Spanish Journal of Psychology (2014), **17**, e67, 1–6.

doi:10.1017/sjp.2014.68

CAMBRIDGE UNIVERSITY PRESS

Contrasting ABA, AAB and ABC Renewal in a Free Operant Procedure

Rodolfo Bernal-Gamboa, Montserrat Carrasco-López and Javier Nieto

Universidad Nacional Autónoma de México (México)

Abstract. One experiment used a free operant procedure with rats to compare ABA, AAB and ABC renewal by using a within-subject testing procedure. All rats were first trained to press a lever for food in context A. Lever pressing was then extinguished in either context A or context B. For rats in the groups ABA and ABC extinction took place in context B, while the rats in group AAB received extinction in the same context in which acquisition took place (context A). Finally, all rats were tested for renewal in two sessions. One extinction session was carried out in the same extinction context and another session in a different context. Rats in the group ABA were tested in context B and in context A; rats in the group AAB were tested in contexts A and B, whereas the group ABC was tested in contexts B and C. The results of the ANOVA showed context renewal since all groups had higher rates of responding when they were tested outside the extinction context, $F(2, 21) = 15.32$, $p = .001$, $\eta_p^2 = .59$; however, AAB and ABC renewal was lesser than ABA renewal, $F(1, 21) = 16.70$, $p = .0001$, $\eta_p^2 = .61$.

Received 15 October 2013; Revised 11 February 2014; Accepted 13 March 2014

Keywords: context, extinction, operant conditioning, rats, renewal.

The renewal effect is the partial recovery of an extinguished conditioned response (CR) produced by a change of contextual stimuli between acquisition, extinction and testing. The ABA procedure involves pairings of a conditioned stimulus (CS) with an unconditioned stimulus (US) in a particular set of contextual cues (context A); then in a second stage the prior CS-US association is extinguished but in a different context (context B); and finally, when subjects are tested in context A, the extinguished CR reappears, that is, responding to the CS is renewed (Bouton & Bolles, 1979; Bouton & Peck, 1989; Rosas, Vila, Lugo, & López, 2001). There are reports showing the renewal effect when conditioning and extinction take place in the same context but testing takes place in a second context (i.e., AAB renewal, Bouton & Ricker, 1994; Rosas & Callejas-Aguilera, 2006). The renewal effect can also be produced when conditioning, extinction and testing take place in three different contexts (i.e., ABC renewal, Bouton & Swartzentruber, 1986; Pineño & Miller, 2004).

There has been a considerable interest in the renewal effect in recent years, partly because it is relevant to the understanding of the underlying mechanisms in different interference phenomena in associative learning (see Bouton, 1991; Nelson, Lamoureux, & León, 2013), but also because it has been proposed as a model for the acquisition and the treatment of unwanted behaviors, emotions and thoughts (Bouton & Nelson, 1998; Conklin, 2006; Laborda, McConnell, & Miller, 2011).

Bouton (1993, 1994) proposed in the early 90's one of the most influential explanations of the renewal effect through his retrieval of information theory. According to this theory, an excitatory association between the CS and the US is established during the initial stage. Then, in extinction the original excitatory association remains in place and a new inhibitory association between the CS and the US is formed, this association competes for expression with the original excitatory association. Bouton suggested that the association established during extinction is more sensitive to changes of contextual stimuli than the association established during excitatory conditioning. Thus, the theory assumes that the retrieval of the original excitatory association should be more readily generalizable to different contextual stimuli, while the recovery of the association acquired during extinction would be context-specific.

Thus, the key factor to finding the renewal effect is not testing the subject in the original context A, but testing responding outside the extinction context. Results showing ABC and AAB renewal support this assumption (see for instance Bouton, 2004; Bouton & Woods, 2008). However, as changing the extinction context is sufficient to renew responding to the CS, Bouton's theory also predicts that the size of ABA, AAB and ABC renewal should be the same. This prediction is not entirely supported by data. For instance,

Correspondence concerning this article should be addressed to Javier Nieto or Rodolfo Bernal-Gamboa. Facultad de Psicología. Universidad Nacional Autónoma de México. Coyoacán. 04510. Ciudad de México (México).

E-mail: janigu@unam.mx; rodolfo.bernalg@gmail.com

We would like to thank Alexis Martínez for his help on running the experiment. This research was funded by the UNAM-DGAPA grant PAPIIT IN307113 –RN307113.

evidence using both animals and human participants has shown a larger ABA than AAB renewal effect (e. g., Bouton, Todd, Vurbic, & Winterbauer, 2011; Nakajima, Tanaka, Urushihara, & Imada, 2000; Romero, Vila, & Rosas, 2003; Rosas, García-Gutiérrez, & Callejas-Aguilera, 2007). There are results from both human and animals showing dissociation between ABA and ABC renewal (e. g., Denniston, Chang, & Miller, 2003; Harris, Jones, Bailey, & Westbrook, 2000; Havermans, Keuker, Lataster, & Jansen, 2005; Rescorla, 2008).

These sets of data are inconsistent with the idea that the same size of renewal should be produced by the three designs. However, the experimental designs used in those papers could not be the most appropriate because they used a between experiments comparison, or they compared only two designs per experiment (i.e., ABA vs. AAB or ABA vs. ABC). Although the clearest way to test Bouton's prediction is to directly compare in the same experiment the size of ABA, AAB and ABC renewal, there are only a few studies that have used this strategy. For example, Thomas, Larsen, and Ayres (2003) using a conditioned suppression paradigm with rats found a smaller AAB renewal than ABA and ABC renewal. In a predictive learning task with humans, Üngör and Lachnit (2008) showed a dissociation of renewal since they found a similar ABA and ABC renewal but no evidence of AAB renewal. More recently, using a conditioned taste aversion procedure with rats, Bernal-Gamboa et al. (2012) found that ABA, AAB and ABC renewal were equal.

Given these inconsistent results, the main goal of the present experiment was to continue testing whether ABA, AAB and ABC procedures produce equal level of renewal in a free operant procedure with rats. As far as we know this kind of preparation has not been used to compare the three renewal designs within the same experiment. We chose a within-subject test for renewal because this kind of design would allow a more precise evaluation of the context-switch effect. Three groups of rats were trained to press a lever for food in context A. Then, responding was extinguished for all groups. For rats in group AAB, excitatory conditioning and extinction were conducted in the same context, whereas rats in groups ABA and ABC received extinction in a different context (context B). Finally, all rats were tested for operant responding in both the extinction context and a different context (in counterbalanced order).

Method

Subjects

Twenty-four female Wistar rats (eight rats per group) weighting in average 231 g were used. The rats were about three months old and experimentally naïve at the beginning of the experiment. They were individually housed in standard Plexiglas cages in a room with a 12–12 hr light-dark cycle. All subjects were maintained with ad libitum access to water but were food-deprived to 83% of their initial body weights throughout the experiment.

Apparatus

Eight identical chambers manufactured by MED Associates (model ENV-008) measuring 29 cm height x 22 cm long x 24 cm wide were used. Each chamber was enclosed by a sound-attenuating shell with an exhaust fan that produced background noise of 60 dB. The side walls and ceiling were made of clear acrylic plastic, while the front and rear walls were made of stainless steel. The floor of the chamber consisted of sixteen 0.5-cm diameter stainless steel rods spaced 1.5 cm apart. A recessed 5 x 5 cm food magazine in which 45 mg Noyes A/I pellets could be delivered was centered on the front wall. In each chamber a retractable lever was positioned to the right of the food tray, 6.8 cm from the floor. A 28 Vdc bulb was placed 4.2 cm above the lever, this light served as a general houselight. The chambers were connected to a PC that controlled and recorded events in the chambers.

The chambers were set up to provide three different sets of contextual cues. Four chambers provided the *Vinegar-Rod* context which consisted of vinegar scent provided by a dish containing 5 ml of white vinegar (Clemente Jacques, Sabormex S.A. de C.V., México, DF) placed outside of each chamber near the front wall. The floor consisted of the sixteen stainless steel rods described before. Two additional chambers provided the *Windex-Sandpaper* context. One of the side walls was covered with a red circle pattern papersheet. The rods of the floor were covered with a sandpaper sheet (number 10). The scent was provided by 5ml of Windex (S. C. Johnson and Son, S. A. de C.V. Mexico) placed outside of each chamber near the front wall. Finally, two additional chambers provided the *Vanilla-Foamy* context. One the side walls was covered with a black vertical diagonal stripes (3.5 cm wide and 3.5 wide apart) papersheet. A vinyl acetate sheet covered the floor rods and a dish containing 5 ml of vanilla oil (McCormick and Company Inc., Maryland) provide the distinctive odor, the dish was placed outside of each chamber near the front wall. Scents were refreshed daily. It's important to note that for all rats, context A was the *Vinegar-Rod* context, while the *Windex-Sandpaper* and the *Vanilla-Foamy* contexts were counterbalanced as context B and context C across rats.

Procedure

Sessions were conducted on successive days at the same time each day. The experiment consisted of three stages: Acquisition, Extinction and Testing (see Table 1). During the first three days all rats received acclimatation

https://doi.org/10.1017/sjp.2014.68 Published online by Cambridge University Press

Table 1. *Experimental Design*

			Test	
Group	Acquisition	Extinction	Extinction	Renewal
ABA	A: 6R-O	B: 4R-	B: 1R-	A: 1R-
AAB	A: 6R-O	A: 4R-	A: 1R-	B: 1R-
ABC	A: 6R-O	B: 4R-	B: 1R-	C: 1R-

Note: A, B & C, was three different contexts, context A was the same for all rats, while context B & C were counterbalanced. "R-O" means that pressing the lever was reinforced. "R-" means that pressing the lever was not reinforced.

to the contexts. On the first day all rats were exposed to context A, on the second day rats experienced context B, and on the third day all rats were exposed to context C. During theses sessions food pellets were delivered approximately 50 times on a variable time 30s schedule (VT 30s). The lever was retracted during these sessions. Each session lasted 20 min.

Acquisition

During the next six sessions the levers were inserted and rats were trained to press the lever for food on a variable interval 30s schedule (VI 30s) in context A. Each session lasted 30 min.

Extinction

At the beginning of this phase rats were assigned to one of three groups ABA, AAB and ABC matched on their rates of responding on acquisition. Four daily 30 min sessions of extinction then followed. For group AAB this phase took place in context A, while for rats in groups ABA and ABC these sessions were conducted in context B. No pellets were delivered during this phase.

Testing

Rats received two 10 min test sessions in both extinction and renewal contexts. The order of testing was counterbalanced across rats. Thus, for half of the rats on each group testing took place first in the extinction context, while for the other half the first test session was conducted in the renewal context. The two sessions were separated by 60 min. The procedure was identical to that of the extinction stage.

Statistical Analysis

The rat´s mean responses per minute for each group were compared using analyses of variance (ANOVA). The rejection criterion was set at $p < .05$, and effect sizes were reported using partial eta-squared (η_p^2).

Results

Acquisition

The left-hand side of Figure 1 shows the mean responses rates during each session of acquisition. The figure indicates that lever pressing was acquired by all groups and that the pressing the lever increased as acquisition progressed. A 3 (Group) x 6 (Session) ANOVA conducted on these data only found a significant main effect of Session, $F(5, 105) = 28.99$, Mean Square Error (MSe) = 10.12, $p = .001$, $\eta_p^2 = .58$.

Extinction

The right-hand side of Figure 1 shows the mean responses per minute during each extinction session. During the extinction, lever pressing decreased in all groups. However, group AAB showed a slower reduction of lever pressing than groups ABA and ABC. A 3 (Group) x 4 (Session) ANOVA conducted on these data showed a significant main effect of Group, $F(2, 21) = 4.57$, $MSe = 6.4$, $p = .02$, $\eta_p^2 = .30$ and Session, $F(3, 63) = 111.61$, $MSe = 1.87$, $p = .001$, $\eta_p^2 = .84$. The Group x Session interaction was also significant, $F(6, 63) = 3.89$, $MSe = 1.87$, $p = .002$, $\eta_p^2 = .27$. Subsequent analyses conducted to explore the Group x Session interaction found that rats in AAB group showed a higher level of responding on Session 1 and 2, $F(1, 21) = 6.03$, $MSe = 2.11$, $p = .008$, $\eta_p^2 = .36$.

Testing

Figure 2 shows the mean responses per minute in both extinction and renewal context during testing. All

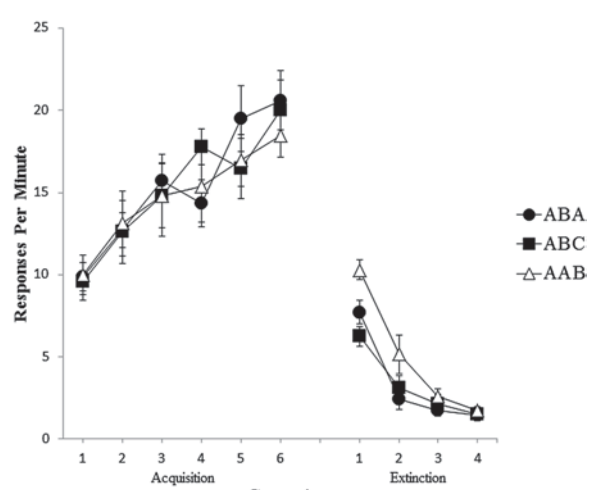

Figure 1. Left-hand panel shows mean lever pressing per min during each session of acquisition for groups ABA, AAB and ABC, while the right-hand panel shows mean lever pressing per minb during each session of extinction for all groups. Error bars denote standard errors of the mean.

https://doi.org/10.1017/sjp.2014.68 Published online by Cambridge University Press

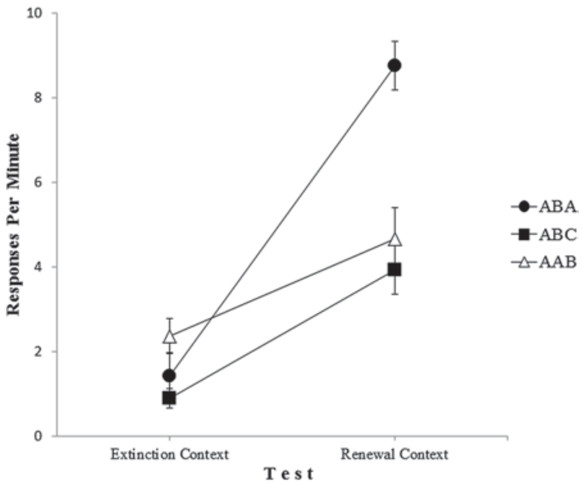

Figure 2. Mean lever pressing per min during the test sessions in the extinction context and in the renewal context for rats in groups ABA, AAB and ABC. Error bars denote standard errors of the mean.

groups showed higher levels of lever responding in the renewal context than in the extinction context. A 3 (Group) x 2 (Test Context) ANOVA conducted on these data showed a significant effect of Group, $F(2, 21) = 10.43$, $MSe = 2.75$, $p = .001$, $\eta_p^2 = .49$ and Test Context, $F(1, 21) = 110.50$, $MSe = 1.94$, $p = .001$, $\eta_p^2 = .84$. More important the Group x Test Context interaction was significant too, $F(2, 21) = 15.32$, $MSe = 1.94$, $p = .001$, $\eta_p^2 = .59$. Planned comparisons of the groups showed that the magnitude of renewal was greater in ABA than in AAB and ABC groups, $F(1, 21) = 16.70$, $MSe = 3.24$, $p = .0001$, $\eta_p^2 = .61$; whereas AAB and ABC renewal were similar, $F < 1$.

Discussion

The main goal of the present experiment was to compare whether the same magnitude of recovery from extinction could be found in the ABA, AAB and ABC renewal using an operant procedure with rats. We found ABA, AAB and ABC renewal with a within-subject testing procedure. This result replicated and extended the results recently obtained by Bouton et al. (2011; see also Todd, Winterbauer, & Bouton, 2012) with a procedure that directly compares the three renewal designs within the same experiment.

The finding of ABA, AAB and ABC renewal is consistent with the idea that testing the subject´s responding outside the extinction context is sufficient to produce the renewal effect. However, there are some important issues that deserve to be discussed. In order to explain the renewal effect, Bouton proposed that the inhibitory association established during extinction is modulated by the contextual cues in which it was acquired. So, extinction context is *necessary* for the expression of extinction learning, whereas the expression of conditioning learning generalizes more readily to a new context. Thus, this hypothesis implies that those associations acquired during conditioning are relatively *context-free*, so the performance learned during conditioning should be generalized to other contexts. This prediction is empirically supported by a large number of reports using both Pavlovian conditioning and predictive learning task with humans (e.g., Bouton & Peck, 1989; Rosas & Callejas-Aguilera, 2006).

However, the present results are inconsistent with that prediction because they showed an immediate decrement of lever pressing only in the groups that experienced a context shift between acquisition and extinction (i.e., ABA and ABC groups). Given that this pattern of result has been found in several experiments that used a free operant procedure (e.g., Bouton et al., 2011), a likely explanation for this pattern of evidence could rely on the nature of the procedure. Rosas, Todd, and Bouton, (2013) noted that in Pavlovian conditioning contexts are always present along with the CS (i.e., a good signal of the US), while in a free operant procedure there is no signal which could play that role. Consequently, given that contextual cues are the only stimuli present in which rats are free to press the lever for food it is more likely that the rat during conditioning forms a direct association between the operant response and the context in which is learned, making the conditioning of free operant response context-dependent.

In conclusion, the idea that suggests that the performance learned during conditioning it generalized almost completely to different contexts might not be useful for situations in which the conditioning context forms a direct association with the US or the response as with the free operant procedures.

The second issue that needs discussion is the differences among ABA, AAB and ABC renewal. Given that the experiment reported here made a direct comparison between the three renewal designs, the present discussion was based on the only two other studies with rats that contrasted directly within the same experiment the three renewal designs. As we mentioned before, Thomas et al. (2003) using a conditioned suppression procedure found a similar retrieval on ABA and ABC renewal but both produced larger release from extinction than AAB renewal. In contrast, Bernal-Gamboa et al. (2012) using a CTA preparation reported similar levels of recovery in three renewal designs. The data presented here using a free operant procedure showed a larger retrieval with the ABA design. A closer examination of the procedures could explain these seemingly contrdictory results.

For example, in order to equate familiarity with all contexts, Bernal-Gamboa et al. (2012), gave the groups

https://doi.org/10.1017/sjp.2014.68 Published online by Cambridge University Press

three daily sessions of the same duration throughout the experiment, one in context A, one in context B and one in context C. In contrast, in the present experiment and in Thomas et al.´s (2003), groups received a couple of pre-exposure sessions with the three contexts before conditioning. Although this latter method controls the novelty of the contextual cues, the rat's experiences with the contexts are different. In addition, Todd (2013) conducted an experiment to test ABA and AAB renewal with a free operant procedure that controlled for the reinforcement histories of contexts A and B during every session. He found that when the associative histories of the contexts are equated, the sizes of AAB and ABA renewal were similar (e.g., Bernal-Gamboa et al., 2012). Thus, this strongly suggests that the amount of context-familiarity plays an important role for the strengths of renewal effect.

Another difference between reports that could be important is that Bernal-Gamboa et al. (2012) didn't find the effect of context change upon conditioning (i.e., aversion learned in context A generalized well to context B). However, in both Thomas's and the present experiment, a context switch effect between conditioning and extinction was found (it's important to note that although Thomas et al. reported that this effect was not significant, the tendency was high, $F(1, 46) = 3.49$, $p = .07$), suggesting that the context formed a direct association with the US during conditioning. Thus, the data reported here could be explain by assuming that the strength of renewal is sensitive to manipulations that favor context-US direct associations during conditioning. Although this view could fit the data it´s important to note that it is only speculative, because we didn't do that manipulation in the present experiment. In conclusion, more research to explore the role of the context of the recovery of operant responses is necessary given that the renewal effect has many clinical implications for relapse (e.g., Bouton, Winterbauer, & Todd, 2012).

References

Bernal-Gamboa R., Juárez Y., González-Martín G., Carranza R., Sánchez-Carrasco L., & Nieto J. (2012). ABA, AAB and ABC renewal in taste aversion learning. *Psicológica*, *33*, 1–13.

Bouton M. E. (1991). Context and retrieval in extinction and in other examples of interference in simple associative learning. In L. Dachowski & C. F. Flaherty (Eds.), *Current topics in animal learning: Brain, emotion and cognition* (pp. 25–53). Hillsdale, NJ: Lawrence Erlbaum.

Bouton M. E. (1993). Context, time, and memory retrieval in the interference paradigms of pavlovian learning. *Psychological Bulletin*, *114*, 80–99. http://dx.doi.org/10.1037/0033-2909.114.1.80

Bouton M. E. (1994). Conditioning, remembering, and forgetting. *Journal of experimental Psychology: Animal Behavior Processes*, *20*, 219–231. http://dx.doi.org/10.1037/0097-7403.20.3.219

Bouton M. E. (2004). Context and behavioral processes in extinction. *Learning & Memory*, *11*, 485–494. http://dx.doi.org/10.1101/lm.78804

Bouton M. E., & Bolles R. C. (1979). Contextual control of the extinction of conditioned fear. *Learning and Motivation*. *10*, 445–466. http://dx.doi.org/10.1016/0023-9690(79)90057-2

Bouton M. E., & Nelson J. B. (1998). The role of context in classical conditioning: Some implications for cognitive behavior therapy. In W. O'Donohue (Ed.), *Learning and behavior therapy* (pp. 59–84). Needham Heights, MA: Allyn & Bacon.

Bouton M. E., & Peck C. A. (1989). Context effects on conditioning, extinction, and reinstatement in an appetitive conditioning preparation. *Animal Learning and Behavior*, *17*, 188–198. http://dx.doi.org/10.3758/BF03207634

Bouton M. E., & Ricker S. T. (1994). Renewal of extinguished responding in a second context. *Animal Learning and Behavior*, *22*, 317–324. http://dx.doi.org/10.3758/BF03209840

Bouton M. E., & Swartzentruber D. (1986). Analysis of the associative and occasion-setting properties of context participating in a pavlovian discrimination. *Journal of Experimental Psychology: Animal Behavior Processes*, *12*, 333–350. http://dx.doi.org/10.1037//0097-7403.12.4.333

Bouton M. E., Todd T. P., Vurbic D., & Winterbauer N. E. (2011). Renewal after the extinction of free operant behavior. *Learning and Behavior*, *39*, 57–67. http://dx.doi.org/10.3758/s13420-011-0018-6

Bouton M. E., Winterbauer N. E., & Todd P. T. (2012). Relapse processes after the extinction of instrumental learning: Renewal, resurgence, and reacquisition. *Behavioural Processes*, *90*, 130–141. http://dx.doi.org/10.1016/j.beproc.2012.03.004

Bouton M. E., & Woods A. M. (2008). Extinction: Behavioral mechanisms and their implications. In J. H. Byrne, D. Sweatt, R. Menzel, H. Eichenbaum, & Roediger (Eds.), *Learning and Memory: A comprehensive reference. Learning Theory and Behaviour*. (Vol. 1, pp. 151–171). Oxford, UK: Elsevier.

Conklin C. (2006). Environments as cues to smoke: Implications for human extinction based research and treatment. *Experimental and clinical Psychopharmacology*, *14*, 12–19. http://dx.doi.org/10.1037/1064-1297.14.1.12

Denniston J. C., Chang R. C., & Miller R. R. (2003). Massive extinction treatment attenuates the renewal effect. *Learning and Motivation*, *34*, 68–86. http://dx.doi.org/10.1016/S0023-9690(02)00508-8

Harris J. A., Jones L., Bailey G. K., & Westbrook R. F. (2000). Contextual control over conditioned responding in an extinction paradigm. *Journal of Experimental Psychology: Animal Behavior Processes*, *26*, 174–185. http://dx.doi.org/10.1037//0097-7403.26.2.174

Havermans R. C., Keuker J., Lataster T., & Jansen A. (2005). Contextual control of extinguished conditioned performance in humans. *Learning and Motivation*, *36*, 1–19. http://dx.doi.org/10.1016/j.lmot.2004.09.002

Laborda M. A., McConnell B. L., & Miller R. R. (2011). Behavioral techniques to reduce relapse after exposure therapy: Applicatiojns of studies of experimental extinction. In T. Schachtman & S. Reily (Eds.), *Applications of conditioning theory*. Oxford, UK: Oxford University Press.

Nakajima S., Tanaka S., Urshihara K., & Imada H. (2000). Renewal of extinguished lever-press responses upon return to the training context. *Learning and Motivation*, *31*, 416–431. http://dx.doi.org/10.1006/lmot.2000.1064

Nelson J. B., Lamoureux J. A., & León S. P. (2013). Extinction arouses attention to the context in a behavioral suppression method with humans. *Journal of Experimental Psychology: Animal Behavior Processes*, *39*, 99–105. http://dx.doi.org/10.1037/a0030759

Pineño O., & Miller R. R. (2004). Signalling a change in cue–outcome relations in human associative learning. *Learning & Behavior*, *32*, 360–375.

Rescorla R. A. (2008). Within-subject renewal in sign tracking. *The Quarterly Journal of Experimental Psychology*, *61*, 1793–1802. http://dx.doi.org/10.1080/17470210701790099

Romero M. A., Vila N. J., & Rosas J. M. (2003). Time and context effects after discrimination reversal in human beings. *Psicológica*, *24*, 169–184

Rosas J. M., & Callejas-Aguilera J. E. (2006). Context switch effects on acquisition and extinction in human predictive learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *32*, 461–474. http://dx.doi.org/10.1037/0278-7393.32.3.461

Rosas J. M., García-Gutiérrez A., & Callejas-Aguilera J. E. (2007). AAB and ABA renewal as a function of the number of extinction trials in conditioned taste aversion. *Psicológica*, *28*, 129–150.

Rosas J. M., Vila N. J., Lugo M., & López L. (2001). Combined effect of context change and retention interval upon interference in causality judgments. *Journal of Experimental Psychology: Animal Behavior Processes*, *27*, 153–164. http://dx.doi.org/10.1037/0097-7403.27.2.153

Rosas J. M., Todd T. P., & Bouton M. E. (2013). Context change and associative learning. *Wiley Interdisciplinary Reviews: Cognitive Science*, *4*, 237–244. http://dx.doi.org/10.1002/wcs.1225

Thomas B. L., Larsen N., & Ayres J. B. (2003). Role of context similarity in ABA, ABC and AAB renewal paradigms: Implications for theories of renewal and for treating human phobias. *Learning and Motivation*, *34*, 410–436. http://dx.doi.org/10.1016/S0023-9690(03)00037-7

Todd T. P. (2013). Mechanisms of renewal after the extinction of instrumental behavior. *Journal of Experimental Pscyhology: Animal Behavior Processes*, *39*, 193–207. http://dx.doi.org/10.1037/a0032236

Todd T. P., Winterbauer N. E., & Bouton M. E. (2012). Effects of the amount of acquisition and contextual generalization on the renewal of instrumental behavior after extinction. *Learning and Behavior*, *40*, 145–157. http://dx.doi.org/10.3758/s13420-011-0051-5

Üngör M., & Lachnit H. (2008). Dissociations among ABA, ABC and AAB recovery effects. *Learning and Motivation*, *39*, 181–195. http://dx.doi.org/10.1016/j.lmot.2007.08.001