

# Habitual Worrying and Benefits of Mindfulness

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Published online: 11 April 2013  
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**Abstract** Although worry is in essence an adaptive mental activity, habitual worrying (repetitive and automatic worried thinking) is dysfunctional. Two studies investigated whether mindfulness mitigated adverse consequences of habitual worrying. The beneficial role of mindfulness was hypothesized on the basis of two key features: a focus on the immediate experience and an attitude of acceptance towards whatever arises in the stream of consciousness. These features map inversely on habitual worrying, which is characterized by a focus away from the present and a non-accepting attitude towards the object of worry. In study 1, it was found that, while habitual worrying correlated significantly with test anxiety, dispositional mindfulness partially mediated this relationship. Study 2 demonstrated that experimentally induced mindfulness made habitual worriers more tolerant to viewing distressing images. Together the studies suggest that mindfulness may function as an antidote to unconstructive consequences of habitual worrying.

**Keywords** Habitual worrying · Mindfulness · Anxiety · Test anxiety

## Introduction

Worrying is a common experience, which people have in various degrees of seriousness and duration. While the content of worries may vary infinitely, the experience itself seems independent of age, sex or culture (e.g. Krueger et al. 2003). In their seminal work on worry, Borkovec et al. (1983)

described worrying as ‘(...) a chain of thoughts and images, negatively affect-laden and relatively uncontrollable’ (p. 10). Worried thinking is aimed at potential dangers or threats, primarily in the future, and can be considered as an attempt to avoid or cope with these adverse events (e.g. Borkovec et al. 1983). Worry is a cognitive component of anxiety (e.g. Borkovec 1985) and forms a key feature of psychopathological conditions such as generalized anxiety disorder (e.g. Borkovec and Roemer 1995), obsessive–compulsive disorder (e.g. Salkovskis 1985) or hypochondriasis (e.g. Warwick and Salkovskis 1990). Worried thoughts may originate from internal sources, for instance bodily sensations, or may be externally triggered, such as an upcoming exam. When such cognitions reach consciousness, they may instigate an episode of worrying, for instance about the anticipated failures or dangers, the ability to cope or metacognitive beliefs about the worrying itself (e.g. Wells and Matthews 1994).

While in essence worrying is adaptive and aimed at preparing an individual for future challenges or dangers, some people worry repetitively and persistently, which may then become dysfunctional (Borkovec et al. 1983; McLaughlin et al. 2007; Verplanken 2012; Watkins 2008). Worrying may thus turn into a *mental habit*, that is, thoughts that occur repetitively and automatically (Verplanken et al. 2007; Watkins 2008). The habit component of thinking refers to the way thoughts occur (‘how’), which can be distinguished from the content of thinking (‘what’). Mental habits are characterized by properties such as thinking being persistent and ruminative, unintentional and, once established, difficult to avoid. The habitual component of thinking can be considered as an acquired overarching style of thinking in a particular domain (e.g. self-worth), thus encompassing a great number of specific cognitions and circumstances. Earlier work demonstrated that the habitual component of negative thinking accounted for unique variance in phenomena such as explicit and implicit self-esteem, symptoms of depression and anxiety, body dissatisfaction and eating disorder propensity (e.g. Verplanken et al. 2007; Verplanken and Tangelder 2011). The habitual component

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of thinking was thus identified as a marker of dysfunctional conditions over and above the cognitive content of thinking. The fact that mental habits are defined at a more general level than specific cognitions and that the habitual quality of thinking accounts for unique variance in dysfunctional conditions makes mental habits particularly interesting objects of study.

Whereas traditional approaches to alleviate dysfunctional mental conditions, such as cognitive behavioural therapy, primarily focus on the content of thinking, the habitual aspect of thinking may be more sensitive to process-oriented approaches. In the present studies, *mindfulness* was investigated as a state of consciousness which has the potential to mitigate adverse consequences of habitual worrying.

## Mindfulness

Mindfulness is characterized by two key features. The first is a receptive attention to the present moment and the awareness of the transient nature of thoughts and emotions. This distinguishes mindfulness from, for example, merely being alert, or attending to specific stimuli. The second key feature is an attitude of being open, curious and nonjudgmental towards whatever arises in the stream of consciousness (e.g. Baer 2003; Bishop et al. 2004; Brown et al. 2007; Shapiro et al. 2006).

Mindfulness has been found associated with a range of indicators of psychological well-being (Brown and Ryan 2003) and has been found beneficial to alleviate stress and anxiety (e.g. Hofmann et al. 2010; see also Roemer et al. 2009). We therefore expected that mindfulness would have the potential to mitigate adverse consequences of habitual worrying. More specifically, this expectation was based on the fact that the core features of mindfulness map inversely onto habitual worrying. Whereas mindful attention is centred on the present moment, worries are typically oriented away from the present, most often to the future (e.g. Borkovec et al. 1983). Also, the notion of impermanence of thoughts and emotions is opposite to habitual worriers' tendency to attribute disproportional weight to their worries, which, for example, occurs when individuals engage in catastrophizing (e.g. Sullivan et al. 2001). Finally, a mindful attitude of curiosity and acceptance is at odds with the typically fearful and non-accepting mindset that accompanies habitual worrying (e.g. Borkovec 1985). Taken together, the contrasting key dimensions of mindfulness versus habitual worrying provided the conceptual basis for investigating mindfulness as a potential antidote to adverse effects of habitual worrying.

Mindfulness can be trained through formal meditative practice, which draws on Buddhist meditation traditions

(see, e.g. Wallace and Shapiro 2006), for instance by long-term meditation practices (e.g. Fredrickson et al. 2008), or training programs such as the 8-week Mindfulness-Based Stress Reduction program (e.g. Kabat-Zinn 2003; Segal et al. 2002). Mindfulness has also been temporarily evoked by brief training sessions in the laboratory (e.g. Erisman and Roemer 2010). In addition, mindfulness has been studied as a dispositional variable (e.g. Brown and Ryan 2003; Brown et al. 2007; Giluk 2009), although there is still a debate in the literature about whether dispositional mindfulness and mindfulness practice reflect the same unitary construct (e.g. Bergomi et al. 2013). In the present study 1, mindfulness was assessed as an individual difference variable and was examined for its relations with habitual worrying and test anxiety. It was expected that habitual worrying would correlate positively with test anxiety and that dispositional mindfulness would correlate negatively with both habitual worrying and test anxiety. Assuming that mindfulness has the potential to take away some of the adverse effects of habitual worrying, it was expected that mindfulness would mediate between habitual worrying and test anxiety. In study 2, mindfulness was experimentally induced and effects were tested on participants' tolerance for distress. The hypothesis was tested that habitual worriers would benefit from a mindfulness intervention and would thus show an increased tolerance for distress compared to habitual worriers in a control condition.

## Study 1

### Method

*Participants and Design* Study 1 consisted of an online survey, which was posted at university websites in the USA and Europe. Because test anxiety was the dependent variable, participants were excluded if they were not doing any exams. Data were only included if participants completed the study. Participants did not receive any credits or money for taking part in the study. A total of 336 participants met the inclusion criteria. There were 64 men and 269 women (three undisclosed sex). The average age was 24 years (range 17–56 years). The study received approval from the Ethics Committee of the Department of Psychology at the first author's university.

*Measures* The habitual quality of worrying was assessed by first presenting a thought-listing task, in which participants wrote down worries they sometimes have and rated the seriousness of these on five-point scales (somewhat worrying–extremely worrying). The number of worries elicited and the averaged rated seriousness were considered as content aspects. Participants were then presented with the 12-

item Habit Index of Negative Thinking (HINT; Verplanken et al. 2007), which assessed the habitual quality of the elicited thoughts. Each item starts with the stem ‘Having those worrying thoughts is something ...’. Sample items are: ‘I do frequently’, ‘I find hard not to do’ and ‘I start doing before I realize it’. Responses were given on five-point scales (strongly disagree–strongly agree),  $\alpha=0.91$ . High scores indicate a strong habit of worrying.

Individual differences in mindfulness were assessed by the 15-item Mindful Attention Awareness Scale (MAAS; Brown and Ryan 2003). Sample items are: ‘I find it difficult to stay focused on what’s happening in the present’, ‘I find myself doing things without paying attention’ and ‘I find myself preoccupied with the future or the past’. Responses were given on five-point scales (almost always–almost never),  $\alpha=0.83$ . High scores indicate a strong tendency to be mindful.

Test anxiety was assessed by 33 items developed by Hodapp and Benson (1997). The items followed the stem ‘When I take an exam or test ...’. Sample items are ‘I ask myself whether my performance will be good enough’, ‘I sometimes find myself trembling before or during tests’ and ‘I know that I can rely on myself’ (reverse coded). Responses were given on five-point scales (not at all typical of me–very typical of me),  $\alpha=0.94$ . High scores indicate high test anxiety.

## Results and Discussion

Means, standard deviations and correlations between the study variables are presented in Table 1. A hierarchical multiple regression analysis was conducted in which test anxiety was regressed on sex and age (step 1), the number and seriousness of the worries (step 2), the habitual quality of worrying (step 3) and dispositional mindfulness (step 4). The results are presented in Table 2. Note that at step 3 the significant increase in variance accounted for by the habitual quality of worrying suggested that this component is distinct from the number and seriousness of the worries (cf. Verplanken et al. 2007). The conditions for mediation were met: The habitual quality of worrying correlated significantly with mindfulness,  $r=-0.48$ ,  $p<0.001$ , and each construct correlated significantly with the criterion, that is, test anxiety,  $r=0.47$ ,  $p<0.001$  and  $r=-0.42$ ,  $p<0.001$ ,

for habitual worrying and mindfulness, respectively. A significant indirect pathway of habitual worrying to test anxiety via mindfulness was demonstrated by a 95 % bias-corrected confidence interval between 0.07 and 0.17, based on using 1,000 bootstrap samples (e.g. Preacher and Hayes 2008; Zhao et al. 2010). In addition to this indirect path, there remained a significant direct path between habitual worrying and test anxiety. Note that these analyses were conducted while controlling for sex, age and the content-related aspects, namely the number and seriousness of worries.

## Study 2

While study 1 suggested that mindfulness plays a role in mitigating adverse effects of habitual worrying, those results were correlational in nature and thus did not allow any causal claims to be made. Also, mindfulness was assessed as an individual difference variable. In study 2, mindfulness was experimentally manipulated and thus allowed causal claims to be made. In addition, in this study another outcome variable was investigated, namely tolerance for distress, which strengthened the external validity of the studies.

## Method

**Participants and Design** Participants were 110 students who were recruited at the first author’s university. There were 36 males and 74 females. The average age was 25 years (range 18–49 years). Participants were paid £5.00 for taking part in the study. Habitual worrying was measured and mindfulness was experimentally manipulated. Participants were randomly allocated to a mindfulness of breathing meditation or control condition (this variable will be further referred to as ‘State of Consciousness’). The study received approval from the Ethics Committee of the Department of Psychology at the first author’s university.

**Procedure** Participants were run individually in the laboratory. The entire experiment was delivered via a computer. The experimenter remained naive to conditions, and was not in contact with the participants until the session had ended.

**Table 1** Means, standard deviations and correlations of the variables in study 1

	<i>M</i>	<i>SD</i>	2	3	4	5
1. Habitual quality of worrying	3.67	0.72	0.32*	0.50*	-0.48*	0.47*
2. Number of worries	6.78	3.27		0.08	-0.24*	0.20*
3. Seriousness of worries	3.63	0.69			-0.22*	0.35*
4. Dispositional mindfulness	3.16	0.57				-0.42*
5. Test anxiety	3.07	0.63				

*N*=336

\* $p<0.001$

**Table 2** Multiple regression analysis predicting test anxiety (study 1)

Independent variables	<i>B</i>	SD	beta	<i>R</i> <sup>2</sup> change	Final beta
Step 1					
Gender	0.23	0.09	0.14*	0.02*	0.09
Age	−0.00	0.00	−0.04		−0.05
Step 2					
Number of worries	0.03	0.01	0.16**	0.15***	0.03
Seriousness of worries	0.31	0.05	0.34***		0.16**
Step 3					
Habitual quality of worrying	0.32	0.05	0.37***	0.09***	0.26***
Step 4					
Dispositional mindfulness	−0.27	0.06	−0.24***	0.04***	−0.24***

*N*=336; *R*<sup>2</sup>=0.30

\**p*<0.05; \*\**p*<0.01;

\*\*\**p*<0.001

Participants first completed demographic questions and assessments of their current mood and the habitual quality of worrying. They were then given instructions for either a mindfulness of breathing meditation session or a control session. This was followed by control questions and a second assessment of mood. Participants were then presented with an image-viewing task through which the main dependent variable was assessed. This was followed by an assessment of social desirability, which was included to control the effects of mindfulness for this potential demand characteristic. Finally, in order to counteract any negative effects of the distressing images, participants were presented with a sequence of pleasant images.

#### Mindfulness of Breathing Meditation Session

Participants in the mindfulness condition were presented with an audio-recorded guided 20-min mindfulness of breathing meditation session (Kabat-Zinn 2002). Key elements of the instruction were: to make a commitment to be present in this moment; to notice where the mind wanders and what it is preoccupied with; when the mind wanders, to gently, without judgment, bring attention back to the present moment without rejecting or suppressing thoughts, emotions and sensations; and to bring acceptance to whatever arises.

Participants in the control condition listened to a 20-min audio-recorded travel documentary (Palin 2000). In a pilot study, this was judged to be engaging, but not emotionally arousing.

**Measures** Checks on the manipulation of mindfulness were presented immediately after the audio episode. Participants were asked to what extent they were distracted by thoughts, feelings or bodily sensations (extremely often–never); found it difficult to let go of thoughts and to observe thoughts, respectively (extremely difficult–not difficult at all) and how relaxed they felt (extremely–not at all). The latter assessment was included to test for relaxation as an alternative explanation for mindfulness. Responses were given on seven-point scales.

Mood was assessed by the 20-item Positive and Negative Affect Schedule (Watson et al. 1988), which has a positive and negative mood subscale, respectively. Responses were given on five-point scales (very slightly or not at all–extremely), alphas=0.90 and 0.87 for the positive and negative subscales, respectively. High scores indicate strong respective moods.

Habitual quality of worrying was measured by the HINT (Verplanken et al. 2007; see “Study 1”). In this study, the instrument was taken without a preceding thought-listing. The instruction was as follows: ‘Most people have worries now and then. The following questions are about *how* worrying thoughts usually come up for you’, which was followed by the 12 items. Responses were given on five-point scales (strongly disagree–strongly agree), alpha=0.87. High scores indicate a strong habit of worrying.

Social desirability was measured by the Brief Marlow–Crowne Social Desirability Scale (Strahan and Gerbasi 1972). The scale consists of ten dichotomous (true–false) items. The dichotomous items were summed into an overall social desirability index. High scores indicate a tendency to give socially desirable responses.

#### The Image Viewing Task

Participants were asked to view and rate a series of images and were told that these might be unpleasant. Ninety-seven images were selected from the International Affective Picture System (Lang et al. 2008). On the basis of a pilot study, images were selected that might trigger worrying thoughts relevant to the participants’ own life, or represented threats or issues that they might personally worry about. The chosen images included, for instance, scenes of car crashes, violence, mutilations, sick people, tumours and cigarettes.

In the main study, the images were randomly presented 5 s each, after which participants were asked to rate how unsettling they found the image on five scales (i.e. disturbing, overwhelming, unpleasant, preoccupying and difficult to cope). All responses were given on seven-point

bipolar scales (e.g. not disturbing at all–extremely disturbing). The items were averaged,  $\alpha=0.91$ . High scores indicate that participants found the images unsettling.

Importantly, participants were instructed to indicate themselves when to stop viewing images. The number of images they chose to see was the dependent variable ('tolerance for distress'). No indications were obtained during the session or in the debriefing that participants were suspicious about our purposes.

## Results and Discussion

Five participants indicated that they had not understood the instruction to stop viewing images themselves, and their data were discarded. Two participants were excluded on the basis of insufficient command of the English language. Therefore, all analyses reported were on the data from 103 participants.

### *Manipulation Checks and Mood*

The manipulation checks and mood assessment were subjected to independent samples *t* tests. Participants in the mindfulness meditation condition, compared to the control condition, were less distracted by thoughts, feelings or bodily sensations,  $M$ -mindfulness=2.61,  $M$ -control=3.67,  $t(101)=4.31$ ,  $p<0.001$ , and found it less difficult to let go of thoughts,  $M$ -mindfulness=3.33,  $M$ -control=4.07,  $t(101)=4.31$ ,  $p<0.001$ . There were no significant differences between the two conditions in the perceived difficulty to observe thoughts,  $M$ -mindfulness=4.59,  $M$ -control=4.24,  $t(101)=1.15$ . Important for the interpretation of the results, there were no significant differences between conditions in how relaxed participants felt,  $M$ -mindfulness=2.71,  $M$ -control=2.74,  $t(101)=0.10$ , or on the mood scales,  $M$ -mindfulness=2.68,  $M$ -control=2.76,  $t(101)=0.49$ , for positive mood,  $M$ -mindfulness=1.32,  $M$ -control=1.39,  $t(101)=0.76$ , for negative mood.

The images were judged as unsettling. This was indicated by an overall average rating of 3.65 on the index composed of how disturbing, overwhelming, unpleasant, preoccupying and difficult to cope the images which participants viewed were rated. This differed significantly from the low end point of the scale,  $t(102)=31.30$ ,  $p<0.001$ . The images were not judged differently between the mindfulness and control conditions,  $M$ -mindfulness=3.51,  $M$ -control=3.77,  $t(101)=1.51$ . The ratings correlated significantly with the habitual quality of worrying,  $r=0.34$ ,  $p<0.001$ .

### *Tolerance for Distress*

The number of images seen varied from 2 to 82,  $M=22$ ,  $SD=18$ . The hypothesis that habitual worriers would benefit most from a mindfulness intervention and would thus show an

increase in tolerance for distress compared to habitual worriers in a control condition was tested by means of moderated multiple regression. The control and mindfulness conditions were coded as  $-1$  and  $+1$ , respectively. The HINT and the number of images seen were standardized. The number of images seen was regressed on the social desirability index, State of Consciousness (condition), the HINT and the State of Consciousness $\times$ HINT interaction. The weights of social desirability and HINT were non-significant, betas=0.11 and 0.00, respectively. State of Consciousness obtained a significant beta weight,  $\beta=0.37$ ,  $p<0.001$ . However, as expected, this main effect was qualified by a significant State of Consciousness $\times$ HINT interaction,  $\beta=0.20$ ,  $p<0.04$ ,  $R^2=0.18$ .

The interaction was decomposed by means of simple slope analysis. There was no statistically significant effect of State of Consciousness for participants with a weak worry habit (1 standard deviation below the mean HINT score),  $\beta=0.17$  (95 % confidence interval between  $-0.10$  and  $0.44$ ). On the other hand, participants in the mindfulness condition with a strong worry habit (1 standard deviation above the mean HINT score) viewed significantly more images than strong worry habit participants in the control condition,  $\beta=0.57$ ,  $p<0.001$  (95 % confidence interval between  $0.31$  and  $0.83$ ). These results thus support the hypothesis.

## General Discussion

The two studies tested the hypothesis that mindfulness has the potential to mitigate adverse consequences of habitual worrying. In the correlational study 1, it was found that, while controlling for the content of worries, the relationship between habitual worrying and test anxiety was mediated by dispositional mindfulness; low levels of habitual worrying were related to low levels of test anxiety through high levels of mindfulness and vice versa, thus suggesting a so-called competitive mediation effect (Zhao et al. 2010). This mediation was accompanied by a direct effect of habitual worrying on test anxiety. This suggests that, as can be expected, mindfulness is not the only mediator and that other factors play a role as well. These factors and their relations with mindfulness may thus be the object of future studies. Study 2 demonstrated that experimentally induced mindfulness made habitual worriers more tolerant to viewing distressing images. The experimental design in this study made the causal relation of mindfulness to tolerance of distress more plausible. Taken together, the two studies suggest that mindfulness has the potential to serve as an antidote to unconstructive consequences of habitual worrying, in this case test anxiety and tolerance for distress as two manifestations of anxiety.



The beneficial role of mindfulness in mitigating dysfunctional correlates of habitual worrying was hypothesized on the basis of two key features of mindfulness, namely the self-regulation of attention to focus on the immediate experience and an attitude of curiosity and acceptance towards whatever arises in the stream of consciousness (e.g. Bishop et al. 2004). These features map inversely on habitual worrying, which is characterized by mental time travelling (e.g. anticipating future negative outcomes) and a fearful, non-accepting attitude (cf. Borkovec 2002; Verplanken 2012). Further studies are needed to investigate in more detail which aspects of mindfulness exactly may be responsible for the beneficial effects on worrying. For instance, based on the Five Facet Mindfulness Questionnaire (Baer et al. 2006), Fisak and von Lehe (2011) found that nonreactivity to inner experience, nonjudgement of inner experience and acting with awareness were unique predictors of worry symptoms, whereas observing and describing were not (note that a similar control item in study 2 did not differ between the conditions). The same was found among meditators by de Bruin et al. (2012). Alternatively, it might be that mindfulness is only effective as a ‘package’. This would support a holistic view that mindfulness is only a meaningful concept as an integrated whole and that mindfulness components should not be studied in isolation (e.g. Rosch 2007; cf. Williams 2010).

Although the present studies did not include assessments of the precise mechanisms through which mindfulness might work, which is a limitation of the studies, the results are compatible with the notion that mindfulness benefits emotional self-regulation. This would fit into a growing body of research on effects of meditative practices and their trait-based correlates on psychological functioning and affect regulation (e.g. Arch and Craske 2006; Brown and Ryan 2003; Erisman and Roemer 2010; Chambers et al. 2009; Davidson et al. 2003; Fredrickson et al. 2008; Hölzel et al. 2011; Koole 2009; McCullough and Willoughby 2009; Williams 2010). Mindfulness might support successful affect regulation in various ways, for instance by regulating attention to the ongoing sensory, cognitive and affective fields of awareness (e.g. Cahn and Polich 2006), strengthening flexible response tendencies (e.g. Moore and Malinowski 2009), reducing emotional reactivity (e.g. Arch and Craske 2006), enhancing emotion differentiation (e.g. Hill and Updegraff 2011) and reinforcing metacognitive modes of processing (e.g. Wells and Matthews 1994). Such skills may thus enhance habitual worriers’ ability to better recognize and disengage from worries and to better modulate their emotional responses. This does not necessarily imply feeling ‘happier’, or being free of worries or negative emotions, but rather acquiring skills to take a more detached attitude towards such experiences, which otherwise would carry away the individual (e.g. Hayes and Feldman 2004).

Some alternative explanations of the effects of mindfulness in study 2 should be considered. The first is that the intervention may have made participants in the mindfulness condition more relaxed than participants in the control condition. This explanation was not supported, as there was no significant effect on self-reported relaxation between the mindfulness versus control condition. Another explanation might be that participants in the mindfulness condition altered or suppressed their emotions. This explanation was not supported either; the mood measures and the distress judgments during the visual image task did not differ between conditions. While relaxation and emotion suppression might sometimes be effective strategies to cope with stress and anxiety, this is not commensurate with mindfulness, which is geared towards increasing awareness and acceptance, rather than denying, changing or suppressing thoughts and feelings. Listening to a documentary might be seen as a more passive activity than meditation, and control participants might thus have been less motivated or bored during the image viewing task. However, this does not explain the relatively low number of viewed images among low worriers in the mindfulness condition. We neither obtained evidence of this during the debriefing. Demand characteristics might have driven participants’ responses in the mindfulness condition. While this might be an alternative explanation for the three significant manipulation check items, the image ratings did not differ significantly between the two conditions, which does not support a demand characteristics explanation. Also, the analysis of the key dependent variable controlled for individual differences in social desirably responding, which renders such an explanation less likely. In sum, while future experiments might test mindfulness manipulations more rigorously as was done in study 2, we are not convinced that satisfactory alternative explanations exist for the present results.

An intricacy is that there are many manifestations of mindfulness and hence a vast amount of paradigms (Davidson 2010). Firstly, there is the distinction between trait and state mindfulness. Although mindfulness was found inversely related to habitual worrying in both studies, dispositional mindfulness may not be the same as mindfulness trained in meditation practices. It should be noted that much depends on the way individual differences in mindfulness are assessed. The MAAS, which was used in study 1, represents primarily the awareness facet of mindfulness, while the meditation session in study 2 stressed the transient nature of thoughts and emotions and the self-compassion aspect in addition to that. Individual differences in mindful awareness may be rooted in basic personality dimensions (e.g. Giluk 2009), but may also stem from long-term meditation training (e.g. Perlman et al. 2010). The latter thus demonstrates that the distinction between trait and state mindfulness is gradual rather than discrete.

Secondly, it may seem surprising that the 20-min mindfulness of breathing meditation session in study 2 had observable effects. It should be noted, though, that these effects have most likely been short-lived. It is likely that more enduring effects can only be attained by intensive meditation training or therapy. This is undoubtedly also true if mindfulness would be used to change adverse effects of habitual worrying, let alone habitual worrying itself, since such habits have a long history and are firmly ingrained in cognitive and neural systems (e.g. Paulesu et al. 2010). In that respect, the present results are limited in scope. Yet the fact that short-lived effects can be obtained may be considered as ‘proof of concept’ and suggests that mindfulness is indeed a powerful and interesting state of consciousness, which is worth further exploring.

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