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Examining the effects of punishment schedule density on the development and maintenance of avoidance and safety behaviours: Implications for exposure therapies

Ioannis Angelakis[a,*], Venessa Lewis[a], Jennifer L. Austin[a], Maria Panagioti[b]

[a] University of South Wales, School of Psychology, Pontypridd, Wales, UK
[b] Division of Population Health, Health Services Research & Primary Care, University of Manchester, Manchester, UK

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ABSTRACT

Background and objectives: Engaging in safety behaviors in the absence of actual threat is a key feature of many psychological disorders, including OCD and depression. Failure to discriminate between threatening and safe environments may make these behaviors resistant to change. The purpose of the current study is to investigate the conditions under which avoidance and safety behaviors are developed and maintained.
Methods: In experiment 1, sixty-seven participants who were initially screened for low obsessive-compulsive behavior were invited to play a computerized game to gain points and avoid their potential loss. In Phase 1, they were exposed to a lean punishment schedule (relatively frequent point losses) and a dense schedule (highly frequent point losses). In Phase 2, they were tested on engagement in safety behaviors, where no punishment had been programmed. In experiment 2, twenty-two new participants were exposed to the lean punishment schedule followed immediately by the no point loss condition (Phase 2), one and two weeks after their initial exposure to the punishment conditions to test for the maintenance of safety behavior over time.
Results: Findings demonstrated that participants developed avoidance immediately, but safety behavior was developed and maintained only for those who were exposed to the lean punishment schedule.
Limitations: Prolonged exposure to dense punishment schedules may yield different results because the contrast between safe and aversive environments may be less discernible.
Conclusions: These findings are important because they provide experimental evidence on the conditions that render safety behaviors difficult to amend, and offer important recommendations for clinical practice.

1. Introduction

Punishment is widely defined as the presence of aversive events that elicit unpleasant emotions from the person (e.g., Azrin & Holz, 1966). It often results in reduction of the behavior that precedes the delivery of the aversive stimuli. Responding to aversive situations through escape and avoidance has a survival function for most species (Bolles, 1970). In the case of avoidance, the person prevents contacting the conditioned aversive stimuli (CS+), whereas escape is concerned with the instant removal of the primary punisher (UCS). By default, the engagement in either behaviors implies that the person is in danger. The maintenance of avoidance behaviors in safe environments, where there is no immediate threat, is known in the extant literature as safety-seeking behaviors (Angelakis & Austin, 2015a; Salkovskis, 1991). Safety behaviors constitute a common pathological trait or symptom in a number of clinical disorders, including obsessive-compulsive disorder (OCD; van de Hout & Kindt, 2004), and depression (Joiner & Metalsky, 2001).

Understanding further the pathological nature of safety behaviors has clinical value due to their counter-therapeutic character (Rachman, Radomsky, & Shafran, 2008). On one hand, there are those who propose that immediately reducing safety behaviors leads to better treatment outcomes, as they have been found to prevent individuals from experiencing disconfirmation of the existence of the aversive events in safe environments (Salkovskis, Hackmann, Wells, Gelder, & Clark, 2007; Sloan & Telch, 2002). On the other hand, there are those who propose that safety behaviors are important at the early stages of the treatment, as they seem to reduce treatment related anxiety and avoidance (De Silva & Rachman, 1984; Milosevic & Radomsky, 2008, 2013; Rachman, Craske, Tallman, & Solyom, 1986; Rachman, Shafran, Radomsky, & Zysk, 2011).

Meulders, Van Daele, Volders, and Vlaeyen (2016) conducted a meta-analysis where they compared both the inclusion and exclusion of

* Corresponding author. University of South Wales, School of Psychology, Pontypridd, Wales, CF37 1DL, UK.
E-mail address: ioannis.angelakis@southwales.ac.uk (I. Angelakis).

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safety behaviors on levels of fear reduction in anxious patients exposed to anxiety or fear provoking situations. The results were inconclusive and the debate on whether the removal of safety behaviors facilitates or hinders fear reduction in exposure-based interventions continues. One reason for this may be a lack of understanding of the contingencies that contribute to the development of avoidance and maintenance of safety behaviors in humans, especially if we consider that '*similar behaviors may serve dissimilar goals*'. Indeed, most research regarding the role of punishment on the etiology of safety behavior has been conducted in laboratory settings using mainly animal subjects (e.g., rats, pigeons or monkeys; for human examples, see Lovibond, Davis, & O'Flaherty, 2000) who are usually subjected to electric shocks (Azrin & Holz, 1966; Catania, 2008; Lerman & Vorndran, 2002; Spradlin, 2002). The current study, therefore, sought to examine more closely the contingencies under which both avoidance and safety behaviors are developed and maintained in humans by utilizing a treasure hunt game.

According to two-factor theory (Mowrer, 1951), avoidance or escape develop through a dual process of classical and operant conditioning. For example, the pairing of neutral stimuli with unconditioned aversive stimuli can transform them into conditioned warning signals (CS+); responses that remove these signals are strengthened through negative reinforcement (Dinsmoor, 1954, 1977). Any stimuli that become associated with the absence of aversive stimuli can become safety signals that act as conditioned positive reinforcers (CS−) for safety behaviors (Dinsmoor & Clayton, 1966). The association of either warning or safety signals also may occur with internal stimuli which are inevitable products of the organism's behavior (e.g., response-produced stimuli; Dinsmoor, 2001). For example, animal literature suggests that, even when warning or safety signals are absent, exposure to punishment results in high rates of avoidance (Dinsmoor, 1955; Sidman, 1953). There are two possible explanations of this. First, the organism's behavior results in response-produced stimuli that correlate with the aversive events and as such these stimuli acquire the capacity to function as internal warning signals. Second, the unavailability of such aversive events may be correlated with the response-produced stimuli of the behavior that terminated them (e.g., avoidance, escape) and as such they come to function as internal safety signals (Dinsmoor, 2001).

Research on avoidance behavior in humans has broadly followed the two-factor theory process. It utilizes response cost contingencies (e.g., point losses) with discrete-trial avoidance procedures through the use of computer-based programs (e.g., Molet, Leconte, & Rosas, 2006; Sheynin, Beck, Servatius, & Myers, 2014b; Sheynin et al., 2014a). These studies argue that the introduction of warning signals facilitates the acquisition of avoidance and that safety behaviors seem to be maintained by the production of safety signals, which have been associated with periods free of point losses (e.g., safety periods), strengthening thus their emission (see Dinsmoor & Sears, 1973; Rachman, 1984). They also suggest that the non-contingent presentation of safety signals seems to suppress their emission (Angelakis & Austin, 2018; Sheynin et al., 2014b), whereas both neutral and aversive stimuli can come to function as safety signals (Angelakis & Austin, 2015b).

The limited research available on punishment schedules with humans and animals suggests that increasing the schedule density by utilizing a higher ratio of punishers or lower intervals between the delivery of punishers (i.e., shock-shock intervals) results in quicker rates of suppression of the punished behavior. The employment of dense punishment schedules also has been found responsible for a quicker recovery rate of the punished behavior following their withdrawal, promoting thus better temporal discriminations (Azrin, 1956, 1960; Azrin, Holz, & Hake, 1963; Estes, 1944; Ferraro, 1967; Filby & Appel, 1966; Hendry & Van-Toller, 1964; Hunt & Brady, 1955; Pietras, Brandt, & Searcy, 2010; Zimmerman & Ferster, 1963). These findings are consistent with the sparse literature on the effects of dense punishment schedules on avoidance behavior suggesting its rapid acceleration under such schedules (Baer, 1960; Bolles & Popp, 1964; Cándido, González, & de Brugada, 2004; Dinsmoor, 1954; Sidman, 1953, 1962).

Although these studies are particularly informative with regards to the effects of dense punishment schedules on both the punished and avoidance behavior, they raise important questions in relation to the development of both avoidance and safety behaviors in humans. Specifically, *how does punishment schedule density affect the development of avoidance and safety behavior in humans? Do these schedules determine the maintenance of safety behaviors in danger-free environments?* In the absence of corresponding experimental data, we endeavored to investigate the effects of a lean and dense punishment schedule on the development of both avoidance and safety behaviors in humans. Given animal findings suggesting that dense punishment schedules produce higher rates of avoidance and promote better discrimination than lean schedules (Azrin & Holz, 1966), we hypothesized that participants who experience the dense punishment schedule will engage in higher rates of avoidance and also will cease engaging in safety behaviors more quickly in the safe environment than those who will be exposed to the lean punishment schedules.

2. General method

2.1. Participants

Participants were recruited via an opportunity and volunteer sample. Recruitment involved distributing adverts, which provided a link to the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002), that potential participants had to complete online via SurveyMonkey®. Due to the high levels of avoidance and safety behaviors typically present in those who self-report symptoms of obsessive-compulsive disorder, this approach ensured exclusion of this population (Deacon & Maack, 2008; McGuire et al., 2012). In particular, potential participants had to meet the following inclusion criteria: (1) Score up to a standard deviation or less above the mean of the study's measures, including the OCI-R (M = 18.82, SD = 11.10; Foa et al., 2002), the Dimensional Obsessive Compulsive Scale (DOCS; M = 10.57, SD = 9.83; Abramowitz et al., 2010), and the Beck Depression Inventory-II (BDI-II; M = 11.03, SD = 8.17; Storch, Roberti, & Roth, 2004), (2) Aged 18 + with no disability that would impede their participation (i.e., color blindness, physical limitations such as chronic leg pain), and (3) Be fluent in English. This study was granted university ethical approval prior to the advertising and recruitment of participants.

2.2. Measures

2.2.1. OCI-R

It is an 18-item questionnaire that measures distress related to common obsessive and compulsive symptoms, including checking, washing, obsessing, hoarding, ordering and neutralizing, on a 5-point Likert scale (Foa et al., 2002). Several studies have reported very good or excellent psychometric properties (Angelakis, Panagioti, & Austin, 2016).

2.2.2. DOCS

It is a 20-item self-report measure that assesses the severity of four OCD symptom dimensions: unacceptable thoughts, contamination, symmetry/ordering and responsibility for harm and mistakes (Abramowitz et al., 2010). Several studies have established the DOCS as a reliable measure of OCD symptoms (Viar, Bilsky, Armstrong, & Olatunji, 2011).

2.2.3. BDI-II

It comprises 21 items designed to measure the existence and the severity of depressive symptoms (Beck, Steer, & Brown, 1996; Yeung, Feldman, & Fava, 2010). The BDI-II has high internal consistency (Cook, Orvaschel, Simco, Hersen, & Joiner, 2004), and very good