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Extinction of aversive eliciting functions as an analog of exposure to conditioned fear: Does it alter avoidance responding?

Carmen Luciano [a,*], Sonsoles Valdivia-Salas [a], Francisco J. Ruiz [a], Miguel Rodríguez-Valverde [b], Dermot Barnes-Holmes [c], Michael J. Dougher [d], Francisco Cabello [e], Vanessa Sánchez [a], Yvonne Barnes-Holmes [c], Olga Gutierrez [f]

[a] Universidad de Almería, Spain
[b] Universidad de Jaén, Spain
[c] National University of Ireland, Irealnd
[d] University of New Mexico, USA
[e] Universidad de Murcia, Spain
[f] Universidad de Barcelona, Spain

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ABSTRACT

Exposure techniques rely on the assumption that the extinction of the classically conditioned response (i.e., fear) will result in the disruption of limiting forms of avoidance behavior, both directly trained and derived/indirectly established. This report presents translational research that attempts to test this assumption in laboratory conditions in two experiments with human volunteers. The procedure in both experiments included six phases: (1) conditional discrimination training for the formation of two 6-member equivalence classes; (2) classical conditioning of elicited responses to Class 1 (A1/B1) and Class 2 (A2/B2) members in the *white* context, followed by conditioning of avoidance/approach responses to Class 1/Class 2 members, respectively, in the *green* context; (3) test for the transfer of avoidance/approach functions and of eliciting respondent functions to D1/F1 and D2/F2 in the *green* context; (4) extinction of classically conditioned responses to A1/B1 in the *white* context; (5) test of the effects of respondent extinction on avoidance responding to the A, B, D, and F stimuli in the *green* context; and (6) test of derived symmetry and equivalence relations. Results show that after successful respondent extinction in the *white* context, only 33.3% participants stopped showing avoidance behavior in the *green* context, and that respondent elicitation was reinstalled during the test (Phase 5). In Phase 4 of Experiment 2, in addition to undergoing respondent extinction, participants were instructed that the white and green contexts were similar. Results show that after successful respondent extinction in the white context during Phase 4, only 10% participants stopped showing avoidance behavior in the green context, and that respondent elicitation was almost eliminated during the test (Phase 5). We discuss these findings and their applied implications.

1. Introduction

Traditionally, conditioning-based approaches to the explanation of anxiety disorders have assumed that a history of direct aversive conditioning is necessary for the acquisition of fear and avoidance responses (Barlow, 2002). Although clinical data indicate that fears often emerge in the absence of any identifiable aversive conditioning (e.g., Rachman, 1977, 1991), and recent research in derived relational responding (see Dymond & Roche, 2009) and associative learning (Field, 2006) has identified ways in which fear and avoidance can be learned indirectly, it could be said that the assumption still holds in general terms, with some aversive conditioning experience needed at some point in the genesis of anxiety.

Conditioning-based approaches have led to the design of exposure techniques, widely used in behavior therapy for the treatment of anxiety disorders (e.g., Barlow, 2002; Deacon & Abramowitz, 2004; Marks, 1981). Exposure therapy is based on the assumption that repeated exposure to the feared object or event (conditioned stimulus), produces the extinction of the aversively conditioned responses (i.e., fear) and, hence, the reduction of their behavioral outcome, namely avoidance (e.g., Craske & Mystkowski, 2006; Mowrer, 1960). In fact, preventing avoidance is

* Correspondence to: Facultad Psicología, Universidad Almería, 04120 Almería, Spain. Tel.: +34 950 015260.
E-mail address: mluciano@ual.es (C. Luciano).

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the ultimate goal of exposure therapy, as this behavioral process is considered a critical factor in the etiology and maintenance of anxiety disorders (e.g., Barlow, 2002; Forsyth, Eifert, & Barrios, 2006; Hayes, 1976; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996).

During the last 15 years, research on the extinction of conditioned fear has focused on the conditions in which exposure treatments work (e.g., Hermans, Craske, Mineka, & Lovibond, 2006), showing that the introduction of inhibitory CSs as "safety-signals" (e.g., the presence of the therapist during exposure) or that the use of safety behaviors such as avoidance have a deleterious effect on fear extinction (e.g., Lovibond, Davis, & O'Flaherty, 2000; Lovibond, Mitchell, Minard, Brady, & Menzies, 2009). Also, it has been shown that the extinction of conditioned fear responses is context sensitive; that is, that a change of context typically produces renewal of already extinguished fear responses (Neumann & Longbottom, 2008; Vansteenwegen, Dirikx, Hermans, Vervliet, & Eelen, 2006), turning fear extinction into a difficult target. Besides the observed difficulties in obtaining fear extinction, somewhat surprisingly the central assumption underlying exposure treatments remains untested in laboratory conditions. That is, there is no laboratory evidence that the extinction of fear responses in the same context in which they were conditioned will alter subsequent avoidance responding in a context in which there is an actual opportunity to avoid.

Research on relational responding during the last decades is successfully addressing some of the limitations of traditional conditioning approaches to the acquisition of fear and avoidance (see Dymond & Roche, 2009; Forsyth et al., 2006). Specifically, there is evidence that a stimulus may acquire eliciting and avoidance functions indirectly by virtue of its relation to another stimulus whose eliciting and avoidance functions were acquired by direct conditioning. For instance, Dougher, Augustson, Markham, Greenway, and Wulfert (1994) demonstrated that after training and testing for two four-member equivalence classes (A1–B1–C1-D1 and A2–B2–C2–D2) and pairing B1 to electric shocks, most participants showed higher skin conductance to C1 and D1 than to C2 and D2 (for similar results, see Rodríguez-Valverde, Luciano, & Barnes-Holmes (2009)). Even more interestingly, Dougher et al. (2007) found higher skin conductance to a non-conditioned stimulus (say C) than to an aversively conditioned stimulus (say B), by virtue of the derived relation of comparison previously established between both stimuli (B is less than C). A similar transfer of function effect has been observed with respondent extinction. Dougher et al. (1994) exposed participants to aversive conditioning by pairing several elements of the same equivalence class (B1, C1, and D1) with shock. Then, only one of the elements underwent extinction (i.e., was presented repeatedly without shock). As a result, the remaining members of the class failed to elicit responses in a subsequent test.

Avoidance-evoking functions may also transfer across members of the same relational network. By using similar procedures to those in Dougher et al. (1994), Auguston and Dougher (1997) trained avoidance responding in the presence of an aversive conditioned stimulus (B1 paired with shock) and then observed that other members of the same equivalence class (C1 and D1) evoked avoidance responding although they had never been directly paired with shock. Also, Roche, Kanter, Brown, Dymond, and Fogarty (2008) showed that the extinction of avoidance responding in the presence of one element of an equivalence class transferred to other elements of the same class. In summary, data show that respondent elicitation and extinction, as well as avoidance-evoking functions and operant extinction of avoidance, may transform according to equivalence and non-equivalence relations. These results attest how importantly verbal processes are involved in human conditioning (e.g., De Houwer, 2009; Lovibond, 2006). To date, however, no study has addressed the impact of respondent extinction of conditioned fear on avoidance behavior, either directly trained or acquired by relational means. Indeed, to our knowledge, no published study has analyzed the transfer of both respondent elicitation and avoidance-evoking functions simultaneously (in the same task and with the same participants). Published work has focused on either one or the other.

The present study attempts to fill this gap, with two goals: first, to design an experimental analog of the acquisition and derived transfer of both respondent fear-elicitation and avoidance-evoking functions by adapting well-known laboratory procedures within the research area of derived relational responding; second, and most importantly, to examine whether respondent fear extinction will reduce the likelihood of subsequent avoidance responding (as an analog of exposure techniques). Two experiments were conducted with electric shocks as unconditioned aversive stimulation during conditioning phases. In contrast to what was done in previous studies, we measured both elicited (skin conductance) *and* operant (avoidance and approach) responses throughout the procedure. In Experiment 1, we tested whether respondent extinction in the same context in which fear responses had been acquired would lead to the alteration of avoidance behavior in a different context (in which avoidance had been trained). Given the low impact of this procedure on avoidance responding, in Experiment 2 we trained a relation of similarity between the context in which respondent extinction occurred and the context in which avoidance responses were available.

2. Experiment 1

2.1. Method

2.1.1. Participants

Eighteen undergraduates (13 females; age range = 19–25) attending different courses (e.g., introductory psychology, maths, law) at Universidad de Almería participated in the experiment. None of them had previous experience with the procedures employed in this study. They were recruited through in-class and on-campus flyer announcements, and each of them received 10 Euro for participation. At the beginning, all participants read and signed a consent form informing them that they would receive mild shocks and that they were free to discontinue participation at any time without having to give up the 10 Euro they received in return. Upon completion of the tasks, participants were fully debriefed.

2.1.2. Setting, apparatus, and stimuli

The setting, apparatus, and stimuli involved in this series of experiments were almost identical to those in Rodríguez-Valverde et al. (2009); thus the following description will mainly focus on their different features. The experiment was run in a laboratory consisting of two adjacent rooms (an experimental cubicle and an observation room) with a two-way mirror for participant observation. All visual stimuli were presented on an HP nx9010 laptop computer (15 in color screen). Skin conductance was measured and recorded according to the constant voltage technique (0.5 V) of exosomatic recording (see Dawson, Schell, & Filion, 1990) through a computerized physiological recording system (BIOPAC Instruments) with non-polarizable Ag/AgCl finger electrodes attached to the palmar side of the distal phalanx of the first and third fingers of the participant's nondominant hand. An isolated square-wave stimulator (Laffayette 82415-IS) was used for the delivery of constant voltage electric shocks (450 ms duration) through two disposable adhesive round electrodes attached to