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# Effects of a training in mental imagery on worry: A proof-of-principle study

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ABSTRACT

Worry is characterized by a predominance of verbal thinking and relatively little mental imagery. This cognitive bias of verbal and abstract processing has been found to impair emotional processing of worry topics so that worrisome thoughts are maintained. On the other hand, engaging in mental imagery during the worry process fosters emotional processing of worry themes. In the present study, we examined whether training high worriers ($n = 71$) to use more mental imagery in their everyday lives is an effective intervention to reduce pathological worry.

Results indicated that our novel training in mental imagery (TMI) led to a significant reduction of worry and impairment, assessed both one and five weeks after the training. Furthermore, in highly anxious participants TMI had beneficial effects on controllability of worry, state anxiety, and positive mood.

Theoretical and clinical implications of our findings and methodological limitations of this proof-of-principle study are discussed.

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## 1. Introduction

Excessive and uncontrollable worrying constitutes the main diagnostic criterion for Generalized Anxiety Disorder (GAD) in the DSM-5 (American Psychiatric Association (APA), 2013). In addition, worrying is also common among healthy individuals (Dupuy, Beaudoin, Rhéaume, Ladouceur, & Dugas, 2001), and differences in the worry process between 'subclinical' high worriers and GAD patients appear to be rather quantitative than qualitative in nature (Ruscio & Borkovec, 2004; Ruscio, 2002). Moreover, both groups find their worrying impairing (Gentes & Ruscio, 2014), giving rise to the idea of worry as a dimensional construct. Although cognitive behavioral therapy for worry, especially in GAD, has yielded promising results (Behar, DiMarco, Hekler, Mohlman, & Staples, 2009), it is of clinical relevance to optimize the treatment by developing additional effective interventions.

It has been repeatedly shown that worry is characterized by a predominance of verbal and abstract thought activity and relatively little mental imagery (e.g.,Behar, Zuellig, & Borkovec, 2005; Goldwin & Behar, 2012) and that this cognitive bias normalizes after successful treatment of GAD (Borkovec & Inz, 1990; Stöber & Borkovec, 2002). According to the cognitive avoidance theory (Borkovec, Alcaine, & Behar, 2004), this verbal and abstract nature of worry can be seen as a prerequisite for an avoidance function of worry. It is proposed that during worrying, intrusive negative mental images occurring in everyday life are replaced by verbal descriptions that create a mental distance. As a result, anxiety and aversive physiological arousal that accompany negative mental imagery are reduced so that worry is negatively reinforced in the short term. In the long run, however, the model proposes that the emotional dampening effect of verbal worry prevents the fear structure from being fully activated (Foa & Kozak, 1986). As a result, emotional processing of worry-relevant stimuli is disturbed and worrisome thoughts can become persistent and more and more uncontrollable (cf. diagnostic criteria for GAD in DSM-5; American Psychiatric Association (APA), 2013).

Evidence for an avoidance function of worry comes from several studies, examining both GAD and subclinical high worrying samples. For example, thinking verbally has been shown to elicit less intense emotional reactions (Holmes & Mathews, 2010) as well as cardiovascular responses (Tucker & Newman, 1981; Vrana, Cuthbert, & Lang, 1986) than imagery-based thought. Moreover, there is evidence that worry-prone individuals tend to distract themselves from arousing negative mental images by drawing their attention to verbal descriptions (Laguna, Ham, Hope, & Bell, 2004), use worrying as a means to distract themselves from more dis-

*Abbreviations:* TMI, training in mental imagery; WL, waiting list control group.

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tressing topics (Borkovec & Roemer, 1995), and to find this strategy helpful to cope with their emotional responses (Llera & Newman, 2014). As GAD patients experience their emotions as more intense, harder to understand and more aversive than healthy controls (Mennin, Heimberg, Turk, & Fresco, 2005), it does not appear suprising that worriers try to avoid emotion-eliciting stimuli (e.g., mental images of feared situations).

There is also accumulating evidence for the detrimental effect verbal worry has on emotional processing in the long run. For example, after having worried explicitly in a verbal thinking style high worriers report an increase of negative thought intrusions (Stokes & Hirsch, 2010), that is still apparent for about a week (Butler, Wells, & Dewick, 1995). Notably, these intrusive negative thoughts can function as a trigger for further worry episodes. According to Rachman (1980), unpleasant intrusive thoughts are indicators of unsatisfactory emotional processing. Taken together, verbal worry promotes further worry in the long term and plays a major part in maintaining anxiety.

Interestingly, an imagery-based worry style, on the other hand, has been shown to have a positive effect on emotional processing. In the short-term, worrying in an imagery-based way evokes more anxiety and a stronger physiological response (Butler et al., 1995; Nelson & Harvey, 2002; Vrana et al., 1986), while in the long run leading to less anxiety regarding a personal worry topic (Nelson & Harvey, 2002) and less negative thought intrusions (Butler et al., 1995; Stokes & Hirsch, 2010; Wells & Papageorgiou, 1995), both being indicative of enhanced emotional processing (Rachman, 1980). These findings are not surprising given that mental imagery has a powerful impact on emotions (for an overview, see Holmes & Mathews, 2010) and therefore is likely to activate the fear structure and foster emotional processing (Foa & Kozak, 1986). Remarkably, all of the studies cited above used only minimal interventions to induce an imagery-based worry style (e.g., defining mental imagery and distinguishing it from verbal thought, practice trials imagining non-worry topics) but nevertheless found a marked positive effect of imagery-based worry on emotional processing. In the present study, we aimed to extend these beneficial effects of imagery-based worry on emotional processing with the help of a more comprehensive, in-depth training in mental imagery.

Results from a related line of research additionally suggest that training individuals to use a more functional thinking style may be a promising strategy to reduce excessive levels of repetitive negative thinking. In a series of studies, Watkins and colleagues (Watkins, Baeyens, & Read, 2009; Watkins & Moberly, 2009; Watkins et al., 2012) trained dysphoric or depressed participants in concrete, imagery-based thinking in order to normalize a bias of abstract and overgeneralized thinking present in depressive rumination. Results showed that concreteness training significantly increased concrete thinking and at the same time reduced dysphoria and depressive symptoms in the long run (Watkins & Moberly, 2009; Watkins et al., 2009). Most convincingly, in a randomized controlled trial the combination of concreteness training and treatment as usual was superior to treatment as usual alone in depressed participants (Watkins et al., 2012). Since depressive rumination and worry can be conceptualized as two variants of unconstructive repetitive negative thinking (RNT) that are both characterized by abstract processing (Ehring & Watkins, 2008), it seems worthwhile to test the effectiveness of a similar training targeting pathological worry. This is especially so, as there is some evidence suggesting that the verbal-abstract bias in pathological worry may be even more pronounced than in depressive rumination (Goldwin & Behar, 2012).

Taken together, the aim of the present study was to gather first evidence on the efficacy of a training in mental imagery (TMI) to reduce the cognitive bias towards verbal and abstract processing that is characteristic of pathological worry and thereby reduce the severity of pathological worry itself. Thus, we developed a comprehensive training designed to foster the general use of mental imagery in everyday life and examined its efficacy compared to a waiting list control group (WL) in a sample of subclinical pathological worriers. Based on the evidence reviewed above, we predicted that the TMI would (1) enhance participants' ability to generate vivid mental images; (2) lead to more mental imagery during worrying; (3) reduce pathological worry and impairment caused by worry; and (4) have a positive effect on the feeling of control over worries, mood, and anxiety. We also examined the stability of the hypothesized effects over time by adding a 5-week follow-up assessment. Moreover, since participants in the WL also received a TMI session after the waiting period we tested whether it yielded comparable results in this group. Additionally, based on evidence that the dysfunctional cognitive processes we aim to alter with this intervention are most marked in highly worry-prone and anxious individual (e.g. Borkovec & Inz, 1990; Freeston, Dugas, & Ladouceur, 1996) we explored whether the effects were moderated by trait worry, trait anxiety, and tendency to use mental imagery in everyday life.

## 2. Method

### 2.1. Participants

Participants were recruited with the help of a short online screening questionnaire. The link to the questionnaire was distributed to students during lectures at the University of Muenster, soliciting individuals with high trait worry. Participants showing a score $\geq 50$ on the Penn State Worry Questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990) in the screening were deemed eligible as this score points to an increased level of pathological worry in community samples (Fisher & Newman, 2013; Gillis, Haaga, & Ford, 1995). In order to minimize possible adverse effects, and also because the study included a novel intervention, we excluded individuals meeting diagnostic criteria for GAD according to the Generalized Anxiety Disorder Questionnaire-IV (GAD-Q-IV; Newman et al., 2002) at the time of screening. To guarantee a homogenous sample, only individuals falling in an age range of 18 to 30 were included.

In total, 605 students completed the online screening questionnaire, 236 of whom met inclusion criteria. After having been informed about the eligibility via e-mail, 82 participants agreed to being called and informed by the examiners about the aims and procedures of the study and to make an appointment for the training session. To preserve participants' naïvety, the study was carried out under the pretense that its purpose was to examine whether a certain mentation style (i.e. thinking in images) was trainable. Participants were debriefed after the last measurement at 5 w follow-up. 71 participants agreed to take part in the study and provided their informed consent in written form at their pre-training assessment, after which they were randomized into the TMI or the WL condition. Our final sample therefore consisted of 71 participants (TMI: $n = 35$, WL: $n = 36$) who attended the training session and completed all pre- and post-trainings assessments. Of these, 10 persons failed to fill out the follow-up questionnaire (TMI: $n = 6$, WL: $n = 4$, $\chi^2(1) = 0.53$, $p = 0.51$) (participant characteristics are shown in Table 1).

### 2.2. Training in mental imagery

The TMI consisted of four modules. All tasks were designed to foster participants' ability to create vivid, detailed, and emotionally laden mental images of positive and negative (i.e., worrisome) future situations in their everyday lives and their willingness to

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