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The cost of fear: Avoidant decision making in a spider gambling task

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ABSTRACT

Individuals with anxiety disorders typically avoid fear-relevant stimuli even if they miss potential rewards. However, few studies have accounted for such costs of fear-related avoidance in doing so. In this study, 51 spider fearful and 49 non-fearful participants completed the Spider Gambling Task, our modification of the Iowa Gambling Task, to investigate whether fear-relevant stimuli trigger avoidant decisions in the presence of potential rewards. In one version, advantageous choices were associated with pictures of spiders, whereas the same pictures were associated with disadvantageous choices in another version. Fearful participants generally avoided choices associated with pictures of spiders, which resulted in lower overall gains in the version with advantageous spider decks. Although this relative avoidance was sustained, fearful participants progressively approach more advantageous spider choices. These findings demonstrate that phobic fear results in irrational avoidant decisions which can result in considerable cost. Potential long-term rewards for approach may, however, diminish absolute avoidance behavior.

1. Introduction

Avoidance behavior is a diagnostic criterion of all anxiety disorders and is considered to contribute to their development as well as maintenance (Craske et al., 2009; Lovibond, 2006). Avoidance and escape are generally thought to be triggered by strong emotional responses to fear-relevant stimuli or situations, which emerge after preferential processing of these stimuli (Gerdes & Alpers, 2013; Gerdes, Pauli, & Alpers, 2009). Such responses can, for example, be seen in heightened self-reported fear and psychophysiological reactions (Alpers, Adolph, & Pauli, 2011; Lang, Greenwald, Bradley, & Hamm, 1993; Pittig, Arch, Lam, & Craske, 2013). As long as avoidance is the central mode of operation towards fear-relevant stimuli, it prevents extinction of fearful responses (Lovibond, Mitchell, Minard, Brady, & Menzies, 2009). Due to avoidance behavior patients suffer substantial costs because they are often not able to pursue other goals and are impaired in relevant situations (Kashdan, Elhai, & Breen, 2008).

While avoidance behavior has usually been assessed through interviews, questionnaires, and behavioral approach tests (BATs), research has recently turned to the laboratory study of more subtle mechanisms of avoidance. For example, avoidance has been documented to result in shorter viewing times of phobia-related pictures (Mogg, Bradley, Miles, & Dixon, 2004; Tolin, Lohr, Lee, & Sawchuk, 1999). With eye-tracking, it has been shown that fearful individuals turn away their gaze from fear-relevant stimuli (Pflugshaupt et al., 2005; Rinck & Becker, 2007). In addition, clinical studies verified reductions of behavioral avoidance by comparing performance in BATs before and after psychological treatments (Williams, Kinney, & Falbo, 1989; Zoellner, Echiverri, & Craske, 2000). Such paradigms provide important insight into avoidance responses towards discrete fear-relevant stimuli.

Adaptive behavior, however, also requires the individual to obtain rewards or positive consequences. When anxious individuals rationally think about aversive situations, even the most aversive situations are explicitly recognized to foster potential personal benefits (Kashdan et al., 2008). Avoidance of discrete fear-relevant stimuli without conflicting approach motivation seems rather adaptive and may not resemble pathological avoidance in anxiety disorders (see adaptive conservatism; Hendersen, 1985). Thus, the fear responses and behavioral avoidance per se are only one part of a complex conflict of deciding to avoid fear-relevant stimuli to reduce fear or approach to gain potential benefits. Pathological avoidance in the framework of this approach-avoidance conflict is, then, characterized by a dysfunctional shift towards avoidant decisions that result in severe impairments for the individual (see also Stein &

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Paulus, 2009). At the same time, offering rewards for approach fear-relevant stimuli may result in diminished behavioral avoidance. A reduction of avoidance behavior relates to common treatment goals for anxiety disorders. Studies investigating avoidance in anxious individuals should, therefore, account for both fear-relevant as well as reward-related stimuli and consequences to better resemble the everyday fear and anxiety and their treatment.

Well-established decision-making paradigms may provide useful tools to investigate these avoidant decisions triggered by fear-relevant stimuli. Decision-making paradigms can combine fear- and reward-relevant stimuli and offer explicit choices between approach and avoidance of the fear-relevant stimuli. Importantly, such paradigms can account for the costs of avoidance, measured as fewer rewards or larger losses, and potential changes in avoidance due to the learning of such rewards and losses. Recent decision-making research also emphasized the interplay of cognitive evaluations of potential rewards and emotional processes (Bechara, Damasio, Tranel, & Damasio, 1997; Brand, Labudda, & Markowitsch, 2006; Loewenstein, Weber, Hsee, & Welch, 2001). In this regard, a particular well-investigated task to simulate real life decision making and its emotional influences is the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Tranel, & Damasio, 2000). The IGT has been administered to various healthy and clinical populations (for a review see Dunn, Dalgleish, & Lawrence, 2006). Briefly, the IGT offers different choices in form of four card decks, which are associated with different short- and long-term gains and losses. Decks with high immediate gains also yield very high occasional losses, resulting in long term loss, decks with small immediate gains result in long term gain, because they only yield small occasional losses. However, the participant has to uncover this contingency over time. Most importantly, although cognitive evaluations of rewards and losses are crucial for advantageous decision making, choices in the IGT seem to be influenced by an emotional bias (Bechara et al., 1997), which is may be stronger for initial decisions under uncertainty (Brand, Recknor, Grabenhorst, & Bechara, 2007).

Recently, the IGT has been used to investigate the influences of anxiety on general decision making. Findings indicate that patients with generalized anxiety and obsessive-compulsive disorder are generally impaired while deciding under uncertain conditions (Cavedini et al., 2002; Mueller, Nguyen, Ray, & Borkovec, 2010; Starcke, Tuschen-Caffier, Markowitsch, & Brand, 2009). Furthermore, there has been no consistent pattern of results with respect to trait anxiety. While one study found that individuals with higher trait anxiety make more advantageous choices resulting in long term gain (Werner, Duschek, Mattern, & Schandry, 2009), another one found the opposite pattern (Miu, Heilman, & Houser, 2008). Avoidant decisions due to the confrontation with a fear-relevant stimulus have not been investigated in the framework of an approach-avoidance conflict. These studies, however, clearly demonstrate the need to control for general levels of unspecific trait and state anxiety.

The present study investigated avoidant decision making as a result of an approach-avoidance conflict. Pictures of spiders were added to the original IGT to specifically investigate how the learning of advantageous choices to maximize overall gains is influenced by specific fear-relevant stimuli. Individuals with and without spider fear were recruited and invited to play this Spider Gambling Task (SGT). In order to maintain the original goal (maximize gain and minimize loss) and examine the emotional effects of the fear-relevant stimuli at the same time, the different stimuli were absolutely task-irrelevant (see Gerdes, Alpers, & Pauli, 2008). Thus, adequate rational behavior would be to only pay attention to the constant feedback of gains and losses and ignore the pictures. Avoidance of the fear-relevant stimuli would, however, reduce advantageous choices of fearful participants, if the spider pictures are associated with an advantageous decision strategy. Here, avoidant decisions would consequentially result in long-term costs for these individuals. Following this, spider fearful participants (SFP) were expected to perform better relative to non-fearful control participants (NFP), when spider pictures are associated with disadvantageous choices (non-conflict version), but perform worse when spider pictures are associated with the advantageous decks (conflict version).

2. Materials and methods

2.1. Participants

Altogether, 100 volunteers participated in the study. Participants were recruited from the general population by advertisements in local newspapers and from the student body of Bielefeld University. They were preselected according to their scores on the German version of the Fear of Spider Questionnaire (Rinck et al., 2002). Following Rinck et al. (2002), participants with scores between 0 and 6 were assigned to the NFP group, participants with a score of 15 or higher to the SFP group (see also Materials and Procedures). Due to possible effects on SGT performance, additional exclusion criteria for all participants were age younger than 20 years or older than 55 years (Denburg, Tranel, & Bechara, 2005); any neurological or other current severe medical condition or organic/traumatic brain damage, and current use of psychoactive medication. All participants volunteered to participate and provided written informed consent prior to the experiment. Participants were randomly assigned to one of the two SGT versions with respect to balanced gender ratio within groups.

Descriptive data of the four experimental groups (2 fear groups × 2 SGT versions) are shown in Table 1. Statistical analysis (one way ANOVAs, Kruskal–Wallis H tests and a χ^2 test for gender ratio) showed significant differences between the experimental groups only for fear of spiders (FSQ). Post-hoc Mann–Whitney U tests (Bonferroni corrected) indicated significant higher fear of spiders scores for both fearful groups compared to each non-fearful group, $Us < 0.001$, $zs = -6.22$ to -6.04, $ps < .001$. No significant differences were found between fearful groups, $U = 237.5$, $z = -1.65$, $p = .099$, or between non-fearful groups, $U = 230.5$, $z = -1.53$, $p = .127$. For fear of spiders, previous clinical samples with diagnosed spider phobia (DSM-IV; American Psychiatric Association, 2000) exhibited average FSQ scores from 20 (Gerdes et al., 2008; Pflugshaupt et al., 2007) up to 90 (Alpers et al., 2009; Muris & Merckelbach, 1996; Rinck & Becker, 2006; Teachman & Woody, 2003). Thus, the average level of fear in the present analogue sample of highly fearful participants ($M = 65.98$, $SD = 25.69$) was comparable to the level of clinically diagnosed patients with spider phobia and even slightly higher than the normative patient group ($M = 58.7$, Rinck et al., 2002). In addition, the average level of fear was much higher than in patients with spider phobia after exposure treatment (Muris & Merckelbach, 1996; Teachman & Woody, 2003). No significant group differences were found for the other demographic, clinical, and neuropsychological variables, i.e. groups were not different in terms of age, gender ration, education, state and trait anxiety, reasoning, risky decision making, or executive functioning.

2.2. Materials and procedure

A screening for eligibility included questions about sociodemographic data, exclusion criteria, and the German version of the Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995; German version: Rinck et al., 2002). The FSQ is a widely used self-report questionnaire and assesses fear of spiders with 18 items (7-point Likert scale; 0 = *Not at all* to 6 = *Absolutely*). For analyses, a sum score