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Is manipulation of mood a critical component of cognitive bias modification procedures?

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ABSTRACT

This paper investigates whether changes in mood state are an important component of *cognitive bias modification* (CBM) procedures. In a novel CBM procedure participants read either positive or negative statements relating to social issues for 5 min. Interpretation bias was measured by means of a scrambled sentence test, which was presented both before and after the CBM procedure. Participants who read the positive statements made more positive resolutions to the scrambled sentences, while participants who read the negative statements made more negative resolutions. Thus, the appropriate positive and negative interpretative biases were induced by the CBM procedure. However, significant mood changes also occurred following CBM. In Experiment 2, a musical mood induction procedure was presented with depressing or elating music. As before, a scrambled sentence test was presented both before and after the musical mood induction. Mood changed in accordance with the valence of the music to the same extent as with CBM. Critically however, performance on the scrambled sentence task did not change for both groups. This demonstrates that a change in mood state is not sufficient for a change in cognitive bias to occur.

General introduction

Cognitive models of emotional vulnerability suggest that negative biases in information processing contribute to emotional distress (Beck & Clark, 1988; Mathews & Mackintosh, 1998; Williams, Watts, MacLeod, & Mathews, 1988, 1997). The assumption is that when anxious individuals experience a stressful situation, they are more likely than non-anxious people to appraise ambiguous information as threatening and to allocate processing resources towards the threat (see Mineka, Rafaeli, & Yovel, 2003 for a review). Cognitive models (e.g. Williams et al., 1988,1997) propose that these selective processing biases serve to generate and maintain anxiety states. While many studies have confirmed that cognitive biases towards negative material are a key feature of emotional disorders (Eysenck, Mogg, May, Richards, & Mathews, 1991; MacLeod, Mathews, & Tata, 1986; Richards & French, 1992), the causal nature of the relationship remains unclear.

The development of procedures designed to actively modify cognitive biases has generated great interest since they allow the causal hypothesis to be directly tested. A number of *cognitive bias modification* (CBM) procedures have been developed and have shown that both the interpretation of ambiguous material and the allocation of attention can be successfully modified in a laboratory context (see Fox, 2008; MacLeod, Koster, & Fox, 2009; Yiend & Mackintosh, 2004 for reviews). Importantly, experimentally induced biases have been shown to have a direct causal impact upon emotional vulnerability (Hirsch, Mathews, & Clark, 2007; Holmes, Lang, & Shah, 2009; Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Murphy, Hirsch, Mathews, Smith, & Clark, 2007; Wilson, MacLeod, Mathews, & Rutherford, 2006). To illustrate, participants "trained" to interpret information in a positive manner report less feelings of anxiety than participants "trained" to interpret ambiguous information in a negative manner during a subsequent experimental stress situation (e.g., Mackintosh et al., 2006). CBM research is important, in that, by experimentally modifying cognitive biases a causal as opposed to a purely associative relationship between processing style and emotional experience can be demonstrated. Several results to date support cognitive models of psychopathology in demonstrating that cognitive biases can causally contribute to emotional status. Such findings also open up the possibility that CBM procedures may be used as therapeutic procedures to target and modify "toxic" biases in emotional disorders (e.g., MacLeod et al., 2009).

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However, a potential problem with CBM is that CBM procedures often have a strong effect on mood state as well as on cognitive bias. This makes it very difficult to assess whether changes in mood and/or changes in cognitive biases are driving the emotional vulnerability effects. For example, the common scenario-based CBM procedure designed to modify interpretative bias is particularly vulnerable to inducing a mood change as well as a cognitive change (Holmes & Mathews, 2005; Mathews & Mackintosh, 2000; Salemink, van den Hout, & Kindt, 2007). To overcome this entanglement between mood and cognitive bias, researchers have allowed participants a rest period after the induction phase of CBM, enabling mood to stabilise before testing for a change in cognitive bias (Holmes, Mathews, Dalgleish, & Mackintosh, 2006). The rationale is that if mood state is equivalent across the two valence-opposing CBM groups whilst a difference in interpretation bias still exists, then the change in cognitive bias cannot be due to a mood change. While this seems reasonable, it is nevertheless possible that the mood change that occurred during the induction phase could have had a latent influence upon the subsequent change in cognitive bias.

The aim of the current study was to assess whether a change in mood state is a sufficient condition for a change to occur in cognitive bias. Two experiments were conducted, both of which were expected to change mood state, but only one of which was expected to influence cognitive processing. The critical question was whether a change in mood state alone would be enough to induce a change in cognitive bias. Thus, in Experiment 1 a modified CBM procedure was used whereby participants read statements rather than scenarios. In Experiment 2, a standard musical mood induction procedure was used since music, from an emotivist viewpoint, is assumed to directly influence mood without affecting cognitive processes (Kivy, 1990; Schellenberg, Nakata, Hunter, & Tamoto, 2007). If mood change is a critical component of CBM then a cognitive change should occur in both experiments. Alternatively, if changes in bias are due to a change in processing style rather than a change in mood state, then cognitive bias should only be modified in Experiment 1.

Experiment 1

Introduction

Traditional scenario-based CBM typically involves 100 scenarios of three lines in length followed by a word stem completion task and comprehension question e.g.,

> "*Your partner asks you to go to an anniversary dinner that their company is holding. You have not met any of their work colleagues before. Getting ready to go, you think that the new people you will meet will find you——*"
> Either "*bo-ing*" (boring) or "*fri- - dly*" (friendly).
> "*Will you be liked by your new acquaintances?*", (Mathews & Mackintosh, 2000)

The scenarios remain ambiguous until the final word stem is resolved, which then defines the valence of the scenario. The assumption is that the final word stem completion induces people to interpret ambiguous information in either a positive or a negative way. However, Mackintosh, Mathews, Yiend, Ridgeway, and Cook (2006, Experiment 2) successfully induced an interpretative bias in addition to obtaining an emotional vulnerability effect using CBM scenarios without the word fragment. Instead, the valence defining word stem was presented as a complete and final word in the scenario. This study therefore showed that CBM can be successful without the need for participants to actively generate valenced meaning (but see Hoppitt, Mathews, Yiend, & Mackintosh, in press for emotion change and imagery with respect to active training). Moreover, Holmes and Mathews (2005); Holmes et al. (2006, 2009) have also achieved changes in interpretation bias and mood without a word fragment *or* comprehension question. Thus the studies by Mackintosh et al. and Holmes and colleagues suggest that the original interpretative CBM methods may have been unnecessarily lengthy and over-complicated.

However, the scenarios designed by Mackintosh et al. (2006) and Holmes and Mathews (2005); Holmes et al. (2006, 2009) still retain the feature of initial ambiguity with disambiguation occurring in the final word or words of each scenario. The present experiment attempts to further streamline scenario-based CBM and test whether this *initial ambiguity* is a key requisite of successful scenario-based CBM procedures. Participants were presented with short statements that do not withhold valence. Furthermore, the statements were presented in the first person singular. A large body of research has shown that a field perspective yields a greater sense of "living the experience" and vividness when recalling scenes (Williams & Moulds, 2008; but see Ayduk & Kross, 2008 for disadvantages of a field perspective). An observer perspective is thought to be used as a cognitive avoidance strategy in order to increase personal detachment from a given remembered situation (McIsaac & Eich, 2004; Williams & Moulds, 2007). A field perspective encouraging increased personally relevant processing may boost the capability of CBM procedures to induce changes in cognitive biases (see Holmes, Coughtrey, & Connor, 2008).

Experiment 1 therefore presented participants with short valenced statements, in the first person singular, relating to either social anxiety or confidence. Visual analogue mood scales (VAMS) were used to measure mood state before and after the manipulation and the Scrambled Sentence Test (SST) (Wenzlaff, 1993) was used to measure interpretation bias both before and after the induction. The SST has been used previously as an index of interpretation bias within CBM research (e.g., Holmes et al., 2009). The SST includes a concurrent memory task which is claimed to disable strategic processing (Rude, Vladez, Odom, & Ebrahimi, 2003; Wenzlaff & Bates, 1998). Thus experimenter demand as a conscious process is unlikely to occur. Based on previous findings using a similar scenario CBM paradigm, the hypothesis is that both interpretation style and mood will change from pre to post manipulation in line with the valence of the statement-based CBM.

Method

Participants

Thirty participants were recruited from a departmental open day for A′ level psychology students. There was a gender distribution of 25 females and 5 males. The age range was 17–21 years with a mean of 17.6 years.

Apparatus

The stimuli were presented to participants via booklets and a set of 30 cards.

Materials

Scrambled sentences. The stimuli consisted of 40 scrambled sentences. Each scrambled sentence comprised of six words randomly ordered in an ungrammatical form. Five of the six words from each sentence could be selected and ordered to form one of two possible coherent sentences. One sentence had a positive resolution and the other sentence had a negative outcome. The six word, scrambled, sentences were initially taken from statements in the Fear of Negative Evaluation (FNE) and Social Avoidance and Distress scales (SADS) (Watson & Friend, 1969) and then modified in order to enable formation of two possible five word coherent sentences, one