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Research report

Optimizing the ingredients for imagery-based interpretation bias modification for depressed mood: Is self-generation more effective than imagination alone?

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ABSTRACT

Negative interpretation is thought to be crucial in the development and maintenance of depression. Recently developed cognitive bias modification paradigms, intending to change these biases towards a more optimistic interpretation tendency (CBM-I), seem to offer new promising implications for cognitive therapy innovation. This study aimed to increase our knowledge of the underlying mechanisms of action of imagery-based CBM-I in the context of depressed mood. We therefore compared the efficacy of CBM-I requiring participants to imagine standardized positive resolutions to a novel, more active training version that required participants to generate the positive interpretations themselves. Fifty-four participants were randomly allocated to (1) standardized CBM-I, (2) self-generation CBM-I or (3) a control group. Outcome measures included self-report mood measures and a depression-related interpretation bias measure. Both positive training variants significantly increased the tendency to interpret fresh ambiguous material in an optimistic manner. However, only the standardized imagery CBM-I paradigm positively influenced mood.

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1. Introduction

In day-to-day life, we encounter numerous examples of information that can be interpreted in more than one way, for instance facial expressions, feedback from others or physiological cues. How we disambiguate or make sense of these stimuli is important for how we further respond to the world. To interpret one's dialogue partner's yawning as a sign of boredom can obviously result in a different, even opposite emotion than attributing it to a simple lack of oxygen in the room. There is empirical consensus that negatively biased interpretation, defined as the tendency to consistently interpret ambiguous stimuli in a negative manner, is associated with dysphoria and depression and might play a key role in the development of disorders (e.g. [Butler and Mathews, 1983](#); [Eley et al., 2008](#); [Hertel and El-Messidi, 2006](#); [Lawson et al., 2002](#); [Mathews and Mackintosh, 2000](#); [Mogg et al., 2006](#); [Reinecke et al., Submitted for publication](#); [Rude et al., 2002](#), [Wisco and Nolen-Hoeksema, 2010](#)).

Cognitive bias modification paradigms (CBM; [Grey and Mathews, 2000](#); [Mathews and Mackintosh, 2000](#); [Mathews and MacLeod, 2002](#)) are computerized training procedures that encourage individuals to adopt a more positive (or negative) information processing style. For instance, in interpretation bias training procedures a more positive interpretation style can be trained by repeatedly presenting virtual scenarios that combine initially ambiguous information with a clearly positive outcome. An example by [Holmes et al. \(2006\)](#) is as follows: "You have started an evening class which is tough going. You are determined to succeed, and after a while, it becomes much easier and more enjoyable" (positive resolution in italics). Such procedures aim to identify the role of cognitive biases in the development of emotional disorders and have the potential to induce reductions in symptom severity by changing bias towards a more positive direction.

Although CBM-I has initially been developed for the training of anxiety-related bias, positive benefits of interpretation modification training could also be reported in the context of dysphoria and depression by a number of studies ([Blackwell and Holmes, 2010](#); [Holmes et al., 2008, 2009, 2006](#); [Lang et al., 2012](#); [Lothmann et al., 2011](#); [Reinecke et al., Submitted for publication](#); [Williams et al., in press](#)). Positive bias modification has not only been shown to be effective in modifying the interpretation of fresh ambiguous information (e.g. [Reinecke et al., Submitted for publication](#)) in the

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trained direction, but it also ameliorates depressed mood and positively influences resilience to negative mood induction (e.g. Holmes et al., 2009).

A line of research (e.g. Holmes et al., 2009) has been interested in the most effective ingredients of these procedures. In line with prior research suggesting a special relationship between imagery and emotion (see Holmes and Mathews, 2005), Holmes et al. (2009) found imagery, rather than verbal processing to be crucial. Participants in the study were presented with 100 auditory scenarios that were initially ambiguous but consistently resolved in a positive manner. They were instructed to either imagine the events or listen to them while thinking about their meaning. Verbal processing of positive training material was not only less effective than imagery, but even led to paradoxical, negative mood responses. In other words, vividly imagining positive virtual events can improve your mood as well as how you interpret events, whereas only verbally thinking about the same positive contents can make you feel worse and negatively influence how you resolve ambiguities. Holmes et al. (2006, 2009) assumed that this surprising discrepancy could have been caused by different underlying mechanisms. While imagery might directly provoke emotion like a positive “as-if” experience, verbal processing might be perceived as less believable. It might more readily provoke a comparison with one’s actual status quo, that could – especially in depressive individuals – turn out to be disadvantageous and thus mood deteriorating. However, the mental visualization of pleasant events alone does not guarantee positive emotion but depends on the precise task instruction. Holmes et al. (2008) demonstrated that only imagery from a field perspective (“through your own eyes”) improves affect as opposed to imagery from an observer perspective (“looking at you”), that could – like verbal processing – lead to adverse effects. Nelis et al. (2012) replicated the impact of imagery vs. verbal processing for positive CBM-I, but not of field vs. observer perspective, suggesting that this aspect requires further exploration. Based on these findings, effective interpretation bias modification can be obtained through a guided imagery training that provides participants with acoustically or visually presented descriptions of ambiguous virtual situations that are consistently combined with positive resolutions that need to be imagined from a field perspective (Holmes et al., 2008; Pictet et al., 2011).

Research in the context of anxiety-related interpretation bias has found active selection of meaning during the training to be critical for modifying subsequent emotional responses to new ambiguous stimuli (Hoppitt et al., 2010). In this study, participants were presented with threat-related ambiguous sentences that were negatively resolved by the final word, e.g. “You have decided to go caving even though you feel nervous about being in such an enclosed space. You get to the caves before anyone else arrived. Going deep inside the first cave you realize you have completely lost your way.” (negative resolution in italics). While participants in the passive group were presented with the entire passage, individuals in the active group were presented with only a fragment (one or more letters missing) of the final word (“... completely lost your w-.”) and therefore had to actively resolve the meaning by themselves (only one possible completion). Active selection of meaning was shown to be superior in modifying later emotional responses in a training-congruent way to images of new emotionally ambiguous descriptions presented after training than mere passive exposure. Hoppitt et al. (2010) suggested that this differential effect may be due to the induction of an implicit production rule, in which participants in the active condition continue to actively generate training-congruent meanings of subsequent ambiguous scenarios.

The self-perception theory (Bem, 1972) suggests that people infer (and modify) their attitudes, cognitions and emotions by

observing their overt behaviours. According to this theory a person becomes, for instance, more committed to a certain attitude or general cognition if they have to argue on behalf of it (even when this position contradicts a previous attitude), in other words “as I hear myself talk, I learn what I believe” (Bem, 1972; Laird and Bresler, 1992; Miller and Rollnick, 2002). This principle has been supported by numerous studies. For example, manipulated facial expressions can trigger changes in emotion (e.g. Laird and Bresler, 1992) as well as changes in attitudes (racial bias) as assessed by the Implicit Association Test (Ito et al., 2006). Sharot et al. (2010) studied participants who rated different vacation destinations both before and after making a blind choice that could not be guided by pre-existing preferences. Their results demonstrated that choices not only reveal preferences, but also shape them even when decisions were made randomly. Interestingly, change in preferences was observed only when participants believed they had been instrumental in making a decision, and not when the decision was made by a computer. We hypothesised that the self-perception principle could also be relevant for the modification of cognitive interpretation bias and be integrated in CBM-I procedures and potentially enhance its effect by instructing participants to not only imagine but to positively complete the initially ambiguous scenarios by themselves.

The aim of this study was to develop a new, more active variant of CBM-I and test its impact on positive mood and interpretation bias in comparison to a control group as well as imagery CBM-I. The purpose of this comparison was to further our knowledge about the mechanisms of action underlying successful CBM-I and to optimize its ingredients to enhance its future therapeutic potential. The positive imagery CBM-I can be described as a standardized guided imagery training that provides participants with auditorily presented descriptions of ambiguous virtual everyday life situations that are consistently combined with positive resolutions (e.g., Holmes et al., 2006). The new training variant, however, instructs participants to not only imagine but to positively complete the initially ambiguous scenarios themselves by speaking one or two phrases into a microphone. As participants in the new training variant have to invent positive resolutions themselves, we expected that they would perceive the scenarios as more authentic than participants in the standardized guided imagery training. Further, the self-generation of positive resolutions (and its subsequent vocalisation) can be seen as a more active process than guided imagery and in terms of the self-perception theory be regarded as “overt behaviour” that could lead to a (greater) modification of cognitions (interpretation bias) and internal states (mood). We therefore hypothesised that the self-generation variant would be more effective in changing interpretation bias and mood towards a more positive direction, based on the principles of self-perception as well as prior findings by Hoppitt et al. (2010).

2. Method

2.1. Participants

54 participants (13 male, 41 female) took part in the study (age in years: $M=22.0$, $SD=2.9$). They were recruited via online advertisements at the website of the Technische Universität Dresden. The majority of them were undergraduate students. One third of the participants (29.6%) in this study showed BDI-scores above the clinical cut-off score with 22.2% reporting symptoms of mild depression (BDI-scores: 14–19) and 7.5% reporting symptoms of moderate depression (BDI-scores: 20–28). Reimbursement for participation consisted of either a small participation fee (5€) or course credits.

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