J. Behav. Ther. & Exp. Psychiat. 45 (2014) 26–32

Contents lists available at ScienceDirect

Journal of Behavior Therapy and Experimental Psychiatry

journal homepage: www.elsevier.com/locate/jbtep

Cognitive bias in action: Evidence for a reciprocal relation between confirmation bias and fear in children

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ARTICLE INFO

Article history:
Received 22 February 2013
Received in revised form
10 July 2013
Accepted 11 July 2013

Keywords:
Cognitive bias
Confirmation bias
Anxiety
Fear
Children

ABSTRACT

Background and objectives: Some cognitive models propose that information processing biases and fear are reciprocally related. This idea has never been formally tested. Therefore, this study investigated the existence of a vicious circle by which confirmation bias and fear exacerbate each other.
Methods: One-hundred-and-seventy-one school children (8–13 years) were first provided with threatening, ambiguous, or positive information about an unknown animal. Then they completed a computerized information search task during which they could collect additional (negative, positive, or neutral) information about the novel animal. Because fear levels were repeatedly assessed during the task, it was possible to examine the reciprocal relationship between confirmation bias and fear.
Results: A reciprocal relation of mutual reinforcement was found between confirmation bias and fear over the course of the experiment: increases in fear predicted subsequent increases in the search for negative information, and increases in the search for negative information further enhanced fear on a later point-in-time. In addition, the initial information given about the animals successfully induced diverging fear levels in the children, and determined their first inclination to search for additional information.
Limitations: As this study employed a community sample of primary school children, future research should test whether these results can be generalized to clinically anxious youth.
Conclusions: These findings provide first support for the notion that fearful individuals may become trapped in a vicious circle in which fear and a fear-related confirmation bias mutually strengthen each other, thereby maintaining the anxiety pathology.

1. Introduction

Cognitive theories have proposed that information processing biases are involved in the onset and maintenance of phobias and anxiety disorders (e.g., Beck, Emery, & Greenberg, 1985). There is much evidence from studies with adult populations that high levels of fear and anxiety are accompanied by various types of cognitive distortions (for a review, see Mathews & Macleod, 1994), and during the past decade this has been demonstrated for children as well (for reviews see Hadwin, Garner, & Perez-Olivas, 2006; Muris & Field, 2008). Most research in this area is cross-sectional in nature, and basically shows that fearful and anxious individuals display biases in attention, interpretation, and memory when processing threat-related cues (Harvey, Watkins, Mansell, & Shafran, 2004). Further, there is evidence from experimental studies showing that when fear is induced by providing threatening information (Field & Lawson, 2008; Muris, Rassin, et al., 2009; Remmerswaal, Muris, Mayer, & Smeets, 2010) or conducting an avoidance training (Huijding, Muris, Lester, Field, & Joosse, 2011), children acquire fear-related cognitive biases. Finally, research has shown that such cognitive biases can be reduced by effective treatment (e.g., Cederlund & Öst, 2011; Mathews, Mogg, Kentish, & Eysenck, 1995). All these studies underline that there is an intimate link between fear/anxiety and cognitive biases.

Direct evidence for the claim that cognitive biases are causally implicated in the development of fear and anxiety is far more sparse. In an attempt to explore this issue, Mathews and Mackintosh (2000) developed an innovative experimental procedure to induce

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http://dx.doi.org/10.1016/j.jbtep.2013.07.005

interpretation bias and examined subsequent effects on anxiety. More precisely, these researchers presented adult participants with ambiguous vignettes which all ended with a word fragment. Participants were instructed to complete these word fragments in such a way that the vignettes were disambiguated either positively or negatively, dependent on the training condition they were randomly assigned to. Results showed that interpretation bias can be successfully trained in either a positive or a negative direction, and most importantly that this has subsequent effects on anxiety. That is, participants who were trained to interpret vignettes in a positive way showed a clear decrease in anxiety, whereas subjects who were trained to interpret the ambiguous vignettes more negatively displayed a significant increase in anxiety. Since this pioneering research, various studies have demonstrated that it is possible to train information processing biases in adults, and to induce marked changes in anxious mood (e.g., MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Mathews, Ridgeway, Cook, & Yiend, 2007).

The investigation of the pathogenesis of childhood anxiety is particularly important, because anxiety disorders belong to the most prevalent types of psychopathology among youths (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003), and often continue to be problematic until adulthood (Öst, 1987). Recently, research has begun to examine the effects of bias modification on anxiety in children. Muris, Huijding, Mayer, and Hameetman (2008) and Muris, Huijding, Mayer, Remmerswaal, and Vreden (2009) employed an experimental method called the "Space Odessey" paradigm in which children were invited to disambiguate brief vignettes describing open-ended situations they would encounter on an imaginary journey to an unknown planet in either a positive or a negative way. Results indicated that the procedure was successful in training children towards a positive or negative interpretation bias, which was associated with congruent effects on fearful avoidance tendencies. Using an adapted but highly similar approach, Lester, Field, and Muris (2011a, 2011b) and Salemink and Wiers (2011) recently demonstrated successful bias modification and subsequent effects on children's animal fear, social fears and trait anxiety, while Vassilopoulis, Banerjee, and Prantzalou (2009) showed that a positive bias modification can be employed in socially anxious children to decrease social anxiety.

Studies using bias modification paradigms yield support for the notion that information processing biases play a causal role in fear and anxiety pathology. Even so, a number of critical issues remain to be resolved. First, because in previous studies children and adults were explicitly trained to process information in a certain way, it remains unclear how processing biases develop, and how such biases influence fear and anxiety in a more natural situation. Second, this research has only focused on the impact of biases on fear and anxiety, but did not look at the reverse direction of causation, namely the effect of fear and anxiety on information processing biases. It is generally assumed that there is a reciprocal relation of mutual reinforcement between information processing biases and fear/anxiety, with one strengthening, or at least maintaining, the other (Mathews & Macleod, 1994; Muris & Field, 2008). To the present authors' knowledge, however, there are no studies that have examined this bidirectional relationship between information processing bias and fear/anxiety. The results of such an experiment could have important implications for our understanding of how information processing biases work in real life.

A prominent example of an anxiety-related information processing bias is the confirmation bias, which refers to the inclination to selectively search for information that confirms danger, while ignoring information that disconfirms threat (Harvey et al., 2004). Previous research has demonstrated that this type of bias occurs in adults with health concerns (Smeets, De Jong, & Mayer, 2000), hypochondriasis (De Jong, Haenen, Schmidt, & Mayer, 1998), spider phobia (De Jong, Mayer, & Van den Hout, 1997), and children who have acquired fear for a novel animal after being provided with threatening information (Remmerswaal et al., 2010). To measure confirmation bias, we designed the Information Search Task (IST), a computerized procedure during which participants can acquire pieces of additional (threat) information about an upcoming stimulus or situation. Interestingly, because iterative fear assessments can be easily incorporated in the IST, this experimental procedure is pre-eminently suitable for examining the bidirectional relation between information processing bias and fear/anxiety.

With this in mind the present investigation employed the IST to study a cognitive bias in real-time action by exploring reciprocal relations between confirmation bias and fear in children aged 8–13 years. The participants were shown the picture of an unknown animal for which they received either threatening, positive, or ambiguous information in order to ensure clear variation in fear beliefs. Then children conducted the IST during which they could repeatedly collect additional (threatening, positive, or neutral) information about the behaviour and living habits of the animal. The computer always provided the children with the confirming information. Before, during, and after the IST, children's fear levels of the animal were assessed. In this way, it became possible to explore the effects of fear on confirmation bias, and vice versa of confirmation bias on fear, thereby uncovering the often hypothesized feedback loop between cognitive bias and fear/anxiety (Mathews & Macleod, 1994; Muris & Field, 2008). More precisely, we not only expected that: (1) higher fear levels in relation to the novel animal would be accompanied with a stronger tendency to search for threatening information (i.e., confirmation bias) and a weaker inclination to search for positive information, but also that (2) the search for differentially valenced information has diverging relations with subsequent fear levels. That is, the search for negative information will be associated with higher levels of later fear, whereas the search for positive information will be related to lower levels of fear.

2. Method

2.1. Participants

Children were recruited from eight primary schools in the south-western part of the Netherlands. Children and parents received an information letter along with a consent form and were asked to return the completed form to the researchers within approximately one week. One-hundred-and-seventy-one children (100 girls, 71 boys) aged between 8 and 13 years ($M = 10.35$, $SD = 1.06$) eventually participated in this experiment. This represented 18% of those who were initially approached. The majority of the children (i.e., 90%) were from original Dutch descent (as indicated by the ethnic background of their parents). The remaining part came from various countries in North-America ($n = 11$), Europe ($n = 9$), Asia ($n = 8$), and Africa ($n = 3$).

2.2. Animal and information

To ensure that children would display varying levels of fear towards the animal, we used Field et al.'s (2001) informational learning procedure. Thus, some children were provided with threatening information, whereas others received ambiguous or even positive information about the animal. Each child was shown the picture of an Australian marsupial (either a Cuscus, a Quoll, or a Quokka), which was downloaded from the internet and printed on an A4-sheet. This type of animal is unknown to young people in the Netherlands, and because of this lack of prior experience it can be assumed that children have no prior ideas about its life style. Three