonassociative cues

The importance of context in conditioning became clear through investigations of the US preexposure effect. The conditions present during conditioning had an obvious effect on TA learning (Aguado et al., 1997; Cole et al., 1996; Valliere et al., 1998). In a series of three experiments, Best, Brown, and Sowell (1984) investigated the specific role contextual stimuli have in conditioning. In Experiment 1, separate groups of rats consumed saccharin, water, or no fluid in a novel environment. All groups then received an IP injection of LiCl. Testing for water consumption took place in the novel environment. The results indicated that the group conditioned to saccharin consumed significantly less water than the other groups. The pairing of saccharin and the novel environment enhanced (potentiated) the conditioning to environmental (nonassociative) cues.

In a similar study Best, Batson, Meachum, Brown, and Ringer (1985) investigated the effects of environmental potentiation in a series of experiments. These researchers discovered that novel tastes form stronger taste aversions

in a novel environment than familiar fluids conditioned in a novel environment. Research concerning nonassociative cues led researchers to form hypotheses concerning differences in retention intervals, the periods of time between conditioning and testing. Nonassociative cues disrupt the CS-US association at shorter intervals (Best, 1982). Because associations made between the US and the environment extinguish with the passage of time (Aguado et al., 1997), they do not disrupt TA learning at longer intervals. This knowledge helped shape the hypothesis in the current study concerning retention interval effects. Aguado et al.(1997) conditioned their test animals in a familiar environment. Best et al. (1985) showed that US-environment associations are stronger for novel environments.

Retention Interval Differences

Batsell and Best (1992c) investigated retention intervals in TA learning in a series of experiments. In the first experiment, animals consumed a saccharin solution that was followed by an IP injection of LiCl. One group was tested 1 day after conditioning, whereas the other two groups were tested 21 days after conditioning. One of the two 21-day groups received an injection of LiCl 1 day prior to testing to control for pharmacological effects of LiCl. The group tested 1 day after conditioning exhibited a significantly weaker taste aversion than the two groups tested 21 days after conditioning. One explanation for these results is that contextual cues (testing environment)

associated with the initial conditioning episode were present at the 1-day retention interval but were absent (i.e., were extinguished) at the 21-day-retention interval.

In another experiment, Batsell and Best (1992c) manipulated the testing environment to determine what effect environmental cues have on retention intervals. They conditioned one group of rats using saccharin as the CS and LiCl as the US, and then placed the rats in a novel environment. Half of these rats were tested 1 day after conditioning, whereas the other half were tested 6 days after conditioning. Another group of rats conditioned to saccharin and LiCl, was left in their familiar home cages. Half of these rats were tested 1 day after conditioning, whereas the other half were tested 6 days after conditioning. All testing was done in the home cages. Animals conditioned in novel environments with both 1-day- and 6-day-retention intervals did not significantly differ. This finding indicated that environmental cues may have disrupted the association between illness and taste or the retrieval of this association. By leaving the 6-day-retention-interval group in the novel environment, the experimenters maintained the level of nonassociative cues. In other words, test animals in the novel environment did not undergo environmental extinction, therefore the novel group tested 6 days after conditioning experienced a disruption similar to the novel group tested 1 day after conditioning. Thus, novel nonassociative cues do not

extinguish over time at the 6-day interval, whereas familiar nonassociative cues do. Groups tested in familiar environments differed significantly; the group tested 1 day after conditioning exhibited a weaker taste aversion than the group tested 6 days after conditioning. One possible explanation for the differences in groups conditioned in a familiar setting is 6 days after conditioning all associations with the familiar cage and illness are extinguished, whereas in the group tested 1 day after conditioning these associations still exist. Nonassociative cues extinguished over time in the animals tested in the familiar environment, whereas nonassociative cues did not extinguish over time in the novel environment, as is evident by the disruption of learning at the 6-day-retention interval. Extinction occurred in the familiar environment and not the novel environment because the test animals had prior non-illness exposure to the familiar environment, whereas no such non-illness exposure existed for the novel environment.

In order to further define the role of nonassociative cues in retention interval differences, Batsell and Best (1992a) conducted an experiment to rule out differences due to differential fluid consumption between varying retention intervals. In this experiment all animals were conditioned in the same manner, with the only difference being the retention interval between conditioning and testing. All groups were limited to 8 ml of water on the day before

testing, with the exception of the group tested the day after conditioning, which received 8 ml of saccharin prior to the conditioning episode. The group tested 1 day after conditioning consumed significantly more saccharin than all other groups indicating a weaker taste aversion. This result indicated that retention interval differences were not an artifact of dehydration.

Batsell and Best (1992a) also investigated the influence of replacement fluids in retention interval differences. They gave replacement fluids to all groups 5 hr after their initial conditioning experience to determine what effects differential thirst may have on test day. The availability of replacement fluids notwithstanding, the groups tested 1 day after conditioning exhibited a weaker taste aversion than groups tested with a longer retention interval. These results provided further evidence that differences in retention intervals were not due to differential dehydration.

In order to control for other factors that may have caused retention interval differences, Batsell and Pritchett (1995) examined potential influences of LiCl (i.e., drug-induced illness) on retention interval differences. Such investigations are important because if a non-drug-based US is effective in inducing taste aversions, researchers can rule out the pharmacological effect of LiCl and other drugs as a possible cause of differential fluid consumption. Batsell and Pritchett used rotation as the US and obtained

the same retention interval effect: Conditioning was stronger 5 days after conditioning then 1 day after conditioning. Clearly, the type of aversive US does not influence the retention interval effect.

Batsell and Davis (1998) exposed rats to lead in their drinking water to increase emotional reactivity (Davis, Freeman, & Nation, 1993). These rats received TA conditioning and were later tested and compared to non-lead-exposed rats to determine what effect chronic lead exposure had on retention intervals. Chronic lead exposure increased the number of nonassociative cues because of the increased emotional reactivity in the rats. The increased level of nonassociative cues resulted in increased drinking if testing occurred 1 day after the taste-illness exposure and decreased drinking if testing occurred 5 days after the taste-illness exposure. In other words, nonassociative cues caused a disruption at the 1 day retention interval, and a potentiation (i.e., increased TA learning) at the 5 day retention interval. These investigations into nonassociative cues provided an explanation for differences observed in retention interval differences.

Rationale for the Present Study

Researchers have established that retention interval differences exist and that nonassociative cues may be responsible for observed differences in fluid consumption (Batsell & Best, 1992c, 1994; Batsell & Davis, 1998). Researchers have also shown that environmental potentiation

occurs when animals are conditioned and tested in a novel environment (Best et al., 1985). Also, Batsell and Best (1992c) have shown that conditioning animals in a novel environment and testing in a familiar environment produced a greater disruption in TA learning than conditioning and testing in a familiar environment. Batsell and Davis (1998) have shown that nonassociative cues may serve to potentiate a taste aversion at a 5-day retention interval.

According to the retention disruption hypothesis, certain predictions can be made concerning the effects of conditioning and testing in a novel environment on retention interval effects. The present research was designed to test these predictions.

Hypothesis 1. A group of animals that is conditioned and tested in a novel environment with a 1-day-retention interval will consume significantly more test fluid than a group of animals that is conditioned and tested in a familiar environment with a 1-day-retention interval. The presence of potentially disruptive nonassociative cues in the novel environment animals will disrupt the conditioned taste aversion for these animals.

Hypothesis 2. A group of animals that is conditioned and tested in a novel environment with a 5-day-retention interval will consume significantly less test fluid than a group of animals that is conditioned and tested in a familiar environment with a 5-day-retention interval. As previous research (Batsell et al., 1984) has shown, groups

conditioned and tested in a novel environment may experience increased TA learning at a 5-day-retention interval.

Hypothesis 3. A group of animals that is tested 1 day after conditioning will consume more test fluid than a group of animals that is tested 5 days after the conditioning period. The effects of nonassociative cues will disrupt TA learning at a 1-day-retention interval, whereas the nonassociative cues will not disrupt TA learning in the 5-day-retention interval groups.

CHAPTER 2

METHOD

Participants

The test animals were 32 Holtzman-derived male albino rats that were born and reared in the Emporia State University animal vivarium. The animals were approximately 80-110 days old at the beginning of the experiment and weighed between 300-520 g. Food was provided ad lib throughout experimental manipulations.

Group Determination

The animals were matched on their average fluid consumption for the 6 days prior to the first conditioning day. Prior to the first conditioning episode, the rats were assigned one of four groups so that they were balanced for fluid consumption. Two groups were conditioned 5 days prior to testing (Groups 5F and 5N), whereas the other two groups were conditioned 1 day prior to testing (Groups 1F and 1N). The letters designate where conditioning and testing occurred: familiar (F) or novel (N). The numbers indicate the retention interval: 1-day-retention interval (1) or 5-day retention interval (5).

Apparatus

A .15% (w/v) saccharin solution was used as the conditioning and test fluid and was presented to the animals in a plastic centrifuge tube. An electronic scale (Acculab V-200) recorded consumption to the nearest .01 g.

All animals were housed in individual Wahmann hanging wire mesh cages (17.75 cm X 17.75 cm X 24.13 cm) with lights left on at all times. The home cages also served as the familiar environment.

Aquariums (25 cm X 30 cm X 50 cm) served as the novel environment. Black plastic was placed on the outside of the aquarium; the floor consisted of animal bedding material. All environments were placed in the same room.

Procedure

Table 1 depicts the schedule of procedures. On Day 1, the animals were placed on a 23.75-hr-water-deprivation schedule. Each animal received 15 min of water exposure per day in the home cage until the first conditioning day (Day 7). On all conditioning days all rats were weighed 6 hr prior to the conditioning episode in order to calculate the appropriate LiCl dose. Conditioning for Groups 5F and 5N occurred 7 days after the start of the experiment. At this time, these animal groups received 15-min exposure to a .15% saccharin solution followed by an IP injection of .15 M of LiCl (12 mg/kg body weight). Animals in Group 5F were individually placed in the familiar environment immediately after the injection, whereas animals in Group 5N were placed in the novel environment immediately after the injection. These animals were maintained for the duration of the experiment in these respective environments until they were tested 5 days later.

	Day 1-7	Day 8	Day 9-11	Day 12	Day 13
RI 1 (F)	Water Dep	Water Dep	Water Dep	Cond	Test
RI 5 (F)	Water Dep	Cond	Water Dep	Water Dep	Test
RI 1 (N)	Water Dep	Water Dep	Water Dep	Cond	Test
RI 5 (N)	Water Dep	Cond	Water Dep	Water Dep	Test

Table 1: Schedule of procedures for all groups. Specific labels for these procedures are as follows: Water dep = animals receive a 15 min exposure to water and Cond = animals are conditioned. Specific labels for the groups under investigation are as follows: N = novel environment, F = familiar environment, 1 = a 1 day retention interval, and 5 = a 5 day retention interval.

Groups 1F and 1N were conditioned in the same manner as Groups 5N and 5F 12 days following the start of water deprivation. Animals in Group 1F were placed in the familiar environment, whereas animals in Group 1N were placed in the novel environment immediately after the LiCl injection. These animals were maintained in these environments until they were tested 24 hr later. No replacement fluids were given after conditioning for any groups.

Testing took place in the home cages for Groups 1F and 5F. Testing for groups 1N and 5N occurred in the novel environment. Testing for all groups consisted of a 15-min exposure to a .15% saccharin solution. The one-bottle test was utilized because Batsell and Best (1992b) had shown it to be more effective at detecting retention interval differences.

CHAPTER 3

RESULTS

Group Comparability

A completely randomized 2 X 2 factorial Analysis of
Variance (ANOVA) including environment (N vs. F) and
retention interval (1 day vs. 5 day) as factors compared
average fluid consumption for the baseline period. This
analysis failed to yield significance for the interaction or
main effects (see Table 2). A similar completely randomized
2 X 2 factorial ANOVA of the animals weight prior to
experimental procedures also failed to yield significance
for the interaction or main effects (see Table 3). Thus, the
groups were deemed comparable on the basis of fluid
consumption and weight prior to the start of the experiment.

Test Differences

Figure 1 depicts fluid consumption for all groups on
the test day. A completely randomized factorial 2 X 2 ANOVA
of fluid consumption comparing environment (N vs. F) and
retention interval (1 day vs. 5 day) yielded significance
only for the environment factor, $F(1, 28) = 8.51$, $p < .007$
(see Table 4), indicating Groups 1F and 5F consumed
significantly more fluid than on the test day. Eta^2
indicated that the environment factor accounted for 22% of
the variance. Table 5 lists the means and standard
deviations on the test day.

Table 2

Two-way ANOVA for the Average Fluid Consumption Prior to
Conditioning by Environment and Retention Interval (RI)

Source	SS	df	MS	F
Environment	.13	1	.13	.01
RI	.23	1	.23	.02
Environment X RI	.01	1	.01	.00
Residual	260.74	28	9.31	
Total	261.09	31		

Table 3

Two-way ANOVA for Weight by Environment and Retention

Interval (RI)

Source	SS	df	MS	F
Environment	2368.44	1	2368.44	.75
RI	1697.98	1	1697.98	.54
Environment X RI	450.75	1	450.75	.14
Residual	88846.28	28	3173.08	
Total	93363.46	31		

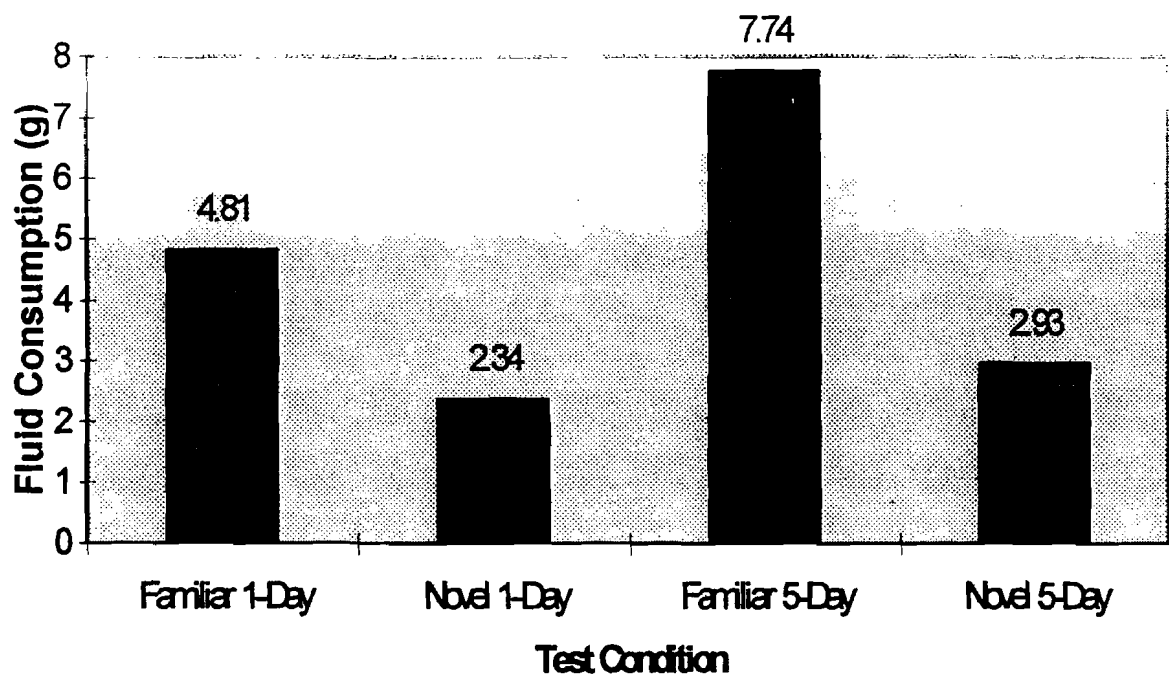Figure 1. Mean fluid consumption (g) for all groups on the test day.

Table 4

Two-way ANOVA for Fluid Consumption on Test Day by

Environment and Retention Interval (RI)

Source	SS	df	MS	F
Environment	106.43	1	106.43	8.50*
RI	24.85	1	24.85	1.98
Environment X RI	10.97	1	10.97	.88
Residual	350.21	28	12.51	
Total	492.47	31		

*f < .01

Table 5

Table of Means and Standard Deviations for Fluid Consumption
on the Test Day

Group	M	SD
Novel-1 day	2.34	1.74
Novel-5 day	2.93	2.06
Familiar-1 day	4.81	3.41
Familiar-5 day	7.75	5.58

CHAPTER 4

DISCUSSION

The group conditioned and tested in a novel environment
with a 1-day-retention interval consumed less fluid than the
group conditioned and tested in a familiar environment with
a 1-day-retention interval; therefore, Hypothesis 1 was not
supported. It was predicted that the group conditioned and
tested in the novel environment would consume more than the
group conditioned and tested in the familiar environment.

The group conditioned and tested in a novel environment
with a 5-day-retention interval consumed less fluid than the
group conditioned and tested in a familiar environment with
the same retention interval, Hypothesis 2 was supported.
Because no significant differences were noted between the
retention intervals, Hypothesis 3 was not supported. It was
predicted that the 1-day groups would consume more test
fluid than the 5-day groups.

The lack of retention interval effects counters
previous research (e.g., Batsell & Best 1992a, 1992c;
Batsell & Davis, 1998). Even though the present study's
results suggest that retention interval differences do not
occur, this conclusion is tenuous because of the abundance
of literature which reports retention interval differences
(Batsell & Best 1992a, 1992b, 1992c, 1994; Batsell & Davis,
1998; Batsell & Pritchett 1995). All procedures utilized in
the present study were consistent with past research
investigating retention interval differences, yet no

retention-interval differences were detected. This
discrepancy between the present and past results
notwithstanding, certain inferences concerning Hypotheses 1
and 2 can be entertained.

The results for Hypothesis 1 were inconsistent with
past research in that the 1-day groups for both familiar and
novel groups did not experience retention interval
disruption (i.e., increased fluid consumption; Batsell &
Best 1992a, 1992c; Batsell & Davis, 1998). Batsell and Best
(1992c) have shown that retention-interval disruptions are
due to a transitory association that occurs between the US
and nonassociative cues. These effects are extinguished
after 1 day, but disrupt learning at a 1-day interval when
animals are conditioned and tested in a familiar environment
(Batsell & Best, 1992c). The conditioning environment is a
source of nonassociative cues. With the exception of one
study by Batsell and Best (1992c), most retention interval
studies have been conducted with the home cage as the
conditioning and testing environment (Batsell & Best, 1992a,
1992b, 1992c; Batsell & Pritchett, 1995). The effects of
nonassociative cues may differ depending upon whether it is
novel or familiar. CS-preexposure research has shown that
the novelty or familiarity of taste influences the strength
of TA learning. In CS-preexposure experiments, an animal is
less likely to make associations with a taste stimulus that
it has sampled prior to experiencing illness (Dawley, 1979).
The animals in the present study spent most of their lives

in an environment in which illness was not experienced;
therefore, the US-context association should be weaker for
the rats conditioned in the familiar environment than rats
conditioned in a novel environment. Thus, when the 1-day
group conditioned in the novel environment was tested in a
novel environment there was a strong US-context association
that had not begun to dissipate, therefore the organism
experienced potentiation (i.e, decreased fluid
consumption), not disruption. In an experiment similar to
the present study, Batsell and Best (1992c) used similar
procedures except that the rats were conditioned in a novel
environment and were tested in a familiar environment
(homecage). Contrary to the present study, disruption was
observed. Therefore, the observed difference in these
studies are most likely due to the place the animals were
tested. These results seem to indicate that there is no
disruption in learning when novel nonassociative cues, such
as the environment, are present at the time of conditioning.
In other words, for a retention-interval disruption to
occur, novel nonassociative cues present at the time of
conditioning must not be present on the test day. More
specifically, animals that are conditioned with novel
nonassociative cues present must have these nonassociative
cues removed (or remove the test animals from the
nonassociative cues) at the time of testing in order to
disrupt TA learning.

A similar explanation can be used to explain the results of Hypothesis 2. Because the 5-day-retention interval group conditioned and tested in the novel environment consumed significantly less test fluid than the group conditioned and tested in the familiar environment with a 5-day-retention interval, Hypothesis 2 was supported. These results corroborate the reports of Best et al. (1984) and Best et al.(1985) and indicate that environmental potentiation is a factor at both retention intervals. Since the US-context association was still present at the 5-day-retention interval, this finding indicates that the test animals form associations differently with novel nonassociative cues (novel environment) than with familiar nonassociative cues (familiar environment). This interpretation is consistent with Batsell and Best (1992c), who reported nonassociative cues were maintained in a novel environment over a 6-day-retention interval. The difference in consumption between novel and familiar environments is evident in that the groups conditioned and tested in a novel environment consumed significantly less fluid than groups conditioned and tested in a familiar environment. Once again it appears as though novel nonassociative cues must not be present at the time of conditioning in order to induce the retention interval disruption. Batsell and Best (1992c) were able to induce a disruption at a 6-day-retention interval with a group that had been conditioned in a novel environment when they tested the animals in a familiar

environment. The present study observed the opposite effect, a potentiation, providing further evidence that novel nonassociative cues must not be present at the time of testing to observe the retention interval disruption.

The present results allow several conclusions to be made. Environmental potentiation occurs at both retention intervals when animals are conditioned and tested in the same, novel environment. Also, the results of this study would seem to indicate that novel nonassociative cues present at the time of conditioning, must not be present at the time of testing in order to induce a retention-interval disruption (i.e., increased fluid consumption). Future research should focus on different types (novel vs. familiar) of nonassociative cues and compare them based on their presence or absence at the time of testing. Also, future research should provide a context preexposure to directly assess the role of context novelty in retention-interval differences.

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Title of Thesis

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