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Reappraisal facilitates extinction in healthy and socially anxious individuals

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ABSTRACT

Background and objectives: Cognitive behavioral therapy (CBT) combines cognitive restructuring with exposure to feared stimuli in the treatment of anxiety disorders. Due to the complexities of cognition–emotion interactions during ongoing CBT, the underlying mechanisms remain unclear, which hinders treatment optimization.
Methods: We created a laboratory analogue by combining reappraisal, a key ingredient of cognitive restructuring, with Pavlovian conditioning, a key ingredient in behavioral treatments. The novel differential Pavlovian acquisition and extinction task featured social stimuli as conditioned and unconditioned stimuli under unregulated and reappraisal instructions.
Results: Findings indicated that reappraising the conditioned stimuli attenuated acquisition (Study 1) and facilitated extinction (Study 2) of conditioned negative valence. In Study 3, highly socially anxious individuals showed deficient extinction learning relative to low socially anxious individuals but compensated for this by using reappraisal.
Limitations: Diagnostic status of participants was not assessed in structured clinical interviews.
Conclusions: Reappraisal of feared stimuli could be useful in prevention and treatment of social anxiety.

1. General introduction

Anxiety disorders are highly prevalent, severely debilitating, and involve considerable societal costs (e.g., Konnopka, Leichsenring, Leibing, & König, 2009). Cognitive behavioral therapy (CBT) has emerged as the treatment of choice for these disorders (e.g., Butler, Chapman, Forman, & Beck, 2006). Core components of CBT are cognitive techniques such as cognitive restructuring and behavioral techniques such as repeated exposure to feared stimuli. It is likely that cognitive and behavioral processes interact in a bidirectional fashion during CBT. Thus, experiences during successful exposures to feared stimuli may change phobic cognitions, and cognitive restructuring of phobic cognitions, in turn, may facilitate fear extinction during exposure.

A growing literature is trying to delineate the mechanisms behind these cognition–emotion interactions during ongoing CBT (e.g., Craske et al., 2008; Hofmann et al., 2007; Kleim et al., 2013; de Quervain et al., 2011; Salkovskis, Hackmann, Wells, Gelder, & Clark, 2007). However, the complexity of a dynamically unfolding therapeutic process makes the establishment of causality difficult. In this regard laboratory research can usefully complement naturalistic process research. Therefore, the present study series created a laboratory analogue of CBT by applying a key feature of cognitive restructuring, the cognitive emotion regulation strategy *reappraisal*, to the laboratory analogue of exposure therapy, Pavlovian conditioning (Bouton, Mineka, & Barlow, 2001).

1.1. Pavlovian conditioning theories of anxiety and exposure therapy

According to conditioning theories of anxiety disorders, etiology and maintenance of pathological anxiety results from a Pavlovian conditioning process, involving contingent pairing of aversive unconditioned stimuli (USs) such as initial panic attacks (as in panic disorder), social stress (as in social anxiety disorder, SAD), or traumatic events (as in posttraumatic stress disorder) with neutral CSs (stimuli, situations, people, see De Houwer, Barnes-Holmes, & Moors, 2013; for a revised definition of learning). After such

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acquisition of conditioned fear, CSs can later provoke aversive-defensive responding even in the absence of the USs, as evidenced during later *extinction* training, when CSs are no longer followed by USs. Failure to decrease such conditioned responding is referred to as *resistance to extinction*. This extinction deficit has been demonstrated in a range of anxiety disorders (Lissek et al., 2005) making it a key maintenance factor in clinical anxiety. Extinction is thought to underlie *exposure therapy*: patients are encouraged to expose themselves to their feared stimuli (the CSs) to realize that the feared consequences (the USs) do not occur, and to decrease their disliking and avoidance of these stimuli. Although exposure therapy is very successful overall, there is room for improvement (Craske et al., 2008; Hofmann & Smits, 2008). Therefore, much of the basic conditioning research has tried to understand the mechanisms underlying extinction, with the ultimate aim of developing novel strategies to improve it (e.g., Graham & Milad, 2011).

1.2. Integrating cognitive emotion regulation with Pavlovian conditioning

This search for ways to optimize exposure therapy has motivated researchers to investigate the role of cognitive emotion regulation in Pavlovian conditioning. In the first study on this topic, participants were conditioned to yellow or blue square-CSs using electric shocks as US under instructions of either attending to their feelings or of cognitively regulating their emotions (i.e. by imagining calming images from nature during CS presentation, Delgado, Nearing, Ledoux, & Phelps, 2008). Results revealed decreased differential skin conductance responding for reappraise vs. attend trials. Neurally, the dorsolateral prefrontal cortex (dlPFC), engaged by reappraisal, seemed to attenuate differential amygdala responding via the ventromedial PFC, suggesting that regulation takes a common final path as extinction learning (Delgado et al., 2008; Hartley & Phelps, 2010). More recently, Shurick et al. (2012) conditioned participants to images of snakes and spiders using electric US. After conditioning, participants were helped in cognitively restructuring negative thoughts and feelings experienced during conditioning. This procedure reduced differential fear and electrodermal responding during a second conditioning session 24 h later. These two studies demonstrated the influence of cognitive emotion regulation over differential fear conditioning. However, three important aspects remain unexplored.

First, the tasks employed by Delgado et al. (2008) and Shurick et al. (2012) did not distinguish an acquisition phase from an extinction phase. However, it would be useful to know *when* cognitive emotion regulation needs to be employed to be successful: during the acquisition phase and thus early during conditioning (analog to the original onset of fear in the course of clinical anxiety), or later during the extinction phase when already established associations need to be changed (analog to CBT treatment of chronic clinical anxiety).

Second, previous research did not examine regulation effects on valence ratings. Valence during Pavlovian conditioning is thought to arise from an *evaluative conditioning* (EC) process that evolves in parallel to the differential responses on autonomic electrodermal, or US-expectancy/fear ratings, both representing expectancy learning. EC has a number of characteristics that make it different from expectancy learning. EC is more resistant to extinction than expectancy learning (Blechert, Michael, Williams, Purkis, & Wilhelm, 2008; Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002; Vansteenwegen, Crombez, Baeyens, & Eelen, 1998; Vansteenwegen, Francken, Vervliet, De Clercq, & Eelen, 2006). EC is also associated with reinstatement (Dirikx, Hermans, Vansteenwegen, Baeyens, & Eelen, 2004; Hermans et al., 2005; Zbozinek, Hermans, Prenoveau, Liao, & Craske, 2014), a laboratory analogue of the return of fear after an initially successful treatment (Rachman, 1989) which makes EC particularly relevant for the long term outcome of exposure therapies. In fact, EC is enhanced in clinical anxiety: patients with panic disorder and post-traumatic stress disorder show a deficit in extinguishing EC responses compared to healthy controls (Blechert, Michael, Vriends, Margraf, & Wilhelm, 2007; Michael, Blechert, Vriends, Margraf, & Wilhelm, 2007). Thus, enhanced EC conditioning might be why many anxiety patients are prone to experience a return of fear after successful exposure therapy.

Third, if adding cognitive emotion regulation to Pavlovian conditioning were clinically relevant, it should help to reduce the extinction deficit seen in several anxiety disorders. Might cognitive emotion regulation in fact reduce the extinction deficit in participants with elevated anxiety? The present study series aimed to answer these three open questions.

1.3. The present research

The present research started off by creating a suitable conditioning framework that would isolate acquisition from extinction, and that would generate reliable and persistent EC effects. Due to their high relevance to daily life social functioning, we chose social stimuli as CSs and USs. Research in social cognitive neuroscience moves away from using static emotional faces in isolation and starts to embed them in written emotional sentences (Davis, Johnstone, Mazzulla, Oler, & Whalen, 2010; Wieser et al., 2014), emotional voice recordings (Iidaka et al., 2010), nonverbal affective gestures (Wieser, Flaisch, & Pauli, 2014) or dynamic videos (Hermann, Keck, & Stark, 2014; Pejic, Hermann, Vaitl, & Stark, 2013) to determine how humans acquire and represent knowledge about unpleasant social encounters and to elucidate associated individual differences such as emotion regulation style (Hermann et al., 2014) or social anxiety (Pejic et al., 2013). Here, we used still images of neutral faces of actors as CSs which predicted aggressive/insulting exclamations of the same actors as USs. In this social conditioning task we expected to condition strong negative valence to the still images (assessed through subjective ratings), thereby modeling a prevalent process in social interactions in daily life. Translation of Pavlovian conditioning into the social domain would also allow us to study putative extinction deficits in individuals with social anxiety, who are particularly sensitive to negative social evaluation (Weeks et al., 2005; Winton, Clark, & Edelmann, 1995) and to test whether cognitive emotion regulation might ameliorate these deficits. We chose to focus on *reappraisal*, defined as changing the way one thinks about a situation to alter one's emotional response, as this is a particularly well studied and clinically relevant cognitive emotion regulation strategy (Gross, 2014). A series of three studies was carried out to address these research aims. Study 1 applied reappraisal during acquisition. Study 2 applied reappraisal during extinction. Study 3 assessed individuals with high social anxiety in the social conditioning task to test whether they would show an extinction deficit and whether reappraisal would help in reducing it.

2.. Study 1: reappraisal during acquisition

Study 1 explored the suitability of the social conditioning task for generating reliable and durable EC effects, and for examining reappraisal. Three conditions were repeatedly presented within participants (explained in more detail below). Two conditions, termed CS_Neg and CS_Neu, simulated the CS+ (the CS that predicts the US during acquisition) and the CS− (the CS that is never paired with the US) of conventional conditioning designs. The difference in negative valence between CS_Neg and CS_Neu after acquisition was