



## The relative effectiveness of extinction and counter-conditioning in diminishing children's fear



Carol Newall <sup>a,\*</sup>, Tiffany Watson <sup>b</sup>, Kerry-Ann Grant <sup>c</sup>, Rick Richardson <sup>d</sup>

<sup>a</sup> Department of Educational Studies, Macquarie University, Australia

<sup>b</sup> Department of Psychology, Macquarie University, Australia

<sup>c</sup> Centre for Emotional Health, Macquarie University, Australia

<sup>d</sup> School of Psychology, University of New South Wales, Australia

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### ABSTRACT

Two behavioural strategies for reducing learned fear are extinction and counter-conditioning, and in this study we compared the relative effectiveness of the two procedures at diminishing fear in children. Seventy-three children aged 7–12 years old ( $M = 9.30$ ,  $SD = 1.62$ ) were exposed to pictures of two novel animals on a computer screen during the fear acquisition phase. One of these animals was paired with a picture of a scared human face (CS+) while the other was not (CS-). The children were then randomly assigned to one of three conditions: counter-conditioning (animal paired with a happy face), extinction (animal without scared face), or control (no fear reduction procedure). Changes in fear beliefs and behavioural avoidance of the animal were measured. Counter-conditioning was more effective at reducing fear to the CS + than extinction. The findings are discussed in terms of implications for behavioural treatments of childhood anxiety disorders.

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Anxiety disorders affect 15–20% of youth, making these disorders among the most prevalent psychiatric conditions in childhood and adolescence (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012; Merikangas, Nakamura, & Ressler, 2009). When left untreated, anxiety interferes with daily functioning, including academic achievement and social skills development (Ezpeleta, Keeler, Erkanli, Costello, & Angold, 2001). The origin of childhood anxiety disorders is a subject of considerable research interest because it informs both post-onset interventions as well as prevention strategies. While there is some debate about the relative contribution of various aetiological factors to childhood anxiety problems, learning experiences (e.g., adverse events, provision of negative information) are considered major contributors to fear and anxiety onset (Askew & Field, 2007; Hoven et al., 2005; Muris & Field, 2010; Rachman, 1977). However, much less is known about the role of children's learning experiences in fear reduction. Understanding how children reduce fear is important for at least two reasons. First, some have suggested that difficulties in reducing fear

normally during childhood may be a marker of risk for anxiety disorders (Craske et al., 2008; Waters, Henry, & Neumann, 2009). Second, understanding the learning processes involved in reducing fear will contribute to the development of effective prevention and treatment strategies (McGuire et al., 2016).

Of the few studies that have examined fear reduction in children, the majority has examined a fear reduction technique called *extinction* (McGuire et al., 2016). In extinction, a conditioned stimulus (CS; e.g., a picture of a bell) that was previously paired repeatedly with a biologically significant and aversive unconditioned stimulus (US; loud ringing) is now presented alone, without the US (e.g., Michalska et al., 2016). The fear elicited by the CS is decreased over repeated non-reinforced presentations. The extinction procedure is the laboratory analogue of exposure therapy for anxiety disorders. In exposure therapy the client experiences, often in a graded fashion, the feared situation or cue. In this way, the client is 'exposed' to the feared CS or context without the anticipated negative outcome, just like extinction. There has been considerable research on extinction over the past decade, with the intent of eventually improving the treatment of adult anxiety disorders (Milad & Quirk, 2012; Quirk et al., 2010). Emerging research suggests that extinction is also an effective technique for reducing fear in children (Craske et al., 2008; Liberman, Lipp, Spence, &

\* Corresponding author. Department of Educational Studies, Macquarie University, 2109, Australia.

E-mail address: [carol.newall@mq.edu.au](mailto:carol.newall@mq.edu.au) (C. Newall).

March 2006; Neumann, Waters, & Westbury, 2008; Waters et al., 2009).

An alternative technique for reducing fear is counter-conditioning, which involves pairing the feared CS with an appetitive/positive outcome (e.g., food instead of a loud ringing). Over repeated CS-positive US pairings, the fear response declines, and is often replaced by an appetitive response (e.g., approach towards the CS; Dickinson & Pearce, 1977). There have been substantially fewer studies on counter-conditioning than extinction in both adults and children. However, the few studies that have examined counter-conditioning in adults indicate that it is not only effective but may even be a superior fear reduction technique compared to extinction (Kerkhof, Vansteenwegen, Baeyens, & Hermans, 2010; Raes & De Raedt, 2012) because it may enhance and deepen extinction by the surprising presentation of a positive outcome (Rescorla & Wagner, 1972). Another reason that counter-conditioning might be more effective than extinction is because it can reduce the new valence acquired by the CS during conditioning. That is, in addition to learning a CS-US association during acquisition, participants may also acquire a “liking” or “disliking” of the CS, a process referred to as “evaluative” learning (for review see De Houwer, Thomas, & Baeyens, 2001). In extinction the CS is merely presented repeatedly by itself, thereby breaking the associative link between the two but not necessarily altering the participants’ liking/disliking of the CS. Indeed, evaluative learning is thought to be relatively robust against extinction (e.g., Díaz, Ruiz, & Bayens, 2005; Mason & Richardson, 2010; Vansteenwegen, Francken, Vervliet, De Clercq, & Eelen, 2006). In contrast, in counter-conditioning the CS is paired with an oppositely-valenced US (e.g., a CS previously paired with an aversive outcome is now paired with a positive outcome) which has been shown to alter evaluative learning (e.g., Baeyens, Eelen, Van den Bergh, & Crombez, 1989). There is emerging evidence in conditioned taste aversion (Kerkhof et al., 2010) and fear learning (Raes & De Raedt, 2012) supporting the suggestion that counter-conditioning may be superior to extinction in adult participants.

A recent finding suggests that counter-conditioning could also be more effective than extinction at reducing learned fear in children 7–12 years of age (Reynolds, Field, & Askew, 2017). Though presented as modelling or vicarious learning, the procedure used in that study has all the hallmarks of Pavlovian conditioning: a novel cue (i.e., CS, which was a picture of an unfamiliar animal presented on screen) is paired with a biologically significant outcome (US; a scared human face). The reason this procedure is often described as ‘vicarious’ is due to the nature of the US. Specifically, the child is being exposed to someone else expressing fear rather than being directly exposed to an aversive stimulus themselves. Vicarious learning has been posited to be a major pathway of anxiety development because children often report indirect experiences (i.e., vicarious observation, being told something is dangerous) as triggers of fear (Askew & Field, 2007; Muris & Field, 2010).

In Reynolds et al.’s (2016) study, counter-conditioning was shown to be a more effective fear reduction technique than extinction. In that study there were a number of indices of learned fear, including self-report, two behavioural avoidance tasks, heart rate, and attention bias. Counter-conditioning led to a reduction on two of these indices (heart rate and avoidance) while, surprisingly, extinction was ineffective at reducing fear on *all* measures. The finding that extinction was completely ineffective is inconsistent with other research in healthy youths who had acquired fear through Pavlovian conditioning (Michalska et al., 2016; Neumann et al., 2008) as well as major theoretical frameworks for fear reduction (e.g., Bouton, 2002; Rescorla & Wagner, 1972). It should also be noted that Reynolds et al. did not replicate a key previous finding from their laboratory – loss of fear on the fear beliefs self-

report measure following counter-conditioning (Dunne & Askew, 2013). These inconsistent and surprising results warrant further investigation into the relative effectiveness of the two fear reduction techniques in children. In the present study, we used a design that was almost identical to that used by Reynolds et al. in order to compare extinction and counter-conditioning in reducing learned fear, as measured on self-report and avoidance, in children 7–12 years of age.<sup>1</sup> Based on emerging evidence in the adult and child literature, as well as the learning theories discussed above, counter-conditioning was expected to be superior to extinction in reducing children’s fear learning in this study.

## 1. Methods

### 1.1. Participants

Of the 73 children (7–12 years of age) that completed the experiment seven were excluded for failing manipulation checks at the end of acquisition training (i.e., they showed no awareness of an association between the CS and the US), leaving 66 children (57.6% male). The majority of families were Caucasian Australian ( $n = 53$ ) while other families self-identified as Asian ( $n = 7$ ), Middle-Eastern ( $n = 1$ ), or ‘other’ ( $n = 5$ ). Subsequent statistical analyses excluded children that did not show learning on the two fear indices ( $n = 12$ ; 18.2%. See below in *Results* for the exclusion process). The remaining children showed either learning on one ( $n = 22$ ; 33.3%) or both indices ( $n = 32$ ; 48.5%). It is worth noting that the majority of children showed some learning (cumulative percentage of 81.8%). The non-learners and learners did not differ on Age, ethnicity, anxiety severity (measured by the *Spence Anxiety Scale*, see below under *Measures*) or gender composition ( $p$  range: 0.17–0.84).

Families were recruited via flyers and advertisements placed in local newspapers, websites, and businesses. Written consent was obtained from each child as well as the child’s parent. Each family received \$50 for their participation in the study as reimbursement for time and travel cost. The study was approved by the Macquarie University Ethics Committee for Human Research (reference number 5201400139).

### 1.2. Measures

#### 1.2.1. Spence children anxiety scale

The Spence Children Anxiety Scale (SCAS) is a 45-item self-report measure used to measure child anxiety (Spence, 1997). On the SCAS, children rate how often each statement happens to them on a 4-point Likert-scale, never (0) to always (3). An example question is, “I worry about things”. Higher scores indicate higher levels of anxiety. The SCAS has previously been shown to have high internal reliability (Spence, 1997). In this study Cronbach’s alpha was good ( $\alpha = 0.89$ ).

#### 1.2.2. Fear Belief Questionnaire

The Fear Belief Questionnaire (FBQ; Field & Lawson, 2003) was used to measure fear beliefs towards each animal picture at baseline, after acquisition, and after fear reduction. Additionally, the FBQ was used to assess fear beliefs towards animal pictures in a pilot study (described below). The FBQ consists of seven hypothetical situations, and responses are reported on a 5-point Likert-scale, ranging from 0 (*No, not at all*) to 4 (*Yes, definitely*). Items in the

<sup>1</sup> This study was in progress prior to the publication of Reynolds et al., and the current study was modelled on the counter-conditioning procedure used in Dunne and Askew (2013).

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