



## Cognitive bias modification for attention and interpretation reduces trait and state anxiety in anxious patients referred to an out-patient service: Results from a pilot study

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### ABSTRACT

It is well established that anxious individuals show biases in information processing, such that they attend preferentially to threatening stimuli and interpret emotional ambiguity in a threatening way. It has also been established that these biases in attention and interpretation can causally influence anxiety. Recent advances in experimental work have involved the development of a paradigm known as Cognitive Bias Modification (CBM), a constellation of procedures which directly modify bias using computerised tasks. Excitingly, these procedures have been shown to reduce bias in attention to threat (CBM-A), and to promote a positive interpretive bias (CBM-I) in anxious populations; furthermore, these modifications are associated with reductions in anxiety. We believe that these techniques have the potential to create a real clinical impact for people with anxiety. Initial studies involved volunteer participants who reached criteria for clinical diagnoses to be made, but emerging evidence suggests that patients referred for therapy also benefit. For the purposes of experimentation researchers have normally looked at one procedure at a time. In order to try to maximise the potential clinical impact we wished to investigate whether the combination of the procedures would be more effective than either alone. We also wished to investigate whether the procedures could be carried out in routine clinical settings with patients referred to an out-patient psychological treatment service. We therefore carried out a pilot study using a combined approach of CBM-A and CBM-I with a sample of 13 anxious patients referred to an out-patient psychology service for cognitive therapy. The results showed successful reductions in threat related attentional and interpretive bias, as well as reductions in trait and state anxiety. Participant reports describe the procedures as acceptable, with the attentional task experienced as boring, but the interpretive one experienced as helpful. While recognising the methodological problems of the pilot study we believe that these results give indications that the techniques could provide an effective intervention for anxiety, and that further study is well justified.

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### 1. Introduction

Individuals who are highly anxious or who have clinical anxiety characteristically experience threat related biases in their cognitive processing. In particular, there is a tendency to preferentially attend to negative stimuli in the environment (e.g., MacLeod, Mathews, & Tata, 1986) and to interpret emotionally ambiguous situations in

a negative manner (e.g., Richards & French, 1992). Using a paradigm known as Cognitive Bias Modification (CBM), recent research has confirmed the causal role that both these biases might play in the development and maintenance of anxiety (e.g., Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; MacLeod, Rutherford, Campbell, Ebsworth, & Holker, 2002; Wilson, MacLeod, Mathews, & Rutherford, 2006).

Cognitive Bias Modification for attention (CBM-A) can train participants to direct their attention away from threat related stimuli, and can also be used to train attention towards threat related material to provide experimental comparisons. MacLeod

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et al. (2002) used a task known as the 'dot-probe' to modify attentional bias, and then assessed the impact of the modification in an anxiety provoking situation. One group of participants was trained to direct their attention towards threat related words appearing on a computer screen, and the second was trained to direct their attention to non-threat words. Those in the threat related group were subsequently shown to respond more quickly to a neutral probe when it appeared in the prior location of the threat related word, since their attention was drawn to that location. Those in the non-threat group were quicker to respond to probes appearing in the prior location of the non-threat word. MacLeod et al. followed this bias assessment with a task to assess the impact of the training on participants' anxiety in a threatening situation. Participants were asked to solve a series of anagrams that were (unknown to them) impossible to solve, and were filmed whilst trying to solve them. The results suggested that participants in the threat group were more anxious than participants in the non-threat group whilst carrying out this task. This finding suggests that attentional bias may play an important role in vulnerability to anxiety.

In a similar way, Cognitive Bias Modification for interpretation (CBM-I) trains participants to interpret emotionally ambiguous material in a negative or positive way in order to induce a negative or positive bias. This training has been shown to carry over into later interpretation of emotionally ambiguous situations, and to modify anxiety vulnerability during a subsequent challenging task. For example, Mackintosh et al. (2006) trained participants to resolve ambiguity by presenting them with 100 scenarios which remained emotionally ambiguous until the final word. In the threat related group the final word resolved the scenario in a threat related way, and in the non-threat group the final word resolved the scenario in a non-threat way. Twenty four hours after training, participants took part in a task designed to test whether a bias had been induced by investigating their interpretation of new ambiguous scenarios. As predicted, participants in the threat condition showed a bias towards threatening interpretations of the later scenarios, and those in the non-threat condition showed a bias towards non-threatening interpretations. In order to assess whether this went on to modify vulnerability to anxiety participants were asked to watch a film showing clips of real-life accident scenes. Participants who were in the threat related condition were more anxious during the film than participants in the non-threat training condition.

The studies mentioned above have involved the participation of non-anxious volunteers to assess the potential that CBM has to modify bias and anxiety vulnerability. Given the success of this paradigm, its use with anxious patients is now being considered. We are aware of four studies that have investigated the attentional training paradigm in clinically anxious populations. Amir, Beard, Burns, and Bomyea (2009) used eight sessions of training to successfully reduce anxiety in individuals with Generalised Anxiety Disorder. Amir, Beard, Taylor et al (2009) used attentional training to reduce symptoms in individuals with Generalised Social Phobia. After training, 50% in the trained condition no longer met DSM-IV criteria for Generalised Social Phobia as compared to 14% in the control condition. At four-month follow-up this difference between groups remained. Schmidt, Richey, Buckner, and Timpano (2009) used eight sessions of attentional training to successfully reduce social and trait anxiety in individuals with Generalised Social Anxiety Disorder. Schmidt et al. (2009) found that after training, 72% of participants in the trained condition no longer met DSM-IV criteria for social anxiety disorder compared to 11% in the control condition, and that these benefits of CBM-A remained at 4-month follow-up. Finally, Hazen, Vasey, and Schmidt (2009) show that 5 sessions of CBM-A produced significant reductions in symptoms of anxiety.

At the time of writing there has been one published report of successful CBM-I in a clinical population of which we are aware. Hayes, Hirsch, Krebs, and Mathews (2010) show that it is possible to induce a relatively benign interpretive bias in a clinically anxious population and to alter levels of negative thought intrusions during a subsequent breathing focus task. However, they did not specifically assess how CBM-I might have altered anxiety levels by providing multiple training sessions over time. This has been shown in experiments with high-anxious participants. Mathews, Yiend, Ridgeway and Cook (2007) showed that training participants to select benign meanings of emotionally ambiguous scenarios reduced trait anxiety in anxious participants in four sessions of training. Salemink, van den Hout, and Kindt (2009) showed that state and trait anxiety can be reduced by modifying interpretive bias in anxious participants with eight sessions of training. Murphy, Hirsch, Mathews, Smith, and Clark (2007) showed that inducing a benign interpretive bias in socially anxious participants reduced anticipatory anxiety in a social situation. Beard and Amir (2008) trained socially anxious participants to endorse positive combinations and reject negative combinations of sentences and words. After eight sessions of training participants in this positive training group were more likely to endorse positive word-sentence pairs in the absence of feedback, and showed a reduction in social anxiety symptoms relative to participants in the placebo training group who had equal numbers of benign and threatening training trials.

Given this apparent effectiveness of both CBM-A and CBM-I in modifying anxiety, we wanted to know whether these experimental procedures could be of use in clinical settings with patients referred for cognitive therapy for anxiety. If so, then their application as alternatives or adjuncts to therapy could provide important clinical tools. It therefore seemed important to investigate whether using the techniques in combination would produce greater effects than using either alone. Amir, Beard, Taylor et al (2009) have certainly suggested that the combination is likely to be more effective, and this gave us further impetus to use a combined package of procedures in order to maximise the potential benefit to patients.

Two further issues seemed important to us. Firstly, the procedures used here are not yet of proven benefit for clinical purposes, and at least some of the tasks may be experienced as boring or monotonous. We wished to find out whether patients referred for cognitive therapy would find it acceptable to be asked to undertake the tasks, whether they would be willing to continue once started, and what their overall experience of the tasks would be. Secondly, we were interested to know, on a very practical level, whether the experimental equipment could be transported to the variety of clinical settings (GP practices, community clinics) in which patients referred to a clinical service are seen, so that their use did not always necessitate visits to research facilities which may be harder to access and potentially more anxiety provoking.

The purpose of the present study was therefore to be a pilot test of the effectiveness and acceptability of a combined package of CBM-A and CBM-I for individuals with clinical anxiety recruited through routine clinical practice, and seen in clinical environments.

## 2. Method

### 2.1. Design overview

This is an AB design investigating the impact of a procedure on cognitive bias and anxiety in a clinical population.

Participants underwent a clinical assessment, following which they attended one CBM session a week for four weeks, each lasting approximately 1 h. The first session involved measurement of

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