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Short report

An informational pathway to the development of a contamination-related memory bias

Adam S. Radomsky*, Jessica M. Senn, Monique Lahoud, Laurie A. Gelfand

Concordia University, Department of Psychology, Montreal, QC, H4B 1R6, Canada

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ABSTRACT

Background and objectives: Following from previous research in which post-encoding suggestions of threat led to the development of a memory bias (in the presumed absence of an attentional bias; Senn & Radomsky, 2012), we sought to examine whether the development of a similar threat-relevant memory bias could be fostered via a purely informational pathway.
Methods: A vignette about a classroom interaction was read aloud to ($n = 96$) undergraduate participants who then completed a post-encoding recall test. Participants were told that the experimenter forgot to read the last sentence of the vignette, and were then randomly assigned either to the Threat condition, in which the additional statement indicated that a character in the vignette had a highly contagious flu, or to the No-Threat condition, in which the additional statement indicated that a character in the vignette had been accepted to graduate school. A second recall test was then administered.
Results: Participants in the Threat condition (but not those in the No-Threat condition) demonstrated aproportionate memory bias in favor of threatening information. This bias was not evident at the initial recall test.
Limitations: Time spent engaging in active recall was not assessed. Also, although the study was designed to minimize demand characteristics, it is possible that these played a role.
Conclusions: An explicit memory bias for threat can be created through informational means alone, even when no threat was present at encoding. Results are discussed in terms of pathways to fear and of cognitive approaches to understanding and treating anxiety disorders.

Theories involving emotion and cognition posit that attention, interpretation and memory are biased toward emotionally-relevant content, particularly when such content is personally significant or meaningful (Bower, 1981; Kovacs & Beck, 1978; Radomsky & Rachman, 2004). Research on memorial biases in association with anxious arousal and/or anxious psychopathology is inconclusive (see Coles & Heimberg, 2002; Mitte, 2008 for reviews). Most studies failing to detect a memory bias employed methods based in traditional cognitive science research (e.g., learn, and then later recall lists of words) and/or stimuli which were low in ecological validity (e.g., word list learning). The failure to detect explicit memory biases in association with anxiety led to other theories which attempted to explain this in the context of well-demonstrated attentional biases, by highlighting differences between the activation of cognitive structures and their recollection (e.g., Mogg, Mathews, & Weinman, 1987).

A number of researchers took a more ecologically valid approach to studying memory in association with anxious arousal employing contaminated objects (Radomsky & Rachman, 1999), threatening objects (Tolin et al., 2001), objects which were the subject of extant repeated checking by study participants (Radomsky, Rachman, & Hammond, 2001), internal physiological sensations among those concerned about social evaluation/social performance (Ashbaugh & Radomsky, 2009, 2011; Mansell & Clark, 1999) and on the whole, were better able to detect the memory biases proposed by earlier theorists. A number of reviews of the literature have concluded that explicit memory biases for threat/in association with anxious arousal are present under ecologically valid conditions (e.g., Coles & Heimberg, 2002; Mitte, 2008; Muller & Roberts, 2005).

In virtually all of these studies, stimuli designed to convey threat (contrasted against those designed to be neutral) were encoded during an early part of the study, and participants were later asked to recall, recognize and/or otherwise remember these stimuli. This

* Corresponding author. 7141 Sherbrooke St. West, Montreal, QC, H4B 1R6, Canada. Tel.: +1 514 848 2424; fax: +1 514 848 4523.
E-mail address: adam.radomsky@concordia.ca (A.S. Radomsky).

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approach is entirely consistent with attempts to understand the role(s) that cognition (including memory) might play in the maintenance of anxious psychopathology; unfortunately, it lends itself to a rather important limitation. Namely, it is impossible to determine whether any observed bias in recall or recollection is simply the result of biases in attention. That is, if participants are known to allocate preferential attentional resources to threatening stimuli (during encoding, for example), it would not be surprising if such stimuli were better remembered (during retrieval). Indeed, recent work in depression has shown that attentional biases can cause memory biases (Blaut, Paulewicz, Szastok, Prochwicz, & Koster, 2013). Further, although consistent with approaches to understanding the *maintenance* of anxiety-related problems, this methodology does not lend itself well to questions and constructs related to the *development* or onset of anxiety-related problems.

Recently, we demonstrated that a memory bias could be detected following a combination of direct experience and information in the absence of attentional bias at encoding (Senn & Radomsky, 2012). Undergraduate participants were asked to interact with a series of 30 neutral objects displayed in two boxes. Following a baseline recall test, participants were randomly assigned to the threat condition (in which they were told that one box was used to hold a tarantula while its terrarium was cleaned; the live tarantula was shown to participants during this manipulation), or the control condition (in which they were told that one box was used to hold the laboratory's printer paper; the paper was shown to participants during this manipulation). Importantly, the other (unmanipulated) box was described across both conditions as in use for the study only. A second free recall test was then administered. Results showed a significantly greater proportion of spider box to unmanipulated box items recalled compared to the proportion of paper box to unmanipulated box items recalled. This difference was not evident at baseline. To our knowledge, this was the first study to demonstrate a memory bias for threat in the presumed absence of an attentional bias (indeed, although attention was not assessed, all objects were neutral at encoding, as no threatening information – or spiders were introduced until after encoding). Further, the experiment demonstrated how such biases might form, in this case through a combination of direct experience (with a live tarantula) and information (connecting the tarantula to some of the objects with which participants had previously interacted). (These results are also consistent with false memory research, where information provided at a later time is integrated with old information to create a new comprehensive memory (e.g., McCloskey & Zaragoza, 1985)).

We propose that consistent with pathways to the development of fear in humans (i.e., direct conditioning, vicarious conditioning, information, and prepared) described by Rachman (1977), there should be similar pathways to the development of memory bias in association with threat/anxiety. The goal of the present study was to assess a purely informational pathway (i.e., without direct experience) to a contamination-related memory bias via a vignette-based experiment. We hypothesized that when provided with threatening information about some of the previously encoded material, participants would display a proportionate memory bias compared to those provided with neutral information about previously encoded material.

Method

Participants

Participants were (n = 96) undergraduate students who participated either for course credit or entry in a cash draw. Participants were on average 21.73 (SD = 5.63) years of age and the majority (81.2%) were female. There were no age ($t(94) = 0.99$, $p = .33$) or sex ($\chi^2(1) = 0.01$, $p = .92$) differences between the two conditions (see below).

Measures

Beck Anxiety Inventory (BAI; Beck & Steer, 1990) and *Beck Depression Inventory-2* (BDI-II; Beck, Steer, & Brown, 1996). The BAI and BDI-II are both well used 21-item questionnaires that assess symptoms of anxiety and depression respectively. In the current study, internal consistencies of these scales were α's = 0.91 and 0.90, respectively.

Vancouver Obsessional Compulsive Inventory (VOCI; Thordarson et al., 2004). The VOCI is a 55-item questionnaire assessing a range of obsessive-compulsive symptoms, including a contamination subscale. The scale has high test-retest reliability (0.91), and internal consistency ($\alpha = 0.96$; Radomsky et al., 2006). Convergent and divergent validity are excellent (Radomsky et al., 2006; Thordarson et al., 2004). Internal consistency in the current sample was $\alpha = 0.95$.

Memory recall test

Both prior to and following the manipulation (see below) participants were asked to write down everything they could recall from a vignette that was dictated earlier in the study. They were given 5 min to complete this task.

Manipulation check questions

Both prior to and following the manipulation (see below) participants rated their anxiety, urge to neutralize their anxiety, and urge to wash their hands on a scale from 0 ('not at all') to 100 ('extremely').

Materials

A short vignette was created describing the experience of an individual completing a group project with two other students. Some of the information mentioned in the vignette relates to physical contact or exchange of items that have been touched (e.g., borrowing pens, shaking hands), while other information is about the person's life or appearance (e.g., number of siblings, type of shoes). The vignette includes details about these and other aspects for both students (e.g., the type of pen each student was using). The vignette is available upon request from the first author.

Procedure

Participants were asked to close their eyes and imagine themselves as the individual in the vignette as the experimenter read the vignette aloud. Participants then responded to emotion state questions (see *Measures*), completed a distractor task, and finally a recall memory test. Participants were then informed that the experimenter had accidentally read an old version of the vignette and had thus forgotten to read the last sentence, at which time this sentence was provided. The content of this additional sentence depended on the condition to which the participant was randomly assigned (Threat or No-Threat). In the Threat condition participants were told that one of the students has a highly contagious flu. In the No-Threat condition participants were told that one of the students was just accepted to graduate school. For each participant one of the students in the vignette had additional information reported about them (the 'manipulated' individual), and no new information was provided about the other student (the 'un-manipulated' individual). Which student became the manipulated individual was counterbalanced across participants.