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Can we harness computerised cognitive bias modification to treat anxiety in schizophrenia? A first step highlighting the role of mental imagery

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ABSTRACT

A new wave of computerised therapy is under development which, rather than simulating talking therapies, uses bias modification techniques to target the core psychological process underlying anxiety. Such interventions are aimed at anxiety disorders, and are yet to be adapted for co-morbid anxiety in psychosis. The cognitive bias modification (CBM) paradigm delivers repeated exposure to stimuli in order to train individuals to resolve ambiguous information in a positive, rather than anxiety provoking, manner. The current study is the first to report data from a modified form of CBM which targets co-morbid anxiety within individuals diagnosed with schizophrenia. Our version of CBM involved exposure to one hundred vignettes presented over headphones. Participants were instructed to actively simulate the described scenarios via visual imagery. Twenty-one participants completed both a single session of CBM and a single control condition session in counter-balanced order. Within the whole sample, there was no significant improvement on interpretation bias of CBM or state anxiety, relative to the control condition. However, in line with previous research, those participants who engage in higher levels of visual imagery exhibited larger changes in interpretation bias. We discuss the implications for harnessing computerised CBM therapy developments for co-morbid anxiety in schizophrenia.

1. Introduction

The prevalence of co-morbid anxiety disorders which occur within individuals diagnosed with schizophrenia has been estimated at 30–85% (Pokos and Castle, 2006). The presence of such anxiety problems is associated with behaviors such as social withdrawal, which contribute to reports of a reduced quality of life (Braga et al., 2005). Recent psychological models of psychosis have highlighted how anxiety processes may be directly associated with the onset and maintenance of some forms of psychotic presentation, such as paranoia (Garety et al., 2001). It is argued that cognitive processes such as scanning for threat, confirmation bias and safety behaviors (removing oneself from a situation perceived to be dangerous) are common within psychosis and serve to maintain perceived threats. Thus anxiety may not only be considered as co-morbid to schizophrenia, rather there may be underlying psychological processes which maintain phenomena associated with both conditions.

It would therefore seem likely that interventions which target the symptoms of anxiety would be beneficial to many individuals who have been diagnosed with a psychotic disorder. Such interventions may have a primary benefit in terms of anxiety reduction, but given the potential common underlying processes, secondary benefits may occur within reduced levels of schizophrenic symptomatology. It is perhaps not surprising that the majority of cognitive behavioral therapy protocols developed for use with individuals diagnosed with schizophrenia are directly aimed at the reduction of positive symptoms (Wykes et al., 2008). However, it is of interest to note that cognitive–behavioral interventions specifically aimed at an anxiety problem have provided an indirect benefit for psychotic symptoms (Good, 2002; Dudley et al., 2005).

One specific process which has long been associated with anxiety is a cognitive bias within the interpretation of ambiguous information. A negative interpretation bias is defined as a systematic tendency to interpret potentially ambiguous information in a negative rather than benign way (Mathews and Mackintosh, 2000). For example, an individual may suddenly hear a loud noise in their house whilst at home alone. Although there are many possible interpretations of this scenario, anxious individuals tend to be biased towards making a negative interpretation such as 'there is an intruder in the house'. In

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comparison, non-anxious individuals may interpret the noise simply as something falling over. Moreover, interpretation bias has now been demonstrated to have a causal effect on anxiety (Mathews and Mackintosh, 2000; Mathews and Macleod, 2002, 2005; Salemink et al., 2007a).

Recent research has focused on the potential to modify negative interpretation biases so that ambiguity is resolved more positively, through the use of new computerised cognitive training techniques (cognitive bias modification: CBM). It has successfully been demonstrated that a single session of CBM can have a significant impact on both interpretation bias and levels of anxiety (Grey and Mathews, 2000; Mathews and Mackintosh, 2000; Holmes et al., 2006; Salemink et al., 2007b), that repeatedly inducing a more benign interpretation bias can reduce trait anxiety (Mathews et al., 2007), and that patients with anxiety disorders can gain symptom reduction from repeated sessions of CBM (Salemink et al., in preparation). Healthy individuals have an optimistic, rather than realistic thinking style (Haaga and Beck, 1995). Therefore we have used the term "positive interpretation bias" to reflect the promotion of the optimistic stance that non-anxious and non-depressed individuals take when confronted with ambiguity.

Other experiments aimed at translating this new technology from the laboratory to the clinic have sought to find the optimal stimuli and instructions for participants. Holmes et al. (2006) developed overtly positive (rather than just non-anxious) training material, resulting in the first successful test of a standardized intervention for increasing positive interpretation bias. Training instructions to either 'imagine' or 'think about the words and meaning' have been contrasted (Holmes et al., 2006, 2009). Mental imagery compared to verbal instructions had more powerful effects on emotion (increases in positive affect and decreases in anxiety). Indeed, within the verbal condition state anxiety increased (rather than decreased) over positive training, with an increase in negative bias. Thus, mere exposure to the CBM stimuli was insufficient to bring about benefits for bias and anxiety — rather, the instructions to use an imagery mode of cognitive processing (rather than verbal) are critical.

Given the significant role of interpretation bias within the development and maintenance of anxiety disorders, clearly, this exciting new technology would have benefits if also applied to treat co-morbid anxiety, for example in schizophrenia. Although the primary clinical target of such an intervention would be anxiety, there are sound theoretical reasons for speculating that any reduction in anxiety would be associated with reduced overall levels of schizophrenic symptomatology. Another advantage of CBM is that it can be delivered via computer, reducing the costs associated with face-to-face talking therapy. Whilst a range of explicit training materials have been developed as part of a 'metacognitive training' package for use with individuals diagnosed with schizophrenia (Moritz and Woodward, 2007), there are currently no reports of the implicit approach employed within CBM being used with this group.

The current exploratory study employs a single session of CBM with a sample of individuals diagnosed with schizophrenia who are exhibiting significant levels of anxiety, in order to assess the feasibility of such an intervention with this client group. The current CBM aimed to modify an existing negative interpretation bias so that ambiguity is resolved more positively. This is referred to as 'positive CBM'. The specific aims of the study are to assess a) whether individuals diagnosed with schizophrenia are able to complete a single session of CBM b) whether a single session of CBM can produce benefits in terms of bias and state anxiety within these clients c) whether key aspects of cognitive functioning associated with schizophrenia have an adverse impact on the benefits of CBM and d) whether (as in previous studies) the use of imagery has a positive impact on the benefits of CBM. A single session of CBM was used given that previous studies have demonstrated significant results within this context (Grey and Mathews, 2000; Mathews and Mackintosh, 2000; Holmes et al., 2006; Salemink et al., 2007b).

Given the importance of the role of imagery on the effectiveness of the paradigm, we incorporated an imagery training session within the study and monitored the use of imagery in relation to outcome (change in interpretation bias and state anxiety). Since it could be argued that any session using computer tasks might have an effect, we added a control condition consisting of three measures of cognitive functioning which have been widely associated with schizophrenia. These were the 'jumping to conclusions' task as a measure of reasoning, a measure of working memory span and a measure of executive functioning. Inclusion of measures of cognitive functioning and imagery enabled analyses to explore whether any potential change in interpretation bias produced by CBM is associated with these factors.

2. Methods

2.1. Design

A within-group design was used, where each participant completed both the cognitive bias modification (CBM) condition and the control condition. The presentation of conditions was counter-balanced through the use of alternating orders across the study sample. The two conditions were separated by a period of at least three days. The study was given ethical approval by Bexley and Greenwich Research Ethics Committee.

2.2. Overview

The CBM methodology used in the current study was based on previous studies (Holmes et al., 2006, 2009; Blackwell and Holmes, 2010). The current CBM for interpretation bias involved the auditory presentation of 100 scenarios to best allow for mental image formation. This contrasts with earlier CBM work which used visual displays of text (Mathews and Mackintosh, 2000). A brief mental imagery training exercise was conducted prior to the presentation of the cognitive training sentences, so as to enhance the extent to which imagery was used. Previous studies have shown this to be a critical ingredient in the procedure (Holmes and Mathews, 2005; Holmes et al., 2006). Emotional valence ratings of ambiguous test descriptions were completed both before and after the CBM condition, and were used as a measure of interpretation bias. A state anxiety measure was also completed both before and after the CBM condition.

The control condition included the same measures of interpretation bias and state anxiety both before and after the control tasks as were used in the CBM condition. The inclusion of the tasks within the control condition enabled control for the length of time and cognitive effort expended between the before and after measures, with reference to the CBM condition. The control condition contained three tasks which measure aspects of cognitive functioning which have been shown to be associated with schizophrenia, and may be associated with an individual's capacity to benefit from CBM procedures.

2.3. Participants

Participants were eligible if they were aged 18–65, had a current diagnosis of schizophrenia and were fluent in English. They were excluded if they had a documented learning disability or organic cause for their psychotic experiences. The 21 participants who completed the study were comprised of 15 men and 6 women with a mean age of 43 years (S.D. = 7.78). A member of the research team (AR) worked with care-cordinators based within local community psychiatric services (South London & Maudsley NHS Trust, London) in order to discuss eligibility criteria and identify potential participants. Those participants who were eligible and provided informed consent were paid a small fee for their participation. Diagnoses were made by independent psychiatrists using DSM-IV criteria. All had a diagnosis of schizophrenia or paranoid schizophrenia. Participants were initially recruited on the basis that their care co-ordinator reported that they suffered from co-morbid anxiety problems and, subsequently, they scored above 40 on the Spielberger Trait Anxiety Inventory.

2.4. Cognitive bias modification condition

2.4.1. Positive training paragraphs

One hundred scenarios were used, based on those employed in previous studies (Holmes and Mathews, 2005; Holmes et al., 2006). Some of the original scenarios were replaced or modified, so that all the training descriptions were likely to be relevant to the everyday life of people diagnosed with schizophrenia. The descriptions were read aloud in a female voice (each lasting approximately 10 to 15 s) and digitally recorded. During the study they were presented stereophonically via headphones. Each training paragraph contained a situation which was initially ambiguous but was ultimately resolved in a positive way. For example: "You are walking down your street and see a gang of children laughing. As you get nearer *you see what they are laughing at, and smile*