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Effects of Exposure Therapy Conducted in Multiple Contexts on the Return of Fear

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September, 2013



## ABSTRACT

The anxiety disorders are a collection of disorders characterized by psychological fear and anxiety and somatic manifestations of fear and anxiety (4th ed., text rev.; DSM-IV-TR; *Diagnostic and Statistical Manual of Mental Disorders*; American Psychiatric Association, 2000). Anxiety disorders can significantly impair a sufferers overall wellbeing and result in significant individual and societal economic burden. Exposure therapy has been proposed to be a core component of anxiety disorder treatment. However, up to 50% of those who are successfully treated experience return of fear after therapy, which may act as a precursor of complete clinical relapse. Spontaneous recovery, reacquisition, reinstatement, and renewal may be four contextually driven mechanisms that can predict return of fear. Renewal, the most widely studied of these mechanisms, was the predominant focus of the current thesis. Renewal of fear occurs when post-therapy encounters with feared stimuli take place in contexts that are different to the treatment context.

The current thesis had two major aims. Firstly, it aimed to narrow the gap between laboratory-based renewal research and clinical work on relapse. This major aim was addressed by applying a transformation research approach using a laboratory-based experiment, a clinical-analogue experiment, and an  $N = 1$  case study. Secondly, the current thesis aimed to determine whether conducting extinction treatment in multiple contexts can attenuate renewal of fear. To investigate this, the current thesis initially used a laboratory-based experiment with 68 non fearful participants. Using self-reported expectancy of shock and startle blink responses, the results showed that re-encounters with an aversive stimuli resulted in renewal of extinguished conditioned behaviour when extinction treatment was conducted in only one context. However, renewal was attenuated when extinction treatment was conducted in three contexts. No renewal was

found for the control group that received the test trial in the same context as during extinction. The first experiment provided laboratory-based evidence that extinction treatment in multiple contexts can attenuate renewal.

In the second experiment, 46 moderate to high spider fearful individuals received exposure to a real-life golden orb spider in either one-real life context or across three real-life contexts. Follow-up testing was conducted one week and four weeks after exposure. No renewal was found for the control group that received follow-up tests in the same context as during exposure treatment. However, three different measures (self-report of fear, heart rate, and behavioural avoidance) showed that renewal of fear had occurred for the group that received treatment in one context and follow-up tests in novel contexts. Moreover, renewal of fear was attenuated for the group that received treatment in multiple contexts. Again, the results indicated that conducting exposure therapy in multiple contexts may enhance the generalisability of exposure therapy and thereby enhance its long-term effectiveness.

In the third and final study ( $N = 1$  case study), a toad phobic individual received an individually tailored exposure session in four different contexts. Follow-up testing was conducted again one week, five weeks, and 1.8 years after treatment. Verbal self-report of fear and behavioural avoidance measures showed no increases from post-treatment to follow-up. This outcome was important because it firstly validated the applicability of laboratory-based research and clinical-analogue experiments to the clinical use of exposure therapy. Secondly, the case study provided clinicians with a precedent of how to incorporate multiple extinction context findings with exposure therapy to enhance the long-term effectiveness of treatment.

In summary, exposure therapy is a central component of contemporary anxiety disorder treatment. However, many sufferers experience return of fear after treatment

has been concluded. A widely investigated mechanism of return of fear is renewal. The current thesis used a series of transformational studies to show that conducting exposure therapy in multiple contexts attenuates renewal of fear. The findings in this thesis are important because they show that the generalisability of exposure therapy can be enhanced by making a relatively simple but important change to the treatment protocol. Moreover, the current thesis discusses that multiple extinction contexts alone or in combination with other methods can be applied not only in the treatment of phobias, but also other primarily anxiety related and non-anxiety related disorders in adults and children. Finally, it is concluded that while much remains to be done in return of fear research, the field is currently on a promising path towards developing effective approaches that may abolish return of fear post exposure therapy.

STATEMENT OF ORIGINALITY

*This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.*

(Signed)\_\_\_\_\_

Siavash Bandarian Balooch

September 2013

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## LIST OF PUBLICATIONS and SUBMITTED ARTICLES FROM DOCTORAL RESEARCH

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2. Bandarian-Balooch, S., Neumann, D. L., & Boschen, M. J. (2012). Extinction treatment in multiple contexts attenuates ABC renewal in humans. *Behaviour Research and Therapy*, 50, 604-609.
3. Bandarian-Balooch, S., Neumann, D. L., & Boschen, M. J. (in press). Renewal of fear: Clinical-analogue findings. In M. N. Purcella (Ed), *Psychology of Fear: New Developments*. New York: Nova Science Publishers.
4. Bandarian-Balooch, S., Neumann, D.L., & Boschen, M. J. (submitted). Exposure Treatment in multiple contexts attenuates return of fear via renewal in high spider fearful individuals.

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Exposure Treatment in Multiple Contexts Attenuates Renewal of Fear.  
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2. Bandarian-Balooch, S., Neumann, D. L., & Boschen, M. J. (July 2013).  
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3. Bandarian-Balooch, S., Neumann, D. L., & Boschen, M. J. (October 2013).  
Exposure Treatment in Multiple Contexts Attenuates Return of Fear via  
Renewal in Spider Fearful Individuals. Australian Association for Cognitive  
and Behaviour Therapy 36<sup>th</sup> National Conference. Adelaide, Australia.



## CHAPTER 1

Chapter 1 is a short introduction to the thesis. The introduction briefly argues the importance of investigating return of fear and renewal of fear (chapters 2, 3, and 4) and presents the major aims of the thesis and the experiments that developed to address the aims (chapter 5). Subsequently, chapter 1 outlines Experiment 1 (chapter 6), Experiment 2 (chapter 7), and the  $N = 1$  Case study (chapter 8). Finally, the chapter provides an overview of the general discussion (Chapter 9).

## Introduction

Mental disorders can significantly impair a sufferers overall wellbeing and result in significant individual and societal economic burden. In Australia for instance, a national survey by the Australian Bureau of Statistics (2007) estimated that the annual cost of mental disorders is AUS\$20 billion per year. Moreover, with life-time prevalence rates of between 16.6% to 26.3% (Kessler & Wang, 2008; Slade, Johnston, Oakley Browne, Andrews, & Whiteford, 2009; Somers, Goldner, Waraich, & Hsu, 2006; Wells et al., 2006), the anxiety disorders are the most prevalent form of mental disorders. Moreover, anxiety disorders are not only associated with financial costs but also intangible costs to individuals and their families and friends.

The anxiety disorders are a collection of disorders characterized by psychological fear and anxiety and somatic manifestations of fear and anxiety (4th ed., text rev.; DSM-IV-TR; *Diagnostic and Statistical Manual of Mental Disorders*; American Psychiatric Association, 2000). Anxiety disorder related symptoms include, rapid beating heart, sweating, stomach ache, shortness of breath, dizziness, fear related thoughts, and trembling. The anxiety disorders include the diagnostic categories of panic disorder, generalised anxiety disorder, the phobias, post-traumatic stress disorder, and obsessive compulsive disorder (DSM-IV-TR)<sup>1</sup>. According to the National Comorbidity Survey Replication (Kessler & Wang, 2008), prevalence rates within the anxiety disorders are highest for specific phobia (12.5%), followed by social phobia (12.1%), post-traumatic stress disorder (6.8%), generalised anxiety disorder (5.7%),

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<sup>1</sup> As this thesis was being written, the DSM-5 (5th ed.; *Diagnostic and Statistical Manual of Mental Disorders*; American Psychiatric Association, 2013) was released. However, DSM-IV-TR criteria and discourse will be used for the anxiety disorders in the majority of this thesis (not Chapter 2), to remain consistent with the overall discourse used in the already published and “in press” chapters of this thesis.

panic disorder (4.7%), obsessive-compulsive disorder (1.6%), and agoraphobia (1.4%). Similar prevalence rates were reported by the Australian Bureau of Statistics (2010).

The anxiety disorders are largely discriminated by the predominant fear and anxiety in the diagnostic criteria (DSM-IV-TR). Panic disorder is largely characterised by sudden (expected or unexpected) episodes of panic attacks. These panic attacks can occur in response to a variety of situations (e.g., sleeping alone) and stimulus exposure (e.g., having coffee). Panic disorder may occur with or without agoraphobia.

Agoraphobia is a fear of public places (e.g., beaches or department stores). The associated fear or anxiety can result in panic attacks and public places are therefore avoided. Obsessive-compulsive disorder is largely characterised by anxiety and discomfort related to unwanted thoughts such as committing violent acts or becoming contaminated. The anxiety and fear in post-traumatic stress disorder is typically in response to fearful thoughts and memories of short-term (e.g., being robbed) or long-term terrifying events (e.g., war). In generalised anxiety disorder, irrational thoughts and apprehension about, for example, harm affective oneself or a loved one, results in significant experiences of worry and anxiety. Finally, the specific phobias are characterised by an intense fear of a particular object (e.g., a snake) or situation (e.g., giving a speech).

Studies have also shown that anxiety disorders have a significant negative impact on the life of a sufferer (e.g., Kessler, Chiu, Demler, & Walters, 2005; Kessler & Wang, 2008; Slade et al., 2009; Kroenke, Spitzer, Williams, Monahan, & Lowe, 2007; Olatunji, Cisler, & Tolin, 2007). More specifically, the negative impacts of anxiety disorders on sufferers include marital and financial problems (Weissman, 1991), diminished well-being (Warshaw, Fieman, Pratt, & Hunt, 1993), role limitations (Koran, Thienemann, & Davenport, 1996), impairment in vitality and physical health

(Cramer, Torgerson, & Kringlen, 2005), reduced overall quality of life (Olatunji, Cisler, & Tolin, 2007), and high diagnostic comorbidity (Strine, Chapman, Kobau, & Balluz, 2005).

Moreover, many individuals do not seek treatment for their anxiety disorder (Kessler, Demler et al., 2005; Wang et al., 2007) and may struggle with their anxiety throughout their lives. Wang et al. (2007) reported that the World Mental Health surveys spanning across countries in all continents of the world show that approximately 0.8% to 36.4% of anxiety disorder sufferers seek treatment. Fortunately, for those that do seek treatment for anxiety disorders, exposure therapy has been found to be an effective in ameliorating their anxiety symptoms (Deacon & Abramowitz, 2004), at least in the short-term.

Exposure therapy has been proposed to be a core component of anxiety disorder treatment (Choy, Fyer, & Lipsitz, 2007; Clark & Ehlers, 2004; Deacon & Abramowitz, 2004; Feske & Chambless, 1995; Moreno, Méndez, & Sánchez, 2001; Power, Sigamarsson, & Emmelkamp, 2008; Roth & Fonagy, 2005). Exposure therapy typically involves exposing a client to a feared object or situation until their fear significantly reduces (Barlow, Craske, Cerny, & Klosko, 1989; Craske, 1999; Öst, 1989). Despite being highly effective in the treatment of anxiety disorders, approximately 30-50% of those that successfully complete exposure therapy experience a return of fear after therapy (Craske & Rachman, 1987; Rachman, 1966; Rose & McGlynn, 1997; Wolpe, 1958).

Return of fear (Rachman, 1989; 1990) is reappearance of fear that has undergone full or partial extinction. Although return of fear is not synonymous to complete clinical relapse, the important role that fear and anxiety play in the various anxiety disorders, makes the return of fear post exposure alarming because return of fear

may act as a precursor of complete relapse. Decades of conditioning research (for a review, see Bouton, 2002; 2004) has shown that spontaneous recovery, reacquisition, reinstatement, and renewal may be four contextually driven mechanisms, which can predict return of fear. The current thesis predominantly focuses on return of fear via a renewal effect.

The renewal effect is the most widely studied mechanism of return of fear (Bouton, 2002; 2004). Just over a decade ago, renewal of fear was limited to studies with rats (for a review, see Bouton, Corcoran, & Westbrook, 2006). Since then, researchers have developed methods that allow for renewal effects to be tested with humans in laboratory-based experiments (e.g., Effting & Kindt, 2007; Neumann, 2006) and clinical-analogue experiments (e.g., Rowe & Craske, 1998; Rodriguez, Craske, Mineka, & Hladek, 1999). Amongst other reasons, laboratory-based experiments are a valuable approach in renewal research because they allow for experimental control of each phase of learning. In contrast, clinical-analogue experiments are highly relevant to clinical settings, but do not provide the same level of control over potential confounding and extraneous variables as laboratory-based experiments do.

Based on Pavlovian conditioning principles (Pavlov, 1927), the typical laboratory-based renewal procedure involves the three phases of acquisition, extinction, and test. These phases vary in context. In the ABA and ABC renewal procedures, during the acquisition phase in one context (A), paired presentations of a conditioned stimulus (CS) with an unconditioned stimulus (US), results in learning of a CS-US association. Subsequently during the extinction phase, the CS is repeatedly presented alone in a different context (B). Renewal of extinguished conditioned responses typically occurs in the test phase when the CS is presented alone again in a novel

context (C; as in ABC renewal) or in the initial acquisition context (A; as in ABA renewal).

Clinical-analogue experiments that examine renewal of fear use a similar methodology to laboratory experiments (e.g., Rodriguez et al., 1999). However, because clinical-analogue experiments use phobic (e.g., Shiban, Pauli, & Mühlberger, 2013) or high fearful samples (e.g., Mineka, Mystkowski, Hladek, & Rodriguez, 1999), for whom fear acquisition (e.g., spider-pain association) has already occurred, a fear acquisition phase is not required. Thus, clinical-analogue experiments only require an exposure treatment phase and a test phase. During the exposure treatment phase, the participant is exposed to the feared object (e.g., a spider) until their fear significantly reduces. During the test phase, fear is again tested in a novel context, resulting in renewal of fear.

According to Bouton's memory model of learning (1993, 1994, 2002, 2004; Bouton & Nelson, 1998), renewal of fear occurs because the initial CS-US association (e.g., spider-pain association) is relatively context independent and readily generalisable across contexts. Furthermore, the extinction process does not destroy the original CS-US association but facilitates learning of a new relatively context dependent CS-noUS association (e.g., spider-nopain association). Thus, subsequent to the extinction process the person has both relatively context independent CS-US associations and relatively context independent CS-noUS associations stored in memory. Subsequent to extinction, because the CS has been associated with the presence and absence of the US, the meaning of the CS becomes ambiguous. This ambiguity is resolved by the present contextual cues (e.g., smells, sounds, sights). Furthermore, because the CS-noUS association is relatively context dependent, contextual mismatches between the extinction context and subsequent CS encounter contexts are more likely to result in the

retrieval of the CS-US association and produce a conditioned response (CR). However, if the extinction context is highly similar to a subsequent encounter context, the CS-noUS association is likely to be retrieved from memory and a CR is not likely to be observed.

The memory model of extinction (Bouton, 1993, 1994, 2002, 2004; Bouton & Nelson, 1998) is particularly valuable to renewal research because it explains when and why a renewal of fear occurs. It can also suggest ways in which the renewal of fear can be attenuated. One promising method of attenuating ABA fear renewal has been to conduct extinction treatment in multiple contexts with the aim to enhance the generalisability of extinction learning. However, some studies have shown that extinction treatment in multiple contexts can attenuate ABA renewal (e.g., Chelonis, Calton, Hart, & Schachtman, 1999; Neumann, 2006) while others have shown that it does not (e.g., Bouton, García-Gutiérrez, Zilskia, & Moody, 2006; Neumann et al., 2007). Subsequent studies combined multiple extinction contexts with a larger number of extinction trials (Thomas, Vurbic, & Novak, 2009) or with increased contextual similarity between extinction and test trials (Bandarian-Balooch & Neumann, 2011) and successfully abolished ABA renewal in animals and humans, respectively.

However, unlike ABA renewal, ABC renewal is more relevant to clinical cases of renewal of fear because the real-life original acquisition context may not be known, may be difficult to access, and it is less likely that the feared object will be re-encountered in the original fear acquisition context than a novel context. Gunther et al. (1998) found that extinction treatment in multiple contexts attenuated ABC renewal in rats, whereas Bouton et al. (2006) found that it does not. More recently, Neumann and Kitlertsirivatana, (2010) documented the methodology required to produce ABC renewal effects in laboratory-based experiments with humans. The more recently

developed methodology allows researchers to test whether conducting extinction treatment in multiple contexts can attenuate renewal of fear using laboratory-based experiments with humans.

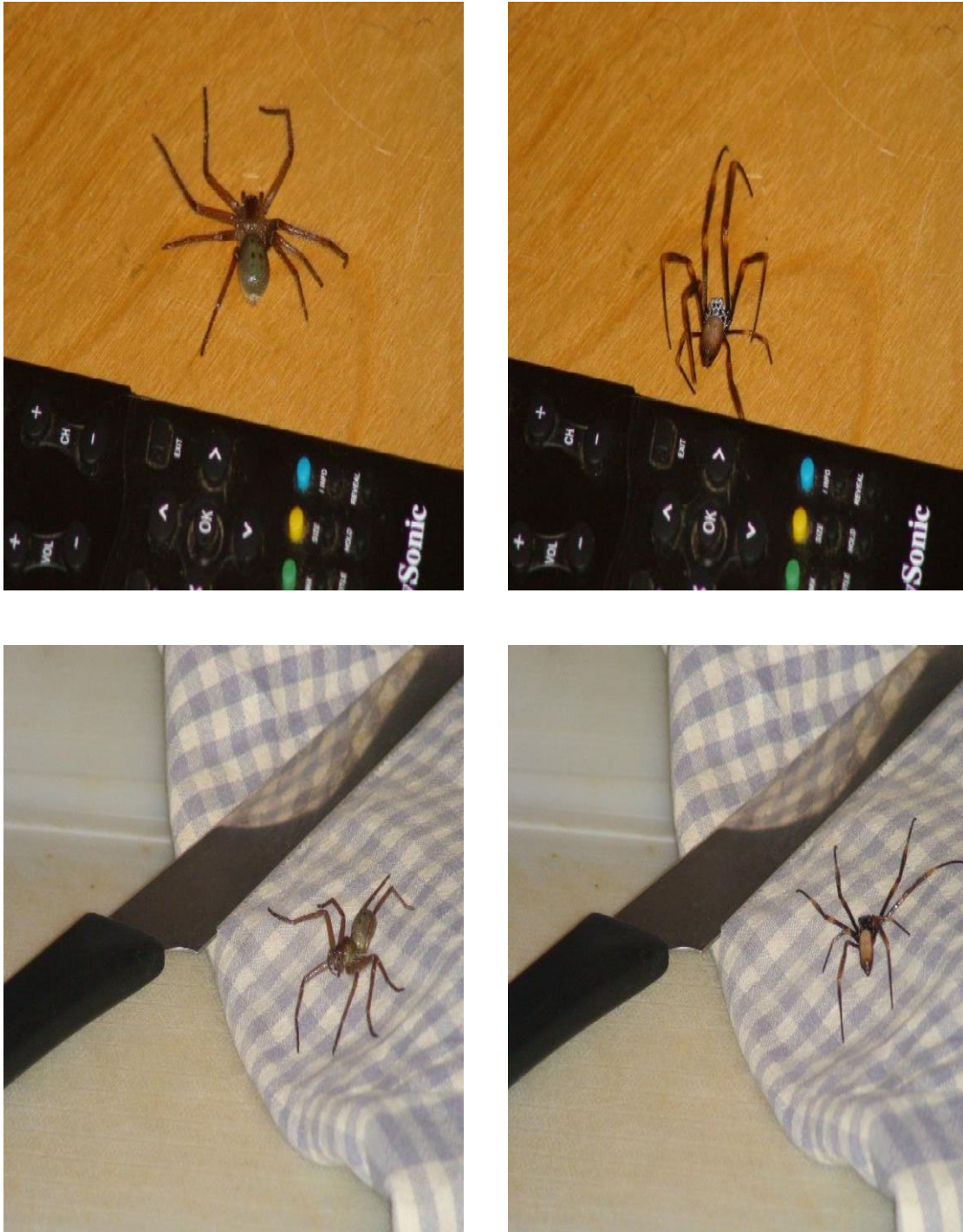
Moreover, Vansteenwegen et al. (2007) found that conducting exposure treatment with a filmed spider in multiple filmed contexts can attenuate ABC type renewal of fear. Similarly, Shiban et al. (2013) showed that conducting exposure treatment with a virtual reality spider in multiple virtual contexts can attenuate ABC type renewal of fear. However, no research has yet been conducted to examine the effects of conducting extinction treatment with high fearful participants in multiple real-life contexts using a living spider.

The current thesis had two major aims. Firstly, it aimed to narrow the gap between renewal research with animals and clinical work with humans. This major aim was addressed by taking animal laboratory-based research into consideration and conducting similar research with humans using laboratory-based experiments, clinical-analogue experiments, and an  $N=1$  case study. To further this aim, findings from laboratory-based animal and human research were frequently applied to the clinic. Chapters 2 to 4 of this thesis are reviews that provide the reader with a thorough understanding of the contemporary progress and issues in return of fear research more generally and renewal of fear research more specifically. Chapter 3 (Bandarian-Balooch, Neumann, & Boschen, 2012a) and chapter 4 (Bandarian-Balooch, Neumann, & Boschen, in press) provide clinical interpretations and examples of clinically relevant research findings. Ideally, the frequent use of clinical examples will bridge the gap between researchers and clinicians through facilitating a mutual discourse where research findings and interests can be discussed.

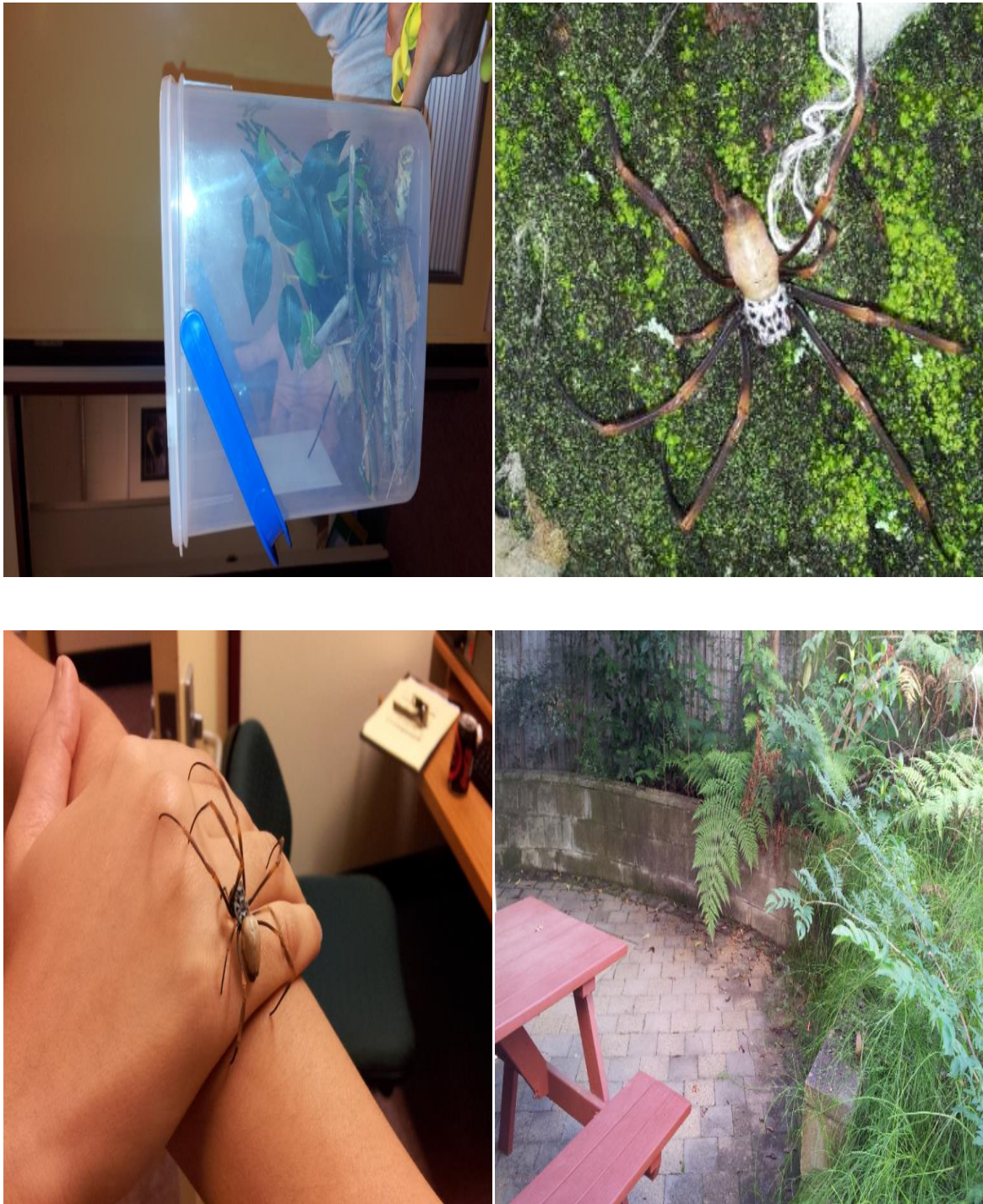


Secondly, the current thesis aimed to determine whether conducting extinction treatment in multiple contexts can attenuate renewal of fear. With the first aim in mind, the current thesis initially used a laboratory-based experiment with humans (chapter 5; Bandarian-Balooch, Neumann, & Boschen, 2012b) and produced results that are likely to be interesting to both experimental researchers and clinicians alike. Using self-reported expectancy of shock and startle blink responses, the experiment was used to test the effects of conducting extinction treatment in multiple contexts on ABC fear renewal. Participants ( $N = 68$ ) received conditional stimulus (CS) and unconditional stimulus (US) pairings in one context (A) followed by extinction treatment (CS presentations alone) in either one other context (B) or three other contexts (BCD). Figure 1 shows examples of the photographs used as CSs and contexts in this experiment. Non-reinforced test trials in a novel context (E) resulted in renewal of extinguished conditioned behaviour for those who received extinction in only one context. However, renewal was attenuated for those who received extinction treatment in three contexts. No renewal was found for the control group that received the test trial in the same context as during extinction.

The first experiment provided laboratory-based evidence that extinction treatment in multiple contexts can attenuate ABC renewal. When applied to the clinic, these results suggested that conducting exposure therapy in multiple contexts may enhance the long-term effectiveness of exposure therapy. However, the applicability of these findings to clinical use of exposure therapy was limited by the use of a non-fearful sample. Thus, to further the applicability of these results to exposure therapy in the clinic, a clinical-analogue study was subsequently conducted.



*Figure 1.* Example stimuli of photographs used as CSs (spiders) and contexts in experiment 1 (chapter 5). The examples show a huntsman in a living room (top left panel), a huntsman spider in a kitchen (bottom left panel), a golden orb spider in a living room (top right panel), and a golden orb spider in a kitchen (bottom right panel).



*Figure 2.* Experiment 2 (chapter 6) example photographs show a spider cage (top left panel), the golden orb spider (top right panel), the spider being handled by a participant (bottom left panel), and an outdoor patio context (bottom right panel).



In the second experiment (chapter 6; Bandarian-Balooch, Neumann, & Boschen, submitted), 46 moderate to high spider fearful individuals were randomly allocated to groups that received a standardised exposure treatment in either one real-life context or three real-life contexts (Figure 2 shows photographs of the real-life spider and contexts used in experiment 2). The spider used was a real-life golden orb spider. Follow-up testing was conducted one week and four weeks after exposure in the treatment context or a novel context. Renewal of fear was found for the single extinction context group when exposed to the feared object in a novel context with self-report of fear, heart rate, and behavioural avoidance. However, renewal of fear was attenuated for the multiple extinction context group. Again, the results indicated that conducting exposure therapy in multiple contexts may enhance the generalizability of exposure therapy and thereby enhance its long-term effectiveness. However, even this experiment is not synonymous to clinical work where clients experience a disabling fear and treatment is individually tailored for the client. Thus, an  $N = 1$  case study was conducted to further determine the applicability of these results in clinical use of exposure therapy.

In the third and final study (chapter 7), a toad phobic individual received an individually tailored one session treatment for phobias (Öst, 1989) in four different contexts. Follow-up testing was conducted again one week, five weeks, and 1.5 years after treatment. Verbal self-report of fear and behavioural avoidance (as measured by distance and time) measures showed no increases from post-treatment to follow-up. This outcome was important because it firstly validated the applicability of laboratory-based research and clinical-analogue experiments to clinical use of exposure therapy. Secondly, the case study provided clinicians with a precedent of how to incorporate multiple extinction context findings with exposure therapy to enhance the long-term

effectiveness of treatment. The implications of these findings and recommendations for future research directions are discussed in chapter 9.

### **Discussion comments**

The current thesis used a series of transformational studies to show that conducting exposure therapy in multiple contexts attenuates renewal of fear. In the discussion of this thesis (chapter 8) it is highlighted that multiple extinction contexts may also be applied in imagined exposure treatment for phobia, used in the treatment of a variety of anxiety disorders (e.g., panic disorder) and non-anxiety related disorders such as substance abuse disorders. The potential benefits of combining multiple extinction contexts with other methods of attenuating renewal (e.g., mental reinstatement) are suggested. Attention is drawn to major gaps in renewal of fear research, including the lack of renewal research with children.

Furthermore, the theoretical implications of the current findings are discussed using Bouton's memory model of learning (1994, 2002, 2004; Bouton & Nelson, 1998), the generalisation decrement theory (Bouton, 2004), and attentional focus theories of learning (Rosas, Callejas-Aguilera, Ramos-Álvarez, & Abad, 2006). Finally, the limitations of the current studies are discussed, such as the need to examine vicariously learned fear and using double-blind studies. Finally, it is concluded that while much is remains to be done in return of fear research, the field is currently on a promising path towards developing effective approaches that may abolish return of fear post exposure therapy.

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## CHAPTER 2

Chapter 2 reports on the role of return of fear in anxiety disorders. The chapter focuses on behavioural mechanisms of fear acquisition and treatment of fear and anxiety related disorders. Subsequently, the chapter discusses the underlying mechanisms of return of fear more broadly and reviews research on reinstatement, spontaneous recovery, and re-acquisition. The aim of the chapter is to provide the reader with an analytic review of the current standing of return of fear research and future research directions that are required to further scientific understanding of the mechanisms that underlie and attenuate return of fear post exposure therapy. Clinical examples are frequently used to enhance the clinical focus of the discussions.

### **Exposure Therapy and Return of Fear**

Collectively, the anxiety disorders are the most prevalent group of psychological disorders (Kessler, Chiu, Demler, & Walters, 2005). Unfortunately, many individuals who suffer an anxiety disorder do not seek treatment (Kessler et al., 2005) and may struggle with their anxiety throughout their lives. For those that do seek treatment, exposure therapy has been found to be effective (Deacon & Abramowitz, 2004). Exposure therapy involves repeatedly presenting a person experiencing a disabling fear or anxiety with a target stimulus or situation until the person's fear is significantly reduced (Barlow, Craske, Cerny, & Klosko, 1989; Craske, 1999; Öst, 1989). Although variants of exposure therapy are considered effective treatments for the anxiety disorders (Chambless & Ollendick, 2001; Craske, 1999; Deacon & Abramowitz, 2004; Emmelkamp, Bouman, & Scholing, 1992; Olatunji, Cisler, & Deacon, 2007), many of those treated experience a return of fear (Craske & Rachman, 1987; Rachman, 1966; Rose & McGlynn, 1997; Wolpe, 1958).

Return of fear is not synonymous with complete relapse. However, the mechanisms that underlie its occurrence need to be understood because they may be precursors to relapse (Rachman, 1989). A combination of laboratory-based (Bouton, Westbrook, Corcoran, & Maren, 2006; Neumann, Boschen, & Waters, 2008) and clinical-analogue research (Bandarian-Balooch, Neumann, & Boschen, in press; Boschen, Neumann, & Waters, 2009) have highlighted the role of contextual changes in return of fear. More specifically, it has been suggested that spontaneous recovery, reinstatement, reacquisition, and renewal are four contextually driven mechanisms that may underlie return of fear (Boschen et al., 2009; Bouton, 2002; 2004).

This chapter presents a broad review of the role of return of fear in anxiety disorders. The current chapter initially discusses the anxiety disorders and the

underlying behavioural mechanisms of fear acquisition. Subsequently, it discusses the proposed mechanisms at work during the exposure therapy process. Finally, it explains how a return of fear is thought to occur via spontaneous recovery, reinstatement, and reacquisition and proposes methods to attenuate each of these mechanisms. To increase the clinical focus of the chapter, clinical examples will be provided.

### **Acquisition and Generalisation of Fear and Anxiety**

The anxiety disorders are a collection of disorders characterized by psychological fear and anxiety and somatic manifestations of these psychological states (4th ed., text rev.; DSM-IV-TR; *Diagnostic and Statistical Manual of Mental Disorders*; American Psychiatric Association, 2000). Epidemiological studies typically report that anxiety disorders have a lifetime prevalence rate between 16.6% - 26.3% (Kessler & Wang, 2008; Slade, Johnston, Oakley Browne, Andrews, & Whiteford, 2009; Somers, Goldner, Waraich, & Hsu, 2006; Wells et al., 2006). Moreover, anxiety disorders frequently precede and are comorbid with other anxiety disorders (e.g., post-traumatic stress disorder may be comorbid with panic disorder with agoraphobia) and major depressive disorder (Hirschfield, 2001; Ritchie, Artero, Beluche, & Ancelin, 2004).

From a phenomenological perspective, the anxiety disorders may be discriminated according to the predominant focus of the fear or anxiety in the diagnostic criteria (DSM-IV-TR). For example, in post-traumatic stress disorder, the primary anxiety may be the memories of a traumatic event (e.g. combat experience). In contrast, for a person with generalised anxiety disorder, the primary anxiety may be that a family member will be harmed. Moreover, it is commonly known to clinicians that clients suffering from anxiety disorders are likely to fear a range of stimuli that can evoke their original fear. For example, in post-traumatic stress disorder, a loud banging noise may evoke memories of a traumatic event (e.g., gun-shots in war). Gradually, the individual with

post-traumatic stress disorder may begin to fear loud banging noises because of the aversive emotions they cause. Similarly, a person suffering from generalised anxiety disorder may experience worry as a result of hearing loud noises because this may evoke thoughts of harm having come to a loved one (Boschen & Oei, 2008).

Conditioning research has provided valuable models that that can be used to explain why and how some people develop anxiety disorders and how their fears gradually generalise to a variety of stimuli in their environment (Bouton, Mineka, & Barlow, 2001; Field, 2006; Hermans, Craske, Mineka, & Lovibond, 2006; Mineka & Zinbarg, 2006). Based on Pavlovian conditioning (Pavlov, 1927), contemporary conditioning models explain that when an unconditioned stimulus (US) such as pain from a snake bite, which is able to trigger an unconditioned response (UR) of fear, is paired with a previously neutral conditioned stimulus (CS; e.g., snakes), a CS-US association is learnt. Subsequently, presentations of the CS alone are able to elicit fear responses known as conditioned responses (CR).

Arguably, once the initial fear association (CS-US association) is learnt, its generalisation to a variety of situations and stimuli may be one of the reasons why a specific fear association may develop into a much larger set of fears and unhealthy behaviours as that seen in anxiety disorders (see Öhman & Mineka, 2001). A long line of research has supported the notion that the initial fear association (CS-US association) readily generalises across contexts (e.g., Bandarian-Balooch & Neumann, 2011; Bouton & King, 1983; Bouton & Swartzentruber, 1986; Hall & Honey, 1989; Lovibond, Preston, & Mackintosh, 1984; Neumann, Lipp, & Cory, 2007) and stimuli (e.g., Lissek et al., 2008) suggesting that it is relatively context independent.

For instance, in a laboratory-based task, Bandarian-Balooch and Neumann (2011) presented a group of students with shape-shock pairings in one context (i.e., brightly lit



room) until they learnt that the presentation of a specific shape is predictive of receiving a shock (initial CS-US association was learnt). Interestingly, when the shape was again presented in a different context (i.e., dark room), the participants continued to expect receiving a shock. Similarly, in Lissek et al. (2008), participants that learnt to associate one CS (i.e., large circle) with a shock, also expected to be shocked after having been presented by another similar CS (i.e., smaller circle). In clinical-analogue studies (e.g., Bandarian-Balooch, Neumann, Boschen, submitted) participants who, for example, acquired a fear of spiders due to an aversive encounter with a spider (i.e., tarantula) in a different country, show intense fear reactions to a spider (i.e., golden orb) they have never seen before.

Moreover, conditioning models explain that the typically observed avoidance response to fearful stimuli and situations is maintained by negative reinforcement of the reduced fear and anxiety (Davey, 1992, Dawson & Schell, 1985; Öhman, Hamm, & Hugdahl, 2000). In this way, avoidance responses are typically triggered when the feared object is encountered. It may be argued that the continued avoidance of the feared object (e.g., snake) results in lack of opportunities to learn that the feared object is not dangerous, thus maintaining the original fear learning associations over time. Taken together, these studies suggest that once acquired, the fear may generalise to other situations and stimuli, which when coupled with long-term avoidance, may be some of the reasons for the significant negative impacts anxiety disorders have on the functioning (Kroenke, Spitzer, Williams, Monahan, & Lowe, 2007) and quality of life (Olatunji et al., 2007) of sufferers.

For example, if a fear association was contained to a specific context and stimulus, such as the specific footpath where a particular snake bit the person, the person would not likely develop a phobic disorder as he or she could easily avoid this

specific footpath and snake and manage a fully functional life free from fear or anxiety of footpaths or snakes in general. However, as previously argued, the initial fear association is readily generalisable across contexts and stimuli. This suggests that subsequent to having been bitten, the person may gradually fear and avoid an increasing amount of similar places and snakes. After an extended period of time, this person may find themselves avoiding all footpaths, forests, backyards, and reptiles, which may significantly impact on their quality of life and overall well-being.

Contemporary conditioning models also take into consideration a range of biological, social, and psychological factors to explain why some people do not acquire anxiety disorders following aversive events while others do. For example, Mineka and Zinbarg (2006) highlighted that the genetic/temperamental vulnerabilities, early childhood aversive events, the nature and intensity of the aversive event and associated stimuli (e.g., fear relevant vs. fear irrelevant stimuli), and nature and quality of events that occur after the aversive event, are all factors that may determine whether a person experiencing an aversive event will or will not acquire an anxiety disorder. In this way, two people that experience a similar aversive event (e.g., being bitten by a snake) may experience different psychological consequences of this event.

For instance, a person that is bitten by a snake with minor injuries as a result, is not genetically predisposed towards anxiety disorders, has had a pet snake as a child, receives much support from family and friends, and has the opportunity to engage in pleasant interaction with snakes after being bitten, is less likely to develop a phobia of snakes. Conversely, a person that is predisposed to anxiety disorders, sustains major injuries from the snake bite, has had several aversive interactions with snakes in the past, is told by friends and family members that snakes are dangerous and should be avoided, and avoids snakes after being bitten, is more likely to develop a phobia of

snakes. Thus, contemporary conditioning models show that a range of factors are involved in the development and maintenance of anxiety disorders. Fortunately, years of behavioural research has also resulted in the development of directive therapies such as behaviour therapy (Olatunji, Cisler, & Deacon, 2010), cognitive behaviour therapy (Stewart & Chambless, 2009), and acceptance and commitment therapy (Forman, Herbert, Moitra, Yeomans, & Geller, 2007), which can be used to treat anxiety disorders.

### **Theoretical Underpinnings of Behavioural Treatment for Anxiety Disorders**

Behaviour therapy, cognitive behaviour therapy and acceptance and commitment therapy share an underlying behavioural approach in the treatment of anxiety disorders. The major difference between these therapies is that behaviour therapy does not directly address cognitions (Spiegler & Guevremont, 2009). Conversely, cognitive behaviour therapy monitors cognitions and implements strategies to promote more healthy and realistic thoughts and beliefs (Beck, 1995). While acceptance and commitment therapy does consider cognitions, in contrast to cognitive behaviour therapy, it focuses on implementing strategies to reduce struggle and fusion with unwanted cognitions and emotions (Hayes, Strosahl, & Wilson, 2003). Apart from these differences, the behaviourally based therapies use variations of psychoeducation, relaxation and breathing exercises, therapist modelling, behavioural activation, rewards for accomplishments, monitoring of change, and exposure to feared stimuli to treat various anxiety disorders (Beck, 1995; Hayes, Strosahl, & Wilson, 2003; Spiegler & Guevremont, 2009).

The one method typically included in the behaviourally based therapies, which has been proposed to be the most valuable in the treatment of fear and anxiety, is exposure therapy. Exposure therapy may be used alone or in combination with other

methods, depending on the anxiety disorder that is treated (e.g., Choy, Fyer, & Lipsitz, 2007; Clark & Ehlers, 2004; Deacon & Abramowitz, 2004; Feske & Chambless, 1995; Moreno, Carrillo, & Meca, 2001; Power, Sigamarsson, & Emmelkamp, 2008; Roth & Fonagy, 2005). Exposure therapy may include relaxation and breathing exercises, skills training, therapist modelling, client fear monitoring, and exposure to a feared stimulus (Barlow et al., 1989; Spiegler & Guevremont, 2009). The exposure process itself requires that the client engages in highly intimate imagined or *in vivo* interaction with the feared object or situation (Barlow et al., 1989; Craske, 1999; Öst, 1989) either through a gradual process such as in graduated exposure therapy or from the onset of therapy such as in flooding. It can be delivered using multiple sessions or using a single one on one treatment session (Öst, 1989) or a group session (Öst, 1996; Öst, Ferebee, & Furmark, 1997).

Furthermore, research has shown that exposure therapy is effective (i.e., produces clinically significant reductions in fear, anxiety, and avoidance) for the treatment of post-traumatic stress disorder, the phobias, obsessive compulsive disorder, and panic disorder (Deacon & Abramowitz, 2004). Exposure therapy has proven to be the most effective behavioural treatment component for the specific phobias (Choy et al., 2007) and post-traumatic stress disorder (Clark & Ehlers, 2004). Furthermore, it has been shown that exposure therapy alone is equally effective as a more holistic cognitive behavioural treatment for the treatment of social anxiety (Feske & Chambless, 1995). Moreover, Roth, and Fonagy (2005) argued that exposure therapy in combination with other methods (e.g., psychoeducation for panic disorder) is crucial for effective treatment of obsessive compulsive disorder, generalised anxiety disorder, and panic disorder.

One of the major strengths of exposure therapy is that it effectively reduces maintenance of the fear and anxiety through reducing avoidance of the feared stimulus (Craske, 1999; Emmelkamp, 2004; Spiegler & Guevremont, 2009). Through reducing avoidance, exposure therapy provides opportunities for clients to gradually approach their feared stimulus in a safe environment until they learn that they no longer need to fear the stimulus or the aversive emotions it may evoke (Craske, 1999; Emmelkamp, 2004; Spiegler & Guevremont, 2009). For example, subsequent to being held hostage in a bank robbery, walking past any bank may evoke aversive flashbacks of the events that occurred during the bank robbery. To reduce these flashbacks and the associated aversive emotions, the person may begin to avoid banks, central city locations, and post offices. However, by providing exposure to these locations as a component of therapy, the person may learn to cope with the flashbacks and associated fear these locations evoke, resulting in significant reduction of the avoidance behaviours, the fear, and the anxiety.

The clinical effect of exposure, such as that seen in the example above, is thought to be exerted predominantly through extinction of Pavlovian conditioned responses (Emmelkamp, 2004; Waters, McDonald, & Koresko, 1972). Pavlovian conditioned responses (CRs), such as fear, in response to a CS (e.g., snakes) are thought to occur due to learnt CS-US associations (e.g., snake-pain associations). It has frequently been proposed that the extinction process reduces CRs by weakening or destroying the CS-US associations (e.g., Rescorla & Wagner, 1972; McClelland & Rumelhart, 1985). Such an explanation would logically lead to the conclusion that successful completion of exposure therapy will destroy the aversive CS-US associations and relapse cannot occur. However, Pavlov (1927) and other researchers that followed (e.g., Konorski, 1948; Pearce & Hall, 1980) noted that the occurrence of spontaneous

recovery of fear post extinction treatment suggests that the fear the CS-US associations are not destroyed during extinction. Over the past decades, an increasing amount of research has corroborated the notion that the extinction process does not destroy the CS-US association (e.g., Bandarian-Balooch et al., in press; Boschen, Neumann, & Waters, 2009; Bouton, 2002; 2004; Bouton et al., 2006; Neumann, Boschen, & Waters, 2008).

One prevailing explanation for the mechanisms at work during the extinction process is the contextually based memory model of learning by Bouton (1993, 1994; Bouton & Nelson, 1998)<sup>2</sup>. Bouton's memory model of extinction (1993, 1994; Bouton & Nelson, 1998) explains that during fear acquisition a CS-US association (e.g., snake-pain association) that is relatively context independent and readily generalisable across contexts is learnt (as discussed previously). The extinction process does not destroy the original CS-US association but facilitates learning of a new relatively context dependent CS-noUS association (e.g., snake-no pain association). Thus, subsequent to the extinction process the person has both relatively a context independent CS-US association and a relatively context dependent CS-noUS associations stored in memory. Subsequent to extinction, because the CS has been associated with the presence and absence of the US, the meaning of the CS becomes ambiguous.

To resolve the ambiguity of the CS, contextual cues are used. Contextual cues can be present in the external environment (e.g., sights, smells, sounds), and interoceptive environment (e.g., drug or affective state). Because the CS-noUS association is relatively context dependent, contextual mismatches between the extinction context (e.g., therapists office) and subsequent CS encounter contexts (e.g., footpath) are more likely to result in the retrieval of the CS-US association and produce a fear CR. However, if the extinction context (e.g., a therapist office) is highly similar to

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<sup>2</sup> See chapter 3 of this thesis for a discussion of other models of acquisition and extinction.

a subsequent encounter context (e.g., a highly similar therapist office), the CS-noUS association is likely retrieved from memory and a CR is not likely to be observed.

The model provided by Bouton (1993, 1994; Bouton & Nelson, 1998) is particularly valuable because it provides a framework that can be used to test how anxiety disorders are acquired, maintained, and treated. Furthermore, the notion that extinction results in contextually modulated new learning rather than destroying the initial fear associations, suggests that given the right circumstances, the fear associations may return, which can be a precursor to clinical relapse (Barlow, Mavissakalian, & Schofield, 1980; Rachman, 1989; 1990). Such notions have been corroborated by clinical research, which has found that approximately 30-50% of those treated by exposure therapy alone or in combination with other treatments, experience relapse of anxiety symptoms post treatment (Craske & Rachman, 1987; Rachman, 1966; Rose & McGlynn, 1997; Wolpe, 1958). The relapse of anxiety symptoms post clinical treatment is, today, often referred to as *return of fear* (Rachman, 1989, 1990).

### **Return of Fear**

According to Rachman (1989, 1990), “return of fear” is the reappearance of fear that has undergone full or partial extinction but it is not complete clinical relapse. The return of fear phenomenon has been replicated by many researchers (e.g., Craske & Rachman, 1987; Mystkowski, Craske, & Echiverri, 2002; Rodriguez, Craske, Mineka, & Hladek, 1999; Rachman, 1966; Rose & McGlynn, 1997; Wolpe, 1958). For example, Rachman (1966) provided exposure therapy to individuals with spider phobia and found that many of those individuals experienced a return of fear 24 hours after treatment. More recently, return of fear has been documented with individuals fearful of public speaking (e.g., Culver, Stoyanova, & Craske, 2011), dental visits (e.g., Elsesser, Wannemüller, & Lohrmann, 2013), and spiders 1 week after treatment (e.g., Mineka,

Mystkowski, Hladek, & Rodriguez, 1999) and 4 weeks after treatment (e.g., Bandarian-Balooch et al., in press).

The central role that fear and anxiety play in the various anxiety disorders makes the return of fear post exposure alarming because return of fear may act as a precursor of complete relapse (Barlow, Mavissakalian, & Schofield, 1980; Rachman, 1989; 1990). This highlights the importance of gaining an improved understanding of why return of fear occurs. Problematically, any treatment and client related variable that has been examined as a predictor of return of fear has found to both positively predict return of fear and not predict return of fear (for a discussion, see chapter 4). For example, requiring a longer duration of therapy to achieve significant fear reduction has shown to positively predict return of fear (Rachman & Lopatka, 1988) and not predict return of fear (Shafran, Booth, & Rachman, 1993) in claustrophobic individuals. While return of fear has been found difficult to predict using treatment and client related variables, decades of conditioning research (for a review, see Bouton, 2002; 2004) has shown that spontaneous recovery, reacquisition, reinstatement, and renewal may be four contextually driven mechanisms that can predict return of fear.

### **Spontaneous recovery**

Dating back to the work of Pavlov (1927), spontaneous recovery is a well-known mechanism of return of fear. Bouton (1988, 1991; 1993) argued that, in addition to being specific to external and internal physical contexts, extinction is also specific to a temporal context (time). Thus, after exposure, if the CS or US are not encountered for a significant amount of time (i.e., if exposure is not continued after completion of therapy), the change in temporal context, may create a contextual mismatch between the extinction and subsequent encounter context, resulting in return of fear via spontaneous recovery (Bouton, 2002; 2004).



Consider the hypothetical case example of, “Jane” a 35 year old woman who experienced her first panic attack at the age of 15 in a shopping mall coinciding with overconsumption of coffee. Not fully understanding what had happened, Jane began to avoid an increasing amount of stimuli, which she believed were involved in causing her panic attacks (e.g., coffee, sugar, chocolate, shopping malls, and other public spaces such as beaches and parks). As an adult, Jane frequently presented to the hospital with a rapidly beating heart, sweating, dizziness, stomach aches, and thoughts that she is “somehow ill” and “possibly dying”. After thorough examinations by medical doctors it was determined that Jane’s problems were psychological in nature and she was referred to a psychologist. Jane agreed to see a psychologist who identified that Jane was suffering from panic disorder with agoraphobia. After, 6 sessions of cognitive behavioural therapy including exposure therapy, Jane no longer experienced panic attacks and no longer used avoidance as a coping strategy, thus, therapy was concluded. However, 1 month later, Jane again went to her local shopping mall for the first time since therapy was concluded. Indicative of spontaneous recovery, Jane began to feel warm and out of breath and instantly left the shopping mall.

This clinical example highlights how return of fear can occur via spontaneous recovery. Spontaneous recovery effects may be a common source of return of fear because time is an ever changing temporal context that can never fully match the exposure therapy context. Not surprisingly, a large amount of laboratory-based studies with animals have shown that the lapse of time after extinction treatment results in spontaneous recovery of conditioned responses (e.g., Bouton & García-Gutiérrez, 2006; Brooks & Bouton, 1993; Brooks, 2000; Rosas & Bouton, 1998; Rosas, Vila, Lugo, & López, 2001, Westbrook, Jones, Bailey, & Harris, 2001). Laboratory-based animal and human spontaneous recovery experiments typically include a conditioning phase, an

extinction phase, and a test for spontaneous recovery phase. Conditioning is firstly conducted by repeatedly pairing a CS (e.g., shape) and US (e.g., shock) until CS alone presentations evoke CRs (e.g., fear). Subsequently, during extinction, the CS is presented on its own resulting in reduced CRs. Once a significant amount of time has lapsed after extinction, the test phase is conducted wherein the CS is again presented on its own. Post extinction CS alone presentations typically result in spontaneous recovery of conditioned responses.

Laboratory-based studies of spontaneous recovery in the human fear conditioning literature is limited (e.g., Ellson, 1939; Guastella, Lovibond, Dadds, Mitchell, & Richardson, 2007; Huff, Hernandez, Blanding, & Labar; 2009). As suggested by Neumann et al., (2008), this may be due to an early and clear demonstration of spontaneous recovery of the galvanic skin response in a human fear conditioning procedure (Ellson, 1939). Nevertheless, the laboratory-based studies have been corroborated by clinical-analogue literature which has shown that the lapse of time between exposure treatment and subsequent follow up testing resulted in spontaneous recovery of fear for up to 50% of individuals (e.g., de Jong, van den Hout, & Merckelbach, 1995; Philips, 1985; Rachman, 1979; Rose & McGlynn, 1997; Woods & McGlynn, 2000).

For instance, Rose and McGlynn (1997) provided exposure treatment to snake phobic individuals and tested participants fear again 1 week and 4 weeks after treatment. In two consecutive studies, they found that a return of fear via spontaneous recovery occurred for approximately 30% of the participants. Spontaneous recovery effects at comparable rates have been found in studies that have used claustrophobic (Woods & McGlynn, 2000) and spider phobic samples (de Jong et al., 1995). Moreover, it has been found that spontaneous recovery can occur just 24 hours after treatment

(e.g., Rachman, 1966) or 4 weeks after treatment (Bandarian-Balooch et al., submitted).

Taken together, research suggests that spontaneous recovery may be a commonly occurring mechanism of return of fear. This highlights the importance of finding ways that the exposure process can be improved, to reduce the occurrence of return of fear via spontaneous recovery effects.

There is surprisingly little research available on ways that exposure therapy can be enhanced to attenuate spontaneous recovery of fear. From the five available studies that directly investigated attenuation of spontaneous recovery (Agras, 1965; Brooks & Bouton, 1993; Brooks, 2000; Huff et al. 2009; Philips, 1985), two did not focus on fear conditioning. Brooks and Bouton, (1993) and Brooks, (2000) showed that presenting rats with an extinction cue immediately prior to tests for return of fear via spontaneous recovery in an appetitive conditioning task attenuated spontaneous recovery of conditioned responses. In accordance with the memory model of learning (e.g., Bouton, 2002), the authors of both these studies explained that the presentation of an extinction cue facilitated retrieval of extinction learning memory and resulted in attenuation of renewal. In clinical settings, this could mean that clients may be at lower risk of experiencing return of fear via spontaneous recovery effects if they carry an object with them (e.g., a watch or an armband) that reminds them of the exposure therapy. While such an idea is intriguing, the extent to which the results of Brooks and Bouton, (1993) and Brooks, (2000) can be applied to fear conditioning with humans remains to be determined by future research.

Using a laboratory-based experiment with humans, Huff et al. (2009) showed that spontaneous recovery effects can be removed by providing participants with extinction treatment 24 hours post acquisition rather than immediately post acquisition. Huff et al. (2009) used photographs of snakes and spiders as CSs, and shocks as the US

and contexts were defined as actual changes in location (laboratory room vs domestic room). Their results showed that both spontaneous recovery and renewal of fear (see chapter 3) in participants who received acquisition and extinction on the same day but test on the next day. These effects were not apparent for the group that received 24 hours between each of the acquisition, extinction, and test phases.

The results of Huff et al. (2009) are interesting because they suggest that if exposure treatment is provided within a certain period after the fear is acquired, spontaneous recovery effects are less likely. In clinical settings, this could for instance mean that a person who is severely injured through being bitten by a snake may benefit more from exposure therapy if the treatment is not provided too early or too late after the injury has occurred. Indeed, it has been shown that CBT for trauma showed more symptom reduction (e.g., traumatic memories) when provided 1-4 months after a traumatic event compared to immediately after a traumatic event (Ehlers & Clark, 2003). Nevertheless, more clinical research is required to examine whether conducting therapy during this "window of long lasting change" will reduce the likelihood of return of fear for the wider range of anxiety disorders.

Using a sample of individuals with various phobias, Agras (1965) found that conducting repeated exposure therapy reduced return of fear via spontaneous recovery. Comparatively, Philips, (1985) found that individuals with emetophobia who received an extended number of exposure therapy sessions showed relatively low rates of return of fear via spontaneous recovery at six months follow-up. These studies suggest that clinicians can enhance the long-term effectiveness of exposure therapy by conducting an extended number of exposure therapy sessions. However, these two studies did not have control groups (i.e., no treatment or single session groups), preventing definitive statements about the effects of extended exposure therapy on return of fear via

spontaneous recovery. The direct effects of conducting multiple sessions versus a single session of exposure treatment on return of fear via spontaneous recovery is particularly important to investigate considering that one session exposure therapy for phobias (Öst, 1989) is commonly used in return of fear research.

Taken together, it has been suggested that return of fear via spontaneous recovery may be reduced by using extinction cues, conducting exposure within a certain period after fear acquisition, and conducting extended exposure. However, more laboratory-based and clinical-analogue research using experimental designs with humans is required to expand the currently limited available research on how exposure therapy can be improved to reduce return of fear via spontaneous recovery.

### **Reinstatement**

Dating back to Pavlov (1927) a series of studies have shown that US presentations alone after extinction can result in a reinstatement of CRs (e.g., Delamater, 1997; Pavlov, 1927; Rescorla & Heth, 1975). In the laboratory-based animal (e.g., Bouton & Bolles, 1979; Bouton & King, 1983; Rescorla & Heth, 1975) and human literature on reinstatement (e.g., García-Gutiérrez & Rosas, 2003; LaBar & Phelps, 2005; Neumann, 2008; Neumann, Lipp, & McHugh, 2012; Westbrook, Iordanova, McNally, Richardson, & Harris, 2002) experiments typically involve a conditioning, extinction, re-exposure to the US, and test phase. Following the conditioning and extinction phases (as explained for spontaneous recovery), the US (shock) is re-presented in the absence of the CS in one context (e.g., context A). After this, CS alone re-presentations in the US re-presentation context (e.g., context A), evoke CRs. Most of the available reinstatement research is conducted in laboratory-based studies using animals (e.g., Bouton & Bolles, 1979; Bouton & King, 1983; Rescorla &

Heth, 1975). Despite this, reinstatement is a mechanism of return of fear that is important to consider in clinical treatment of anxiety disorder.

Again, consider the hypothetical case example of “Jane”. Subsequent to successful exposure therapy for her panic attacks, knowing that Jane is physically healthy, Jane and her psychologist, agreed that it is a good idea for Jane to begin running along the beach. They thought that this would benefit Jane’s physical health as well as provide her with continued exposure to the beach, which she had avoided for many years prior to therapy. However, one day, Jane, exerted herself too much in the hot sun. She began to feel overly hot, dizzy, light headed and feared that she will faint, and decided to discontinue training for the day. Coincidentally, these physical and cognitive experiences resulting from her physical exertion also overlapped with Jane’s original panic attack symptoms. Indicative of return of fear via reinstatement, the next time that Jane went for a run, the instant that she saw the beach, she suddenly felt, dizzy, and light headed and had thoughts that “something bad is likely to occur”.

This clinical example of return of fear via reinstatement highlights the contextual nature of reinstatement. Westbrook et al. (2002) provided one viable explanation for why reinstatement occurs. They suggested that during extinction, the CS is associated with the context in which it is presented. When the US is re-presented in the same context, the novel context-shock association can influence responses to the US via context-US and context-CS associations. In this way, the context itself is seen as a dangerous context in which dangerous things are likely to occur. Thus, any stimulus associated with the context becomes potentially dangerous. While this explanation does require further empirical testing, there is ample evidence in the animal literature to suggest that like spontaneous recovery, reinstatement is a contextually driven mechanism of return of fear (Bouton, 2002; 2004).

For example, in animal experiments, reinstatement is mainly observed when US and CS re-presentations occur in the same context (e.g., Bouton, 1984; Bouton & Bolles, 1979; Bouton & King, 1983; 1986; Bouton & Peck, 1989; Frohardt, Guarraci, & Bouton, 2000). Further corroborating that reinstatement is context based; there is evidence to suggest that the strength of reinstatement can be predicted from the strength of contextual conditioning (Bouton, 1984). Thus, the more ambiguous the nature of the CS, the more need there is to use contextual cues to resolve the ambiguity, and the more likely it is that reinstatement will occur (Bouton, 2002).

Similarly, using fear conditioning procedures with humans, LaBar and Phelps (2005) and Neumann et al. (2012) observed reinstatement of extinguished skin conductance and verbal fear responses respectively, only when post extinction US re-presentations were given in the same context as the subsequent test presentations of the CS. Other laboratory-based fear conditioning experiments have also confirmed the contextual dependence of reinstatement effects (e.g., Hermans et al., 2005; Norrholm et al., 2006).<sup>3</sup> However, to more precisely determine the applicability of reinstatement effects in return of fear post exposure, clinically focused researched is required.

The study by Rachman and Whittal (1989) is the only clinical-analogue study that has directly investigated reinstatement of fear. In that study, spider and snake phobic individuals were provided with exposure treatment in which fear responses were successfully extinguished. At follow-up testing two weeks after treatment, participants in the control group received behavioural approach testing as usual, while the participants in the experimental group received electric shocks to the arm during the

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<sup>3</sup> Although it is beyond the scope of this chapter to discuss the irregularities of laboratory-based reinstatement research (for a discussion, see Neumann et al., 2008), it must be noted, that there are studies which have observed reinstatement effects in humans independent of the context in which it is tested (e.g. Dirikx, Hermans, Vansteenwegen, Baeyens, & Eelen, 2004; Neumann, 2008).

behavioural approach test. However, this did not produce differential verbal or physiological fear responses between the groups, showing that reinstatement of fear did not occur. Rachman and Whittal, (1989) argued that the shock was not strong and aversive enough to cause reinstatement of fear. This was supported by their finding that the shock presentations did not elicit increased heart rate in the experimental group. There is, however, indirect evidence of the occurrence of return of fear via reinstatement. Rodriquez et al. (1999) examined predictors of return of fear and found that aversive experiences post exposure treatment were predictive of return of fear. This type of return of fear could arguably be best explained as a reinstatement effect.

More clinical-analogue research is required to determine which circumstances produce return of fear via reinstatement and how often reinstatement is likely to occur post exposure treatment. One major difficulty with conducting clinical-analogue reinstatement research was noted by Boschen et al. (2008). They argued that, because the production of reinstatement effects requires re-experiencing a fear or similar aversive response post successful exposure treatment (e.g., feeling a pain that is strong enough to equate to the pain of being bitten by a spider), such experiments are difficult to examine in ethical and experimentally controlled clinical-analogue research. Indeed, while these difficulties may prevent reinstatement to be investigated for phobia related problems, examinations of reinstatement effects may be ethically conducted in clinical-analogue research with non-phobia related disorders.

For instance, in a laboratory-based investigation of renewal, Finlay and Forsyth (2009) produced return of fear (via renewal effects) using inhalation of carbon dioxide enriched air. The partial oxygen deprivation caused by inhalation of carbon dioxide results in a variety of both psychological and autonomic physiological responses that are similar to the symptoms of panic attacks (Forsyth, Eifert, & Canna, 2000; Forsyth,



Lejuez, & Finlay, 2000). If applied to reinstatement research, participants that experience panic attacks would initially need to receive exposure to internal and external conditioned stimuli (CSs) as usual. After this, prior to follow-up tests, participants would be encouraged to receive oxygen-enriched air in a controlled environment to experience some of the aversive symptoms of a panic attack (US). If the panic-like symptoms are aversive, re-exposure of conditioned stimuli may result in return of fear via reinstatement. Of course, to ensure that no harm is done to participants, such a procedure would have to be provided to those who are willing to experience relapse of anxiety symptoms and additional exposure treatment in a controlled environment. If such a method can ethically be used in clinical-analogue research, it could open a window into a highly important field of clinical research.

### **Reacquisition**

Return of fear via reacquisition occurs when the CS is again paired with the US after successful extinction (Bouton, 2002). Research on reacquisition is limited to laboratory-based experiments with rats (e.g., Bouton, 1986; Bouton & Swartzentruber, 1989; Kehoe & Macrae, 1997) and rabbits (e.g., Napier et al., 1992). The typical experimental procedure of reacquisition involves acquisition and extinction phases, followed by re-pairing of the CS and US. Subsequently, during test, the CS is again presented on its own. The re-pairing of the CS and US results in a reacquired ability of the CS to elicit a CR (Bouton, 2002).

For example, Napier et al. (1992) found that re-conditioning in rabbits was significantly faster for a CS that had been used in conditioning and extinction than a novel CS. Interestingly, the observation that fewer CS-US pairings are required to elicit a CR after extinction compared to when the CS-US association is initially learnt (i.e., rapid reacquisition; Kehoe & Macrae, 1997; Napier et al., 1992) suggests that the initial

fear association is intact after extinction and subsequent re-pairings facilitate its expression, resulting in return of fear. However, several studies have also shown that reacquisition can be relatively slow (i.e., many CS-US re-pairings are required to elicit a CR; Bouton, 1986; Bouton & Swartzentruber, 1989; Ricker & Bouton, 1996).

Bouton, (2002; 2004) suggested that the discrepant findings regarding the speed of re-acquisition, could be resolved by taking into consideration the role of the context. This is because the context will determine the meaning of a CS that has become ambiguous due to aversive conditioning, extinction, and re-conditioning. Bouton, (2002; 2004) argued that, reacquisition will occur faster if re-pairings and subsequent tests are conducted in the initial acquisition context (where contextual cues facilitate retrieval of CS-US associations). Conversely, reacquisition will be slower if re-pairings and tests are conducted in the extinction context (where contextual cues facilitate retrieval of CS-noUS associations). This explanation has been supported by a study, which showed that reacquisition requires less pairings (becomes faster) if an acquisition context cue is present during re-pairing of the CS-US association (Bouton & Swartzentruber, 1989). Despite being restricted to laboratory-based research with animals, the occurrence of return of fear via reacquisition has important clinical implications.

Once again, consider the case of Jane. Subsequent to successful exposure, Jane decided to have a cup of coffee with a friend at a shopping mall. However, upon drinking coffee in the shopping mall, Jane experienced an increase in her heartbeat, which promptly reminded her of the circumstances of her first panic attack (i.e., extensively drinking coffee at the shopping mall). Indicative of reacquisition, the retrieval of this aversive memory resulted in a rapid onset of a full-blown panic attack.

The above example highlights the clinical relevance of reacquisition. Thus, the lack of reacquisition studies with humans (Boschen et al., 2009; Neumann et al., 2008)

should not be confused with the notion that reacquisition is not important to consider in clinical settings. Indeed, as seen in the clinical example above, an initial aversive experience may, due to a variety of psychological vulnerabilities (e.g., genetic predisposition towards phobias) and environmental factors (e.g., living in a snake infested area), predict subsequent aversive experiences.

Similar to reinstatement, it may be difficult to design ethical clinical-analogue experiments to investigate reacquisition. However, many available laboratory-based studies with animals and humans investigate spontaneous recovery, reinstatement, and renewal. These methodologies can be readily applied to study reacquisition of fear. For instance, Bandarian-Balooch, Neumann, and Boschen (2012b) paired pictures of spiders in different photographed contexts to examine the renewal effect. During the acquisition phase, participants received pairings of spider images with shocks in one context (A). During the extinction phase, participants in the standard extinction group received CS alone presentations in a different context (B). During test in a novel context (C), it was observed that the contextual change resulted in renewed fear of the CS for the participants that received standard extinction treatment. Using a similar methodology, researchers can include a CS-US re-pairing phase, prior to the test phase to examine reacquisition of fear in humans. If successful, such studies can also be used to investigate how the extinction process can be enhanced to attenuate return of fear via reacquisition.

Currently, no studies have directly investigated attenuation of reacquisition by changing the extinction treatment process. However, it has been shown that reacquisition effects become slower (e.g., more CS-US re-pairings are required) when an extinction cue is present during test (Bouton & Swartzentruber, 1989). Thus, the presence of an extinction cue (e.g., a wristband used during exposure treatment) may

reduce the strength of subsequent CS-US re-pairings resulting in attenuation of return of fear via reacquisition.

### **Conclusion**

Contemporary conditioning models (e.g., Öhman and Mineka, 2001) provide researchers and clinicians alike with complex models that can be used to understand the underlying mechanisms involved in the acquisition and treatment of anxiety disorders. As detailed in the current chapter, the key component of the behaviourally based treatments for anxiety disorders is likely to be exposure therapy (Emmelkamp, 2004). However, the evidence suggests that successful reduction of fear post exposure therapy does not guarantee the long-term effectiveness of treatment (Rachman, 1989). To complicate matters, attempts to identify predictors of return of fear post treatment have revealed inconsistent results.

Nevertheless, decades of research with animals (Bouton, 2002; 2004) and humans (Boschen et al., 2009; Neumann et al., 2008) has furthered our knowledge on the factors involved in relapse of anxiety disorders post successful treatment. This research has highlighted the role of spontaneous recovery, reinstatement, reacquisition, and renewal as contextual mechanisms that may underlie a return of fear post exposure therapy of anxiety disorders. The current chapter highlighted the relevance of the first three mechanisms of return of fear in both research and clinical treatment of anxiety disorders. Furthermore, the current chapter identified methods that can enhance the long-term effectiveness of the exposure therapy and thwart return of fear via the spontaneous recovery, reinstatement, and reacquisition. However, the most researched and reliably observed mechanism of return of fear is renewal (e.g., Bandarian-Balooch, Neumann, & Boschen, 2012a; Bouton, 2002; 2004; Bouton et al., 2006; Neumann et al.,

2008). The remaining chapters will focus on the renewal effect and its role in the return of fear.

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### CHAPTER 3

Chapter 3 is a published review (paper 1), which draws on experimental research to identify reasons for return of fear via a renewal mechanism following exposure therapy and how it can be reduced. The theories that underlie fear conditioning are outlined and the chapter shows that the extinction process does not remove fear. Experimental methods to reduce renewal-based return of fear are reviewed and the application of this research in clinical settings is discussed. This review has been published as a chapter in the book *Beyond the Lab: Applications of Cognitive Research in Memory and Learning*. Modifications to the published version, including page numbers and header (changed from Context Effects on Memory Retrieval Following the Pavlovian Extinction Process to Renewal of Fear) have been made to fit the format of the current thesis. A signed statement of contribution is provided followed by the chapter as published.

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

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My contribution to the paper involved:

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## CHAPTER 4

Chapter 4 is a published review (paper 2) of clinical-analogue studies that have examined return fear via a renewal mechanism. The chapter argues for the value of clinical-analogue return of fear research in clinical settings. It discusses the effects of individual difference variables on the likelihood of experiencing renewal of fear after exposure therapy. Finally, the chapter highlights methods that have been used to reduce renewal of fear and how these methods can be applied in clinical settings. This review is currently in press as a chapter in the book *Psychology of Fear: New Developments*. Modifications to the published version, including page numbers and header (changed from Renewal of Fear: Clinical-Analogue Findings to Renewal of Fear) have been made to fit the format of the current thesis. A signed statement of contribution to co-authored paper is provided followed by the review.

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## CHAPTER 5

Chapter 5 presents an overview of Experiment 1 (chapter 6), Experiment 2 (chapter 7), and the  $N = 1$  case study (chapter 8). The chapter discusses currently available research on attenuation of renewal of fear. Subsequently, the aims of the thesis and the specific hypotheses and implications of each experiment are outlined.



### Research Aims

The renewal effect is the most widely studied mechanism of return of fear (Bouton, 2002; 2004) and it is the predominant focus of the current thesis. The renewal effect has been reliably observed in laboratory-based studies using animals (for a review, see Bouton, Corcoran, & Westbrook, 2006) and humans (for a review, see Bandarian-Balooch, Neumann, & Boschen, 2012a; Neumann, Boschen, & Waters, 2008). In two reviews, the current standing of the laboratory-based ((Bandarian-Balooch et al., 2012a) and clinical-analogue research (Bandarian-Balooch, Neumann, Boschen, in press)<sup>7</sup> on renewal of fear was discussed.

Bandarian-Balooch et al. (2012a) revealed a range of methods that can be used to both produce and attenuate renewal of fear in the laboratory. Furthermore, the review suggested that more recent methodological developments (Neumann & Kitlertsirivatana, 2010) should allow for investigation of ABC renewal of fear in humans and thereby address a major gap in laboratory-based renewal of fear research. Bandarian-Balooch et al. (in press) highlighted that despite having been reliably produced in clinical-analogue research, attempts to predict and attenuate renewal of fear have produced variable results. Thus, specific techniques that can be used to increase the validity of predictive analysis of renewal of fear were discussed. More, importantly it was suggested that investigating the effects of conducting exposure treatment in multiple real-life contexts with a real life spider in high fearful and clinical populations will bridge the gap between laboratory-based research and clinical work.

In laboratory-based research with humans, the two commonly researched types of renewal of fear are ABA renewal and ABC renewal (Neumann et al., 2008). In these renewal designs, fear conditioning occurs in one context (context A), extinction occurs

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<sup>7</sup> See chapter 3 and 4 of the current thesis respectively

in another context (context B), and test for renewal occurs in either the original acquisition context A (as in ABA renewal) or in a novel context C (as in ABC renewal). The reliable observation of renewal in laboratory-based and clinical-analogue studies suggests that there is a need for improving the long-term effectiveness of exposure therapy. One promising method of attenuating renewal of fear has been to conduct exposure therapy in multiple contexts with the aim to enhance the generalisability of the treatment (for a review, see Bandarian-Balooch et al., 2012a).

It has been suggested that multiple extinction contexts in combination with other methods such as extended treatment (Thomas, Vurbic, & Novak, 2009) and context similarity (Bandarian-Balooch & Neumann, 2011) may be required to attenuate ABA renewal. However, because of its clinical relevance (for a discussion, see Bandarian-Balooch et al., 2012a), ABC renewal of fear is the predominant focus of the current thesis. In rats, one study found that extinction treatment in multiple contexts attenuated ABC renewal (Gunther et al., 1998) and one study found that it does not (Bouton et al., 2006). More recently, Neumann and Kitlertsirivatana, (2010) documented the methodology required to produce ABC renewal effects in laboratory-based experiments with humans. The more recently developed methodology by Neumann and Kitlertsirivatana (2010) allows for examination of whether extinction treatment in multiple contexts can attenuate renewal of fear using laboratory-based experiments with humans.

In clinical-analogue research, the methodology to investigate ABC renewal of fear was first used a decade ago (Rowe & Craske, 1998). Clinical-analogue renewal of fear research typically adopt a “BC” renewal of fear design because fear acquisition (in context A) has already occurred (e.g., the client has already acquired a fear when presenting for treatment). Clinical-analogue research has confirmed that conducting

exposure treatment with a filmed spider in multiple filmed contexts (Vansteenwegen et al., 2007) or conducting exposure treatment with a virtual reality spider in multiple virtual contexts (Shiban, Pauli, & Mühlberger, 2013) can attenuate “BC” type renewal of fear. However, no research has yet been conducted to examine the effects of conducting extinction treatment with high fearful participants in multiple real-life contexts using a living spider.

The effect of conducting exposure therapy in multiple contexts has not been studied in real life clinical cases with a client that experiences clinical level of fear or anxiety. Despite their clinical relevance, clinical-analogue studies are not synonymous to clinical cases<sup>8</sup>. In clinical-analogue studies, experimental control of the treatment is maximised through the use of standardised treatment protocols (e.g., Bandarian-Balooch, Neumann, & Boschen, submitted<sup>9</sup>; Mineka et al., 1999; Rodriguez et al., 1999; Shiban et al., 2013; Vansteenwegen et al., 2007). As such, all participants complete the same pre-determined exposure hierarchy in pre-determined contexts irrespective of the clinical relevance of the hierarchy and contexts for the individual clients. Conversely, clinical exposure therapy tailors the treatment protocol to the client as much as possible to enhance the relevance of treatment to the client (Craske, 1999). Examining the effects of conducting individually tailored exposure therapy in multiple contexts on renewal of fear with a client that experiences clinical level of fear is required to support the clinical applicability of the existing clinical-analogue findings.

### **Aims**

The current thesis aims to address the problem of the occurrence of return of fear via a renewal effect post exposure therapy. More specifically, the thesis aims to test the

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<sup>8</sup> For a discussion of the applicability of clinical-analogue research to clinical cases see Bandarian-Balooch et al., in press (chapter 4).

<sup>9</sup> See chapter 7 of this thesis

hypothesis that the return of fear of specific stimuli that occurs via a renewal effect will be attenuated by conducting exposure in multiple contexts. Two experiments and a case study will be used to test this hypothesis. The experiments are programmatic in moving from a laboratory-based experiment with healthy individuals to finishing with a clinical treatment context with an individual suffering from specific phobia.

### **Experiment 1 Overview**

The aim of Experiment 1 is to test the hypothesis that ABC renewal will be attenuated when conducting exposure in multiple contexts in a laboratory-based fear conditioning procedure. By using an experimental design that incorporates an acquisition and extinction phase of a fear conditioning procedure, the processes that occur during the acquisition and extinction of phobias in real life will be analogised. In contrast to clinically based experiments with pre-existing fears (e.g., Mineka et al., 1999), the present design will afford control over the fear acquisition context and allow for strict manipulation of contexts used during extinction treatment.

To enhance the clinical relevance of Experiment 1, the experimental stimuli will use images of spiders and an aversive shock unconditional stimulus. Spiders are regarded as *fear-relevant* stimuli (Neumann & Longbottom, 2008). To ensure that the prepotency of the fear relevant versus the fear irrelevant stimuli is controlled for, a differential fear conditioning paradigm will be used (Mineka & Öhman, 2002). Expectancy ratings (Neumann et al., 2008) and startle responses (Grillon, 2002) will be used to measure self-report and physiological fear. The research hypotheses will be tested using both within-subjects and between-groups comparisons. The main factor of the study will consist of Design with three groups (ABB, ABE, and A(BCD)E). The ABB and ABE groups will receive extinction in one context only. The ABB group will serve as a control group and will be exposed to a context during the acquisition phase

that is different to the context used during the extinction and test phases. The ABE renewal group will be exposed to a different context at each phase of the experiment. The A(BCD)E multiple extinction context group will receive extinction in three different contexts and will be exposed to a new context at each phase of the experiment.

### **Hypotheses**

The hypotheses are based on prior research and Bouton's (1988, 2002, 2004) memory model of extinction. The memory model of extinction proposes that exposure in multiple contexts provides an increased number of shared contextual cues with the context in which subsequent test exposure will be conducted, thus enhancing the generalisation of extinction treatment. This could result in an increased likelihood that the extinction learning will be retrieved during the test phase and an attenuation of renewal will result. Therefore, it is hypothesised that there will be attenuation of renewal in self-reported expectancy and startle responses for participants in the A(BCD)E design. The ABE design group is expected to show a strong renewal effect, whereas the ABB design group is expected to show no renewal. Lastly, it is hypothesised that there will be no difference between the A(BCD)E and ABB groups.

### **Implications**

Increased understanding of the effect of exposure therapy on anxiety disorders is an important aim. If the hypotheses in this study are supported, it will provide a strong empirical base to conduct further testing of exposure treatment in multiple contexts in more clinically relevant study designs.

### **Experiment 2 Overview**

The aim of Experiment 2 is to test the hypothesis that exposure treatment conducted in multiple contexts will prevent return of fear of spiders when the spider is re-encountered in a novel context. A clinical-analogue experiment involving a 16 step

exposure hierarchy will be used within a one session in-vivo exposure treatment session (Öst, 1989) to simulate the exposure therapy process. Each step will include increasingly fear provoking encounters with the phobic stimulus. The use of real objects (e.g., actual spiders) in naturally varying real-life contexts (e.g., bathroom vs. outdoor patio) to treat naturally acquired fears in samples that are considered high in fear will increase the applicability of the present research outcomes to treatment in the clinic.

Behavioural avoidance tests, self-report questionnaires and subjective units of distress ratings, and heart rate measures (e.g., Mineka, et al., 1999; Mystkowski et al., 2002, Rodriguez et al., 1999; Rowe & Craske, 1998) will be used to measure treatment effectiveness and return of fear via renewal. Participants' fear of spiders will be examined at four stages: pre exposure, post exposure, follow-up 1 conducted 1 week after post exposure, and follow-up 2 conducted 4 weeks after post exposure. The procedure is here termed a BE design due to the lack of an explicit acquisition phase.

The main factor in the study will consist of Design with three levels, (BB, BE, and BCDE). Three groups will be used. The BB group will serve as a control and receive exposure in one context, which will be the same as the subsequent follow up contexts. The BE group will also receive exposure in one context, but this context will be different to subsequent follow up contexts. The BCDE group will receive exposure in three different contexts that will all be different to each subsequent follow up context.

### **Hypotheses**

Similar to Experiment 1, the hypotheses on the effects of exposure treatment conducted in multiple contexts on return of fear were developed using Bouton's (1988, 2002, 2004) memory model of extinction. It is hypothesised that there will be greater renewal of fear for the BE group than the BB group as indicated by larger SUDS, BAT, and HR scores. It is also hypothesised that there will be a greater renewal of fear for the

participants in the BE group than the BCDE group. Lastly, it is hypothesised that there will be no difference between the BCDE and BB group.

### **Implications**

The potentially beneficial effects of conducting exposure therapy in multiple contexts has been suggested already (e.g., Boschen, Neumann, & Waters, 2009), but it has not been directly tested using real-life contextual changes and real-life spiders in a clinical-analogue experiment. If it is found in Experiment 2 that exposure treatment conducted in multiple contexts reduces or ultimately abolishes return of fear the same methodology can be applied to clinical treatments to reduce relapse following successful treatment. The exposure treatment provided in Experiment 2 will be standardized such that all participants will receive the same treatment. If the treatment is effective when the same protocol is used for all participants (thus disregarding specific treatment needs of participants), it may be argued that it will be even more effective when the treatment is tailored to fit the specific needs of a client.

### ***N* = 1 Case study Overview**

The aim of the *N* = 1 case study is to translate the use of multiple extinction contexts investigated in Experiment 1 and 2 to a clinical case. The case study will draw upon what is learnt from the first two experiments and devise an individually tailored treatment plan that incorporates the use of multiple extinction contexts. Research on renewal and return of fear has generated many ideas about factors that may improve the exposure therapy process and potentially reduce relapse (for a discussion, see Bandarian-Balooch et al., 2012a; Bandarian-Balooch et al., in press). However, to date, there have been no reports of how these suggestions could be incorporated with common treatment methods (e.g., Behaviour Therapy). A detailed example of a clinical case study that incorporates multiple extinction contexts is important because it will

allow clinicians to adapt their current practice to these relatively novel suggestions. Arguably, more clinicians are likely to use these novel methods if they prove effective in the clinic and if they are made easy to implement.

In contrast to Experiments 1 and 2 where the stimuli used were spiders, the treatment plan in the case study will be implemented on a person that is experiencing phobia of toads. A complete clinical assessment could not be performed with a client experiencing spider fear. However, a client with toad phobia willing to participate in the case study had presented to the researchers. For these practical reasons, a toad phobic rather than a spider phobic client was used for the case study. The added benefits of using a non spider related phobic client for the cases study is that the case study will show that the treatment enhancing effects of conducting exposure therapy in multiple contexts are not restricted to phobia of spiders. The treatment plan will be largely based on manualized formats of cognitive and behavioural therapies for specific phobias (e.g., Andrews, Crino, Hunt, Lampe, & Page, 1994; Antony, Craske, & Barlow, 1995; Bourne, 2002; Öst, 1989). The exposure therapy component of the case study will consist of a one session in-vivo exposure to a cane toad (Öst, 1989). Behavioural approach tests (including approach distance and time), self report questionnaires, and subjective measures of fear will be used as measures of behavioural avoidance and subjective fear. The client's fear of toads will be examined at five stages: pre-exposure, post-exposure, 1 week post-exposure, 5 weeks post-exposure, and approximately 1.8 years post-exposure.

### **Hypotheses**

Based on successful attenuation of renewal in Experiment 1 and successful reduction of renewal of fear in Experiment 2 it is expected that the client will experience a reduction in fear of toads post-treatment and that no significant return of



fear via renewal will be present when the toad is again encountered in a novel context during follow up.

### **Implications**

The results of the  $N = 1$  case study may provide information on potential challenges that need to be addressed when conducting exposure therapy in multiple contexts. For instance, it may be that clients whom perceive exposure treatment in multiple extinction contexts as an implausible solution to their fear may not respond as well to the treatment and other solutions may have to be devised. Successfully reducing return of fear using a clinical study provides valuable information on how multiple extinction context research can be applied in the development of individualised exposure therapy treatment plans for clinical phobia.

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## CHAPTER 6

Chapter 6 reports on attenuation of ABC renewal of fear using extinction treatment in multiple contexts, which was conducted in Experiment 1 (paper 3). This experiment included the participation of 68 non-spider fearful University students in Australia. Experiment 1 is a journal article that has been published in *Behaviour Research and Therapy*. Modifications to the published version, including page numbers and header (changed from Attenuation of ABC Renewal to Renewal of Fear) have been made to fit the format of the current thesis.

Additionally, Experiment 1 was presented as an oral paper at the Australian Association for Cognitive and Behaviour Therapy 35<sup>th</sup> National Conference on July 2012 in Gold Coast Australia. Evidence of acceptance of Experiment 1 as an oral paper is included in Appendix D. A statement of contribution to co-authored published paper is provided followed by Experiment 1 as published in *Behaviour Research and Therapy*.

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper. The bibliographic details of the co-authored paper, including all authors, are:

Bandarian-Balooch, S., Neumann, D. L., & Boschen, M. J. (2012). Extinction treatment in multiple contexts attenuates ABC renewal in humans. *Behaviour Research and Therapy*, 50, 604-609.

My contribution to the paper involved:

Conducting a critical literature review

Development of the experiment proper

Collection, analysis, and reporting of data

Write up of study

Submission for publication

Editing of article (under supervision) before and after response from editors and reviewers.

(Signed) \_\_\_\_\_ (Date)\_\_\_\_\_

Siavash Bandarian Balooch

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## **Extinction Treatment in Multiple Contexts Attenuates ABC Renewal in Humans**

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### Abstract

Renewal has been implicated as one of the underlying mechanisms in return of fear following exposure therapy. ABC renewal is clinically more relevant than ABA renewal and yet it is a weaker form of renewal, suggesting that conducting extinction treatment in multiple contexts may be sufficient to attenuate ABC renewal. Using self-reported expectancy of shock and startle blink responses the current study examined the effects of conducting extinction treatment in multiple contexts on ABC fear renewal.

Participants ( $N = 68$ ) received conditional stimulus (CS) and unconditional stimulus (US) pairings in one context (A) followed by extinction treatment (CS presentations alone) in either one other context (B) or three other contexts (BCD). Non-reinforced test trials in a novel context (E) resulted in renewal of extinguished conditioned behaviour for those who received extinction in only one context. However, renewal was attenuated for those who received extinction treatment in three contexts. No renewal was found for the control group that received the test trial in the same context as during extinction. Suggestions are provided for clinicians seeking to prevent or attenuate return of fear following exposure therapy.

Keywords: exposure therapy, extinction, renewal, return of fear, context

### **Extinction Treatment in Multiple Contexts Attenuates ABC Renewal in Humans**

The development of specific phobia has been explained via fear conditioning processes whereby a previously non-threatening conditional stimulus (CS) invokes fear through its association with an aversive unconditional stimulus (US) (Davey, 2002). Extinction treatment, also known as exposure therapy in clinical applications, aims to treat phobia through repeatedly presenting the feared CS without the presence of the US. However, approximately 30-50% of individuals experience relapse of anxiety symptoms after treatment has been completed (Choy, Fyer, & Lipsitz, 2007; Craske & Rachman, 1987; Rose & McGlynn, 1997). In clinical research, this relapse is typically referred to as return of fear (ROF; Rachman, 1979).

Research using non-human animal subjects (e.g., Bouton & Bolles, 1979; Thomas, Vurbic, & Novak, 2009; Dirikx et al., 2007) and human participants (e.g., Effting & Kindt, 2007; Neumann & Kitlertsirivatana, 2010; Vansteenwegen, Dirikx, Hermans, Vervliet, & Eelen, 2006) has shown that extinction may result in novel and context-specific learning of a CS-noUS association that does not generalize to other contexts (Bouton, 2002). Therefore, contexts that evoke the original fear learning memory (CS-US association) rather than the extinction learning memory (CS-noUS association) are more likely to lead to ROF. The present research focuses on the procedure known as *renewal*.

The typical renewal procedure involves the three phases of acquisition, extinction, and test (Boschen, Neumann, & Waters, 2009; Bouton, 2002). These phases vary in context. In the ABA and ABC renewal procedures, a CS-US association is learned during the acquisition phase in one context (A) through paired presentations of the CS and US. Subsequently during the extinction phase the CS is repeatedly presented alone in a different context (B). Renewal of extinguished conditioned responses

typically occurs in the test phase when the CS is presented alone again in a novel context (C; as in ABC renewal) or in the initial acquisition context (A; as in ABA renewal). Finding ways to reduce the renewal effect is important because it may lead to approaches that improve the effectiveness of exposure therapy by reducing ROF.

Rowe and Craske (1998) noted that ROF via a renewal effect may be attenuated by conducting exposure therapy in multiple contexts. However, experimental research has revealed inconsistent results on the effects of multiple extinction contexts on ABA renewal (Neumann, Boschen, & Waters, 2008). Two studies, one using rats (Chelonis, Calton, Hart, & Schachtman, 1998) and one using humans (Neumann, 2006), successfully attenuated ABA renewal by conducting extinction treatment in multiple contexts. However, two subsequent studies using rats (Bouton, García-Gutiérrez, Zilskia, & Moody, 2006) and humans (Neumann, Lipp, & Corey, 2007) did not replicate these results. Conducting extinction treatment in multiple contexts alone may not be sufficient to attenuate ABA renewal. Studies that combined multiple extinction contexts with a larger number of extinction trials (Thomas, Vurbic, & Novak, 2009) or with increased contextual similarity between extinction and test trials (Bandarian Balooch & Neumann, 2011) have successfully abolished ABA renewal.

To date, most research has investigated the effects of multiple extinction contexts on ABA renewal. However, in a clinical treatment scenario, ABC renewal (i.e., ROF in a novel context) is more relevant than ABA renewal. The original acquisition context is not always known or easy to replicate and exposure to the feared stimulus in a novel context represents an ever-present danger for ROF via ABC renewal. For reasons such as these, it is important to examine the effects of multiple extinction contexts on ABC renewal.

However, the effects of multiple extinction contexts on ABC renewal have also been inconsistent. Gunther, Denniston, and Miller (1998) found that extinction treatment in multiple contexts attenuates ABC renewal in rats, whereas Bouton et al. (2006) reported that it does not. In studies with humans, the lack of a methodology to produce a clear renewal effect (see Effting & Kindt, 2007; Havermans, Keuker, Lataster, & Jansen, 2005; Neumann, 2006) has made it difficult to investigate the effects of multiple extinction contexts on ABC renewal. Neumann and Kitlertsirivatana (2010) suggested that the inability to reproduce ABC renewal effects in humans was due to the low degree of change between contexts. By increasing the amount of change by using photographs of real environments as contexts, they successfully reproduced ABC renewal of self-reported shock expectancy in humans.

The present research examined the effects of multiple extinction contexts by adapting the ABC renewal procedure developed by Neumann and Kitlertsirivatana (2010). In contrast to their study, fear-relevant stimuli (spiders) were used to increase the applicability to clinical practice. ABC renewal has been found to be weaker than ABA renewal (Neumann & Kitlertsirivatana, 2010). For this reason, only the manipulation of multiple extinction contexts was used. Expectancy ratings and startle responses were used to measure learning. An ABB (control) group and ABE group (ABC renewal) received extinction in one context. An A(BCD)E multiple extinction context group received extinction in three different contexts. It was hypothesized that there would be a renewal of shock expectancy and startle response magnitude for the ABE group during test. It was also hypothesised that there would be an attenuation of renewal for the A(BCD)E group.

## Method

### Participants

Sixty-nine undergraduate psychology students participated in exchange for partial course credit after providing informed consent to a protocol granted institutional ethical approval. Fifteen participants were removed from the analyses due to not making expectancy responses on more than 60% of the trials ( $n = 7$ ) or failing to show learning of the stimulus contingencies ( $n = 8$ ). The final sample consisted of 52 participants (37 females and 15 males) with a mean age of 22.60 years (range = 17 to 60,  $SD = 7.18$ ). Participants were randomly assigned to one of three groups: a control group, ABB ( $n = 18$ ), a single extinction context group, ABE ( $n = 17$ ), and a multiple extinction context group, A(BCD)E ( $n = 17$ ).

### Apparatus

Participants sat facing a 1.8 m wide  $\times$  1.2 m high white screen on which the CSs were presented by a Panasonic Model PT-L557E LCS projector. The CSs were two colour digital photographs of a golden orb weaver (*Nephila plumipes*) and a giant greenbellied huntsman (*Typostola barbata*). The nature of which spider served as the CS+ or CS- was counterbalanced. The five distinct contexts were a bathroom, a living room, a bedroom, a kitchen, and a home entry. Each spider (CS) was photographed from thirteen different angles in varying locations within each of the five contexts. Each context was also photographed in the absence of the CS to provide images shown during the intertrial exposure contexts. This resulted in 165 pictures. The order of the photographs was counterbalanced between the acquisition and test phase, and randomised during extinction so that no photo was used more than any other. The US was a 200 ms electro-tactile stimulus generated by an IWORX SI100 stimulus isolator

and delivered to the participant's inner forearm via two disposable AD Instruments MLA1010B Ag/AgCl electrodes.

Participants' responses were measured using self-reported expectancy of the shock (see Bandarian Balooch & Neumann, 2011; Lissek et al., 2008; Neumann & Kitlertsirivatana, 2010). After 1 s following the onset of some CS presentations the text *Level of risk?* was presented on the screen. The question was presented above the CS and cued the participants to report their perceived level of risk of the shock. Participants indicated their level of risk along a scale where 1 = *very low*, 2 = *low*, 3 = *moderate*, 4 = *high* using the V, B, N, and M keys, respectively, on the computer keyboard.

Electromyographic (EMG) recordings of the blink reflex were made using two 4mm Ag/AgCl domed electrodes filled with Surgicon E10 electrolyte placed over the *orbicularis oculi*. The raw EMG signal was obtained with an AD Instruments ML132 Bio Amp in conjunction with a PowerLab 4/20 data acquisition system using a sampling rate of 1000 Hz. The startle blink reflex was elicited by presentations of white noise for 50 ms at an intensity of 110 dB(A) with rise time of below 1 ms through Sennheiser HD-25 headphones. The Depression Anxiety Stress Scales 21-item version (DASS21, Lovibond & Lovibond, 1995) and Spider Phobia Questionnaire 31 item version (SPQ; Klorman, Weerts, Hastings, Melamed, & Lang, 1974) were also used. Item 23 on the SPQ was altered to fit an Australian sample (Neumann & Longbottom, 2008).

### **Procedure**

Participants initially completed the DASS21 and SPQ. The electro-tactile shock electrodes and startle blink electrodes were next attached. The intensity of the electro-tactile shock stimulus was individually set at a level that each participant reported as "unpleasant, but not painful" (Neumann, Lipp, & Siddle, 1997). The mean shock level across all participants was 82.31 V ( $SD = 16.40$ ) and did not differ between groups,

$F(51) = .67, p = .52$ . Participants were next informed that they would be presented with the shock stimulus and several pictures of two different spiders from different angles in varying locations in a home. They were instructed to focus their attention on learning the stimulus contingencies and ignore the startle stimuli. The participants were informed that when the text “*Likelihood of shock?*” appeared on the screen, they were to report their level of expectancy of receiving a shock, as quickly as possible.

Table 1 shows the experimental trials used in the three groups. During acquisition, there were 10 presentations of the CS+, US, and CS-. The US coincided with the end of the CS+. During extinction, both the CS+ and CS- were presented 12 times alone without US presentations. In the test phase, the CS+ and CS- were presented once each. For the ABB (control) group a different context to that used during the acquisition phase was used during the extinction and test phases. The ABE group received each phase of the experiment in a novel context. The A(BCD)E group received each phase of the experiment in a novel context with three different contexts used during extinction. The type of context used in each phase was counterbalanced across groups.

Expectancy ratings were recorded once for each CS on trials 1, 4, 7, and 10 during acquisition, trials 1, 4, 5, 8, 9, and 12 during extinction and for the test trial. Startle blink responses were recorded on trials 1, 3, 6, and 10 during acquisition, trials 1, 3, 6, 9, 10, and 12 during extinction, and once during test. They were also recorded during the intertrial intervals after trial 2, 4, 6, and 8 during acquisition, and after trials 2, 5, 8, and 11 during extinction, and once in the test phase. Startle blink responses during CS presentations were elicited 5500 ms following CS onset and during the intertrial intervals were elicited 7500 ms after the CS ended. The order of presentation



of the CSs was randomized, with the condition that the same CS was allowed to be presented no more than two times in a row. In addition, the first CS presented in each phase was counterbalanced across participants during acquisition, extinction, and test. The intertrial intervals were 12, 15, or 18 s.

### **Scoring and Statistical Analysis**

The between subjects independent variable was Design with three levels (ABB, ABE, and A(BCD)E). The within subjects independent variables were CS with two levels (CS+, CS-) and Trial with either four levels (acquisition) or six levels (extinction). The dependent variables were shock expectancy ratings and startle blink response magnitude. The participants were regarded as showing learning of the stimulus contingencies if they reported expectancy ratings of 3 or 4 on the two last trials of the acquisition phase and 1 or 2 on the two last trials of the extinction phase. A total of 4.1% of the data was missing and was replaced using linear interpolation of scores during the same experimental phase.

The startle responses were scored based on the guidelines of Blumenthal, Cuthbert, Filion, Hackley, Lipp, and Van Boxtel (2005). A Butterworth filter with a 30-500 Hz passband was used to digitally filter the raw EMG. The EMG was rectified and smoothed with a finite impulse response filter (25 coefficients, low-pass cut-off filter of 40 Hz). The response amplitude (magnitude of the response) was defined as the difference between the onset of the response and the maximum of the response (highest part of the waveform) in a window of 20-200 ms following the blink eliciting stimulus.

Separate oneway ANOVAs revealed no significant difference between the groups on mean ITI startle blink magnitude, age, shock-level, SPQ, and DASS21 scores, all  $F_s < 2.71$ ,  $p > .05$ . Forty-three participants were used for the startle blink analyses as three participants were removed due to equipment error and six were

removed due to having above 60% missing responses. Prior to analyses startle blink responses were converted to a percent change score to take into account individual variability in overall blink magnitude (Lipp, Neumann, & McHugh, 2003). The percent change scores were calculated using the formula  $(CS - ITI)/ITI * 100$  and a square root transformation was used to normalise the distributions (Lipp & Neumann, 2004). In case of violations to the assumption of sphericity, Greenhouse-Geisser corrections were applied. Post hoc analyses used *t* tests with Bonferroni corrections. The statistical significance was set at an  $\alpha$ -level of .05.

Table 1

*Design, Stimulus Presentations, and Trials Numbers for the ABB, ABE, and A(BCD)E groups*

Group	Experimental phase				
	Acquisition	Extinction			Test
ABB	A: 10 CS+US	B: 4 CS+	B: 4 CS+	B: 4 CS+	B: 1 CS+
	A: 10 CS-	B: 4 CS-	B: 4 CS-	B: 4 CS-	B: 1 CS-
ABE	A: 10 CS+US	B: 4 CS+	B: 4 CS+	B: 4 CS+	E: 1 CS+
	A: 10 CS-	B: 4 CS-	B: 4 CS-	B: 4 CS-	E: 1 CS-
A(BCD)E	A: 10 CS+US	B: 4 CS+	C: 4 CS+	D: 4 CS+	E: 1 CS+
	A: 10 CS-	B: 4 CS-	C: 4 CS-	D: 4 CS+	E: 1 CS-

*Note.* A, B, C, D, and E refer to the different contexts. CS = Conditional stimulus; US = Unconditional Stimulus. 10, 4, and 1 refer to the number of trials within each phase.

## Results

### Expectancy of Shock

The expectancy ratings across all groups and experimental phases are shown in Figure 1. All groups developed an expectancy of shock during acquisition, which was subsequently extinguished. During test, a renewal of shock expectancy was found for the single extinction context renewal group but not in the multiple extinction context renewal group or the control group.

To examine expectancy ratings during the acquisition phase, a  $3 \times 2 \times 4$  (Design  $\times$  CS  $\times$  Trial) ANOVA was conducted. A significant main effect for CS,  $F(1, 49) = 34.13, p < .001, \eta_p^2 = .41$ , a main effect for Trial,  $F(3, 147) = 13.01, p < .001, \eta_p^2 = .21$ , and a CS  $\times$  Trial interaction,  $F(3, 147) = 31.75, p < .001, \eta_p^2 = .05$ , confirmed that participants learned to expect the shock after the CS+ and not to expect the shock after the CS-.

Using the last acquisition trial and first extinction trial as Trial factors, a  $3 \times 2 \times 2$  (Design  $\times$  CS  $\times$  Trial) ANOVA was conducted to investigate whether expectancy ratings were affected by the change of context from acquisition to extinction. The analyses revealed a significant main effect of CS,  $F(1, 49) = 59.56, p < .001, \eta_p^2 = .55$ , and a significant CS  $\times$  Trial interaction,  $F(1, 49) = 19.17, p < .001, \eta_p^2 = .01$ .

Expectancy of shock for the CS+ was significantly higher on the last acquisition trial than the first extinction trial,  $t(16) = 3.91, p < .001, d = 1.95$ . Conversely, expectancy during the CS- was lower during the last acquisition trial than the first extinction trial,  $t(16) = 3.31, p = .002, d = 1.66$ .

To examine expectancy for the extinction trials, a  $3 \times 2 \times 6$  (Design  $\times$  CS  $\times$  Trial) ANOVA was conducted. Results revealed a main effect for CS,  $F(1, 49) = 39.38, p < .001, \eta_p^2 = .47$ , a main effect for Trial,  $F(5, 245) = 34.05, p < .001, \eta_p^2 = .41$ , and a

CS  $\times$  Trial interaction,  $F(3, 169) = 9.37, p < .001, \eta_p^2 = .16$ , confirming that extinction occurred.

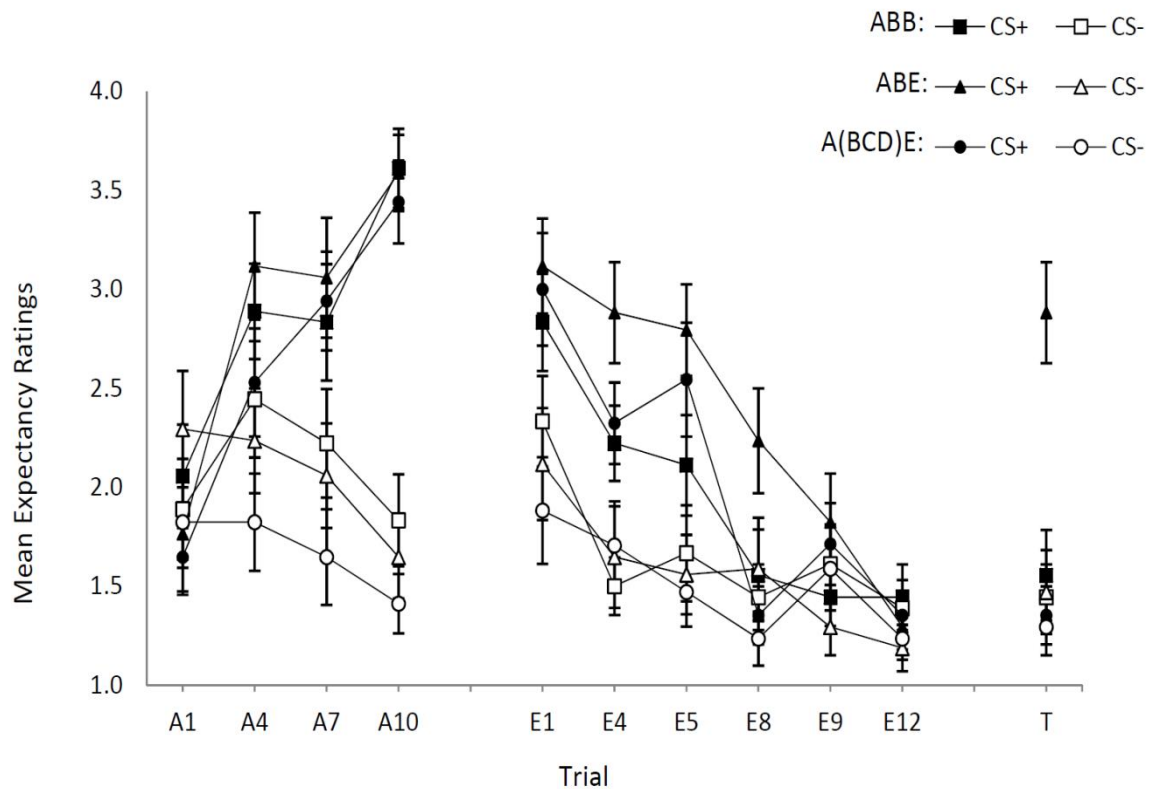


Figure 1. Mean expectancy ratings across trials in each experimental phase for the ABB, ABE, and A(BCD)E groups. A = acquisition, E = extinction and T = test. Error bars reflect the standard error of the mean.

Renewal was first tested by comparing the last extinction trial with the first test trial using a  $3 \times 2 \times 2$  (Design  $\times$  CS  $\times$  Trial) ANOVA. The results showed numerous main effects and interactions that were subsumed by a significant Design  $\times$  CS  $\times$  Trial interaction,  $F(2, 49) = .11.06, p < .002, \eta_p^2 = .31$ . Post hoc analyses ( $\alpha' = .008$ ) compared the difference between the trials separately for each CS type and group. There were no significant differences between the trials for the CS- in any of the groups, all  $ts < 2.18, p > .11, d < 1.09$ . Additionally, there were no significant differences between the trials for the CS+ in the ABB and A(BCD)E groups, both  $ts < 0.62, p > .56, d < 0.09$ .

However, expectancy during the CS+ was significantly larger on the test trial than on the last extinction trial for the ABE group,  $t(16) = 8.80, p < .001, d = 2.5$ .

Renewal was also tested by a  $3 \times 2$  (Design  $\times$  CS) ANOVA using the test trials alone. Results showed a significant main effect of CS,  $F(1, 49) = 19.14, p < .001, \eta_p^2 = .28$ , a significant main effect of Design,  $F(2, 49) = 8.10, p = .001, \eta_p^2 = .25$ , and significant Design  $\times$  CS interaction,  $F(1, 49) = 13.39, p < .001, \eta_p^2 = .35$ . The interaction was examined by comparing the CS+ and CS- separately for each group ( $\alpha' = .016$ ). The results revealed no significant differences between the CS+ and CS- for the ABB and A(BCD)E groups, both  $ts < .40, p > .67, d < 0.20$ . However, expectancy during the CS+ was significantly larger than during the CS- for the ABE group,  $t(33) = 9.50, p < .001, d = 4.75$ .

### Startle Blink Responses

Figure 2 shows the startle blink responses across all groups and experimental phases. As can be seen in Figure 2, all groups developed larger startle blink responses to the CS paired with a shock during acquisition. The magnitude of this potentiation decreased during extinction. During the test phase, a renewal of startle blink responses occurred for the single extinction context renewal group but not for the multiple extinction context renewal group and the control group.

A  $3 \times 2 \times 6$  (Design  $\times$  CS  $\times$  Trial) ANOVA revealed a significant main effect of CS,  $F(1, 40) = 13.68, p = .001, \eta_p^2 = .26$ , to confirm conditioning. A significant main effect of Trial,  $F(3, 89) = 3.34, p = .022, \eta_p^2 = .08$  was also found. The last acquisition trial was compared to the first extinction trial using a  $3 \times 2 \times 2$  (Design  $\times$  CS  $\times$  Trial) ANOVA. The analyses revealed a significant main effect of CS,  $F(1, 40) = 20.13, p < .001, \eta_p^2 = .34$ , and no other effects, thus demonstrating that potentiation generalised from acquisition to extinction.

A  $3 \times 2 \times 6$  (Design  $\times$  CS  $\times$  Trial) ANOVA yielded a main effect of CS,  $F(1, 40) = 13.17, p = .001, \eta_p^2 = .25$ , and a main effect of Trial,  $F(1, 43) = 3.29, p = .015, \eta_p^2 = .08$ . To confirm that extinction occurred, a  $t$  test comparing the CS+ and CS- on the last extinction trial was conducted and it showed no significant difference,  $t(42) = 0.24, p = .81, d < 0.08$ .

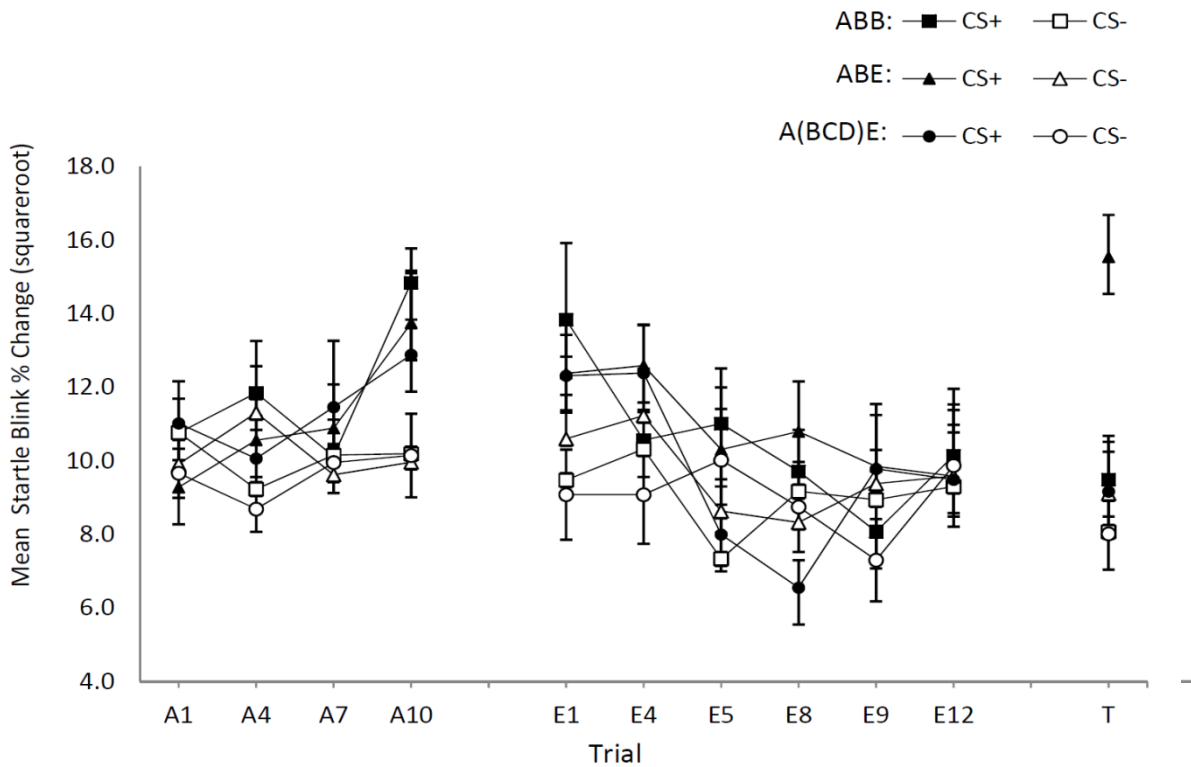


Figure 2. Mean startle blink % change (square root) across trials in the acquisition and extinction phase and the test phase for the ABB, ABE, and A(BCD)E groups. A = acquisition, E = extinction and T = test. Error bars reflect the standard error of the mean.

The first test for renewal that used a  $3 \times 2 \times 2$  (Design  $\times$  CS  $\times$  Trial) ANOVA showed a significant main effect of CS,  $F(1, 40) = 10.78, p = .002, \eta_p^2 = .21$ , a significant CS  $\times$  Trial interaction,  $F(1, 40) = 19.40, p = .029, \eta_p^2 = .11$ , and a significant Design  $\times$  CS interaction,  $F(2, 40) = 5.11, p = .044, \eta_p^2 = .14$ . Post hoc analyses ( $\alpha' = .008$ ) revealed no significant differences between the trials for the CS- in any of the

groups, all  $t_s < 1.84$ ,  $p > .08$ ,  $d < 0.58$ . However, startle responses during the CS+ was significantly larger on the test trial than on the last extinction trial for the ABE group,  $t(16) = 5.91$ ,  $p < .001$ ,  $d = 2.96$ , but not for the ABB and A(BCD)E groups, both  $t_s < 0.64$ ,  $p > .52$ ,  $d < 0.32$ . Thus renewal of shock expectancy occurred for the ABE group and not for the ABB and A(BCD)E groups.

The final test for renewal that used a  $3 \times 2$  (Design  $\times$  CS) ANOVA revealed a significant main effect of Design,  $F(2, 40) = 7.60$ ,  $p = .002$ ,  $\eta_p^2 = .28$ , a main effect of CS,  $F(1, 40) = 16.50$ ,  $p < .001$ ,  $\eta_p^2 = .29$ , and a Design  $\times$  CS interaction,  $F(2, 40) = 4.20$ ,  $p = .022$ ,  $\eta_p^2 = .16$ . Multiple  $t$  tests comparing the CS+ to the CS- separately for each group ( $\alpha' = .016$ ) revealed significantly larger startle responses during the CS+ than during the CS - for the ABE group,  $t(14) = 3.67$ ,  $p = .002$ ,  $d = 2.12$ , but not for the ABB and A(BCDE) groups, both  $t_s < 1.61$ ,  $p > .21$ ,  $d > 0.63$ .

### Discussion

The present experiment extended the findings of Neumann and Kitlertsirivatana (2010) by showing that ABC renewal can be produced with fear-relevant CSs. It also tested the effects of conducting extinction in multiple contexts on ABC renewal. The current experiment has extended previous human renewal studies by both producing and abolishing ABC renewal of expectancy ratings and startle blink responses. Acquisition learning in one context and extinction learning in a second context resulted in renewal of expectancy of the US and startle blink responses when the CS+ was presented again in a third novel context during test. However, CS+ presentations during test did not yield renewal when extinction was conducted in multiple contexts. These results indicate that extinction treatment in multiple contexts alone may be sufficient to abolish ABC renewal in humans.

In contrast to Neumann and Kitlertsirivatana, (2010) who used fear-irrelevant pictures of tools as CSs the current study used fear-relevant pictures of spiders. An advantage of using fear-relevant CSs is that it is more applicable to ROF which may occur following exposure treatment of disorders, such as specific phobia, in which fear is a central component. Moreover, the fear-relevant stimuli appeared to yield larger ABC renewal effects. The current study revealed larger Cohen's  $d$  effect sizes for the increase in CS+ expectancy ratings between the last extinction trial and test trial ( $d = 2.5$ ) and test trial alone ( $d = 4.75$ ) than Neumann and Kitlertsirivatana ( $d = 0.76$  and  $2.5$ , respectively). The fear-relevant CSs used to produce ABC renewal in the current study may therefore be both methodologically advantageous to researchers and more representative of the intensity of post treatment ROF that may occur for individuals that suffer from various fear and anxiety related disorders.

The observed ABC renewal effect for the expectancy and startle blink responses made it possible to test the hypothesis that renewal would be attenuated for the A(BCD)E group. Analyses revealed that there was no change in expectancy and startle blink responses to the CSs for the ABB and A(BCD)E groups from the last extinction trial to the test trial. This suggested that renewal had been attenuated in the A(BCD)E group. Further, between-group comparisons at test revealed larger US expectancy and startle blink responses to the CS+ (but not CS-) for the ABE group compared to the ABB and A(BCD)E groups with no observable differences between the two latter groups. In addition, analyses for the test trials revealed larger expectancy and startle blink responses to the CS+ than the CS- in the ABE group but not in the ABB and A(BCD)E groups. Taken together, these results confirmed the hypothesis that renewal would be attenuated for the A(BCD)E group.



The attenuation of ABC renewal using multiple extinction contexts found here is inconsistent with the report of Bouton et al. (2006) who did not find such an effect. However, the findings are consistent with Gunther et al. (1998) who found that extinction treatment in multiple contexts attenuates ABC renewal in rats. The current study is the first laboratory based study to successfully produce and subsequently attenuate ABC renewal in humans. Although ABC renewal in humans is a relatively rare finding in the laboratory, ROF via an ABC renewal mechanism has been consistently observed in clinical analogue research. In this research, participants with pre-existing fears of spiders are treated in one context, and ROF is observed when they are exposed to the feared stimulus again in a novel context (Mineka, Mystkowski, Hladek, & Rodriguez, 1999; Mystkowski, Craske, & Echiverri, 2002; Mystkowski, Craske, Echiverri, & Labus, 2006; Mystkowski, Mineka, Vernon, & Zinbarg, 2003).

However, to date, the study by Vansteenwegen, Vervliet, Iberico, Baeyens, Van den Bergh, and Hermans (2007) is the only clinical analogue of exposure treatment in the clinic that has investigated whether multiple extinction contexts can attenuate ROF via an ABC renewal effect. Vansteenwegen et al. (2007) attenuated the renewal of fear of spiders in a sample of spider-anxious students using repeated confrontations of videotaped spiders in multiple contexts. The current findings complement this literature by using a methodology to manipulate the fear acquisition phase and examine the mechanisms that promote or prevent ROF in samples that do not have pre-existing fears.

Contextual cues play a prominent role in the renewal of extinguished conditioned responses in humans (Neumann, 2007). A plausible explanation for the role of these cues in attenuating renewal following multiple extinction contexts is provided by Gunther et al. (1998). They explained that each context contains stimulus elements that

are shared with parts of stimulus elements in other contexts. Following the standard ABE procedure, the fear acquisition context, extinction treatment context, and test context are likely to have the same number of shared stimulus elements on average. However, acquisition learning generalises more readily than extinction learning. When both the acquisition context and extinction context share the same number of shared stimulus elements with the test context, retrieval of acquisition learning is more likely to occur. Conversely, extinction in multiple contexts, results in more shared stimulus elements between the extinction and the subsequent test contexts compared to between the acquisition and test contexts. Thus, extinction learning is more likely to be retrieved during test and result in the attenuation of renewal.

In the present experiment, the different contexts were photographs taken from the same house. Many of the rooms used as the contexts shared the same colour walls, wooden floors, and bright daylight. For the participants that received extinction treatment in multiple contexts, the greater number of shared stimulus elements between the three extinction contexts and test context compared to the acquisition context and test context, may have promoted generalisation of extinction learning rather than acquisition learning. As a result, there was an attenuation of renewal.

Another similar explanation for the current findings is that the relationship between the CS and US becomes ambiguous following conditioned CS-US associations during acquisition and CS-noUS associations during extinction (Bouton, 1988). During test, this ambiguity is resolved by the memory retrieval cues that are present in the context. The greater the contextual cue overlap between acquisition and test, the more likely that acquisition learning memory will be retrieved and renewal will occur. Conversely, the greater the contextual cue overlap between extinction and test the more likely that extinction learning memory will be retrieved and renewal will be attenuated.

Accordingly, ABC renewal can be attenuated by conducting extinction treatment in multiple contexts as the procedure creates more overlapping cues between the contexts present during extinction and test compared to the contexts present during acquisition and test.

Results consistent with both of the aforementioned explanations have been found in studies that have systematically manipulated the degree of overlap between contexts presented during extinction and test with ABA renewal designs in animals (Thomas, Larsen, & Ayres, 2003) and in humans (Bandarian Balooch & Neumann, 2011). The attenuation of ABC renewal observed in the current experiment also appears to be consistent with these explanations. However, future researchers can test these notions more specifically by examining the effects of increasing the degree of similarity between extinction and test contexts using ABC renewal designs.

A particular strength of the current study is the use of startle blink responses to measure fear responses. While expectancy ratings are the most sensitive measure of renewal (e.g., Effting & Kindt, 2007; Neumann et al., 2007) they are indirect measures of fear. Startle blink responses, in contrast, are direct, objective, and valid physiological measures of fear (Alvarez, Johnson, & Grillon, 2007). Additionally, the consistency between the subjective expectancy ratings and startle responses observed in the current study alludes to the notion that expectancy ratings were closely linked to participants' level of experienced fear. This increases the applicability of the current results to exposure therapy of, for instance, phobias wherein fear is involved in the acquisition and maintenance of the disorder (Mineka & Öhman, 2002). Whether or not the current results can be applied to improve exposure therapy of disorders in which fear is not a central component (e.g., substance use disorder, disgust reactions in OCD) requires further investigation.

The findings from the present experiment provide guidance for clinicians seeking to reduce the risk of relapse via ROF following exposure therapy. Clinicians that seek to maximise the generalisability of exposure therapy for various anxiety disorders from the therapist's office to other contexts can do so by conducting exposure therapy in multiple contexts. However, clinicians may consider some of the difficulties that may arise in doing so. For instance, a commonly observed effect of extinction in multiple contexts is an increase in expectancy of shock, typically coinciding with the first or second context change during the extinction phase (Bandarian Balooch & Neumann, 2011; Neumann, 2006; Neumann et al., 2007). A clinical translation of this effect may suggest that changing contexts early or mid exposure therapy will result in the client experiencing an increase in fear coinciding with the context change. It is likely to be beneficial if it viewed as "controlled ROF" that can be managed in therapy to reduce the likelihood of post therapy ROF. In this way, it is beneficial to the long-term therapeutic outcome of their client.

Few recommendations are available to help clinicians decide how many contexts are needed to prevent ROF via a renewal effect following exposure therapy. There is evidence from laboratory-based experiments that using more than three contexts may be redundant (Neumann et al., 2007). However, the decision on the number of exposure contexts should also be guided by clinician's resources as well as client presentations including their presenting problem, financial resources, and therapeutic motivation. Keeping these factors in mind, clinicians may, for instance, conserve the number of extinction contexts to those that the client agrees are likely to be most problematic. Moreover, therapists may be better able to reduce ROF via a renewal effect if they vary exposure therapy across multiple external and internal contexts (Bandarian Balooch, Neumann, & Boschen, 2012).

In summary, the current research found reliable ABC renewal providing further support to the methodology used by Neumann and Kitlertsirivatana (2010). It also found that ABC renewal can be attenuated by conducting extinction treatment in multiple contexts further providing support to previous laboratory studies in rats (Gunther et al., 1998) and clinical analogue studies in humans (Vansteenwegen et al., 2007). These findings provide clinicians with evidence of a mechanism that can partially explain why their clients relapse following exposure therapy. It also provides clinicians with empirically validated methods of potentially reducing relapse. Clinicians that incorporate multiple extinction contexts with their currently existing therapy programs are likely to enhance the generalisability of extinction learning to novel contexts. This in turn, is likely to reduce the likelihood of relapse occurring via a renewal mechanism.

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## CHAPTER 7

Chapter 7 reports on attenuation of renewal of fear using exposure treatment in multiple real-life contexts with a real-life spider, which was conducted in Experiment 2 (paper 4). This experiment included 46 moderate to high spider fearful individuals in Australia. Experiment 2 has been submitted as a journal article to a peer-reviewed international journal. Modifications have been made to the page numbers of the submitted manuscript to fit the formatting of the current thesis.

Additionally, Experiment 2 was presented as an oral paper at the Annual Behavioural Basis of Health Mid-Year Conference on October 2013 in Gold Coast, Australia. Evidence of presenting Experiment 2 (paper 4) as an oral paper is included in Appendix E. Experiment 2 has also been accepted as part of an oral paper at the Australian Association for Cognitive and Behaviour Therapy 36<sup>th</sup> National Conference in October 2013 in Adelaide, Australia. Evidence of acceptance of Experiment 2 as part of an oral paper is included in Appendix F. A signed statement of contribution to co-authored published paper is provided followed by Experiment 2.

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper. The bibliographic details of the co-authored paper, including all authors, are:

Bandarian-Balooch, S., Neumann, D.L., & Boschen, M. J. (submitted). Exposure Treatment in multiple contexts attenuates return of fear via renewal in high spider fearful individuals.

My contribution to the paper involved:

- Conducting a critical literature review
- Development of the experiment proper
- Development and execution of treatment
- Collection, analysis, and reporting of data
- Write up of article
- Submission for publication

(Signed) \_\_\_\_\_ (Date) \_\_\_\_\_

Siavash Bandarian Balooch

(Countersigned) \_\_\_\_\_ (Date) \_\_\_\_\_

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Secondary Supervisor: Mark J Boschen

## CHAPTER 8

Chapter 8 is an  $N = 1$  case study of an individual with toad phobia in Australia. The case study shows that conducting exposure therapy in multiple contexts can attenuate renewal of fear. A toad phobic female received one session of exposure therapy in four treatment relevant contexts. Phobic symptomatology and associated distress was assessed using structured clinical interviews, subjective reports of fear, and measures of avoidance. The results showed that renewal of fear was attenuated at 1 week, 5 weeks, and 1.8 years after treatment. The implications of these findings in enhancement of the long-term effectiveness of exposure therapy in clinical settings are discussed.

The findings of the current chapter will be presented as part of an oral paper (together with Experiment 2) at the Australian Association for Cognitive and Behaviour Therapy 36<sup>th</sup> National Conference in October 2013 in Adelaide, Australia.

In order to comply with copyright this paper is not published here.

## CHAPTER 9

Chapter 9 provides a general discussion of the current thesis. It highlights the benefits of using a transformational approach to investigating return of fear. Subsequently, the chapter argues that conducting exposure in multiple contexts does enhance the long-term effectiveness of treatment. Chapter 9 further discusses the wide applicability of exposure therapy in multiple contexts in the treatment of anxiety related and non-anxiety related disorders in children and adults. Moreover, the theoretical implications of the current findings are discussed. Finally, attention is drawn to major gaps in renewal of fear research and methods of addressing these issues are discussed.

## **General Discussion**

The current thesis had two major aims. Firstly, it aimed to narrow the gap between laboratory based and clinical research within a single research program on the renewal of fear. This major aim was addressed by conducting laboratory based research with humans (based on laboratory-based research with animals) conducting clinical-analogue experiments with moderate to high spider fearful participants, and by using an  $N = 1$  case study with a person with toad phobia to investigate the generalisation of extinction learning to a novel exposure context. In the current thesis, consideration of related fields of return of fear research resulted in improved understanding of why return of fear via renewal occurs and why it may be attenuated by conducting exposure therapy in multiple contexts. The second and more direct aim of the current thesis was to test whether conducting exposure therapy in multiple contexts can enhance the generalisability of treatment and attenuate renewal in clinically relevant applications.

### **Exposure Therapy in Multiple Contexts Attenuates Renewal of Fear**

The results of two experiments and a case study showed that conducting exposure therapy in multiple contexts can attenuate renewal of fear. Seeking to extend renewal research with rats (e.g., Bouton, García-Gutiérrez, Zilski, & Moody, 2006) to humans, the first experiment utilised the more recently developed laboratory-based methodology of investigating ABC renewal with humans (Neumann & Kitlertsirivatana, 2010). Not only was ABC renewal successfully replicated using self-report and physiological measures (startle blink responses) but it was also shown that renewal of fear was abolished when extinction treatment was conducted in multiple extinction contexts (Bandarian-Balooch, Neumann, & Boschen, 2012b; chapter 6).

The aforementioned findings provided a basis for the development of Experiment 2 (Bandarian-Balooch, Neumann, & Boschen, submitted; chapter 7), where



the effects of conducting exposure treatment in multiple real-life contexts with a real-life spider was investigated using a clinical-analogue design. Consistent with previous clinical-analogue renewal of fear studies (e.g., Mineka, Mystkowski, Hladek, & Rodriguez, 1999; Mystkowski, Craske, Echiverri, & Labus, 2006; Shiban, Pauli, & Mühlberger, 2013), it was found that when exposure treatment is conducted in one context only, a contextual mismatch between the exposure context and follow-up test context resulted in renewal of fear. However, verbal and physiological measures of fear and behavioural avoidance measures showed that renewal of fear was attenuated when exposure treatment was conducted in multiple contexts. Again, the results suggested that conducting extinction treatment in multiple contexts enhanced the generalisability of extinction learning across contexts. The results of Experiment 2 suggested that similar results might be obtained if clinicians conduct exposure therapy in multiple contexts with a phobic client.

The  $N = 1$  case study with a toad phobic client addressed two major research problems which had not been answered by previous renewal of fear research. These included whether exposure therapy in multiple contexts will be effective for attenuating renewal of non-spider related fear and which challenges that arise in constructing and implementing individually tailored exposure therapy in multiple contexts with phobic clients. The results showed that conducting one exposure therapy session in multiple contexts significantly reduced the client's fear and avoidance of toads from pre to post-treatment. The client did not experience a renewal of fear at 1 week, 5 weeks, and 1.8 years after therapy. The failure to observe renewal suggests that conducting exposure therapy in multiple contexts enhances the generalisability of exposure therapy.

Moreover, the phobic stimulus used was a toad, which supported the conclusion that the

long-term enhancement effects of conducting exposure therapy in multiple contexts are not limited to spider fear.

One particularly interesting challenge in conducting individualised exposure therapy in multiple contexts with a phobic client was dealing with increased client fear coinciding with intra-therapy contextual changes. An increase in expectancy of shock, typically coinciding with the first or second context change during the extinction phase is commonly observed in laboratory-based renewal research with humans (e.g., Bandarian-Balooch & Neumann, 2011; Bandarian-Balooch et al., 2012b; Neumann, 2006; Neumann, Lipp, & Cory, 2007).<sup>12</sup> Bandarian-Balooch et al. (2012b) suggested that such increases can be considered as opportunities to address intra-therapy renewal of fear. Indeed, this proved to be a necessary component of therapy with the client in the case study as thoughts such as “the toad seems more jumpy/agitated in this room” were frequently voiced following intra-therapy contextual changes. Future, research may examine the extent to which dealing with this intra-therapy type renewal of fear is related to attenuation of renewal of fear post-therapy. For example, does intra-therapy renewal enhance or reduce the attenuation of renewal following therapy?

Taken together, the two experiments and the case study all supported the notion that conducting exposure therapy in multiple real-life contexts with real-life phobic stimuli may enhance the long-term effectiveness of exposure therapy and reduce the likelihood of renewal of fear post-therapy. The remainder of the chapter will discuss the main issues in conducting exposure in multiple contexts including the use of non in-vivo exposure, group exposure therapy, and the role of interoceptive contexts in renewal

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<sup>12</sup> This pattern was also observed in the clinical-analogue publication of this thesis (Bandarian-Balooch et al., submitted), however for brevity, this was not discussed.

of fear. Subsequently, the benefits of using a variety of methods (e.g., mental reinstatement) in isolation and in combination with multiple extinction contexts on attenuation of renewal will be discussed. The applicability of the current findings in enhancement of exposure therapy for specific phobia, non-phobia related anxiety disorders (e.g., panic disorder), and non-anxiety related disorders (i.e., substance dependence disorders) will also be discussed. The theoretical implications of the present findings on current learning and attention theories will be discussed. Finally, limitations of the current studies (i.e., the conditioning versus vicarious learning) will be presented. Recommendations for future directions for research (i.e., renewal research with children) will be provided throughout the chapter.

### **Main Issues of Conducting Exposure in Multiple Contexts**

In all of the experiments conducted here, in-vivo stimuli and contexts were used. It may not be financially feasible for clinicians and clients to conduct exposure therapy in multiple relevant locations. However, a commonly used approach that may reduce the costs of exposure therapy is to use imagined exposure therapy. Imagined exposure therapy is a commonly used type of therapy wherein the client uses fantasy and imagination to visualise a feared stimulus or situation (Andrews, Crino, Hunt, Lampe, & Page, 1994; Antony, Craske, & Barlow, 1995; Bourne, 2002; Craske, 1999). The current results suggest that even in imagined exposure therapy a range of different relevant contexts and situations should be envisioned to enhance the generalisability of exposure therapy. For instance, shark phobic clients may be encouraged to envision different types of sharks in different types of water (e.g., oceans and rivers), with varying availability of light (e.g., night and day), and in different types of situations (e.g., a shark swimming under, next to, and above the client). It may also be worth examining whether the long-term effectiveness of imagined exposure therapy is

enhanced by conducting the imagined exposure in multiple relevant real-life contexts (e.g., conducting imagined exposure to sharks in a pool or at the beach).

Other methods that can be used when in-vivo exposure is not feasible include conducting exposure treatment using videoed contexts and feared stimuli (Vansteewegen et al., 2007) or virtual contexts and virtual feared stimuli (Shiban et al., 2013). However, the extent to which viewing videos of feared the stimulus is comparable in strength and generalisability to in-vivo therapies in producing long-term and cross-contextual reduction of fear is questionable. In Vansteewegen et al. (2007), electrodermal measures of fear showed a statistically significant reduction in fear from pre to post treatment. However, a clinically significant reduction in self-reported fear was not observed. Indeed, the authors explained that providing extinction treatment with minimal instructions from a therapist cannot be expected to result in clinically significant reductions of fear. Moreover, Vansteewegen et al. (2007) did not test for generalisability of treatment to real life stimuli further questioning the extent to which their results applied to real life situations and stimuli. Subsequent to successfully reducing participant fear and avoidance using virtual reality technology, Shiban et al. (2013) aimed to test whether reduction in avoidance generalised to real-life stimuli and contexts. However, the lack of a control group prevented conclusions regarding the extent to which virtual reality treatment generalised to real life contexts and stimuli. Future researchers using non in-vivo therapies may consider including non-treatment control groups to allow conclusions to be made regarding the extent to which such therapies generalise to real-life situations and stimuli.

Another method that can be used to reduce the costs of therapy is to conduct group exposure sessions in multiple contexts. Öst (1996) conducted group exposure therapy with spider phobic individuals and found that at 1 year follow-up, between 75-

85% of individuals in larger exposure groups ( $n = 7-8$ ) and between 85-95% of individuals in smaller exposure groups ( $n = 3-4$ ) continued to show clinically significant improvements. While promising, these results also suggest that up to 25% of the sample did not show clinically significant improvement and an even greater number may have shown return of fear if assessed later. Conducting group exposure therapy in multiple contexts may reduce the costs of therapy and further enhance the long-term effectiveness of treatment through reducing the likelihood of renewal of fear.

However, conducting group exposure therapy in multiple contexts may present some challenges. For instance, the people present during the therapy (i.e., other group members and the therapist) may become salient cues within the exposure context. The absence of those people (contextual cues) in novel context encounters after treatment may reduce the likelihood that exposure treatment memory is retrieved and result in a renewal of fear. In Experiment 2 and the case study of the current thesis, this potential problem was addressed by requiring that each task be completed in the absence of the therapist such that the therapist did not act as a salient retrieval cue of the exposure therapy context. Therapists seeking to conduct group exposure therapy may follow the methodology used in the current experiments and encourage clients to conduct each step of the treatment in the absence of other group members and the therapist prior to completion of treatment. Doing so may decrease the client's reliance on contextual cues that may not be present in future novel context encounters and enhance the generalisability of treatment. In addition, clients may be provided with salient objects present during treatment (i.e., a pen) that promote retrieval of the extinction context memory and reduce the likelihood of renewal of fear as that seen in Culver et al. (2011).

Bouton (2002) noted that contexts can also be interoceptive such as mood or drug state. This notion is important to consider because behaviour therapies are

frequently combined with medication during the treatment of anxiety disorders and this may affect the short-term and long-term effectiveness of therapy (Foa, Franklin, & Jason, 2002). Foa et al. (2002) highlighted that theoretically, the blocking of fear as a result of anxiolytic medication that is meant to assist therapeutic adherence (e.g., Greist, 1992), may be detrimental to the long-term effectiveness of treatment of, for instance, panic disorder, where experience of the bodily symptoms of a panic attack may be crucial. In a clinical renewal of fear example, a client that receives exposure to a feared stimulus while under the influence of mood stabilising medication (low anxiety interoceptive context) may experience a renewal of fear when medication is stopped (moderate or high anxiety interoceptive contexts) and the feared stimuli is re-encountered.

Consistent with this argument, it has been found that the use of mood stabilising medication that suppress full expression of fear and anxiety can impede the long-term effectiveness of exposure therapy for some anxiety disorders (e.g., Barlow, Gorman, Shear, & Woods, 2000; Marks et al., 1993). More specific to renewal of fear research, Mystkowski, Mineka, Vernon, and Zinbarg (2003) found that a contextual mismatch between the interoceptive exposure treatment context (i.e., high caffeine state) and subsequent follow-up context (i.e., no caffeine state) resulted in renewal of fear of spiders. In Experiment 2 of the current thesis, it was found that depressed mood predicted avoidance of the spider in novel contexts during a behavioural approach task 4 weeks after treatment. This suggests that some of the participants not only experienced a change in external context but also a change in interoceptive context during follow-up testing. It is possible that for those participants the added effects of external and interoceptive contexts resulted in an overall contextual change that was too strong to be thwarted by conducting exposure therapy in multiple contexts alone.

One obvious way for clinicians to deal with renewal of fear as a result of change in interoceptive context and external context would be to, for instance, not combine medication with exposure therapy where this is not necessary. However, it may be necessary to combine medication with therapy to effectively treat some disorders. In addition, interoceptive contexts may also naturally vary according to the person's current emotional state (e.g., happy or sad). Thus, a more effective way to reduce the likelihood of renewal of fear due to a combination of change in internal and external contexts may be to conduct treatment in multiple interoceptive contexts (e.g., conducting exposure therapy with different dosage levels of medication and without medication) and external contexts.

The notion that working through a variety of emotionally taxing situations (interoceptive contexts) in therapy, is essential for transfer of therapeutic effects from therapy to real-life situations to occur is perhaps most commonly advocated by psychodynamic therapists (e.g., Busch, Rudden, & Shapiro, 2004). However, clients can be encouraged to allow experience and expression of a full range of emotions as they arise during exposure therapy as well. In Experiment 2 and the case study of the current thesis, participants were frequently observed to experience not only fear during the exposure therapy process, but also joy, doubt, guilt, shame, anger, and sadness. The therapist frequently worked through these emotions with the clients as they arose during the exposure therapy process. It must be stated, however, that at the time of treatment the aim of such therapeutic discussions was to stabilise the clients mood and increase their motivation to complete the exposure rather than enhancing the generalisability of treatment across contexts. Nevertheless, having worked through these emotions as they arose for some clients during the exposure therapy process may have assisted in enhancing the long-term effectiveness of treatment. With these interesting findings in

mind, future research may specifically examine the benefits of addressing multiple interoceptive and external contexts on the generalisability of exposure.

### **Multiple Methods of Attenuating Renewal**

Conducting exposure treatment in multiple contexts is not the only method that may attenuate renewal of fear<sup>13</sup>. Interestingly, laboratory-based research has generated many possible methods of attenuating renewal (for a review, see Bandarian-Balooch et al., 2012a). For instance, using a laboratory-based task, Huff et al. (2009) provided extinction treatment 24 hours post acquisition rather than immediately post acquisition. Their results showed both spontaneous recovery and renewal of fear in participants who received acquisition and extinction on the same day but test on the next day. However, renewal of fear and spontaneous recovery was attenuated for participants that received 24 hours between each of the acquisition, extinction, and test phases.

Laboratory-based findings are important because they generate treatment suggestions that can be tested in clinical-analogue research and ultimately applied in clinical settings to enhance the long-term effectiveness of therapy. Currently, only a handful of methods to enhance the long-term effectiveness of renewal of fear have been examined in clinical-analogue experiments. Rowe and Craske (1998) tested the effects of using multiple stimuli on renewal and found that this method is not effective for attenuating renewal.<sup>14</sup> Culver, Stoyanova, and Craske, (2011) examined whether the presence of salient extinction treatment cues (i.e., a unique pen) can attenuate renewal of fear of public speeches. Highlighting the limitations of using retrieval cues to enhance exposure therapy, Culver et al. (2011) only found weak attenuation of renewal of fear in one of two experiments.

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<sup>13</sup> For a more in depth discussion see chapter 3 and chapter 4 of this thesis

<sup>14</sup> Lang and Craske (1999) tested the effects of using multiple stimuli and extended exposure on renewal of fear. However, the lack of a clear renewal of fear did not allow for tests for attenuation of renewal.



Conversely, Mystkowski et al. (2006) found that mentally recalling what was learnt during treatment, prior to and during follow-up testing for renewal resulted in attenuation of renewal of fear in spider fearful individuals. Similarly, Elsesser, Wannemüller, and Lohrmann (2013) found that mentally reinstating the treatment contexts attenuated renewal of fear of dental visits in a sample of individuals with dental phobia. While promising, mental rehearsal of treatment related information as a method of attenuating renewal of fear may be limited to fear evoking encounters that are foreseeable (e.g., visiting the dentist or giving a public speech).

Clinical-analogue research has generally examined the effects of the different methods to attenuate renewal in isolation. However, more recent research in laboratory-based experiments has suggested that using a combination of methods produces an additive effect that can thwart renewal of fear altogether (Bandarian-Balooch & Neumann, 2011; Thomas, Vurbic, & Novac, 2009). Although the notion that a combination of methods can be used to enhance the generalisability of treatment is relatively recent in return of fear research, this notion has been suggested for quite some time in behaviour modification research (for a review, see Stokes & Baer, 1977; Stokes & Osnes, 1989).

For instance, it has been suggested that behaviour modification may need to combine multiple stimuli and settings to generalize behaviour from one context to the other (Stokes & Baer, 1977; Stokes & Osnes, 1989). Plenis et al. (1987) trained emotionally disturbed adolescents in conversational and problem solving skills using multiple topics and settings during each part of training (i.e., modelling and instructions). They found that the clients' improvements in conversational and problem solving skills generalised to new situations and topics. Hughes, Harmer, Killian, and Nlarhos (1995) taught conversational skills to a group of students with moderate mental

retardation. By using multiple peers, situations, and conversational topics they managed to generalise the clients' skills from one school context to another.

Psychodynamic and behaviourist approaches have long proposed that avoidance of an aversive experience, rather than the experience of fear itself, results in pathological anxiety (Foa & Kozak, 1986). From a therapeutic viewpoint, this may pose difficulties in clinical treatment of anxiety cases and representation of anxiety due to ongoing avoidance of aversive stimuli post-therapy. One method of ensuring that return of fear does not result in clinical relapse may be highlighting that return of fear is a "normal" experience and develop skills during therapy that can be used post-therapy. Another effective method may be to encourage the experience of intra-therapy return of fear as an opportunity for clients to learn to approach rather than avoid the feared stimulus (Boschen, Neumann, & Waters, 2009). The current results show that conducting exposure therapy in multiple contexts results in contextually based intra-therapy renewal of fear (see chapter 6, 7, and 8). However, the client is encouraged to continue exposure despite experiencing renewal of fear and over the course of treatment, intra-therapy renewal of fear and behavioral avoidance no longer coincide with contextual changes. Thus, one particularly effective mechanism of change inherent in multiple context exposure may be that it promotes intra-therapy renewal of fear and teaches clients to engage in approach rather than avoidance behaviours once renewal of fear is experienced. Given the complexity of behavioural and cognitive patterns involved in anxiety disorders, using a combination of methods, is likely to be most effective in the long term.

Based on results such as that observed in Plienis et al. (1987), Stokes and Osnes (1989) suggested that for behaviour learnt during treatment to generalise beyond the therapeutic setting, methods such as using multiple stimuli in multiple settings, broad

skills learning, and self-mediated physical stimuli (e.g., a notebook reminding of appropriate behaviour) need to be combined in therapy. In renewal of fear research, there is laboratory-based evidence that using a combination of methods may be more effective than using these methods alone (Bandarian-Balooch & Neumann, 2011; Thomas et al., 2009). In Thomas et al. (2009), the isolated and combined effects of conducting extinction treatment in multiple contexts and conducting extended exposure were examined in laboratory-based experiments with rats. In this study, ABA renewal (a particularly strong form of renewal)<sup>15</sup> was not successfully attenuated by conducting extinction treatment in multiple contexts alone or by conducting extended extinction alone. However, when these two methods were combined (extended extinction treatment in multiple contexts), renewal of fear was removed altogether.

In a laboratory-based experiment with humans, Bandarian-Balooch and Neumann, (2011) examined the isolated and combined effects of conducting extinction treatment in multiple contexts and conducting extinction treatment in a context that is similar to where the phobic stimulus is likely to be encountered in the future (context similarity). The results of Bandarian-Balooch and Neumann (2011) showed that both extinction treatment in multiple contexts and context similarity attenuated renewal when these methods were used alone. More interestingly, similar to Thomas et al. (2009), when the two methods were combined (i.e., giving extinction treatment in multiple contexts that are similar to the test context), renewal of fear was removed altogether. Taken together, research on renewal of fear suggests that combining multiple extinction contexts with other promising methods of attenuating renewal, such as mental reinstatement of extinction context (Mystkowski et al., 2006), may be required to thwart renewal altogether.

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<sup>15</sup> For a discussion of the different types of renewal see chapter 3.

The results of Experiment 2 supported the notion that a combination of methods may be required to completely abolish renewal. Subjective units of distress and avoidance ratings showed complete abolishment of renewal for the multiple context group at each follow-up testing. However, heart rate data showed a significant increase in fear from post-treatment to follow-up 4 weeks after treatment suggesting that renewal of fear was not abolished altogether. To abolish renewal of fear, future clinical-analogue research could combine any one of the aforementioned techniques with exposure in multiple contexts to maximise treatment benefits and further reduce the likelihood of renewal of fear occurring.

In the case study conducted here, incorporating multiple extinction contexts with more commonly used exposure therapy techniques resulted in extended duration of treatment assessment. The inclusion of multiple contexts necessitated discussions about, for instance, which contexts to include in treatment and the effects of contextual changes on treatment outcomes. These discussions increased the duration of assessment and client conceptualisation feedback by a total of one hour. Moreover, the duration of treatment (3 hours and 10 minutes) was approximately one hour longer than the average 2 hour duration of treatment reported by previous clinical (e.g., Öst, 1989) and clinical-analogue studies (e.g., Mineka et al., 1999; Mystkowski et al., 2002; Rodriguez et al., 1999). While the increased duration of treatment cannot be solely attributed to conducting therapy in multiple contexts (e.g., the duration of therapy will likely change as a function of phobic stimuli and severity), it is reasonable to assume that the more methods combined and incorporated in therapy the lengthier assessment, feedback, and treatment will be. Thus, clinicians may consider which treatment enhancements methods are the most effective, relevant, and practical to combine in therapy according to client presentation, input, and feasibility of treatment.

For example, combining multiple extinction contexts with carry along objects (e.g., a pen used by the client during therapy) that are meant to act as exposure context retrieval cues may not be effective for a client that has poor memory. For such a client, it may be more beneficial to combine exposure in multiple contexts with extended training and thorough rehearsal of various treatment related skills to ensure that the client retains features of the treatment contexts and the skills learnt during treatment. Another client may require a more intensive and short duration treatment due to financial restrictions. Such a client may receive exposure treatment in multiple contexts and be asked to rehearse the steps of treatment and practice mentally reinstating the treatment context in their own time outside of treatment. The client in the current case study reported being short on time but having a good memory. Thus, the long-term effectiveness of treatment for her might have been enhanced further had she been provided with a treatment context retrieval cue (which the client considers relevant and useful) in addition to exposure in multiple contexts. Ideally, future research will provide more empirically validated guidelines on various combinations of methods that can be incorporated with exposure therapy to enhance the long-term effectiveness of exposure treatment.

### **Applicability of Renewal of Fear and Multiple Extinction Contexts in the Clinic**

The effects of conducting extinction treatment in multiple contexts have been tested in laboratory-based experiments with animals (e.g., Bouton, García-Gutiérrez, Zilski, & Moody, 2006) and humans (e.g., Neumann, 2006) and in clinical-analogue studies with high fearful participants (e.g., Bandarian-Balooch et al., submitted). The applicability of clinical-analogue renewal research has also been discussed in detail in (Bandarian-Balooch, Neumann, & Boschen, in press; chapter 4). Perhaps the most

convincing evidence that multiple extinction contexts can enhance the long-term effectiveness of exposure treatment comes from clinical-analogue studies. Clinical-analogue studies have shown that exposure treatment conducted in multiple videoed contexts with videoed spiders (Vansteenwegen et al., 2007), in virtual contexts with virtual spiders (Shiban, Pauli, & Mühlberger, 2013), and in real-life contexts with real-life spiders (Experiment 2 and case study in the current thesis) enhances generalisability of treatment and attenuates renewal of fear. As can be seen, multiple extinction context research is currently restricted to adult populations with high spider fear (e.g., Bandarian-Balooch et al., submitted) or spider phobia (Shiban et al., 2013).

However, clinical-analogue studies have also explored the production and attenuation of renewal of fear for populations with high social anxiety (Culver et al., 2011) and dental phobia (Elsesser et al., 2013). The fear acquisition component of all the phobias can be linked to Pavlovian conditioning processes (Öhman & Mineka, 2001). Moreover, the exposure therapy component of the treatment is similar for all of the anxiety disorders (e.g., Emmelkamp, Bouman, & Scholing, 1992). Thus, theoretically the long-term effectiveness of the exposure treatment component for these disorders can also be enhanced by conducting exposure therapy in multiple contexts.

As part of traditional cognitive behavioural treatment for anxiety in relation to public presentations, a client may be encouraged to give presentations to the therapist in their office while negative automatic thoughts are addressed (e.g., Emmelkamp et al., 1992). In Experiment 2 and the case study, intra-therapy renewal of fear frequently coincided with participants reporting negative automatic thoughts (i.e., “the spider is angrier now and will bite me”). Addressing such thoughts in therapy may have contributed to reducing post-therapy renewal of fear (see chapter 8 for a discussion). This suggests that for social phobia exposure treatment, to reduce the likelihood of

renewal of fear post therapy, the therapist may also conduct exposure therapy wherein the client is provided with an opportunity to practice giving presentation in multiple additional relevant contexts (e.g., larger and smaller rooms with greater and smaller number of audiences). Additionally, fearful thoughts that arise as a result of each unique treatment context may be addressed accordingly to ensure that irrelevant contextual changes do not result in renewal of fear post therapy.

Theoretically, doing so should enhance the generalisability of treatment across contexts and reduce the likelihood of renewal of fear. Nevertheless, further research is required to examine whether renewal of fear can be attenuated in non-spider phobia related disorders by conducting exposure in multiple contexts. Moreover, research is required to determine whether treatment for non-phobia related anxiety disorders (e.g., panic disorder) can be enhanced by conducting exposure therapy in multiple contexts. Fortunately, the methodology used to test the effects of multiple extinction contexts on renewal of fear can be readily applied to non-phobia related disorders.

For instance, in Experiment 1 pictures of spiders superimposed on pictures of real-life contexts where spiders may be encountered in real-life were used to increase the strength of renewal and to increase the relevance of the experiment to spider phobia. Doing so resulted in ABC renewal effects with larger effect sizes than previous studies that did not find a clear ABC renewal effect (for a discussion, see Bandarian-Balooch et al., 2012a). Similarly, Finlay and Forsyth (2009) examined renewal of panic related symptoms using stimuli that are relevant to panic disorder. In a sample of 61 healthy individuals, Finlay and Forsyth (2009) produced renewal of fear using inhalation of carbon dioxide enriched air. The partial oxygen deprivation caused by inhalation of carbon dioxide resulted in a variety of both psychological and autonomic physiological responses that are similar to the symptoms of panic attacks (Forsyth, Eifert, & Canna,

2000; Forsyth, Lejuez, & Finlay, 2000). Similar to phobia-related renewal of fear research, the authors found that a contextual mismatch between the extinction context and subsequent test context resulted in a renewal of fear.

The findings in Experiment 1 and Finlay and Forsyth (2009) can be extended to laboratory-based and clinical-analogue research<sup>16</sup> to examine whether conducting exposure treatment in multiple contexts can enhance the long-term effectiveness of exposure therapy for panic disorder. Future research examining non-phobia related return of fear may take into consideration the methodology used in Experiment 1 and in Finlay and Forsyth (2009) and use stimuli that are relevant to the anxiety disorder that is being investigated. Such an avenue of research would fill a gap in the currently existing literature on how return of fear generally and renewal of fear more specifically can be produced and attenuated for a range of anxiety disorders.

Another area of research that has been scarcely researched and requires future attention is the field of non-anxiety disorder related renewal research. There is, for instance, evidence that renewal is important to consider in substance abuse related conditions (e.g., Collins & Brandon, 2002; Stasiewicz, Brandon, & Bradizza, 2007) as they may be formed due to Pavlovian conditioning processes (e.g., Brandon, Piasecki, Quinn, & Baker, 1995). Similar to the reduction of fear observed following extinction treatment for fear and anxiety related disorders, it has been shown that extinction treatment does reduce drug cravings (e.g., Drummond & Glautier, 1994; Stasiewicz et al., 1997).

Also similar to renewal of fear research, it has been shown that a contextual mismatch between the extinction context and subsequent test context results in a renewal of alcohol cravings. For example, Collins and Brandon (2002) conducted a

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<sup>16</sup> For an example of how to examine return of fear of panic related symptoms in clinical-analogue research see chapter 2 of this thesis.



laboratory-based study and successfully produced renewal of alcohol cravings in a sample of 78 non-alcoholic social drinkers. More interestingly, they also found that providing participants with an extinction context retrieval cue (novel coloured pencil used to record urge ratings), attenuated renewal of alcohol cravings. This study highlights that the findings and research applications of renewal research extends beyond fear related problems. Moreover, it shows that similar methods that have been used to attenuate renewal of fear can be applied to attenuate renewal of cravings. Thus, it is likely that cue exposure treatment can also be enhanced by conducting treatment in multiple contexts.

In Experiment 2 and in the case study, for instance, each context presented novel challenges for the participants, which required participants to learn unique skills to handle the feared stimuli. For example, in the case study, the movement of the toad was restricted by the walls of the room in the treatment context. To touch the toad, the client learnt to wait for the toad to jump into a corner and once its movements were restricted, the client touched the toad. However, in the grassy lawn, the participant learnt to stand in front of the toad to hinder its movements prior to touching it. Similarly, abstaining from substances may require a variety of social skills and problem solving skills depending on the situation. The results of Experiment 2 and the case study when applied to substance dependence disorders, suggest that the long-term effectiveness of cue exposure may be enhanced by conducting exposure coupled with situation relevant skills training in multiple contexts (e.g., parties, bars, and restaurants) that the client determines relevant (for a discussion, see chapter 8).

Another major gap in renewal research is investigations of renewal of fear in children and adolescents. This area of research deserves particular attention as unaddressed childhood anxieties may persist into adulthood (e.g., Öhman & Mineka,

2001) or develop into other more complex anxiety disorders in adulthood (e.g., Silove, Manicavasagar, Curtis, & Blaszczynski, 1996). Despite the large availability of research into, for instance, one session exposure therapy treatment of specific phobias (Ollendick et al., 2009), there is no research on return of fear in children. However, the absence of this research must not be taken as an indication of a lack of occurrence of return of fear in children. In Ollendick et al. (2009), for example, 196 children from U.S.A and Sweden with various specific phobia diagnoses (i.e., dog, blood, and insect phobia) were provided with one session exposure therapy treatment. While the treatment was successful for a large number of children, at 6-months follow-up, 50% of the children continued to show anxiety related symptoms. Moreover, post-treatment to 6 months follow-up testing showed a decline in the percentage of symptom free children from 48% post-treatment to 44% at follow-up. While these differences are modest and indeed indicative of an effective treatment, they do also implicate that some of the children of the study could have experienced a return of fear. Given time, this return of fear may develop into full-blown clinical relapse.

To generalise renewal of fear and multiple extinction contexts findings to clinical work with children, researchers may follow the recommendations of the current thesis by firstly examining the renewal effect (albeit with children) in laboratory-based experiments prior to doing so in clinical-analogue studies. Laboratory-based experiments are comparatively less costly, thus successful demonstrations will increase the feasibility of such renewal research in clinical-analogue studies with children. Secondly, laboratory-based investigations of renewal of fear with children will also provide a good indicator of the likely strength of renewal and the extent of contextual manipulation needed to produce renewal of fear in children.

A potential difficulty in conducting renewal of fear research with children is that the USs typically used in laboratory-based research (i.e., electrocutaneous shocks) are ethically problematic when used with child participants. Neumann, Waters, and Westbury (2008) addressed this ethical issue by pairing outlines of diamonds and triangles (CSs) with the unpleasant US of a sound of a three-pronged garden fork being scraped over slate. Using this methodology, Neumann et al. (2008) found acquisition of conditioned responses with startle blink responses, expectancy judgements, and skin conductance responses. Of further interest, extinction of conditioned responses was detected for all measures following CS alone presentations. Moreover, effect size means for expectancy ratings ( $\eta p^2 = 0.68$ ) and startle blink magnitude ( $\eta p^2 = 0.42$ ) of acquisition learning in Neumann et al. (2008) was larger than expectancy ratings ( $\eta p^2 = 0.31$ ) and startle blink magnitude ( $\eta p^2 = 0.17$ ) in Bandarian-Balooch et al. (2012b). This suggests that the methodology of Neumann et al. (2008) can readily be applied to test for renewal of fear and attenuation of renewal of fear using multiple extinction contexts.

Clinical-analogue studies of renewal of fear and attenuation of renewal of fear using multiple extinction contexts with high fearful children is also important to consider as this will likely reveal findings that are directly applicable in clinical settings such as that seen in the work of this thesis with adults. Again, clinical-analogue renewal of fear research and research on multiple extinction contexts has frequently used spiders such as Chilean rose tarantulas (e.g., Mineka et al., 1999) that are not considered harmful to adults but may potentially be harmful to children. This issue can be addressed by either using imagery or virtual reality (e.g., Shiban et al., 2013) or using less dangerous spiders. Interestingly, children also present with a variety of phobias and anxiety disorders that may not be frequently observed in adults and do not involve dangerous stimuli such as phobia of loud noises and separation anxiety disorder (e.g.,

Ollendick et al. 2009). With this notion in mind, future clinical-analogue research may, for instance, examine the effects of conducting exposure therapy in one context versus multiple contexts on renewal of fear of loud noises.

Clinical investigations of conducting exposure therapy in multiple contexts with children with anxiety disorders are likely to present unique challenges. In the current case study, treatment plan development required discussions between the therapist and client to determine contexts that the client experienced fear in (e.g., forest pathway near their house) and contexts that were likely to become problematic after treatment (e.g., forest in the location that the client intended on moving to in the near future). The development of relevant contexts may have exerted some of the renewal attenuating effects observed in this study. However, depending on the child clients age, he or she may not be aware of a wide array of current and future contexts that may evoke a renewal of fear. Some of these contexts may be derived in therapy with the child and some may logically be derived by the therapist. However, to further ensure the relevance of the contexts used for therapy the child's caretakers may need to be involved in the development of a treatment plan. In addition, the child's caretaker may be encouraged to continue exposure with their child outside of therapy in multiple relevant contexts.

### **Theoretical Implications of the Current Findings**

Throughout this thesis, the results have been largely explained within the framework of Bouton's memory model of learning (Bouton, 1993, 1994, 2002, 2004; Bouton & Nelson, 1998)<sup>17</sup>. However, other conditioning models such as the generalisation decrement model also explain the renewal effect (for a discussion, see Bouton 2004; Neumann, Boschen, & Waters, 2008). According to the generalisation

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<sup>17</sup> For a more in depth discussion of Bouton's memory model of learning also see chapter 3 of this thesis.

decrement model, during fear acquisition, a configural CS-context stimulus is formed whereby the CS and the context become a configural whole rather than separate elements. Furthermore, during fear acquisition, this CS-context stimulus enters into an association with the US (i.e., a CS-context-US association is formed). In this way, for example, when a person is bitten by a spider in the forest, the person forms a configural whole between the spider and the forest that becomes associated with pain (i.e., a spider-forest-pain association is formed). Similar to Bouton's model of learning, the generalisation decrement model explains that acquisition learning remains intact after extinction learning.

In contrast to Bouton's model of learning (e.g., 1993), the generalisation decrement model suggests that acquisition learning (as well as extinction learning) is context specific and new learning regarding the CS-US association does not occur during extinction. Instead, if the extinction context is different to the acquisition context (e.g., office) a new CS-context configural stimulus (i.e., CS-office stimulus) is formed. Thus, the decrease observed in CRs during extinction is due to learning in regards to the CS-context stimulus formed during fear acquisition not readily generalising to the CS-context stimulus formed during extinction (i.e., a generalisation decrement occurs).

In support of the generalisation decrement model notion that each type of learning is context specific, some studies have found that renewal of fear does not occur when the CS is encountered in a novel context after extinction treatment (e.g., Effting & Kindt, 2007; Havermans, Keuker, Lataster & Jansen, 2005). For instance, Effting and Kindt (2007) used a laboratory based study to investigate various forms of renewal and did not find convincing evidence that renewal of fear occurs when the CS is encountered in a novel context post extinction treatment (i.e., ABC renewal did not occur). Similarly, Neumann et al. (2007), investigated ABC renewal and found that

novel context encounters with stimuli which had previously been associated with a US resulted in renewal of CRs. However, a CS, which had not been previously associated with a US and would not be expected to show an increase in CRs also showed a significant increase in CRs. Thus, the lack of clear renewal findings prevented the conclusion to be made that renewal of fear occurs when the CS is encountered in a novel context. Moreover, this finding provided support for the notion that acquisition and extinction are context specific and the lack of transfer of learning from one context to the other reflects a generalisation decrement across stimuli.

In contrast to the generalisation decrement model, the results of the experiments in the current thesis and previous laboratory-based (Neumann & Kitlertsirivatana, 2010) and clinical-analogue research (Mineka et al., 1999; Mystkowski et al., 2006), suggest that a re-encounter with the CS in a novel context after treatment does result in renewal of fear. These findings are largely consistent with Bouton's memory model of learning (e.g., 1993). When fear acquisition learning is relatively context independent when it is the first association learnt, new and relatively context dependent learning occurs during extinction, and the occurrence of renewal is dependent on the type of learning that is expressed and what is expressed is dependent on contextual cues. If contextual cues promote retrieval of acquisition learning, renewal of CRs will occur, if extinction learning retrieved, renewal of CRs will not occur. Indeed the current findings are largely consistent with the three defining factors of Bouton's memory model of learning.

Consistent with the explanation of Bouton's memory model of learning (e.g., Bouton, 1993), in Experiment 1 of the current thesis (chapter 6) the contextual mismatch between the acquisition and extinction contexts did not result in a significantly different CRs. Further consistent with the notion that extinction learning is relatively context dependent, a contextual mismatch between the extinction treatment

context (when treatment was conducted in one context) and subsequent test context resulted in a renewal of conditioned fear responses for many participants (CRs). Moreover, for the participants that received extinction treatment in multiple contexts, intra-extinction treatment contextual changes were observed to result in increases in fear responses. Finally, consistent with the notion that the type of learning that is expressed is dependent on cues present in the context, conducting extinction treatment in multiple contexts attenuated renewal of fear. This possibly occurred due to extinction in multiple contexts having increased the number of shared cues between the extinction and novel test context resulting in retrieval of extinction learning rather than acquisition learning.

Experiment 2 and the case study conducted here (chapter 7 and 8 respectively) did not include experimental fear acquisition phases. Rather, as argued by Vansteenwegen et al. (2007), clinically focused renewal of fear experiments assume that fear conditioning has naturally occurred for the participants prior to participation in the experiment. Thus, participant expression of fear (CRs) in the presence of an aversive stimuli (i.e., spider) during the initial fear tests in a context that they have not been in before (e.g., the experimental laboratory) is taken as evidence that fear acquisition has successfully generalised to novel contexts. Indeed, in Experiment 2 and the case study, high levels of fear and behavioural avoidance were observed during the initial tests with stimuli and contexts which were novel to the participants. Thus, these studies supported the conclusion that fear learning is relatively context free and readily generalises across contexts.

In Experiment 2, those participants that received exposure treatment in one context showed a renewal of fear as measured by a triad of measures (verbal, physiological, and behavioural), coinciding with exposure to the fearful stimuli in a novel context at follow-up testing. Moreover, intra-therapy contextual changes were

frequently observed to result in renewal of fear for the client in the case study. Taken together, these findings support Bouton's (1993, 1994, 2002, 2004) memory model of learning that acquisition learning is relatively context free and extinction learning is relatively context dependent. Finally, consistent with the notion that what is expressed is dependent on present contextual cues, conducting exposure in multiple contexts resulted in attenuation of renewal of fear in both the Experiment 2 and the case study.

However, it must be noted that these models have been used to explain the results of the current thesis in a post-hoc manner. Thus, the experiments conducted here have not directly tested the applicability of these models to explaining attenuation of renewal following multiple context exposure. Given the importance of such models in generating future research and understanding the underlying processes of conditioning, it is important to conduct experiments using humans in which the different predictions of these models are tested. Previously, the lack of a clear methodology to produce ABC renewal effects has potentially prevented such experiments from being conducted in humans. One way to contrast Bouton's model of learning (e.g., 1993) with the generalisation decrement model is to use recently validated laboratory-based methods (Neumann & Kitlertsirivatana, 2010) to examine the occurrence and strength of various forms of renewal (e.g., ABA, AAB, and ABC renewal). In such a study, the occurrence of renewal of fear in the original acquisition context but not in a novel context would be consistent with the generalisation decrement model. The occurrence of renewal in both the original acquisition context as in novel contexts would be consistent with Bouton's model of learning (e.g., 1993).

Interestingly, the current findings that extinction treatment in multiple contexts enhances the generalisability of extinction treatment are also consistent with attention theories, which are built as extensions of contextual conditioning models (for a review,



see Rosas, Callejas-Aguilera, Ramos-Álvarez, & Abad, 2006). These theories explain that increased experience enhances the predictability of the stimuli and reduces attention to the context (Myers & Gluck, 1994). In turn, this reduces the context specificity of learning and enhances the generalisability of extinction learning. Increased experience may also be considered as more than simply increased number of exposure trials as that seen in Myers and Gluck (1994). In Experiment 2 and the case study, providing exposure treatment in multiple contexts possibly diversified participant exposure experiences. As a result, participants were required to handle the feared object using different techniques. The diverse set of skills learnt through this process may have increased control of the feared objects and reduced participant attention to the treatment context. The reduced attention to contextual cues may have enhanced the generalisability of exposure learning to novel contexts, resulting in attenuation of renewal of fear. Future research could test this notion further by systematically controlling for the diversity of experience with handling a spider and testing for differential recall of contextual stimuli.

### **Limitations of the Current Studies**

The controlled yet artificial nature of Experiment 1 may raise questions regarding the extent to which its findings with non-fearful participants can be applied to clinical settings with fully phobic clients. The programmatic outline of the current thesis (i.e., moving from a laboratory-based experiment with healthy individuals to finishing with a clinical treatment context with an individual suffering from specific phobia) proved to be particularly valuable in addressing this potential limitation. In fact, Experiment 1 and 2 and the case study revealed similarities in intra-therapy and post-therapy observations. For instance, intra-therapy renewal of fear coinciding with

contextual changes was observed for some participants in all experiments and in the case study. Additionally, the two experiments and the case study showed evidence of attenuation of renewal with more than one measure of fear.

Another limitation in Experiment 1 is that it used a classical conditioning process wherein a CS was explicitly paired with a US until a CS-US association was formed. However, fear acquisition can also occur through other conditioning processes such as vicarious learning and verbal transmission (for a discussion, see Poulton & Menzies, 2002; Rachman, 1977). Currently, colleagues at Macquarie University in Australia are in the process of publishing results which show that renewal of fear can occur for vicariously conditioned associations (C. Newall, personal communication, June 19, 2013). Future research can further the application of multiple extinction context research, by examining whether conducting extinction treatment in multiple contexts attenuates renewal of vicariously or verbally conditioned associations.

One limitation of Experiment 2 is that while the verbal and behavioural measures showed complete attenuation of renewal, the heart rate data did not. Arguably, the change in temporal context (due to the lapse of time between therapy and follow-up) and physical context between treatment and follow-up testing should reveal return of fear via spontaneous recovery and renewal of fear. Any increases in fear observed in the control group should be attributed to spontaneous recovery effects alone. In Experiment 2, the heart rate data of the multiple exposure context group showed significantly greater renewal of fear than the control group (but lower than the renewal group) suggesting that only partial attenuation of renewal occurred for the multiple exposure context group.

Physiological measures of fear such as heart rate, skin conductance, and startle blink responses, are arguably more objective measures of fear than verbal self-reports

and more specific measures of fear than behavioural avoidance ratings and therefore demand particular attention. For instance, the dissociation in measures seen in Experiment 2 may have been due to desirability effects as the participants may have attempted to please the experimenter by reporting lower fear than they were actually experiencing as indicated by physiological measurement. Thus, the results of Experiment 2 highlighted the possibility that conducting exposure treatment in multiple contexts may be restricted in how much it enhances the generalisability of treatment. One way to address this limitation in future research is to combine multiple extinction contexts with other methods of attenuating renewal (e.g., mental reinstatement) to further enhance the generalisability of treatment with the aim of ultimately abolishing renewal of fear. Such an experiment may apply the methodology used by Bandarian-Balooch and Neumann (2011) in laboratory-based and clinical-analogue experiments to investigate the individual and combined effects of various clinically applicable methods of attenuating renewal of fear.

Another limitation of Experiment 2 was that the same therapist conducted all of the treatments and the groups were not blind to the therapist. While this may have controlled for such variability as therapist skill level, it may also have resulted in experimenter and participant allegiance effects on the results. For example, across the groups may have wanted to please the experimenter by reporting lower fear than they were actually experiencing (potentially as indicated by participant heart rate data) and pushing themselves further than they would have been willing to should the therapist not have known about it. Such factors may explain the discrepancy between the verbal, behavioural, and physiological reports of fear discussed earlier. While such effects were partially controlled for by standardising treatment and ensuring the absence of the

therapist during the behavioural approach test, only the use of double-blinded designs would have fully addressed such issues.

A limitation of the case study is that no groups or control subjects were included. Ideally the case study should have mimicked the group organisation of Experiments 1 and 2 and included at least one control, one renewal, and one multiple extinction context participant. The inclusion of a control participant (which would receive treatment and follow-up in the same external context) would have provided specific data in regards to the extent to which the observed return of fear is caused by spontaneous recovery (due to change in temporal context from post-treatment to follow-up). The inclusion of a renewal participant would have enabled investigations regarding whether renewal of fear following single context exposure also occurs for phobic populations that receive individually tailored treatments (and not just standardised treatments as seen in clinical-analogue studies). Finally, the hypothetically larger fear that would have been observed for the renewal participant compared to the multiple extinction context participant at follow-up would have allowed for stronger conclusions to be made in regards to the effects of conducting treatment in multiple contexts. Given the benefits of such a design, it is recommended that this be conducted in future research. In doing so, it is ethically important to ensure that participants who experience renewal of fear are provided with additional treatment in multiple contexts such that the likelihood of further renewal of fear is reduced.

Moreover, the case study was limited in that one measure of verbal fear and two measures of behavioural fear were included and no measure of physiological fear was included. Inclusion of a physiological measure of fear would have provided valuable objective data on the true fear experiences of the client. The inclusion of a physiological measurement of fear will be important to include in future research that examines

renewal of fear in clinical settings. Such a study could apply the methodology of Experiment 1 (startle blink responses) or 2 (heart rate) or that of Shiban et al. (2013) using skin conductance measures to exposure therapy as seen in clinical settings.

### **Conclusion**

Using a series of transformational studies the current thesis showed that conducting exposure therapy in multiple contexts attenuates the renewal of fear. Using a transformational approach highlighted strengths and weaknesses of a range of experimental approaches in examining production and attenuation of renewal of fear. Thus, the findings of the current thesis are likely to be important to behavioural researchers concerned primarily with theoretical models of contextual behaviourism, researchers concerned primarily with laboratory-based applications of behavioural research in clinical settings, and to clinicians alike. Moreover, the thesis created a common field of discourse which can be used by researchers and clinicians alike to discuss relapse as investigated in conditioning research and in the clinic.

Most importantly, the current research has addressed a long standing (e.g., Rachman 1977) observation that intra-therapy fear reduction alone can no longer be considered as an indication of long-term treatment success. The thesis has highlighted that return of fear is an ever-present danger post-treatment and has attempted to raise researcher and clinician attention to this problem. Finally, it suggested a series of future avenues of research not just pertaining to renewal of fear but also to spontaneous recovery, reinstatement, and re-acquisition research. It has shown that collaborative efforts to understand fear acquisition and treatment are successful in addressing return of fear. Ultimately, given enough time, these collaborative efforts should allow for not

only the abolishment of renewal of fear, but also return of fear through other mechanisms and maybe even relapse post exposure therapy as well.

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## APPENDIX A

## EXPERIMENT 1 INFORMATION SHEET AND CONSENT FORM

(PRINTED ON UNIVERSITY LETTERHEAD)

The effects of multiple contexts on learning

## INFORMATION SHEET

Who is conducting the research?

Any matter or concern regarding the research can be raised with the chief investigators whose contact details are provided below.

Dr. David Neumann  
 School of Psychology  
 Gold Coast Campus  
 Ph: 555 28307 Fax: 555 28291  
 Email: [D.Neumann@griffith.edu.au](mailto:D.Neumann@griffith.edu.au)

Siavash Bandarian Balooch  
 School of Psychology  
 Gold Coast Campus  
 Ph: 0432113820  
 Email: [s.bandarianbalooch@griffith.edu.au](mailto:s.bandarianbalooch@griffith.edu.au)

Dr. Mark Boschen  
 School of Psychology  
 Gold Coast Campus  
 Ph: 555 28283 Fax: 28291  
 Email: [m.boschen@griffith.edu.au](mailto:m.boschen@griffith.edu.au)

Why is the research being conducted?

The following study is being conducted as part of a student research project by Siavash Bandarian Balooch, which is being supervised by Dr. Neumann and Dr. Boschen.

What you will be asked to do.

Your participation will involve the following activities:

- Complete a 21-item questionnaire that asks the extent to which you have had certain feelings or states over the past week.
- Complete a 31-item questionnaire that asks the extent to which you fear spiders.
- You will be presented with various stimuli and will be asked to indicate your expectation of when one of the stimuli will occur. This stimulus will be an electrotactile stimulus presented on the inside of your forearm. You will also be presented with stimuli consisting of photographs of spiders and be presented with a short duration white noise.
- The electrotactile stimulus has negligible electrically based risks. This is because the stimulation is produced by an electrically isolated device that conforms with the IEC 601-1 International Safety Standards with an isolation rating of 5,300V RMS. This is the safety standard required for most medical equipment. The risks are also minimised by setting the stimulus at an individual level that you determine is “unpleasant, but not painful”. The level that you set will remain unchanged throughout the experiment.
- The expected duration of your participation will be a ½ hour.

The basis by which participants will be selected or screened

Students who are studying a psychology course at Griffith University are invited to participate.

#### The expected benefits of the research

The findings of this study are expected to help us understand more about how people learn associations between stimuli and what factors influence this learning. This knowledge is relevant to the practice of clinical psychology.

#### Risks to you

As noted above, the risks associated with the use of the electrotactile stimulus have been negated through the use of an electrically isolated device and setting of the intensity at an individual level.

#### Your confidentiality

Confidentiality of the data will be maintained whereby the consent form will be stored separately from the rest of the data. Numerical codes only will be used for identifying data.

#### Your participation is voluntary

Participation in this research project is voluntary and that you may withdraw at any time without penalty or explanation. Refusal to participate will not involve any penalty or loss of benefits to which you might otherwise be entitled. Your relationship with the School of Psychology and Griffith University will not be affected.

Course credit, equal to the duration of the full experiment, will be offered for participation. You will still receive course credit even in the event of the experiment being discontinued.

#### Questions / further information

Any matter or concern regarding the research can be raised with the partner investigator on the contact details provided above.

#### The ethical conduct of this research

Griffith University conducts research in accordance with the *National Statement on Ethical Conduct in Human Research*. If you have any concerns or complaints about the ethical conduct of this research project you should contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on 3735 5585 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)).

#### Feedback to you

Feedback can be provided at the end of the study to inform you of the results obtained. If you would like a summary of the results please tell the experimenter so that relevant details can be recorded to e-mail the summary to you.

#### Privacy statement

The conduct of this research involves the collection, access, and / or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal, or

other regulatory requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University’s Privacy Plan at [www.gu.edu.au/ua/aa/vc/pp](http://www.gu.edu.au/ua/aa/vc/pp) or telephone (07) 3735 5585.

The effects of multiple contexts on learning

CONSENT FORM

- I understand that participation involves completing a learning task in the Psychophysiological Laboratory at the School of Psychology (Gold Coast). The task involves the presentation of photographs of spiders, loud noises, and an electro-tactile stimulus. My participation will involve indicating my expectancy of when the electro-tactile stimulus will occur.
- I understand that I am not required to participate in this research project if I do not wish to do so and I can withdraw from the study at any time without needing to explain my reasons for withdrawing. No loss of benefit or treatment will occur as a result of my withdrawal nor any penalty will be incurred.
- I understand that confidentiality of the data will be maintained whereby this consent form will be stored separately from the rest of the data and codes will be used for identifying myself and the other participants. Feedback, in the form of a lay summary, will be provided at the end of the study if I desire.

**I have read the information sheet and the consent form.** I agree to participate in: “The Effects of Multiple Contexts on Learning” research project, and give my consent freely. I understand that the project/study will be carried out as described in the information statement, a copy of which I have retained. I can contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on (07) 3735 5585 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)) if I have any concerns about the ethical conduct of the project.

Signatures:

.....  
Participant

.....  
Date

.....  
Investigator

.....  
Date



## APPENDIX B

## EXPERIMENT 2 INFORMATION SHEETS AND CONSENT FORMS

(PRINTED ON UNIVERSITY LETTERHEAD)

The effects of multiple contexts on learning

## INFORMATION SHEET

Who is conducting the research?

Any matter or concern regarding the research can be raised with the chief investigators whose contact details are provided below.

Associate Professor David Neumann  
School of Psychology  
Gold Coast Campus  
Ph: 555 28307 Fax: 555 28291  
Email: [D.Neumann@griffith.edu.au](mailto:D.Neumann@griffith.edu.au)

Siavash Bandarian Balooch  
School of Psychology  
Gold Coast Campus  
Ph: 0432113820  
Email: [s.bandarianbalooch@griffith.edu.au](mailto:s.bandarianbalooch@griffith.edu.au)

Dr. Mark Boschen  
School of Psychology  
Gold Coast Campus  
Ph: 555 28283 Fax: 28291  
Email: [m.boschen@griffith.edu.au](mailto:m.boschen@griffith.edu.au)

Why is the research being conducted?

The following study is being conducted as part of a student research project by Siavash Bandarian Balooch, which is being supervised by Associate Professor Neumann and Dr. Boschen.

What you will be asked to do.

Your participation will involve the following activities:

- Complete a 21-item questionnaire that asks the extent to which you have had certain feelings or states over the past week.
- Complete a 31-item questionnaire that asks the extent to which you fear spiders.
- Complete a 10-item medical and treatment history questionnaire.
- You will be presented with a spider at a three metre distance and will have your heart rate measured and be asked to indicate your subjective level of distress in the presence of the spider.
- Close proximity to spiders may be required during this experiment.
- You will be asked to volunteer for providing your contact details such that you can be contacted for the subsequent stages of the experiment. The expected duration of your participation to this point of the experiment will be ½ hour.
- The subsequent stages of the experiment include exposure treatment using a 16 step exposure hierarchy wherein you will be asked to perform actions that require increasingly intimate encounters with a spider. Maximum allotted time for this part of the experiment is 3 hours.
- Upon successful completion this part of the experiment you will be asked to return to do two follow up sessions, one week after exposure treatment and again 4 weeks

after exposure treatment. The duration of each follow up session is expected to be ½ hour.

- The total number of hours you can accrue from participating in this study is 5 hours.

The basis by which participants will be selected or screened

Students who are studying a psychology course at Griffith University are invited to participate. Those found to have medical or treatment histories that place them at risk of experiencing adverse consequences as a result of the exposure treatment will not be included in the subsequent exposure treatment stages of the experiment.

The expected benefits of the research

The findings of this study are expected to help us understand more about how exposure treatment of phobias can be improved. This knowledge is relevant to the practice of clinical psychology.

Risks to you

There is an existing risk of being bitten by a non dangerous spider as close proximity to spiders is required during this experiment. As noted above, the risks associated with experiencing medical or psychological complications will be reduced by excluding participants that have medical or psychological problems that place them at risk of harm.

Your confidentiality

Confidentiality of the data will be maintained whereby the consent form will be stored separately from the rest of the data. Numerical codes only will be used for identifying data.

Your participation is voluntary

Participation in this research project is voluntary and that you may withdraw at any time without penalty or explanation. Refusal to participate will not involve any penalty or loss of benefits to which you might otherwise be entitled. Your relationship with the School of Psychology and Griffith University will not be affected.

Thirty minutes of course credit will be offered to those that complete this part of the experiment. Those that initiate the exposure treatment will be offered for 3 hours of course credit for participation. You will still receive 3 hours of course credit even in the event of the experiment being discontinued. An additional 1 hour of course credit will be offered upon initiation in each of the 2 follow up studies.

Questions / further information

Any matter or concern regarding the research can be raised with the partner investigator on the contact details provided above.

The ethical conduct of this research

Griffith University conducts research in accordance with the *National Statement on Ethical Conduct in Human Research*. If you have any concerns or complaints about the ethical conduct of this research project you should contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on 3735 5585 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)).

#### Feedback to you

Feedback can be provided at the end of the study to inform you of the results obtained. If you would like a summary of the results please tell the experimenter so that relevant details can be recorded to e-mail the summary to you.

#### Privacy statement

The conduct of this research involves the collection, access, and / or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal, or other regulatory requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at [www.gu.edu.au/ua/aa/vc/pp](http://www.gu.edu.au/ua/aa/vc/pp) or telephone (07) 3735 5585.

The effects of multiple contexts on learning

CONSENT FORM

- I understand that participation involves completing a learning task in the Psychophysiological Laboratory at the School of Psychology (Gold Coast). The task involves the presentation of a spider in various contexts. My participation will involve indicating my subjective distress while gradually engaging in increasingly intimate encounters with the spider.
- I understand that I am not required to participate in this research project if I do not wish to do so and I can withdraw from the study at any time without needing to explain my reasons for withdrawing. No loss of benefit or treatment will occur as a result of my withdrawal nor any penalty will be incurred.
- I understand that confidentiality of the data will be maintained whereby this consent form will be stored separately from the rest of the data and codes will be used for identifying myself and the other participants. Feedback, in the form of a lay summary, will be provided at the end of the study if I desire.

**I have read the information sheet and the consent form.** I agree to participate in: “The Effects of Multiple Contexts on Return of Fear” research project, and give my consent freely. I understand that the project/study will be carried out as described in the information statement, a copy of which I have retained. I can contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on (07) 3735 5585 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)) if I have any concerns about the ethical conduct of the project.

Signatures:

.....  
Participant

.....  
Date

.....  
Investigator

.....  
Date

## The effects of multiple contexts on learning

## INFORMATION SHEET

Who is conducting the research?

Any matter or concern regarding the research can be raised with the chief investigators whose contact details are provided below.

Associate Professor David Neumann  
School of Psychology  
Gold Coast Campus  
Ph: 555 28307 Fax: 555 28291  
Email: [D.Neumann@griffith.edu.au](mailto:D.Neumann@griffith.edu.au)

Siavash Bandarian Balooch  
School of Psychology  
Gold Coast Campus  
Ph: 0432113820  
Email: [s.bandarianbalooch@griffith.edu.au](mailto:s.bandarianbalooch@griffith.edu.au)

Dr. Mark Boschen  
School of Psychology  
Gold Coast Campus  
Ph: 555 28283 Fax: 28291  
Email: [m.boschen@griffith.edu.au](mailto:m.boschen@griffith.edu.au)

Why is the research being conducted?

The following study is being conducted as part of a student research project by Siavash Bandarian Balooch, which is being supervised by Associate Professor Neumann and Dr. Boschen.

What you will be asked to do.

Your participation will involve the following activities:

- Complete a 31-item True or False questionnaire (Spider Phobia Questionnaire) that asks the extent to which you fear spiders.
- Provide your telephone number and email if you are interested in being contacted by the research team to participate in further screening for exposure treatment.
- Return the blank or completed Information sheet, Consent form, and 31 True or False Questionnaire (Spider Phobia Questionnaire) to the experimenter.

The basis by which participants will be selected or screened

Students at Griffith University are invited to participate. Those that participate will be screened based on their responses on the questionnaire and will be invited to participate in a second component of the study. In this component, close proximity with a spider may be experienced. Participants that have medical or treatment histories that place them at risk of experiencing adverse consequences as a result of exposure to a spider will not be included in the subsequent exposure treatment stages of the experiment.

The expected benefits of the research

The findings of this study are expected to help us understand more about how exposure treatment of phobias can be improved.

Risks to you

There are no risks of you joining this screening procedure. As noted above, should you agree to join the exposure treatment stages of the therapy, the risks associated with

experiencing medical or psychological complications will be reduced by excluding participants that have medical or psychological problems that place them at risk of harm.

#### Your confidentiality

Confidentiality of the data will be maintained whereby the consent form will be stored separately from the rest of the data. Participants contact details will initially be stored alongside the Spider Phobia Questionnaire data. The contact details will be destroyed once the participant has been contacted, determined that they will not be contacted, upon participant request, or for the maximum duration of 1 year. Subsequently, numerical codes only will be used for identifying data.

#### Your participation is voluntary

Participation in this research project is voluntary and that you may withdraw at any time without penalty or explanation. Refusal to participate will not involve any penalty or loss of benefits to which you might otherwise be entitled. Your relationship with the School of Psychology and Griffith University will not be affected.

No Course credit will be offered for completing this screening questionnaire.

#### Questions / further information

Any matter or concern regarding the research can be raised with the partner investigator on the contact details provided above.

#### The ethical conduct of this research

Griffith University conducts research in accordance with the *National Statement on Ethical Conduct in Human Research*. If you have any concerns or complaints about the ethical conduct of this research project you should contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on 3735 5585 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)).

#### Feedback to you

Feedback can be provided at the end of the study to inform you of the results obtained. If you would like a summary of the results please tell the experimenter so that relevant details can be recorded to e-mail the summary to you.

#### Privacy statement

The conduct of this research involves the collection, access, and / or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal, or other regulatory requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at [www.gu.edu.au/ua/aa/vc/pp](http://www.gu.edu.au/ua/aa/vc/pp) or telephone (07) 3735 5585.

The effects of multiple contexts on learning  
 CONSENT FORM

- I understand that participation involves completing 31 item True or False Questionnaire (Spider Phobia Questionnaire).
- I understand that completing this questionnaire and providing my contact details to the main experimenter does not obligate me to participate in the remainder of the experiment.
- I understand that I am not required to participate in this research project if I do not wish to do so and I can withdraw from the study at any time without needing to explain my reasons for withdrawing. No loss of benefit or treatment will occur as a result of my withdrawal nor any penalty will be incurred.
- I understand that confidentiality of the data will be maintained whereby this consent form will be stored separately from the rest of the data. I understand that my contact details will be stored alongside the Spider Phobia Questionnaire data until I have been contacted, the research team determines that I will not be contacted, I request removal of my contact details, or a maximum duration of 1 year. Subsequent to this period, only codes will be used for identifying myself and the other participants. Feedback, in the form of a lay summary, will be provided at the end of the study if I desire.

**I have read the information sheet and the consent form.** I agree to participate in: “The Effects of Multiple Contexts on Return of Fear” short screening process, and give my consent freely. I understand that the project/study will be carried out as described in the information statement, a copy of which I have retained. I can contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on (07) 3735 5585 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)) if I have any concerns about the ethical conduct of the project.

Signatures:

.....  
 Participant

.....  
 Date

.....  
 Investigator

.....  
 Date

## APPENDIX C

## N = 1 CASE STUDY INFORMATION SHEET AND CONSENT FORM

(PRINTED ON UNIVERISTY LETTERHEAD)

The effects of multiple contexts on return of fear

## INFORMATION SHEET

Who is conducting the research?

Any matter or concern regarding the research can be raised with the chief investigators whose contact details are provided below.

Associate Professor David Neumann  
School of Psychology  
Gold Coast Campus  
Ph: 555 28307 Fax: 555 28291  
Email: [D.Neumann@griffith.edu.au](mailto:D.Neumann@griffith.edu.au)

Siavash Bandarian Balooch  
School of Psychology  
Gold Coast Campus  
Ph: 0432113820  
Email: [s.bandarianbalooch@griffith.edu.au](mailto:s.bandarianbalooch@griffith.edu.au)

Dr. Mark Boschen  
School of Psychology  
Gold Coast Campus  
Ph: 555 28283 Fax: 28291  
Email: [m.boschen@griffith.edu.au](mailto:m.boschen@griffith.edu.au)

Why is the research being conducted?

The following study is being conducted as part of a student research project by Siavash Bandarian Balooch, which is being supervised by Associate Professor. Neumann and Dr. Boschen.

What you will be asked to do.

Your participation will involve the following activities:

- Complete a 21-item questionnaire that asks the extent to which you have had certain feelings or states over the past week.
- Complete a 31-item questionnaire that asks the extent to which you fear toads.
- Complete a Structured Clinical Interview for DSM-IV-TR.
- You will be presented with a toad at three metres distance be asked to indicate your subjective level of distress in the presence of the toad. Subsequently, using a 16 step exposure hierarchy (created by yourself and the experimenter) during treatment, you will be asked to perform as step on the hierarchy that you identify as being best willing and able to.
- Close proximity to toads may be required during this experiment.
- The total expected duration of your participation is 3 hours.
- The data collected from you will be used in the researchers PhD thesis and possibly in a case study publication. Information regarding your real name, date of treatment, real age, background and developmental history, family history, and occupational and educational location/history will remain hidden/anonymous.



- Despite best efforts to conceal your identity people that know you very well may be able to identify you when reading any potential future published articles/the researchers PhD thesis.

#### The expected benefits of the research

The findings of this study are expected to help us understand more about how exposure treatment of phobias can be improved. This knowledge is relevant to the practice of clinical psychology.

#### Risks to you

The risks associated with experiencing medical or psychological complications (e.g., ingestion of bacteria from cane toad or contact with eyes) will be reduced through frequently washing our hands with soap and alcohol and using gloves in the event that you have any open wounds on your hands.

#### Your confidentiality

Confidentiality of the data will be maintained whereby the consent form will be stored separately from the rest of the data. Numerical codes only will be used for identifying data. As mentioned above The data collected from you will be used in the researchers PhD thesis and possibly in a case study publication. Information regarding your real name, date of treatment, real age, background and developmental history, family history, and occupational and educational location/history will remain hidden/anonymous. Despite best efforts to conceal your identity people that know you very well may be able to identify you when reading any potential future published articles/the researchers PhD thesis. Despite of this being unlikely you are not to agree with the use of your data or further experimentation if you are opposed to the notion that someone does recognise you through the case study/PhD thesis.

#### Your participation is voluntary

Participation in this research project is voluntary and that you may withdraw at any time without penalty or explanation. Refusal to participate will not involve any penalty or loss of benefits to which you might otherwise be entitled. Your relationship with the School of Psychology and Griffith University will not be affected.

#### Referral options

Should you experience distress from the research or need to withdraw from the research there will be several referral options available to you. In accordance with the Better Access Initiative, you can access a psychologist (for a maximum of 10 sessions per year) through your general practitioner. Other referral options can also be discussed with the research team.

#### Questions / further information

Any matter or concern regarding the research can be raised with the partner investigator on the contact details provided above.

#### The ethical conduct of this research

Griffith University conducts research in accordance with the *National Statement on Ethical Conduct in Human Research*. If you have any concerns or complaints about the ethical conduct of this research project you should contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on 373 54375 or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)

#### Feedback to you

Feedback will be provided at the end of the study to inform you of the results obtained and future directions in the event that you are experiencing phobia relapse. If you would like a summary of the results please tell the experimenter so that relevant details can be recorded to e-mail the summary to you.

#### Privacy statement

The conduct of this research involves the collection, access, and / or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal, or other regulatory requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at <http://www.griffith.edu.au/privacy-plan> or telephone (07) 373 54375.

## The effects of multiple contexts on learning

## CONSENT FORM

- I understand that participation involves completing a learning task in the Psychophysiological Laboratory at the School of Psychology (Gold Coast). The task involves the presentation of a toad in various contexts. My participation will involve, completion of the Toad and Frog Phobia Questionnaire, the Depression Anxiety and Stress Scale (21-item version) and indicating my subjective distress while gradually engaging in increasingly intimate encounters with the toad.
- I understand that I am not required to participate in this research project if I do not wish to do so and I can withdraw from the study at any time without needing to explain my reasons for withdrawing. No loss of benefit or treatment will occur as a result of my withdrawal nor any penalty will be incurred.
- I understand that confidentiality of the data will be maintained whereby this consent form will be stored separately from the rest of the data and codes will be used for identifying myself and the other participants. Feedback, in the form of a lay summary, will be provided at the end of the study if I desire.

**I have read the information sheet and the consent form.** I agree to participate in: “The Effects of Multiple Contexts on Return of Fear” research project, and give my consent freely. I understand that the project/study will be carried out as described in the information statement, a copy of which I have retained. I can contact the Manager, Research Ethics, at Griffith University Human Research Ethics Committee on (07) 373 54375 (or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au)) if I have any concerns about the ethical conduct of the project.

Signatures:

.....  
Participant

.....  
Date

.....  
Investigator

.....  
Date

## APPENDIX D

Proof of acceptance of Experiment 1 as an oral paper at the Australian Association for Cognitive and Behaviour Therapy 35th National Conference on July 2012

(Acceptance was sent to secondary supervisor Dr Mark J Boschen)

Mark

----- Forwarded message -----

From: **Mark Boschen** <[m.boschen@griffith.edu.au](mailto:m.boschen@griffith.edu.au)>

Date: 19 June 2012 08:40

Subject: AACBT National Conference 2012

To: Mark Boschen <[m.boschen@griffith.edu.au](mailto:m.boschen@griffith.edu.au)>

Dear Dr Boschen

I am delighted to confirm the acceptance of your submission ("Extinction Treatment in Multiple Contexts Attenuates ABC Renewal in Humans") for presentation as an oral paper at the 35<sup>th</sup> AACBT National Conference, to be held on 17 – 21 October, 2012, at the Gold Coast, Queensland.

The Scientific Program has now been finalised, and your paper is scheduled to be presented on Thursday 18 October, in the session commencing at 2.30pm. You will have 20 minutes for your paper, and should ensure that you allow time for questions from the audience during this time.

The standard of submissions this year has been exceptionally high, and I am happy to be able to include your research as part of what promises to be an interesting and stimulating Conference Scientific Program.

To assist with planning the Conference, would you please confirm via email your willingness to present at this time?

I look forward to seeing you at the Conference in October.

Mark Boschen PhD

Chair, Scientific Committee

AACBT National Conference, 2012

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## APPENDIX E

Proof of acceptance of Experiment 2 Annual Behavioural Basis of Health Mid-Year Conference on October 2013 in Gold Coast, Australia.

(As no formal acceptance letter was received the timetable for the presentations is attached).



### Presentation Timetable


Time	Presenter	Talk Topic
9:30am	David Shum	Welcome to BBH Mid-Year Conference. <i>Brief Discussion on BBH Matters</i>
9:45am	Siavash Bandarian-Balooch	Return of Fear Post Exposure Therapy: Can We Stop It.
10:00am	Haley Webb	The role of friends in adolescent appearance concerns.
10:15am	Suzie Drummond	Applying a future-oriented paradigm to the Transactional Model of Stress and Coping.
10:30am	Brenton McNally	The development and validation of the CAPS model in a reckless behaviour context: Identifying the predictors of unsafe driving behaviours.
10:45am	Tara Spokes	Using EEG source analysis to explore the age-related differences in automatic processing.
<b>Morning Tea (20 MINUTES)</b>		
11:30am	Monique Holmes	Do children worry? Yes they do.
11:45am	Paula Brough	Researching occupational health: Key issues and next steps.
12:00pm	Caroline Donovan	Using BRAVE-ONLINE to reach preschool children with anxiety disorders.
12:15pm	Glenda Andrews	Relational processing and the frontal lobes
<b>LUNCH (1 HOUR)</b>		

## APPENDIX F

Proof of acceptance of Experiment 2 as an oral paper at the Australian Association for Cognitive and Behaviour Therapy 36th National Conference in October 2013 (Original acceptance letter was sent to symposium organiser Dr Carol Newall who shared the information with Siavash Bandarian Balooch)

aacbt 2013 

    Move to Inbox  More

Fwd: AACBT 2013 - Notification of Acceptance  Inbox x



**Carol Newall** <carol.newall@mq.edu.au>  
to Bronwyn, Allison, me

Dear Allison, Bronwyn, and Sia,

Our AACBT symposium has been accepted (see below). Please note that you will need to register by **Tuesday 13 August 2013**

I look forward to seeing everyone in Adelaide.

Regards,  
Carol

----- Forwarded message -----  
From: AACBT 2013 Conference <lucy@wsm.com.au>  
Date: Mon, Jul 22, 2013 at 3:51 PM  
Subject: AACBT 2013 - Notification of Acceptance  
To: Carol Newall <carol.newall@mq.edu.au>



**22 July 2013**

Ref: 321

Dr Carol Newall  
Lecturer  
Macquarie University  
Institute Of Early Childhood  
MACQUARIE UNIVERSITY NSW 2109  
AUSTRALIA

Dear Dr Newall

On behalf of the Australian Association for Cognitive and Behaviour Therapy (AACBT) 36th National Conference 2013 Organising Committee, we are pleased to inform you that your submission for the 36th National Conference to be held 24-27 October 2013 at the Hotel Grand Chancellor, Adelaide, Australia.

**PRESENTATION DETAILS**