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Cognitive-behavioural therapy reduces unwanted thought intrusions in generalized anxiety disorder

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ABSTRACT

Background and objectives: Voluntary attempts to suppress certain thoughts can paradoxically increase their intrusive return. Particular impairments in thought suppression are thought to be key mechanisms in the pathogenesis of mental disorders. To assess the role of this processing bias in the maintenance of generalized anxiety disorder (GAD), we investigated whether it is susceptible to cognitive-behavioural treatment (CBT).

Methods: 22 GAD patients and 22 healthy controls (HC) were tested twice within 15 weeks, with patients receiving CBT in between. A subset of patients was additionally tested while waiting for treatment to control for retest effects. Using a mental control paradigm, we measured intrusion frequency during the voluntary suppression of thoughts related to (a) the individual main worry topic, (b) a negative non-worry topic, and (c) a neutral topic. Self-reported worry was measured before and after treatment, and at 6-months follow-up.

Results: Compared to HC, GAD showed specifically more worry-related intrusions. CBT reduced this bias to a healthy level, over and above mere test-retest effects.

Limitations: This study could not clarify whether the demonstrated effect mediates other changes, or how it relates to other cognitive biases in GAD.

Conclusions: The results indicate that thought suppression processes are not only impaired in GAD, but that the impairment is specific to the patients' worries, and that it can be successfully targeted by CBT. This highlights the importance of thought suppression processes in the maintenance of GAD.

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1. Introduction

Generalized anxiety disorder (GAD) is characterized by excessive worry regarding a broad range of topics, such as health, financial security and relationships. Patients experience severe difficulty in controlling and stopping worrying thoughts, to a degree that it significantly affects everyday life functioning. The lack of control over worry processes is such a central component of GAD that it has been added as a defining diagnostic criterion to the fourth version of the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychological Association, 2000). Following the Metacognitive Model of GAD (Wells, 2005), negative beliefs about worry play an essential role in worry processes spiralling out of control: Concerns that worry thoughts might

become uncontrollable, unbearable, or even dangerous, also described as worry about worry, fuel the development of control and avoidance strategies such as reassurance or thought suppression. However, these control attempts prevent experiences that would disconfirm dysfunctional beliefs about worry, thereby reinforcing the relevance and frequency of worry intrusions. This study addresses the impact of cognitive-behaviour therapy (CBT) on such worry intrusions, which we measured using an experimental thought suppression paradigm.

Experimental research has shown that thought suppression, a strategy GAD patients are believed to apply in an attempt to control intrusions, paradoxically exacerbates the intrusive return of unwanted thoughts (Wegner, Schneider, Carter, & White, 1987). The theory of 'ironic processes' (Wegner, 1994) assumes that two processes are involved when trying to keep unwanted thoughts outside of awareness: a *top-down operating process* to actively draw attention away from aversive thoughts towards distracter thoughts, and an *automatic monitoring process* maintaining vigilance for the

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re-appearance of an aversive thought to initiate the allocation of further operating process resources if required. Ironically, sustained vigilance for aversive thoughts comes with a lowered detection threshold for the appearance of such stimuli, making the rebound of intrusive thoughts more likely (Wegner, 1994). Thought suppression experiments have been shown to be very effective tools in studying such intrusion amplification processes (assumed to play a role in GAD patients) in healthy individuals. Participants are instructed not to think of a certain image or thought, for instance a white bear, for a few minutes (Wegner et al., 1987). A broad range of studies in non-clinical samples has demonstrated two interesting phenomena: Participants seem to show a) an *enhancement effect*, reflected in an increased occurrence of thoughts they are instructed to suppress, and b) a *rebound effect*, implying increased occurrence of the suppressed thought following the suppression period (e.g., Rassin, 2005; Salkovskis & Campbell, 1994; Wenzlaff & Wegner, 2000). Other studies have confirmed that suppression paradoxically leads to increased vigilance for the suppressed thoughts, reflected in stronger interference effects for these words in a colour-naming Stroop task (Klein, 2007; Page, Locke, & Trio, 2005).

Translated to clinical populations, this paradigm provides an ideal opportunity to experimentally capture the experience of impairments in voluntary control over aversive thoughts in patients with disorders such as GAD. Although only very few clinical studies exist to date, there is convincing evidence that both during unrestricted thinking-aloud as well as during voluntary, instructed thought suppression, treatment-seeking GAD patients have particular difficulty in successfully inhibiting worry-related thoughts compared to healthy controls (Becker, Rinck, Roth, & Margraf, 1998). Such results support the assumption that impairment in these processes might be a key mechanism in the development and maintenance of psychopathology (Najmi & Wegner, 2009; Wegner, 1989). However, it remains open whether impairments in thought control are malleable, and therefore susceptible to treatment.

CBT approaches are recommended as first-line interventions in GAD (National Institute for Health and Clinical Excellence, 2007). The experience of habituation to fear stimuli during repeated exposure or relaxation (e.g., Borkovec, Alcaine, & Behar, 2004; Öst, 1987) has been shown to be effective in reducing anxiety, somatic symptoms, and worry (e.g., Borkovec, Newman, Pincus, & Lytle, 2002; Hoyer et al., 2009; Mitte, 2005). Moreover, CBT in GAD has been proven effective in reducing attentional bias to threat (Mathews, Mogg, Kentish, & Eysenck, 1995) and implicit threat generalisation (Reinecke, Rinck, Becker, & Hoyer, submitted for publication). However, to date no research has addressed whether CBT has an impact on the frequency of unwanted worry intrusions that occur during thought suppression in GAD (Becker et al., 1998), leaving open to what degree this bias is in fact linked to the pathogenesis of the disorder.

In this article, we present a study investigating whether the recently reported increased frequency of worry intrusions in GAD patients is susceptible to CBT treatment. In addition, we add to earlier studies by investigating whether the effect of increased intrusion frequency is specific to worry-related material, or whether it generalizes to other negative thoughts. A group of GAD patients was tested with the white-bear paradigm before and after treatment and compared to a group of healthy controls. In three experimental blocks, participants indicated the involuntary occurrence of a specific neutral thought, negative worry thought, or negative non-worry thought that they were instructed to suppress. In addition, a patient waiting group was tested twice before treatment to be able to distinguish treatment effects from mere retest effects. We hypothesized that i) before treatment, GAD

patients and healthy controls would show no differences in intrusion frequency concerning negative non-worry and neutral topics, but that patients would show increased intrusions of worry-related thoughts, and ii) that these increased worry intrusions in GAD patients would normalize following treatment, over and above mere retest effects.

2. Materials and methods

2.1. Participants

Twenty-two patients with a GAD diagnosis and 22 control participants were tested.¹ Patients were recruited from the waiting list of the Dresden University of Technology outpatient clinic for psychotherapy. DSM-IV diagnoses were assessed using the Composite International Diagnostic Interview (CIDI; Wittchen & Pfister, 1997). Six of the patients fulfilled criteria for comorbid major depression and two for a specific phobia. Healthy controls (HC) were recruited via newspaper ads. They were screened for psychiatric diagnoses using the Anxiety Disorders Interview Schedule for DSM IV (ADIS; DiNardo, Brown, & Barlow, 1994). To be included in the study, they were required not to clinically or sub-clinically fulfil the criteria of any DSM-IV diagnosis, and not to fulfil any of the criteria for a GAD diagnosis. Educational level, age, and gender were matched between the two groups (*years of education*: GAD $M = 14.3$, $SD = 2.1$, HC $M = 14.3$, $SD = 2.0$, $t(42) = .1$, $p = .943$; *age*: GAD $M = 44.2$, $SD = 13.2$, HC $M = 42.1$, $SD = 14.6$, $t(42) = .5$, $p = .613$; *gender*: GAD 68% female, HC 73% female, $X^2(1) = .1$, $p = .741$).

2.2. Procedure and materials

2.2.1. General procedure

Each participant was invited to two experimental assessments, with 15 weeks in between. While GAD participants received CBT treatment during that time, HC were not given any intervention. In addition, a subset of GAD patients ($N = 8$) was randomly selected to additionally participate in a baseline assessment 15 weeks before treatment. These additional data were recorded to allow for the comparison of treatment effects to mere test–retest effects in the experimental task. During each session, participants worked on the Mental Control Task. Furthermore, they completed the *Inventory to Diagnose Depression* questionnaire (IDD; Zimmermann, Coryell, Wilson, & Corenthal, 1986) and the trait form of the *State-Trait Anxiety Inventory* (STAIT; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). GAD participants were also given the *Penn State Worry Questionnaire* (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) to assess trait worry and to capture the general, excessive, and uncontrollable characteristics of pathological worry, and the *White Bear Suppression Inventory* (WBSI; Wegner & Zanakos, 1994) to measure the individual experience of intrusive thoughts and images (Schmidt et al., 2009). Treatment success was followed up in GAD patients by re-applying PSWQ and WBSI 6 months after the end of treatment.

2.2.2. Treatment

Psychologists currently undergoing postgraduate clinical psychology training delivered protocol-driven CBT over 15 weekly sessions (see Hoyer et al., 2009). Therapists were intensively trained, and all sessions were videotaped for adherence monitoring during weekly team supervisions (JH). GAD patients were recruited

¹ Subsample of these participants had also taken part in a previously published study (Reinecke et al., 2010).

from a larger-scale clinical trial that aimed at comparing the impact of two different treatment approaches on GAD symptom severity (Hoyer et al., 2009). Therefore, some of the patients included in the present study received worry exposure CBT ($N = 11$; Becker & Margraf, 2002), while others received applied relaxation CBT ($N = 11$; Öst, 1987). The worry exposure treatment rationale revolved around the systematic reduction of cognitive avoidance and reassurance behaviours and the concept of habituation. Applied relaxation treatment focused on using rapid progressive muscle relaxation following the recognition of first signs of anxiety, as provoked by imagining feared situations. The type of treatment received did not affect any of the analyses described below, all $F < 1.05$, all $p > .320$. Therefore, the two treatment groups were merged.

2.2.3. Mental control task

The task design was chosen in order to be consistent with the methodology used by Becker et al. (1998), who were the first to experimentally demonstrate increased worry intrusion frequency in generalized anxiety disorder. However, while the previous paper had only investigated thought intrusions during a negative worry-related block and a neutral white-bear block, the present study also included a negative control condition. This way, we were able to establish whether patients would only show increased intrusions regarding disorder-specific worry thoughts, or whether such difficulties would generalize to any negative topic. Recent work has shown that both patients and healthy controls worry about similar topics, predominantly revolving around relationships, health and finances (Hoyer, Becker, & Roth, 2001; Roemer, Molina, & Borkovec, 1997). In contrast, the thought of drowning – although evidently threatening for everyone, does not represent a typical worry domain. Therefore, this category was included as the negative control condition. In an initial practice phase, participants were instructed to verbalize aloud any thoughts that went through their mind for 3 min to get used to the procedure. For the following three suppression blocks, the experimenter left the room, and participants continued reporting their thinking-aloud for 3 min each. However, they were restricted in a way that in each block a certain thought was to be suppressed: (a) *negative worry-related block*: thoughts associated with their main worry (e.g., being in debt), (b) *negative worry-unrelated control block*: thoughts of drowning, (c) *neutral control block*: thoughts of white bears. Participants indicated with a keyboard button whenever a banned thought occurred nevertheless. The order of blocks was counterbalanced. In order to assure task compliance, thinking-aloud was audiotaped and participants were informed that these recordings would be checked by the experimenter. All participants complied with the task instructions. However, the degree of compliance was not quantified.

2.3. Statistical analyses

The main experimental outcome parameter was the number of intrusions per block, measured as the number of button presses. The effects of GAD diagnosis and thought content on the number of intrusions were assessed using mixed-design analyses of variance (ANOVAs) and post-hoc two-tailed t -tests in SPSS 19.0.

3. Results

3.1. Self-report measures

Before treatment, GAD showed significantly higher depression (IDD) and anxiety (STAIT) scores than HC, both $t(42) > 5.14$, both $p < .001$ (Table 1). Treatment significantly reduced depression

Table 1

Mean questionnaire scores (and standard deviations) in GAD patients (GAD) and healthy controls (HC).

	HC ($N = 22$)	GAD ($N = 22$)		
		pre	post	6-months
IDD	2.8 (1.7)	12.3 (7.4)	4.7 (7.2)	–
STAIT	33.8 (5.6)	51.0 (11.1)	41.3 (9.6)	–
PSWQ	–	58.7 (7.6)	45.9 (9.3)	44.9 (8.5)
WBSI	–	49.8 (8.6)	37.1 (9.4)	33.9 (8.5)

Note: IDD = Inventory to Diagnose Depression, STAIT = State Trait Anxiety Inventory – Trait form, PSWQ = Penn State Worry Questionnaire, WBSI = White Bear Suppression Inventory.

(IDD), anxiety (STAIT) and worry (PSWQ, WBSI) scores in GAD patients, all $t(21) > 4.70$, all $p < .001$. Post-treatment worry scores also remained stably reduced over the 6-month follow-up period, PSWQ and WBSI both $t(21) < 1.49$, both $p > .156$. The treatment group GADs (TG) and the waiting group GADs (WG) did not differ from each other on the IDD (TG: $M = 11.6$, $SD = 8.3$; WG: $M = 14.1$, $SD = 5.5$), the STAIT (TG: $M = 51.9$, $SD = 6.0$; WG: $M = 49.5$, $SD = 17.3$), the PSWQ (TG: $M = 58.8$, $SD = 6.7$; WG: $M = 58.6$, $SD = 9.4$), or the WBSI (TG: $M = 49.9$, $SD = 10.0$; WG: $M = 49.8$, $SD = 5.7$), all $t(20) > .75$, all $p < .462$.

3.2. Mental control task

3.2.1. Intrusions before and after treatment in GAD versus healthy controls

In the first analysis, we tested the hypotheses that (a) GAD patients show specifically increased intrusions of worry-related thoughts compared to healthy controls, and that (b) these worry intrusions normalize through treatment. Therefore, we compared the numbers of intrusions in the three suppression conditions in GAD before and after treatment to those in HC before and after waiting (Fig. 1). These scores were subjected to a $group$ (GAD, HC) \times $block$ (white-bears, drowning, worry) \times $time$ (pre, post) mixed-design ANOVA. Due to technical failure, the post-treatment data of 4 subjects of the waiting group were not recorded. This analysis is therefore based on 18 GAD patients. A significant three-way interaction, $F(2,76) = 13.82$, $p < .001$, $d = 1.22$, was followed-up by additional $block \times group$ mixed-design ANOVAs separated for the pre assessment and the post treatment/waiting assessment. To investigate changes over time, an additional $group \times time$ ANOVA and follow-up paired-samples t -tests were run for the worry block only.

a) *Intrusions in GAD patients versus healthy controls.* The analysis of the baseline data (Fig. 1, left) showed that intrusion frequency was significantly higher in GAD patients than in HC in the worry block, $t(42) = 3.08$, $p < .01$, $d = .94$, but not in the white bears block or drowning block, both $t(42) < .14$, both $p > .888$, both $d < .06$, yielding a significant $block \times group$ interaction, $F(2,84) = 10.35$, $p < .001$, $d = 1.00$. Correspondingly, intrusion frequency was unaffected by block type in HC, $F(2,42) = .49$, $p = .614$, $d = .29$, whereas the block types differed in GAD, $F(2,42) = 14.71$, $p < .001$, $d = 1.67$. Bonferroni post-hoc tests revealed that GAD patients had more intrusions of their main worry topic than of white bears or drowning (both $p < .01$), while the latter two did not differ significantly from each other.

b) *The effect of CBT on intrusion frequency.* The $block \times group$ ANOVA for the post-treatment data (Fig. 1, right) indicated a significant interaction of the two factors, $F(2,76) = 3.66$, $p < .05$, $d = .63$. However, none of the follow-up independent-samples t -tests carried out for each of the block conditions reached significance, all $t(38) < 1.50$, all $p > .143$, all $d < .45$. This suggests that treatment normalized the initially increased worry intrusions in

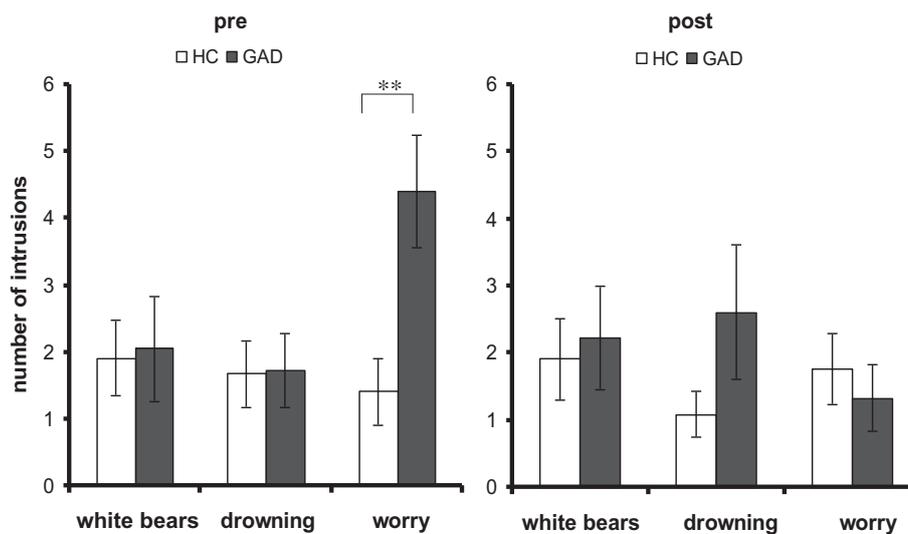


Fig. 1. Mean number of intrusions reported by GAD patients ($N = 18$) versus healthy controls ($N = 22$) in the three experimental conditions before and after treatment/waiting. Error bars show standard errors of the means.

GAD patients. This was confirmed by an additional *group* \times *time* ANOVA and follow-up paired-samples *t*-tests for the worry block: While HC showed no change in worry intrusion frequency throughout the waiting period, $t(21) = 1.16$, $p = .257$, $d = .17$, GAD showed a significant reduction following treatment, $t(17) = 3.81$, $p = .001$, $d = .99$, yielding a significant *group* \times *time* interaction, $F(1,38) = 18.02$, $p < .001$, $d = 1.37$.

3.2.2. Controlling for test-retest effects

In this analysis, it was tested whether CBT affects the frequency of worry intrusions in GAD over and above mere test-retest effects. We therefore included worry intrusion frequency scores measured (a) before and after intervention in the GAD treatment group (before: $M = 4.50$, $SD = 4.40$; after: $M = 1.64$, $SD = 2.31$) and (b) before and after waiting in the GAD waiting group (before: $M = 3.50$, $SD = 2.73$; after: $M = 4.25$, $SD = 3.20$). These were subjected to a *group* (treatment, waiting) \times *time* (pre, post) mixed-design ANOVA. While worry intrusion frequency was similar in the two GAD groups at baseline, $F(1,20) = 8.12$, $p = .01$, $d = 1.28$, $t(20) = .58$, $p = .569$, $d = .27$, it was significantly lower in treated GAD patients than waiting patients at post-assessment, $t(20) = 2.22$, $p < .05$, $d = .97$. This was confirmed by additional paired-samples *t*-tests carried out separately for each group, showing a significant decrease of intrusions in the treatment group, $t(13) = 3.09$, $p < .01$, $d = .83$, and no change in the waiting group, $t(7) = 2.05$, $p = .080$, $d = .27$.

4. Discussion

In this study we investigated whether the previously demonstrated (Becker et al., 1998) increased frequency of worry thought intrusions during a suppression task in GAD patients generalizes to other negative non-worry domains, and whether it improves during CBT. We hypothesized that patients would only differ from controls with respect to the severity of disorder-related worry intrusions, and that this effect would normalize following intervention. The results replicate earlier findings (Becker et al., 1998) by demonstrating that patients with GAD show an increased frequency of worry-related thoughts: While intrusion frequency was not different from healthy controls in the neutral thought condition, GAD patients had significantly more intrusions than

controls in the worry thought condition. This effect reflects the uncontrollability of worry which patients with GAD experience (Becker et al., 1998). In addition, our results suggest that thought suppression impairment in GAD is limited to worry thoughts. It does not generalize to other negative non-worry thoughts: GADs and controls had similar intrusion frequencies in the drowning condition.

Most importantly, results show that 15 sessions of cognitive-behavioural treatment normalized the uncontrollability of worry thoughts in a way that the frequency of worry intrusions during voluntary suppression went down to the level shown by healthy controls. This effect was significantly different from a mere retest effect, as a group of waiting list GAD patients who were tested twice did not show such a change. This finding supports cognitive theories of GAD (e.g., Borkovec et al., 2004; Newman & Llera, 2011) and thought suppression models (Najmi & Wegner, 2009; Wegner, 1994) that highlight impairments in thought suppression as significant in the pathogenesis of the disorder. Our results suggest that while reduced worry thought control might play a relevant role in the maintenance of GAD, the bias does not seem to represent an enduring vulnerability factor for the development of the disorder. Thought suppression might primarily operate successfully as an effort to down-regulate feared thoughts and images, before a full-blown disorder develops (e.g., Borkovec et al., 2004; Wells, 2005). However, in clinical states, patients become drawn into a vicious cycle of intrusions and their perception as uncontrollable, even more elaborate thought suppression attempts and, consequently, more frequent intrusions (e.g., Wells, 2005). Our data show that this process is reversible if forms of therapy are applied which counteract the subjectively experienced need for suppression of worry-related thoughts at all: As patients learn to confront and endure their worries during CBT, they also make the experience that efforts to avoid worries, such as thought suppression, will no longer be necessary.

Previous research using thought suppression paradigms also indicates that intrusions are more likely to break through when using elaborate targets such as a story, compared to single-word targets (see Abramowitz, Tolin, & Street, 2001). It is assumed that this phenomenon is underpinned by an increased detection rate for more complex targets at the level of automatic target search, due to a higher number of links to other thoughts that might prompt an

intrusion (Abramowitz et al., 2001). Previous research into the fear network in GAD has shown that not only clearly worry-related thoughts (e.g., cancer), but also semantically merely peripherally related words (e.g., diagnosis) are linked into the fear schema, capable of provoking a fear response (Reinecke, Becker, Hoyer, & Rinck, 2010). Considering this generalisation effect within a worry domain, it is possible that when asking GAD patients to suppress their main worry, increased effort is required due to the simultaneous activation of links to words or thoughts associated with the target word. This effect might contribute to the finding of increased intrusion frequency in GAD patients before therapy while trying to suppress unwanted thoughts. Similarly, our observation of reduced worry frequency during the suppression task after CBT might be underpinned by fear associations within the worry network becoming less elaborate during treatment (Reinecke et al., submitted for publication).

These considerations also point to a range of limitations of this study that need to be taken into account. First, although the white-bear paradigm has been shown to be effective in demonstrating increased intrusion frequency in clinical populations (e.g., Becker et al., 1998; Conway, Howell, & Giannopoulos, 1991; Shipherd & Beck, 2005), we have not established yet how this phenomenon relates to other cognitive biases seen in mental disorders. Cognitive models of anxiety assume that cognitive fear schemata guide anxiety-specific information processing in a broad way. If, as described above, thought suppression is influenced by the degree of complexity of an underlying fear network, then attentional bias for disorder-specific material might fuel into the development of intrusions as well. Numerous studies provide evidence that anxiety disorders are associated with attentional preference and vigilance for feared stimuli (for a review, see Mathews & MacLeod, 2005). Considering that we ask participants to suppress a thought related to their main worry that they probably show an attentional bias for, and considering that intrusions are thought to be caused by monitoring processes that increase vigilance for the banned thoughts, a potential role of attentional bias in intrusion development appears evident. This potential relationship would be worthwhile to be explicitly addressed in future research. Similarly, although also not a primary aim of this study, our results allow no conclusions as to whether the demonstrated experimental effects mediate changes in clinical symptom severity. Follow-up treatment studies more closely monitoring not only changes in intrusion frequency, but also clinical symptom severity using a range of self-report and clinician-administered measures in large clinical populations, would be essential to further determine the role of these biases in fear development and recovery.

Another limitation of the present study is that while we investigated thought control during voluntary suppression of an a-priori defined thought category (i.e., main worry), we did not establish intrusion frequency in a baseline category where participants freely report any thoughts that come to mind without any external suppression instructions. While the advantage of our approach is that it allows a more economic, hypothesis-driven measurement of a-priori defined intrusions using button presses instead of rater-evaluations of recorded think-aloud protocols as the dependent variable, it does not allow explicit conclusions as to whether CBT only affects voluntary thought control strategies in GAD patients, or whether it also has an impact on patients' natural thought suppression attempts. A further study limitation relates to the fact that worry is not only linked to GAD but to a broad range of other emotional disorders such as depression and bipolar disorder (Kertz, Bigda-Peyton, Rosmarin, & Bjorgvinsson, 2012). It remains to be tested whether the effects observed here are uniquely associated with GAD, or whether similar effects would be seen in groups of patients with other anxiety or affective disorders. This could have

important potential implications not only for treatment, but also for differential diagnostics.

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Declaration of interests

None of the authors has financial interests to disclose.

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