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Context specificity of extinguished schedule-induced drinking within an ABA renewal design in rats

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The main goal of this study was to explore whether extinction of schedule-induced adjunctive drinking (polydipsia) may become under contextual control. Drinking was induced by a Fixed-Time 30 sec food delivery schedule (FT30). Experiment 1 used a 2 x 2 factorial design with Schedule (FT30 vs. food at the start of the session), and Stimulus (Presence or absence of a 10 sec tone at the end of each 30 sec period within a session) as factors. Acquisition and extinction were conducted in two different contexts, returning to the acquisition context at testing. Experiment 2 tested contextual control of extinction against a control that remained in the extinction context at testing. Recovery from extinction was observed as an increase in water intake (as well as in magazine entries) during the test, regardless of the presence of the tone. Implications for the understanding of schedule-induced drinking as a conditioned response are discussed.

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Food-deprived rats may consume an excessive amount of water when food reinforcement is intermittently presented. Falk (1961) named this phenomenon as schedule-induced polydipsia, and understood it as an adjunctive behavior in the sense that it did not seem to be related to the animal's reinforcement expectancy: Excessive drinking appears fairly early within the inter-food interval, rather than at the end of it, when the operant response dominates rat's behavior. In general terms, adjunctive behaviors may be or may not be induced by the reinforcement schedule, being polydipsia (drinking) an instance of the first type (i.e., the prototype of schedule-induced adjunctive behaviors: Reid & Staddon, 1990). Recent reflections (e.g., Baum, 2012; Killeen & Pellón, 2013) abound on the similarities between adjunctive behavior and more conventional learned behaviors, thus suggesting common mechanisms. The main goal of this experimental series is to advance in exploring the parallel between adjunctive drinking and other conditioned behavior, such as operant or Pavlovian responding. Specifically, in this experimental series we explored whether schedule-induced drinking (SID) may become under contextual control the same way other conditioned behaviors do.

Contexts have been shown to play an important role on conditioned performance (see Bouton, 1993; Rosas, Callejas-Aguilera, Ramos-Álvarez & Abad, 2006; Rosas, Todd, & Bouton, 2013). The role of context on retrieval of behavior has been shown to be particularly important in those situations in which the information is ambiguous (e.g., Bouton, 1997, 2002; Callejas-Aguilera & Rosas, 2010; Darby & Pearce, 1995; Nelson, 2002; Rosas & Callejas-Aguilera 2006; but see Nelson & Callejas-Aguilera, 2007). This feature has been largely explored in extinction, in which the same stimulus or behavior initially paired with a specific outcome is subsequently presented without the outcome. It has been found that when original acquisition occurs in one context (context A), and extinction is conducted in a different context (context B), the return to the conditioning context (context A) during the test leads to a renewal of the conditioned behavior. This phenomenon is called ABA renewal, in which the letters represent the context in which each of the experimental phases (acquisition, extinction, and testing) takes place, and has been extensively studied in both, classical (Bouton & Bolles, 1979; Bouton & King, 1983; Goddard, 1999; Rosas & Bouton, 1997, 1998) and operant conditioning literature (e.g., Bouton & Todd, 2014; Nakajima, Tanaka, Urushiara & Imada, 2000; Trask & Bouton, 2014). A similar effect is found when acquisition and extinction are conducted in the same context, and the context is changed during the test (AAB renewal: Bouton & Ricker, 1994; Rosas, García-Gutiérrez, & Callejas-Aguilera, 2007; Thomas, Larsen, & Ayres, 2003), or when acquisition, extinction, and testing take place in three different contexts (ABC renewal: Thomas et al., 2003). The combined results of these studies suggest that the key factor on context dependence of extinction is the context change between extinction and testing, regardless of the context in which acquisition takes place (e.g., Bouton, 1993). However, ABA renewal is usually found to be stronger than AAB and ABC renewal (see for instance León, Callejas-Aguilera, & Rosas, 2012; Nakajima, et al., 2000; Tamai & Nakajima, 2000; Thomas et al., 2003).

As far as we know, there are no previous studies showing contextual control of SID. However, contextual control of SID would be expected, regardless of whether adjunctive drinking is understood as Pavlovian or operant behavior. Although contextual control of extinction of SID would not allow deciding whether adjunctive drinking is either Pavlovian or operant, finding extinction and contextual control of SID would add to the pool of results suggesting that adjunctive drinking should be understood as conditioned behavior.

EXPERIMENT 1

Experiment 1 was conducted to explore whether extinction of SID is context dependent, and whether SID and its contextual control depended on whether the food was signaled by a conditioned stimulus (CS) or not. This is a somewhat controversial issue in the literature. Stimulus control that affects operant behavior has been occasionally shown to affect also adjunctive drinking, but evidence is mixed. The use of a discriminative stimulus has been shown to increase water consumption (e.g., Corfield-Sumner, Blackman, & Stainer, 1977; Pellón & Blackman, 1987; Porter & Kenshalo, 1974), to reduce water consumption (Patterson & Boakes, 2012, Experiment 2) or to have no clear relationship with water intake (e.g., Allen & Porter, 1977; Allen, Porter, & Arazie, 1975). So, although there is some evidence that the presence of a CS might affect SID development (e.g., Lashley & Rosellini, 1980), the evidence is scarce and does not allow to predict whether contextual control develops differently when only the inter-food time signaled the presence of the food (temporal conditioning), or when besides the time, a signal was included. As far as we know, no evidence of contextual dependence of temporal conditioning has been reported in the literature. However, the role of the US as a signal of proximal USs (e.g., Goddard, 1999), and other forms of temporal discrimination, such as inhibition of delay (Rosas & Alonso, 1997) have shown to be under contextual control, setting the grounds to predict that extinction of temporal conditioning may become under contextual control as well.

The design of the experiment is presented in Table 1. Four groups of rats received acquisition in context A, extinction in context B, and returned to context A during testing with water available at any given time (ABA renewal design, e.g., Bouton & Bolles, 1979). Design of Experiment 1 was a 2 x 2 factorial in which one of the factors was the presence or the absence of a 10-sec tone every 20-sec within the session, while the other factor was the food-delivery schedule (FT30 vs Start). Thus, during acquisition, groups FT30 received food intermittently every 30 sec within the session, while groups Start received the same overall amount of food, but it was delivered all at once at the beginning of the session. In group T-FT30 the tone was presented in the last 10 sec of the inter-food interval, while in group T-Start the tone was presented at the same time within the session as the T-FT30 group, but no food was delivered at the end of the tone. We expected that intermittent presentation of food at regular intervals would allow for temporal conditioning to develop in groups FT30 (Pavlov, 1927), while no conditioned responding was expected to appear in groups Start, in which the food was delivered at the beginning of the session. The presence of the tone in group T-FT30, as it kept a perfect contingency with the presence of the food may facilitate conditioning with respect to group FT30 in which only the time could be used to predict the moment in which the reinforcer was delivered, though it has been reported in the literature that temporal cues may exert stronger control than stimulus cues when food-food interval is fixed (Kirkpatrick & Church, 2000).

Intermittent presentation of food was expected to lead to SID in groups FT30 (see for instance Castilla & Pellón, 2013; Reberg, 1980) compared to groups Start, which would serve as controls for prandial drinking in this situation. Finally, an interesting question in this design was whether the presence of the tone would affect SID or not. If adjunctive drinking is a special type of operant behavior, it may be overshadowed by the presence of a signal of the food, such as it has been shown with other operant responses in the literature (e.g., Pearce & Hall, 1978).

Following the acquisition phase in context A, animals received extinction in context B in which no food was presented in any groups. In groups T the tone was presented at the same rate as during acquisition, but no food was delivered. Extinction was expected to develop for both, conditioned responding and adjunctive drinking.

During the final test phase rats received the same treatment that they had received during extinction, with the exception that the test phase was conducted in context A, i.e. the acquisition context. Renewal of performance was expected with the return to the acquisition context at testing (e.g., Bouton & Bolles, 1979). The key question here was whether recovery would appear in adjunctive drinking as well as in operant conditioned responding (e.g., Nakajima et al., 2000). Additionally, the experiment allowed exploring whether recovery of conditioned performance with the context change depended on the presence of the tone as a signal of the food in a temporal conditioning situation.

Table 1. Design of Experiment 1.

Group	Acquisition	Extinction	Test
T-FT30	A:T+	B:T-	A:T-
T-Start	A:+|T-	B:T-	A:T-
FT30	A:+	B: -	A: -
Start	A:+| -	B: -	A: -

Note. Acquisition, Extinction and Test name experimental phases. Two different environments were counterbalanced as contexts A and B. T indicates the presence of a 10-sec Tone. Signs + and – indicate the presence and absence of food, respectively. FT30 indicates that rats, when receiving food, received it every 30 seconds. Start indicates that rats, when receiving food, received all of it at once at the beginning of the session.

METHOD

Subjects. Thirty-two male Wistar rats provided by Charles River Laboratories (Lyon-France) were used in this experiment. They were about 90 days old with a mean free-feeding weight of 298 g. (range 276-319 g.) at the beginning of the experiment, and were experimentally naïve. Rats were individually housed in standard Plexiglas cages inside a room maintained on a 12-12 hr light-dark cycle with the light part of the cycle at 8 a.m. Environmental conditions were constant (21ºC of room temperature and 60% humidity). After 7 days of acclimation period with free access to food and water, rats were weighted and food (rodent chow) access was progressively reduced until weights reached 85% of their weight *ad libitum*. Rats were weighted daily and were maintained at 85% of free-feeding weight throughout the experiment by giving them an adjusted amount of chow following the experimental session of each day. Following the procedure used by Boakes, Paterson, Kending, and Harris (2014), and with the goal of reducing variability across individuals without depriving them, water was freely available to all animals in their home cages, except for 45 min before the experimental sessions. The daily sessions took place between 9 am and 1pm, approximately.

Apparatus. The experiment was conducted at the Laboratory of Animal Behavior and Cognition of the Centre of Animal Production and Experimentation of the University of Jaén. Two sets of four operant chambers housed in the same room of the laboratory served as the two contexts used in this experiment. Each operant chamber was housed in its own sound attenuating enclosure. Ventilation fans provided background noise of 60 dB, and the operant chambers were lit with one 2-W Led fluorescent tube mounted to the ceiling of the sound attenuating enclosure. All operant chambers had the same design (Panlab S.L., Barcelona), measuring 25 cm x 25 cm x 25 cm (l x w x h). Front and rear walls were made of aluminum whereas the side walls were made of methacrylate (clear for the door access in the left side, and black for the right side). Ceiling was made of aluminum except for a circular opening of 11.5 cm of diameter covered by clear methacrylate that allowed the houselight to illuminate the operant chamber.

A pellet dispenser (Panlab S.L., model LE100X52) supplying 45-mg standard rat food pellets (Bio-Serv, Frenchtown, NJ, USA) to a recessed food cup (3.5 x 3.5 cm) was centered in the front wall 3.5 cm above the level of the floor. Magazine behavior was detected through a magnetic mechanism that was activated every time the animal entered its head within the food cup, displacing a small cover of clear methacrylate (3,5 cm high × 3,5 cm wide). A movement of this small cover, approximately 3 cm, could be automatically recorded as a magazine entry. The auditory CS was a 10-sec presentation of a 2850-Hz 85 dB tone presented through a module placed 22 cm above the floor level in the top right corner of the rear wall (Panlab, SL. Model LE100X41). A bottle containing water was placed outside the operant chamber with a spout of 0.5 cm of diameter that came through a 3.5 x 3.5 cm hole placed in the rear wall 9 cm above the floor level (see Clark, 1962). This arrangement might increase competition between drinking and magazine training, undermining the possibility of misinterpreting drinking and food-seeking behavior.

The eight operant chambers were divided in two sets of four operant chambers with differences in olfactory, visual and tactile features. In one set of operant chambers the floor was made of stainless steel grids (0.2 cm of diameter, spaced 1.7 cm) that were mounted parallel to the front wall, and a cup containing Vicks VapoRub (The Proctor & Gamble Company, Cincinnati, OH, USA) was placed outside the operant chamber, within the sound attenuating enclosure. In the second set of operant chambers the floor was made of holes (1.0 cm of diameter spaced 0.5 cm), the left wall was covered by a checked pattern made with 2.5 x 2.5 cm white and black squares, and a cup with white wine vinegar (6% acidity) was placed within the sound attenuating enclosure, outside the operant chamber. These two sets of operant chambers were counterbalanced as contexts A and B.

A computer located within the same room controlled the apparatus, being the presentation of stimuli and the recording of behavior done through Packwin V 2.03 software (Panlab, S.L. Barcelona, Spain).

Procedure. As mentioned earlier, the design of the experiment is presented in Table 1. Before starting with the experimental sessions rats were ascribed to groups T-FT30, T-Start, FT30 and Start matched on their body-weight and water consumption during the last three days of the food-deprivation regime before the experimental sessions started.

Acquisition. Each of the 18 acquisition sessions was 30 min long and took place in context A. In groups FT30 a single pellet of food was delivered every 30 sec within the session. For group T-FT30 this pellet was immediately preceded by a 10 sec tone. Groups Start were identical to their homologous FT30 groups with the exception that all the food pellets (60) were delivered at a rate of 1 pellet per second starting 30 sec after the beginning of the session.

Extinction. The 6 extinction sessions were identical to the acquisition sessions with the exception that they took place in context B and no food was delivered at any time.

Test. The 3 test sessions used the same procedure as in extinction with two exceptions: Testing took place in context A, and sessions were 5 min long with the aim of avoiding that any possible difference between groups that may appear at the beginning of the session would be obscured if longer sessions were carried out (given that no food was being provided). In this regard, it is noteworthy that when the interval schedule is long enough (e.g., 3 min or more) in extinction conditions excessive water consumption decrease and tends to disappear as time passes since the previous food delivery (e.g., Falk, 1966; Wayner, & Greenberg, 1973).

Dependent variables and data analysis. Water consumption was recorded in milligrams throughout the experiment by weighing the bottles before and after each session with each rat. Consumption is reported in milliliters (mL), assuming a direct correspondence to the milligrams recorded.

The interval between food deliveries was divided in three 10-sec periods. Note that the final period was coincident with the period in which the tone was present in groups T. A magazine entry was computed each time the rat placed its nose within the magazine (Goddard & McDowell, 2001). Magazine entries were recorded during each period. The dependent variable for magazine entries was the change on entries across periods, understood as deviations from the uniform distribution. As magazine entries were expected to increase as the time of the presentation of the food approached, change in magazine approaches was computed by subtracting the amount of entries during the middle period from the amount of entries during the final period. Behavior during the first 10 s post-pellet was ignored, because it mostly consists of activity directed towards the arrived pellets. A change in magazine approaches of 0 indicates that the number of magazine entries occurring in last 10-sec period was identical to the number of entries occurring in the middle period. Positive scores indicate that the number of entries in the last period of the inter-pellet interval was greater than the number of entries in the middle period interval. Note that this was a conservative measure of temporal conditioning. It is reasonable to think that temporally conditioned magazine approaches would have already started to show by the middle period, reducing the possibility of finding differences with respect to the final period of the food-food fixed interval in which the signal was presented in T-FT30 group.

Water consumption and change in magazine approaches were evaluated with an analysis of variance (ANOVA). The rejection criterion was set at $p < .05$.

RESULTS AND DISCUSSION

Acquisition and extinction. Figure 1 presents mean water intake (left) and mean changes in magazine approaches per trial (right) throughout the 18 sessions of acquisition and the 6 sessions of extinction in groups T-FT30, T-Start, FT30 and Start. Inspection of this figure suggests that both

SID and magazine behavior were rapidly acquired in FT30 groups, while no changes were observed in groups Start. Also there seems to be a trend to lower water intake in group T-FT30 in comparison to group FT30, while the opposite was found with the change in magazine entries. It also appears that extinction proceeded rapidly. There was an abrupt decrease in both, water consumption and change in magazine entries between the end of acquisition and the beginning of extinction, so that groups FT30 quickly behaved similar to groups Start. Statistical analysis confirmed most of these impressions.

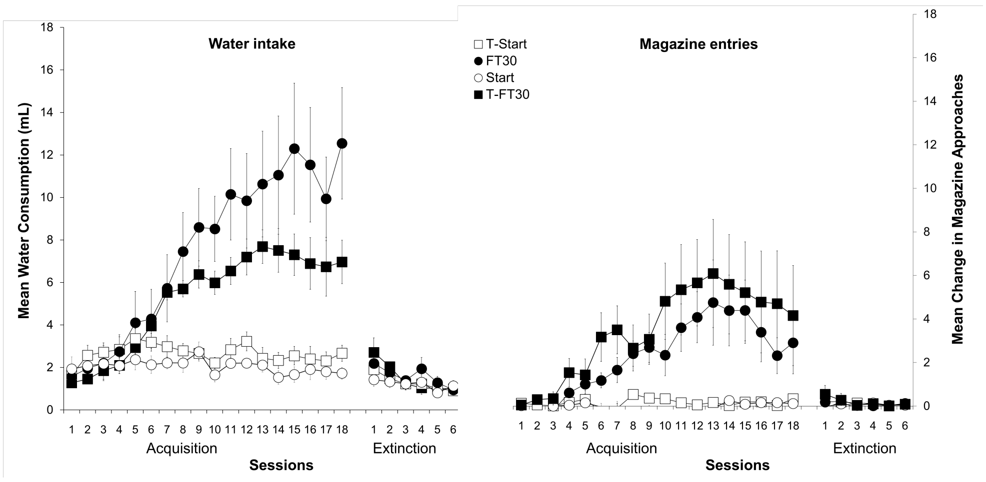


Figure 1. Mean water intake (left) and mean change in magazine entries per trial along the interpellet interval (right) throughout the 18 sessions of acquisition and the 6 sessions of extinction in groups T-FT30, T-Start, FT30, and Start of Experiment 1. Error bars represent the standard error of the mean.

A 2 (Schedule) x 2 (Tone) x 18 (Session) ANOVA conducted with the acquisition data on water consumption found a significant main effect of Schedule, F(1, 28) = 26.67, MSe = 87.16, $\eta^2 = 0.488$, $p < 0.001$, and Session, F(17, 476) = 14.94, MSe = 4.79, $\eta^2 = 0.348$, $p < 0.001$. The Schedule x Session interaction was significant, F(17, 476) = 16.14, MSe = 4.79, $\eta^2 = 0.366$, $p < 0.001$. No other main effect or interaction was significant, largest F(1, 28) = 3.47, MSe = 87.16, $\eta^2 = 0.110$, $p = 0.073$, for the Schedule x Tone interaction. Subsequent analysis conducted to explore the Schedule x Session interaction found that the simple effect of Schedule was significant from Session 7 onwards, smallest F(1, 30) = 13.02, MSe = 5.63, $\eta^2 = 0.303$, *p* = 0.001.

Statistical analysis on the change in magazine entries yielded similar results. A 2 (Schedule) x 2 (Tone) x 18 (Session) ANOVA conducted on the change scores during the acquisition phase found a significant main effect of Session, F(17, 476) = 6.78, MSe = 3.87, $\eta^2 = 0.195$, $p < 0.001$, and Schedule, F(1,28) = 15.41, MSe = 73.57, $\eta^2 = 0.355$, *p* = 0.001. Schedule x Session interaction was also significant, F(17,476)=6.64, MSe=3.87, $\eta^2 = 0.192$, $p < 0.001$. No other main effect or interaction was significant, largest *Fs < 1*. Analysis of the interaction yielded a significant simple effect of Schedule from Session 4 onwards [smallest F(1,30) = 5.06, MSe= 1.56, $\eta^2 = 0.144$, *p* = 0.032].

The right side of each graph presents performance during the extinction sessions. With respect to water intake, a 2 (Schedule) x 2 (Tone) x 6 (Session) ANOVA found a significant main effect of Session, F(5, 140) = 15.96, MSe = 0.33, $\eta^2 = 0.363$, $p < 0.001$, and a significant Tone x Session interaction, F(5, 140) = 2.76, MSe = 0.33, $\eta^2 = 0{,}090$, *p* = 0.021. No other main effect or interaction was significant, largest F(5, 140) = 2.24, MSe = 0.33, $\eta^2 = 0.074$, *p* = 0.054, for the Schedule x Session interaction. Subsequent analyses conducted for exploring the Tone x Session interaction found that the simple effect of Tone was not significant at any level of the Session factor, largest F(1, 30) = 1.82, MSe = 1.66, $\eta^2 = 0.057$, *p* = 0.187.

With respect to changes in magazine behavior during extinction, a 2 (Schedule) x 2 (Tone) x 6 (Session) ANOVA only found a significant Schedule x Session interaction, F(5, 140) = 2.29, MSe = 0.13, $\eta^2 = 0.076$, *p* = 0.049. No other effect or interaction was significant, largest F(5, 140) = 1.24, MSe = 0.13, $\eta^2 = 0{,}042$, *p* = 0.296. However, subsequent analysis of the Schedule x Session interaction found that the simple effect of Schedule was not significant at any level of the Session factor, largest F(1, 30) = 3.38, MSe = 0.42, $\eta^2 = 0.101$, *p* = 0.076.

Acquisition and extinction proceeded similarly for water intake and magazine entries. Both increased as trained progressed. There was a trend for SID being favored by the absence of the Tone that would be in line with the idea of the tone overshadowing drinking. However, that trend might simply reflect competition between drinking and magazine entering during the tone, being this one the signal for immediate food delivery (see Boakes, 1977). The opposite trend was observed with the change in magazine entries, with higher responding in the presence of the Tone. However, none of those trends was statistically reliable. What is observed here is that our procedure allowed for detecting both, schedule-induced drinking, and schedule-induced magazine responding based on temporal conditioning (Pavlov, 1927).

Extinction proceeded quickly. The speed of extinction might seem surprising. This is especially relevant as extinction took place in a context different from that of acquisition. The context switch could have produced a generalization decrement that may have led to conditioned behavior in Context A not being extinguished. This issue has been often discussed in the literature (see for instance Holder, 1988; Rosas & Bouton, 1997). However, it should be noted that recordings are taken as a whole 60-trial performance, something that would be expected to hide progression of extinction.

As water intake was recorded as a whole during the session, no further analysis could be conducted. However, when comparing the change in magazine entries during the first extinction trial (2.13 ± 1.91) with the change in magazine entries in the first trial of the last acquisition session (1.88 ±3.27) in group T-TF30, no differences were found, $F < 1$, suggesting that the context switch had no effect on magazine performance in this group. No differences were found in group FT30 either, though performance in the first couple of trials of each session in this group was quite low, given that no good cues for temporal discrimination are present until the first food is presented. Because of the time needed to place the 8 rats in the operant chambers and start the computer, rats had no valid temporal cue to anticipate when the first food would be presented. Although this analysis does not guaranty that the context change went without effect, given that this effect might have been shown as a differential rate of extinction during the session, it suggests that performance transferred reasonably well to the new context where extinction took place. Given that water intake generally followed a similar pattern to change than magazine entries, it may be reasonable to generalize this assumption to schedule-induced water consumption.

Test. Figure 2 presents water intake (left) and changes in magazine entries (right) during the last session in context B (E6), and the 3 sessions of testing in context A for groups T-FT30, T-Start, FT30 and Start. The return to the acquisition context (A) during testing seemed to have different effects as a function of the schedule of food delivery. In general, groups FT30 seemed to show greater responding at testing that groups Start, though the differences appeared at different points in water intake and magazine behavior. Statistical analysis confirmed these first impressions.

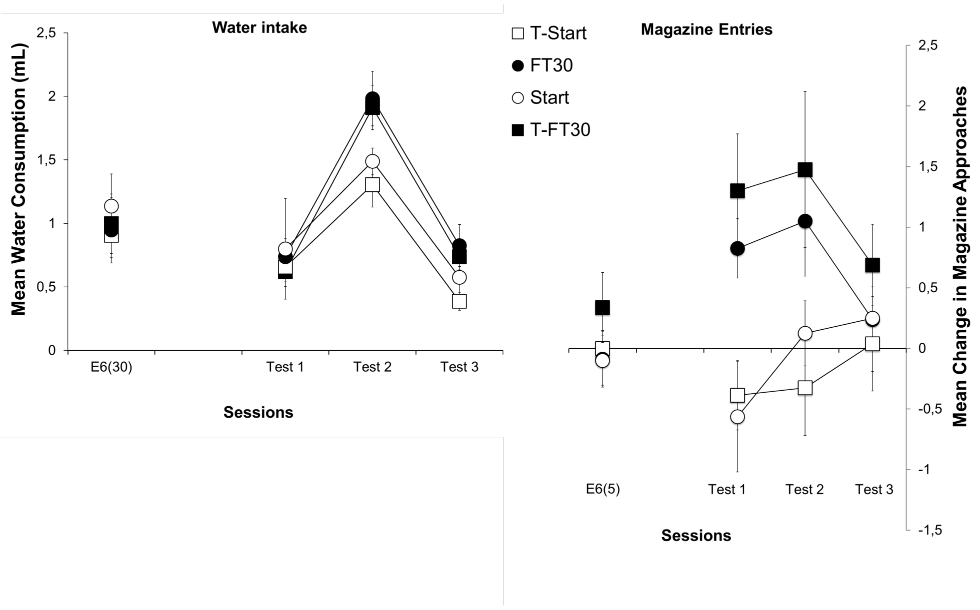


Figure 2. Mean water intake (left) and mean change in magazine entries per trial (right) throughout the last extinction session (E6) and the 3 testing sessions in groups T-FT30, T-Start, FT30 and Start of Experiment 1. The number next to E6 indicates the duration of the recording (either 30 or 5 min). Error bars represent the standard error of the mean.

A 2 (Schedule) x 2 (Tone) x 3 (Session) conducted with water consumption during the test phase found a significant main effect of Session, F(2, 56) = 72.92, MSe = 0.15, $\eta^2 = 0.723$, $p < 0.001$. Most important, the Schedule x Session interaction was also significant, F(2, 56) = 4.88, MSe=0.15, $\eta^2 = 0.148$, $p = 0.011$. No other main effect or interaction was significant, largest F(1, 28) = 3.51, MSe = 0.49, $\eta^2 = 0.111$, $p = 0.072$ for the main effect of Schedule. Subsequent analysis conducted to explore the Schedule x Session interaction found that the simple effect of Schedule was significant in both, T2 and T3 sessions [F(1, 30) = 10.67, MSe = 0.23, $\eta^2 = 0.262$, $p = 0.003$; F(1, 30) = 5.31, MSe = 0.14, $\eta^2 = 0.150$, $p = 0.028$, respectively]. Additional analysis comparing performance between the last test session of extinction [E6(30)] and each of the testing sessions found that drinking during the second session of testing increased in both, FT30 and Start conditions [FT30, F(3, 45) = 35.36, MSe = 0.15, $\eta^2 = 0.702$, $p < 0.001$, and F(3, 45) = 12.89, MSe = 0.19, $\eta^2 = 0.462$, $p < 0.001$, respectively]. Taken together, these results show that the increase on water intake found with the return to the acquisition context at testing was greater in rats in the FT30 condition than in rats in the Start condition, suggesting recovery from extinction of SID with the context change. As recording the water intake is taken as the whole intake during the session, the comparison should be considered highly conservative, given that involves comparing water intake during a 30 min extinction session with water intake during a 5 min test session.

With respect to changes in magazine behavior, a 2 (Schedule) x 2 (Tone) x 3 (Session) ANOVA conducted with the change in magazine entries during the test only found a significant main effect of Schedule, F(1, 28) = 23.45, MSe = 1.18, $\eta^2 = 0.456$, $p < 0.001$. No other effects or interactions were significant, largest F(2, 56) = 2.59, MSe = 1.34, $\eta^2 = 0.085$, $p = 0.084$, for the Schedule x Session interaction. A complementary 2 (Schedule) x 2 (Tone) x 2 (Session) ANOVA conducted with the first 5 min of the last extinction session [E6(5)] and the first test session found a main effect of Schedule, F(1, 28) = 21.45, MSe = 0.55, $\eta^2 = 0.434$, $p < 0.001$. Most interesting for the goals of the experiment, the Schedule x Session interaction was also significant, F(1, 28) = 7.45, MSe = 0.99, $\eta^2 = 0.210$, $p = 0.011$. No other main effect or interaction was significant, largest F(1, 28) = 2.53, MSe = 0.55, $\eta^2 = 0.083$, $p = 0.123$, for the main effect of Tone. Subsequent analyses to explore the interaction found that the simple effect of Schedule was significant in the test session, F(1, 30) = 17.19, MSe = 1.1, $\eta^2 = 0.364$, $p < 0.001$, but it was not significant in the extinction session, $F < 1$. Taking together the results of these analyses, it is shown that recovery from extinction of magazine behavior was found at testing regardless of whether the tone was present or not.

Thus, similarly to what it was found with water intake, and with other results in the literature, the return to the acquisition context after being extinguished in a different context seemed to renew acquisition performance (e.g., Bouton & Bolles, 1979), regardless of whether the food was announced by the tone or not. The increase in magazine entries in the absence of the tone should be considered a conservative measure of recovery given that, as stated above, rats had no clear temporal cue to anticipate when the food was presented at the beginning of the session. With this caution, to our knowledge this is the first evidence of an ABA renewal effect of temporal conditioning, given that contextual control was found regardless of whether the tone was signaling the food besides the time or not (see Rosas & Alonso, 1997). Finally, the small increase in water consumption on FT30 groups should be considered a conservative measure of renewal. Note that test sessions lasted 5 minutes, while acquisition and extinction sessions lasted 30 minutes. Thus the increase on water consumption found in this experiment may be estimated to have reached approximately half of the water intake at the end of acquisition.

It should be noted that renewal is inferred here from the comparison between behavior at the end of extinction and testing. This type of comparison confounds context-switch effects with the possible effect of the delay between extinction and testing. That is, the observed effect may be caused by spontaneous recovery, rather than by renewal. Leaving aside whether spontaneous recovery may be considered a form of renewal in which the context that is changed is the temporal one (Bouton, 1993: Rosas & Bouton, 1997, 1998), it is unlikely that the effects reported here are due to the passage of time, rather than to the context change. The time between extinction sessions was the same one that between the extinction and testing sessions. However, there is no evidence of spontaneous recovery of water intake between extinction sessions. At any rate, we should be cautious about extracting firm conclusions from comparing behavior that is recorded at different times, even when it involves the same animal. Experiment 2 was conducted with the goal of solving this problem by comparing at testing performance of different groups of rats within the extinction or the acquisition context.

EXPERIMENT 2

The main goal of Experiment 2 was to explore context dependence of SID in a situation in which animals are tested either within the extinction context or within the acquisition context. Comparing recovery at testing within different contexts also allowed for replicating the main effects of contextual control observed in Experiment 1. The presence of the signal (tone) did not have reliable effects on either the water intake or the change in the magazine entries as shown in Experiment 1. However, we discussed in Experiment 1 the noise that the absence of the tone may have in renewal performance, given that at the beginning of the session the animal has no clear temporal cues that may use, due to the necessary time to place the rats in the operant chambers and start the procedure. Given that difficulty, we decided to keep the signal in Experiment 2, assuming, with Kirkpatrick and Church (2000), that temporal cues will exert control as well in this arrangement. At any rate, this should not affect the main goal of this study, the evaluation of contextual control of SID.

Experiment 2 used a 2 x 2 factorial design in which one of the factors was the food delivery schedule (FT30 vs Start) while the other was the test context (Acquisition vs Extinction contexts). The design is presented in

Table 2. All rats received acquisition in context A, and extinction in context B. During acquisition, groups T-FT30 received food every 30 sec preceded by a 10-sec tone, while groups T-Start received the same amount of food at the beginning of the session altogether, and the tone was presented by itself at the same times than in groups T-FT30. During extinction the tone was presented by itself in context B and no food was provided. The test was conducted in two phases: Extinction and Reacquisition. During these tests conditions were identical to the extinction and acquisition phases, respectively, with one exception: Tests were conducted in the acquisition context (A) in groups A, while they were conducted in the extinction context (B) in groups B. The use of two types of test in this experiment was implemented with the goal of increasing the sensitivity of the procedure for detecting differences. Indeed, reacquisition test was conducted with the goal of magnifying the possibility of detecting subtle differences in performance across groups that may evolve more clearly during reacquisition than during extinction.

According to the results obtained in Experiment 1, both magazine entries and SID were expected to recover in groups tested in the acquisition context with respect to the groups tested in the extinction context, replicating the main result of Experiment 1 with a between-subject design. As stated above, the results of Experiment 1 allow for alternative interpretations of the recovery observed at testing in terms of spontaneous recovery. Although this design does not allow for testing whether spontaneous recovery occurs within this procedure, as T-FT30-A and T-FT30-B were tested at the same time, spontaneous recovery from extinction should have equally affected both, ensuring that any difference detected here is due to the contexts-switch.

METHOD

Subjects and Apparatus. Thirty-two female Wistar rats obtained from Charles River Laboratories (Lyon-France) were used in this experiment. The maintenance housing and apparatus were the same as in Experiment 1. They were about 90 days old with a mean free-feeding weight of 264 g. (range 246-284 g.) at the beginning of the experiment. Rats had previously participated in a procedure of alcohol preference after consummatory-successive-negative contrast in which different apparatus and reinforcers were used.

Apparatus were as described for Experiment 1. The design of the experiment is presented in Table 2. All details that are not specified were identical to the ones used in Experiment 1.

Table 2. Design of Experiment 2.

Group	Acquisition	Extinction	Extinction Test	Reacquisition Test
T-FT30-A	A:T+	B:T-	A:T-	A:T+
T-Start-A	A:+, T-	B:T-	A:T-	A:T+
T-FT30-B	A:T+	B:T -	B:T-	B:T+
T-Start-B	A:+, T-	B:T -	B:T-	B:T+

Note. Acquisition, Extinction, Extinction Test and Reacquisition Test refer to the different phases of the experiment. Two different environments were counterbalanced as contexts A and B. T indicates the presence of a 10-sec Tone. Signs + and – indicate the presence and absence of food, respectively. FT30 indicates that rats, when receiving food, received it every 30 seconds. Start indicates that rats, when receiving food, received all of it at the beginning of the session.

Procedure

Acquisition and Extinction. Groups received the same treatment received by their homonymous groups in Experiment 1 (T-FT30 and T-Start), with acquisition taking place in context A, and extinction taking place in context B for every rat.

*Renewal Test. P*rocedure was the same as that used in Experiment 1, with the exception that only two sessions of testing were conducted, and that the test was carried out in the extinction context in groups T-FT30-B and T-Start-B, while it was conducted in the acquisition context in groups T-FT30-A and groups T-FT30-A.

Reacquisition Test. Procedure used during the reacquisition test was identical to the one used during acquisition with the exception that there was a single session that lasted 5 min. As reacquisition test was conceived as an extension of the extinction test, it was conducted in the same context in which the extinction test had taken place (the acquisition context in groups A and the extinction context in groups B).

Data analysis. Dependent measures and data analyses were identical to the ones used in Experiment 1.

Two rats (one in group T-FT30-A and one in group T-FT30-B) were excluded from the experiment because they failed to show evidence of successful conditioning and water consumption. The lack of conditioning was not surprising given that they did not eat most of the provided pellets in any of the conditioning sessions.

RESULTS AND DISCUSSION

Acquisition and Extinction. Figure 3 presents water intake (left) and mean changes in magazine approaches per trial (right) throughout the 18 sessions of acquisition and the 6 sessions of extinction in groups T-FT30-A, T-Start-A, T-FT30-B and T-Start-B. Acquisition and extinction seemed to proceed similarly to what it was found for the homonymous groups in Experiment 1, with quick acquisition and extinction observed in groups FT30 and no changes in groups Start.

A 2 (Schedule) x 2 (Context) x 18 (Session) ANOVA conducted with water consumption during acquisition found a significant main effect of Schedule, F(1, 26) = 40.55, MSe = 176.84, $\eta^2 = 0.609$, $p < 0.001$, and Session, F(17, 442) = 24.74, MSe = 6.93, $\eta^2 = 0.488$, $p < 0.001$. The Schedule x Session interaction was significant, F(17, 442) = 22.32, MSe = 6.93, $\eta^2 = 0.462$, $p < 0.001$, due to the presence of a significant simple effect of Schedule from Session 4 onwards, smallest F(1, 28) = 4.63, MSe = 5.22, $\eta^2 = 0.213$, $p = 0.04$. The simple effect of Schedule also appeared in Session 1, F(1, 28) = 4.39, MSe = 0.73, $\eta^2 = 0.135$, $p = 0.045$, though according to the descriptive data, in Session 1 drinking was lower in groups FT30 than in groups Start. No other main effect or interactions were significant, largest $F < 1$.

The analysis of the mean change in magazine approaches yielded similar results. A 2 (Schedule) x 2 (Context) x 18 (Session) ANOVA on the change score during acquisition found a significant main effect of Schedule, F(1, 26) = 26.64, MSe = 271.24, $\eta^2 = 0.506$, $p < 0.001$, and Session, F(17, 442) = 18.02, MSe = 6.76, $\eta^2 = 0.409$, $p < 0.001$. The Schedule x Session interaction was also significant, F(17, 442) = 16.76, Mse = 6.76, $\eta^2 = 0.392$, $p < 0.001$, due to the presence of a simple effect of Schedule from Session 3 onwards, smallest F(1, 28) = 5.80, MSe = 2.71, $\eta^2 = 0.172$, $p < 0.023$. No other main effect or interaction was significant, largest $F < 1$.

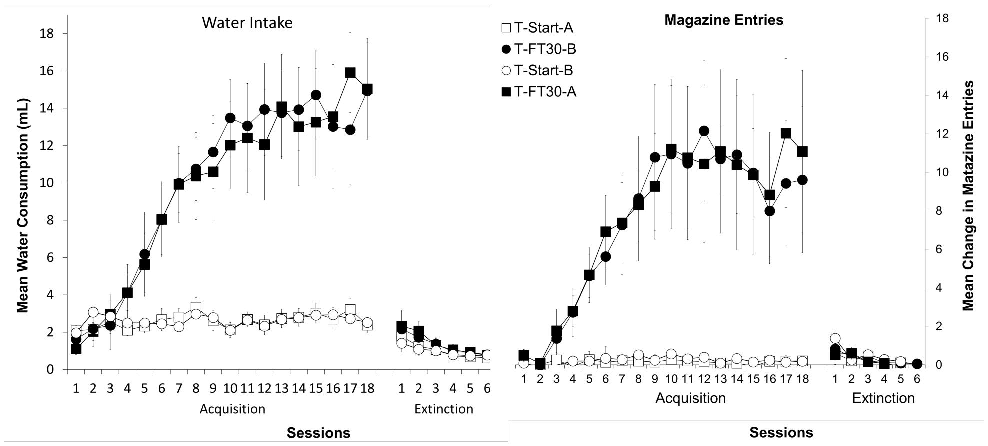


Figure 3. Mean water intake (left) and mean change in magazine entries per trial along the interpellet interval (right) throughout the 18 sessions of acquisition and the 6 sessions of extinction in groups T-FT30-A, T-Start-A, T-FT30-B and T-Start-B, of Experiment 2. Error bars represent the standard error of the mean.

The right side of each graph presents performance during the extinction phase. A 2 (Schedule) x 2 (Context) x 6 (Session) ANOVA on water consumption during extinction only found a significant main effect of Session, F(5, 130) = 15.92, MSe = 0.41, $\eta^2 = 0.380$, $p < 0.001$. No other main effect or interaction was significant, largest F(1, 26) = 2.63, MSe = 2.33, $\eta^2 = 0.092$, $p = 0.117$. The same analyses conducted with the change in magazine approaches found significant main effects of Schedule, F(1, 26) = 5.79, MSe = 0.55, $\eta^2 = 0.182$, $p = 0.024$, and Session, F(5, 130) = 11.27, MSe = 0.30, $\eta^2 = 0.302$, $p < 0.001$, and a significant Schedule x Session interaction, F(5, 130) = 4.46, MSe = 0.30, $\eta^2 = 0.146$, $p = 0.001$. The interaction was due to the presence of a simple effect of Schedule in Session 1, F(1, 28) = 7.42, MSe = 1.09, $\eta^2 = 0.210$, $p = 0.011$, that disappeared afterwards, largest F(1, 28) = 2.94, MSe = 0.41, $\eta^2 = 0.095$, $p = 0.098$. No other main effect or interaction was significant, largest F(5, 130) = 1.41, MSe = 0.30, $\eta^2 = 0.051$, $p = 0.224$.

As in Experiment 1, acquisition and extinction proceeded similarly for water intake and the change in magazine approaches. As in Experiment 1, extinction seemed to proceed quite quickly. However, comparing mean changes in magazine approaches of groups T-FT30-A and T-FT30-B at the first trial of the last acquisition session [(10.11 ± 4.00) and (12.27 ± 3.86), respectively], and at the first trial of the first extinction session [(1.59 ± 2.16) and (4.56 ± 2.31), respectively] only found a significant main effect of Session, F(1, 12) = 23.59, MSe = 19.23, $\eta^2 = 0.663$, $p < 0.001$, showing that the context switch between acquisition and extinction did not have detectable effects on performance. As in Experiment 1, this null effect does not imply that the context-switch did not have an effect on acquisition performance, but it seems clear that this effect was not big enough as to be detected in the first extinction trial.

Extinction test. The top row of Figure 4 presents water intake (left) and changes in magazine approaches per trial (right) during the last extinction session (E6) and the 2 test sessions conducted in extinction in groups T-FT30-A, T-FT30-B, T-Start-A, and T-Start-B. No differences seem to be observed in water intake as a function of the context of testing or the food-delivery schedule. However, the change in magazine approaches seems to be greater for group T-FT30-A than for group T-F30-B, while no differences seem to appear between groups Start. Statistical analyses confirmed these impressions. A 2 (Schedule) x 2 (Context) x 2 (Session) conducted with water consumption found a Schedule x Session significant interaction, F(1, 26) = 4.88, MSe = 0.02, $\eta^2 = 0.158$, $p = 0.036$, caused by the presence of a significant simple effect of Session in Start condition, F(1, 14) = 5.48, MSe = 0.03, $\eta^2 = 0.281$, $p = 0.035$, that was not significant in condition FT30, $F < 1$. No other effect or interaction was significant, largest F(1, 26) = 2.62, MSe = 0.02, $\eta^2 = 0.092$, $p = 0.117$, for the Session x Context interaction. Additional analysis comparing performance between the last test session of extinction [E6(30)] and each of the testing sessions found that drinking during the first and second sessions of testing decreased with respect to E6(30) [F(1, 26) = 16.35, MSe = 0.10, $\eta^2 = 0.39$, $p < 0.001$, and F(1, 26) = 22.89, MSe = 0.09, $\eta^2 = 0.47$, $p < 0.001$, for first and second test session extinction, respectively]. Thus, no effects of context change on water intake at testing were found in Experiment 2.

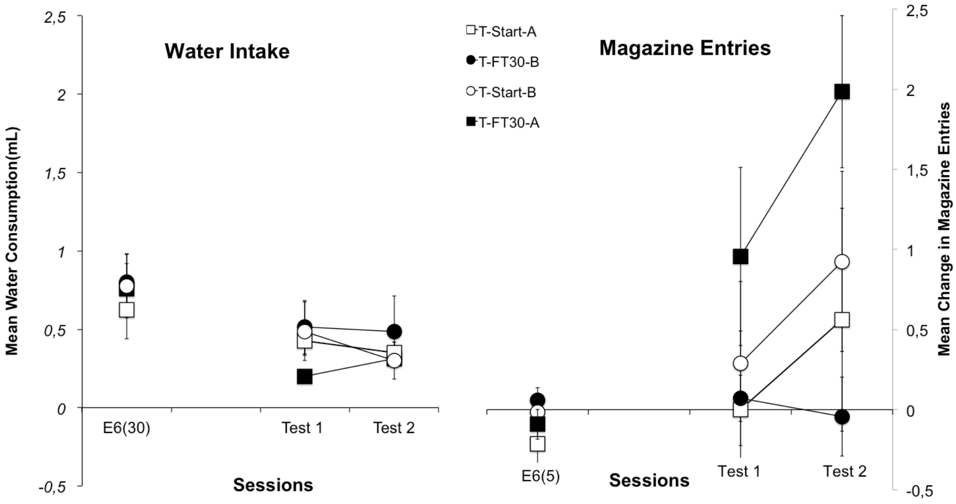
The same analysis conducted with the change in magazine approaches found a significant main effect of Session, F(1, 26) = 4.44, MSe = 0.94, $\eta^2 = 0.146$, $p = 0.045$, and a significant Schedule x Context interaction, F(1, 26) = 6.59, MSe = 1.80, $\eta^2 = 0.202$, $p = 0.016$. This interaction was due to the presence of a simple effect of Context in FT30 condition, F(1, 12) = 5.55, MSe = 2.68, $\eta^2 = 0.316$, $p = 0.036$, that did not appear in Start condition, $F < 1$. No other main effects or interactions were significant, largest F(1, 26) = 2.66, MSe = 1.8, $\eta^2 = 0.093$, $p = 0.115$, for the main effect of context. As expected, the change in magazine approaches was higher when the animals were tested in the acquisition context after being extinguished in a different context (group T-FT30-A) than when they were tested in the extinction context (group T-FT30-B). No differences were found in groups Start. Comparisons with the last session of extinction [E6(5)] reinforced these conclusions. There were no differences between the last extinction and the first test sessions, suggesting that spontaneous recovery is not observed under these conditions.

Results obtained in this test differed from the ones obtained in Experiment 1. Apparently, no evidence of recovery of SID is observed, while a clear, and no surprising recovery effect was found on the change in magazine approaches when the test is conducted in the acquisition context with respect to when the test is conducted in the extinction context (e.g., Bouton & Bolles, 1979). However, note that recovery of water intake appeared later than recovery of magazine entries in Experiment 1 (in Session 2 for the former when for the later it was evident already in Session 1). It is possible that the pattern of recovery by context change is different for SID and magazine performance, or that our measurement technique was not sensitive enough to detect these differences. Results of the reacquisition test were in agreement with these ideas.

Reacquisition test. Results of the reacquisition test are presented at the bottom row of Figure 4. Results in this test were somewhat complementary to the ones obtained in the extinction test. In this case, water consumption seemed to be greater in the group tested in the acquisition context (T-FT30-A) than in the group tested in the extinction context (T-FT30-B), a difference that did not appear in the groups that did not received intermittent food (groups Start). However, no differences as a function of the context of testing were found in the changes in magazine approaches, though reacquisition was observed in groups FT30 with respect to groups Start. Statistical analysis confirmed these impressions. A 2 (Schedule) x 2 (context) ANOVA conducted with water intake found significant main effects of Schedule, F(1, 26) = 38.26, MSe = 0.29, $\eta^2 = 0.595$, $p < 0.001$, and Context, F(1, 26) = 4.76, MSe = 0.29, $\eta^2 = 0.155$, $p = 0.038$. Most importantly, the Schedule x Context interaction was also significant, F(1, 26) = 6.25, MSe = 0.29, $\eta^2 = 0.194$, $p = 0.019$. This interaction was caused by the presence of a simple effect of Context in conditions T-FT30, F(1, 12) = 4.82, MSe = 0.61, $\eta^2 = 0.286$, $p = 0.049$, that did not appear in conditions T-Start, F(1, 14) = 1.92, MSe = 0.01, $\eta^2 = 0.121$, $p = 0.187$. The same analysis conducted with the changes in magazine entries only found a significant main effect of Schedule, F(1, 26) = 41.54, MSe = 16.49, $\eta^2 = 0.615$, $p < 0.001$. No other main effect or interaction was significant, $Fs < 1$. Thus, reacquisition was observed in conditions FT30 with respect to conditions Start. In the change in magazine approaches, reacquisition was identical regardless of the context in which it took place. However, reacquisition of SID was greater in the acquisition context than in the extinction context, the expected result if extinction of SID would have become under contextual control.

In summary, as in Experiment 1, acquisition and extinction proceeded similarly for SID and for changes in magazine approaches. Additionally, both types of behavior showed recovery from extinction when tested in the acquisition context with respect to when they were tested in the extinction context. However, recovery for water intake and magazine entries was observed under different tests and at different times. Recovery of magazine behavior was observed earlier and during an extinction test, while recovery of water intake was observed later and within a reacquisition test. A difference between Experiments 1 and 2 was the sex of the rats used in each experiment, males in Experiment 1 and females in Experiment 2. Though there are not theoretical reasons that led us to expect differences on developing of SID, or contextual control of SID depending on the sex of the rats, it is true that there seems to be a greater responding in the magazine in Experiment 2 (females) than in Experiment 1 (males), and that magazine entries may have competed with drinking, making detecting potential effects more difficult. At any rate, this would make our measure of contextual control more conservative, but should not affect our conclusions. These results suggest important parallels on recovery from extinction of adjunctive and conditioned behavior that are consistent with the similarities found between SID and operant responding in other studies (e.g., Killeen & Pellón, 2013). However, the observed results also reveal an asymmetry between the two behaviors that may, or may not be due to differential sensitivity of the used tests.

Renewal Test



Reacquisition Test

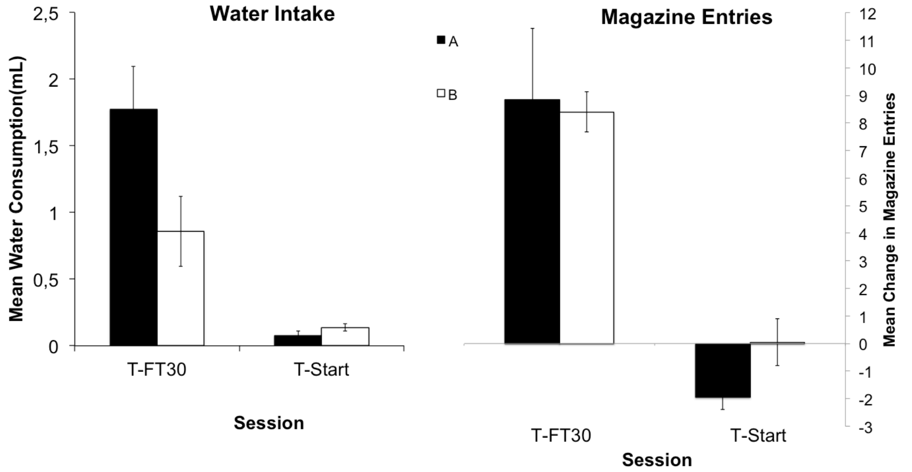


Figure 4. Mean water intake (left) and mean change in magazine entries per trial (right) in groups T-FT30-A, T-Start-A, T-FT30-B and T-Start-B during last extinction session and the Extinction test (top row) and during the Reacquisition test (bottom row) of Experiment 2. Error bars represent the standard error of the mean.

GENERAL DISCUSSION

The main goal of the present experimental series was to explore whether retrieval from extinction after a context change may be found with SID while compared with conditioned changes in magazine entries that were concurrently recorded. SID was observed when food was presented under an intermittent food delivery schedule of FT30 compared to rats that received all the food at the beginning of the session and regardless of whether the food was signaled by a tone or not (see also Castilla & Pellón, 2013; López-Crespo, Rodríguez, Pellón, & Flores, 2004; Pellón & Pérez-Padilla, 2013; Reberg, 1980). Retrieval of both, SID and magazine behavior was found when the test was conducted in the acquisition context after being extinguished in a different one, both, when compared with the end of extinction (Experiment 1) and when compared with animals that received the test in the extinction context (Experiment 2).

The general pattern of results suggests that contextual control of extinction may be found similarly for SID and magazine entries within a temporal conditioning paradigm. This result was obtained regardless of whether the presence of the food was signaled just by the time elapsed since the last food occurrence, or by a tone that was presented at the end of the inter-food interval. This is an interesting result, as it shows that recovery from extinction with the context change may be also found with time conditioning, a result that has not been often reported in the literature (but see Rosas & Alonso, 1997).

Though that recovery from extinction after a context change was observed in both, water intake and magazine approaches, recovery seems to follow a different pattern on the two behaviors. According to most reports in the literature, renewal of magazine entries is a transient phenomenon that appears early in the test session, disappearing after a few extinction trials (e.g., Bouton & Ricker, 1994; Brooks & Bouton, 1994). Contextual control of magazine entries followed a similar pattern in these experiments, though the short length of the test sessions may give an equivocal impression of a more lasting recovery. However, when retrieval of adjunctive drinking is evaluated, it seems to follow a different pattern. No effect is detected in the first sessions of testing, appearing later than recovery of magazine entries.

A possible explanation for this asymmetry in performance could be that magazine entries and drinking are competing behaviors, particularly in the experimental setting used in these experiments, in which the food cup and the water bottle were in opposite corners of the operant chamber (see Clark, 1962). However reasonably this tentative explanation may be, we can consider it only speculative, and it is difficult to think that may fully account for the obtained results, given than during the acquisition training both behaviors developed concurrently at the same rate. An alternative and somewhat less interesting explanation for this asymmetry could be a differential sensitiveness on the measurements used to evaluate each behavior in these experiments. Magazine performance was recorded trial by trial at the time immediately previous to the presentation of the food. Water intake was taken as the whole consumption throughout the session, a measure that is likely to be cruder. However, this only would have made detection of contextual control of extinction conservative, but cannot easily explain why recovery becomes bigger after the first test session. It also may be the case that the pattern of results is explained by a combination of both features, a crude measure of water intake that needs of bigger differences to be detected combined with a competition between behaviors that made detection of increases on water intake easier when recovery from magazine responses begun to decline. At any rate, there are no data in this experimental series that allow for differentiate between these explanations, and additional research will be needed to state whether the differential patterns of recovery between adjunctive drinking and magazine entries remains when different measures of water intake are taken.

The use of a crude measure of water intake also precludes observing the course of extinction during the session, so that the present data do not allow for a comparison between extinction of the induced behavior and extinction of the conditioned one. Note that comparison between the extinction courses of both types of behaviors was not the goal of this experimental series. However, this is an interesting goal for future research involving online recording of drinking behavior. Given the differences observed in the moment of recovery from extinction to appear in the present experimental series, it could be speculated that some differences on extinction between either Pavlovian or instrumental behaviors and adjunctive drinking may appear.

In any case, what it is clear in these experimental series is that extinguished SID is under contextual control, being recovered when the animal is returned to the acquisition context during the test. Given the parallel between developing of acquisition, extinction, and recovery between magazine entries and SID, the results obtained in this experimental series are in agreement with those results suggesting that SID is a conditioned behavior that may be affected by the environmental outcomes (e.g., Lashley & Rosellini, 1980, 1987; Pellón & Blackman, 1987; Pellón & Pérez-Padilla, 2013; Reberg, 1980). This pattern of results is also in agreement with those theoretical approaches that place SID under the same explanations that underlie Pavlovian (e.g., Staddon, 1977) or instrumental (e.g., Killeen & Pellón, 2013) conditioning. However, there is nothing in these results that favors an interpretation of SID as either Pavlovian or operant behavior. It is true that the parallel has been found with magazine behavior, a mostly Pavlovian response (bus see Pellón, Ibias, & Killeen, 2015), but that does not imply that SID is a Pavlovian response. Differences between SID and magazine entries have also been reported here. What it may be concluded from these experimental series is that, regardless of whether the SID is interpreted as Pavlovian or operant, its extinction is context dependent.

Finding context dependence of extinction of SID has important implications from the applied point of view. If excessive adjunctive behavior may become under contextual control, as this experiments seem to suggest, context switching may be used as a modulating variable in those situations in which excessive behavior appears. Contextual control of extinction of adjunctive behavior is particularly interesting from the treatment perspective given that, as it happens with Pavlovian and instrumental responding, the effects of an extinction treatment upon excessive behavior are expected to be attenuated by a context change, something that a therapist should keep always present (e.g., Bouton, 2002).

A final issue with the data obtained in this experimental series would be whether the contextual control reported here is true renewal or not. Although there is certain controversy in the literature with respect to the conditions that should fulfill an experimental phenomenon to be called renewal (see for instance Laborda, Witnauer & Miller, 2011; Nelson, Sanjuan, Vadillo-Ruiz, Pérez, & León, 2011; Urcelay & Miller, 2014), renewal traditionally has implied a phenomenon that may not be explained by direct associations between the contexts and the outcome (e.g., Bouton, Rosengard, Achenbach, Peck, & Brooks, 1993; Nelson et al., 2011).

One of the key factors in this interpretation is the lack of a generalization decrement with the context change between acquisition and extinction (for a review see Bouton, 1993). When such generalization decrement appears, recovery observed during the test in an ABA renewal design may be due to expression of a behavior that was never extinguished, given that the context change between acquisition and extinction involves a partial loss of the conditioned stimulus that elicited the conditioned responding during acquisition. Although the comparison between the beginning of the last acquisition session and the beginning of the first extinction session did not yield differences in the present experiments, we should be cautious about reaching the conclusion that "true" renewal has been found here (see Nelson et al. 2011). The context change may not have affected performance in the first extinction trial, but that does not imply that extinction develops similarly in the acquisition and the extinction contexts. This is an empirical question that the design of these experiments does not allow to test. Consequently, the conclusion that these experimental series allows for is that contextual control from extinction of SID and magazine entries within an ABA renewal design may be found within the same situation, even though there is an asymmetry on the time this contextual control appears for the two behaviors. Additional research should be conducted to disentangle the mechanisms that underlie this recovery effect, and the implications they have to understand contextual control of SID.

RESUMEN

Especificidad contextual de la extinción de la bebida inducida por programa en un diseño de renovación ABA en ratas. El objetivo principal de este estudio fue evaluar si la extinción de la bebida adjuntiva inducida por programa (polidipsia) podía quedar bajo control contextual. La bebida se indujo mediante un programa de administración de comida de tiempo fijo 30 segundos (TF30). El experimento 1 utilizó un diseño factorial 2 x 2 con Programa (TF30 vs. comida al inicio de la sesión) y Estímulo (presencia o ausencia de un sonido de 10s al final de cada periodo de 30s dentro de la sesión) como factores. La adquisición y la extinción se realizaron en contextos diferentes, regresando al contexto de adquisición durante la prueba. El experimento 2 introdujo una condición de control que recibió la prueba en el contexto de extinción. La recuperación de la extinción se observó como un aumento en la ingesta de agua (así como en las entradas en el comedero) durante la prueba, independientemente de la presencia del sonido. Se discuten las implicaciones de estos resultados para la interpretación de la bebida inducida por programa como una respuesta condicionada.

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