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Adding imagery rescripting during extinction leads to less ABA renewal

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ABSTRACT

Objective: Although extinction is highly effective in reducing a conditioned fear response, return of the fear response (renewal) outside the extinction context often occurs. The present study investigated whether US devaluation, through imagery rescripting during extinction, resulted in less renewal than mere extinction.

Method: Seventy psychology students were subjected to a fear conditioning paradigm. During fear acquisition CS+ was always followed by the US, whereas CS− was never followed by the US. For all groups the acquisition phase took place in context A. During extinction both CS+ and CS− were offered, but no US was presented. For three groups extinction was conducted in a different context, context B (ABA groups). The fourth group received extinction in the acquisition context (AAA group) in order to demonstrate that renewal indeed took place. During extinction, participants received either an imagery rescripting (IR) instruction to devaluate the US (ABAir), a US-unrelated imagination instruction to assess the general influence of imagination (ABAcont), or no instruction at all (ABAno and AAAno). Subsequently, testing occurred for all groups in the acquisition context A.

Results: The results indicated that renewal of the US expectancy ratings was reduced if imagery rescripting (ABAir) was added to mere extinction (ABAno). Next to the reduction in renewal, imagery rescripting (ABAir) also resulted in the devaluation of the US valence, indicating that the mental representation of the US had changed. These findings are not only in line with contemporary conditioning theories, but also suggest that adding imagery rescripting to extinction might be beneficial in the treatment of anxiety problems.

1. Introduction

Fear conditioning involves the pairing of a neutral stimulus with an aversive event (unconditioned stimulus, US). This neutral stimulus does initially not evoke an emotional response. However, after repeated pairing with the US the neutral stimulus comes to function as a valid predictor (conditioned stimulus, CS) for the occurrence of the US, resulting in an anticipatory fear response on its presentation (e.g., Watson & Rayner, 1920).

Conditioning as a theoretical framework has gained enormous power not only to explain the aetiology of fear, but also in therapies that reduce fear. Exposure therapy is a widespread and highly effective method to attenuate a conditioned fear response by means of extinction. In an extinction procedure the CS is repeatedly presented without the US, diminishing the CR. Likewise, in a typical exposure session patients are also presented with the feared stimulus or situation until the conditioned fear response is extinguished (e.g., Marks, Hodgson, & Rachman, 1975; Öst, 1989, 1996, 1997). Exposure therapy has proven to be an effective treatment in a variety of anxiety problems such as specific phobias (Öst, 1997), panic disorders (Barlow, Allen, & Basden, 2007), and post-traumatic stress disorder (Foa, Rothbaum, & Furr, 2003).

Recent studies have indicated that associative learning can occur even if the CS or the US are not actually present (see for overviews Dadds, Bovbjerg, Redd, & Cutmore, 1997; Dwyer, 2003; Field, 2006). This implies that the acquisition of a conditioned response can take place if no direct CS–US presentation is experienced. That is, pairing an actual CS with a mentally imagined US can evoke a CR on subsequent CS presentations, and vice versa, a mentally imagined CS can come to evoke a CR after pairings with an actually present US (see for an overview Dadds et al., 1997). Even more, just thinking about a specific CS–US combination, for example imagining that a snake (CS) strangles you (US), might result in a conditioned fear response (but see for an alternative explanation Dadds et al., 1997).

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In a more recent conditioning model presented by Davey (1997) the strength of the CS–US association is not only influenced by the number of experienced pairings of the CS and US. Davey distinguishes two processes, expectancy evaluation and US revaluation, that can affect the CR. The first process stresses the influence of the predictive value or (expected) contingency between the CS and US on the CR. In this process not only direct conditioning experiences determine the associative strength between the CS and US, but also pre-existing beliefs and verbally and culturally transmitted information contribute to the establishment of a CS–US association (see for experiments Askew, Kessock-Philip, & Field, 2008; Muris, Bodden, Merckelbach, Ollendick, & King, 2003).

According to the second process, US revaluation, the mental representation of the US can change even if the US is not encountered. For example, socially or verbally transmitted information about the US can inflate or devaluate the US representation resulting in a stronger or diminished CR on subsequent CS presentations (see Davey, 1997; Field, 2006 for reviews).

Next to extinction or exposure procedures, imagery techniques that affect the mental representation of the CS and/or US can be implemented in the treatment of anxiety-related problems (Dadds et al., 1997). According to the model of Davey (1997) a devaluation of the US representation should result in a diminished CR on subsequent CS presentations. Arntz et al. have hypothesized that Imagery Rescripting (IR) might act through US revaluation (Arntz, in press; Arntz, Tiesema, & Kindt, 2007; Arntz & Weertman, 1999). This technique has been successfully applied in a variety of anxiety-related disorders such as post-traumatic stress disorder (e.g., Arntz et al., 2007), social phobia (e.g, Wild, Hackmann, & Clark, 2007), and specific phobias (see for an overview Holmes, Arntz, & Smucker, 2007; Hunt & Fenton, 2007). During IR patients are asked to activate the memory of an aversive event and to mentally rescript it into another more neutral or positive image. For example, a traumatic memory of sexual abuse is rescripted by imagining that an adult intervenes and stops the abuser.

If the assumed mechanism of IR is correct, the advantage of IR over extinction is that the former directly acts upon the US presentation and therefore, can more easily generalize to other stimuli and environments. This is not the case with an extinction or exposure procedure. After extinction the CS is thought to have an ambiguous meaning; it predicts both the occurrence and the absence of the US. Especially the second-learned CS–noUS association is highly vulnerable to context changes after extinction (see for an overview Bouton, 2002, 2004). One robust phenomenon that indicates this vulnerability is the renewal effect. In the most common renewal paradigm, ABA renewal, acquisition of the CS–US association takes place in context A and subsequently, the extinction is conducted in another context, context B. When the CS is then presented in the original acquisition context, context A, renewed responding is observed, indicating that the CS–US rather than the CS–noUS association is retrieved from memory (but see Nelson, del Carmen Sanjuan, Vadillo-Ruiz, Pérez, & León, 2010). Indeed this ABA renewal has been frequently observed in both animal (e.g., Thomas, Larsen, & Ayres, 2003) and human fear conditioning studies (e.g., Effting & Kindt, 2007; Vansteenwegen et al., 2005). Less renewed responding is expected after an IR intervention. Even if the original CS–US association is retrieved, no strong CR is expected as the US representation itself has been changed. To our knowledge, no study has been conducted that examined the influence of IR during extinction on renewal. Therefore, the main aim of the present study is to investigate the influence of IR during extinction on renewal using an ABA paradigm. It was hypothesized that changing the US representation during an extinction procedure should reduce renewed responding at test and devaluate the US.

2. Method

2.1. Participants

Seventy psychology students (20 males, 50 female) with a mean age of 22.02 years (range: 18.17–33.25 and SD: 2.64 years) participated and received 1 h of course credit for their contribution. All participants signed a written informed consent before onset of the experiment and were pseudo randomly assigned to one of four experimental groups, with the restriction of an equal female/male distribution in each group (but, see inclusion criteria 2.4). The experiment was conducted in line with the declaration of Helsinki and approved by the local ethical committee (ECP-81).

2.2. Apparatus

2.2.1. Computer task

Two different pictures of a motorcycle (335 × 302 pixels) and a car (522 × 211 pixels) functioned as conditioned stimuli (CSs). An aversive IAPS picture (Lang, Bradley, & Cuthbert, 2008) of a mutilated dead child (3051, valence rating: 2.30, arousal rating: 5.62, 1024 × 683 pixels) served as unconditioned stimulus (US). The motorcycle was never followed by the US (CS−), whereas the car was consistently followed by the US (CS+) during acquisition. To control for stimulus order effects two different versions were used, with one version being the exact opposite of the other version (e.g. CS+, CS−, CS− versus CS−, CS+, CS+, for all phases and conditions). The CSs were presented against one of two different background pictures (1024 × 683 pixels): an abandoned residential area with a playing ground and a service station. These backgrounds functioned as contexts. The role of the pictures and backgrounds was not counterbalanced as we wanted the scene (see below) to be identical for all participants. Counterbalancing without changing the scene would have resulted in a less credible script during the extinction phase (see below, e.g. seeing the motorcycle at the residential area reminds you to make an appointment for the check-up of your own motorcycle). Pictures and backgrounds were presented via a computer screen. The US expectancy was measured in two ways: skin conductance response (SCR) and an online visual analogue scale (VAS). Electrodermal activity was continuously recorded with AgCl electrodes (1 cm diameter) attached to the volar surfaces of the medial phalanges of the first and second finger of the nondominant hand. Prior to attachment the participants cleaned their hands with tap water. A Brainvision professional Brainamp ExG Skin Conductor passed the signal to Brain Vision Analyzer 2.0 software. The VAS was presented on each CS presentation at the bottom of the screen. The indicator, defined by a vertical line of 1 cm, could be set anywhere between the outer left (certainly no aversive picture) and outer right (certainly an aversive picture) end of the scale by clicking the left mouse button. The whole task was run on an IBM-compatible desktop computer and programmed with E-prime software (Psychology Software Tools, http://www.pstnet.com/).

2.2.2. Questionnaires

Three questionnaires were administered: the Dutch Beck Anxiety Inventory (BAI, Creamer, Foran, & Bell, 1995), the Dutch State Trait Anxiety Inventory (STAI-DY, Van der Ploeg, 1982), and the Dutch version of the short version of the Bett's Questionnaire upon Mental Imagery (QUMI, Sheehan, 1967). The BAI is a self-report questionnaire that contains 21 items measuring state anxiety. Responses can be scored on a 0–3 scale ranging from "not at all" to "severely", giving a score between 0 and 63. The STAI-DY contains two separate lists for state and trait anxiety. Each list contains 20 items and scoring is similar to the BAI (range per list 0–60).The QMI assesses