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Escaping from worries: Comparing the effectiveness of focusing on one's breath, a neutral and a positive distractor in worry control

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Abstract
Focused-distraction strategies are commonly used for thought control, but their effectiveness in handling personal worries with different types of distractors has rarely been examined. To examine this issue, 101 undergraduate and graduate students whose depression levels fell below mild depression were recruited (64.4% female, M_{age} = 20.27) and were randomly assigned to one of the three strategy conditions: 34 participants for the focused-breathing strategy (FBS), 34 for the focused-positive-distractor strategy (FPS), and 33 for the focused-neutral-distractor strategy (FNS). After a short introduction and practice, they applied the assigned strategy during a 5-min worry control session to prevent thoughts regarding a recent worrying event. The number of worry intrusions was measured using an online self-caught method. Participants rated their emotional states before and after the worry control session. Their working memory capacities (WMCs) and depressive tendency were comparable across conditions. The results showed the FBS and FPS groups exhibited fewer worry intrusions than did the FNS group. Furthermore, worry intrusions were negatively related to WMC for the FNS group but independent of WMC for the other two. The above findings together indicate that the FBS and FPS are relatively effective and effortless methods for reducing worry intrusions. Negative emotions decreased after the worry control session for all groups. However, decoupling of negative emotions from worry intrusions was only observed for the FBS and FNS groups. Overall, FBS outperforms FPS and FNS in managing worries from the above aspects. Several theoretical and practical implications of the study were discussed.

Keywords Worry · Thought suppression · Focused-distraction strategy · Focused breathing · Mindfulness · Positive distractors

Introduction

Worry is defined as repetitive, uncontrollable thoughts regarding possible negative future outcomes (Borkovec et al., 1983). Although a moderate level of worry can be adaptive because it can motivate people to solve problems and prepare for the future (Davey, 1994; Szabó & Lovibond, 2002), excessive worry can damage people's mental capacities and attentional control (Eysenck et al., 2007; Hayes et al., 2008) and increase negative emotions, such as anxiety (Llera & Newman, 2010; Oathes et al., 2008). Having excessive worry and anxiety is considered the core symptom of generalized anxiety disorder (American Psychiatry Association, 2013). Even for the nonclinical population, persistent worries can prolong and escalate stress reactions, including high physiological and psychological arousal, which is harmful to one's health over time (Brosschot & Van Der Doef, 2006; Brosschot et al., 2007; Llera & Newman, 2010; Newman et al., 2013). Moreover, worry is positively correlated with dysfunctional coping strategies (Sebri et al., 2021), which in turn results in an even more stressful situation and traps one in a vicious cycle. Therefore, knowing how to reduce worry intrusion and increase a sense of controllability in daily life is important for people's well-being and for preventing the development of generalized anxiety disorder.

Controlling worry intrusion is generally difficult for two reasons. First, the control of unwanted thoughts requires mental resources (e.g., Brewin & Beaton, 2002; Brewin & Smart, 2005), which are usually limited among people

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haunted by worries. Second, the association of worrisome thoughts with negative moods might make worry control challenging because, according to the mood congruency theory, thoughts congruent to the mood state are more difficult to suppress than incongruent ones are (Bower, 1981; Conway et al., 1991; Howell & Conway, 1992). Evidence has shown that controlling negative thoughts is more difficult than controlling positive ones when a person is in a negative emotional state, and vice versa (Howell & Conway, 1992). In addition, people with depression find it harder to control negative thoughts than healthy controls do (Conway et al., 1991; Howell & Conway, 1992; Wenzlaff et al., 1988). Therefore, identifying a strategy that can effectively control worry intrusions with limited mental resources and reduce associated negative emotions is crucial.

However, the issue of the immediate effect of strategies that individuals can use in daily life for worry control has been relatively ignored. The current study was thus conducted for this purpose, particularly to focus on the usefulness of attention distraction strategies in various aspects of worry control for the nonclinical population.

Attention distraction is a common approach people use to avoid unwanted thoughts (e.g., Coles & Heimberg, 2005). With this strategy, people divert their attention to a distractor or an activity to prevent themselves from being occupied with an unwanted thought. In addition, Regan et al. (2016) showed that people who tend to use the strategy also tend to select an adaptive strategy (e.g., the problem-focused coping strategy) in facing stress. Moreover, the application of both strategies is associated with decreased psychological distress (Coles & Heimberg, 2005; Khanipour, 2011; Ragan et al., 2016). It is thus a promising strategy for worry control. However, the evidence regarding its effectiveness in controlling for negative thoughts, particularly for worrisome thoughts, is insufficient and inconsistent. Because researchers have used different groups of participants, types of distractors, and performance indices (Ainsworth et al., 2017; Feldman et al., 2010; Harvey & Payne, 2002; Ju & Lien, 2016; Lin & Wicker, 2007; Najmi et al., 2009; Salkovskis & Reynolds, 1994; Watson & Purdon, 2008; Wegner et al., 1987), the effects of the strategy are far from clear or conclusive.

In this study, we aimed to assess systematically the usefulness of three types of focused-distraction strategies, which all involve attention deployment but use different distractors, in different aspects of worry control, including participants' ability to reduce worry intrusions and associated negative emotions, dependency on mental resources, and ability to decouple negative emotions from worry intrusion. These strategies were the focused-neutral-distractor strategy (FNS), the focused-positive-distractor strategy (FPS), and the focused-breathing strategy (FBS), all of which are known to be useful for controlling certain types of unwanted thoughts. Relevant literature for each type was reviewed in the following sections.

Focused-neutral-distractor strategy

Redirecting attention to a neutral and unrelated distractor has long been considered an effective method of preventing the intrusion of unwanted thoughts and regulating negative emotions (e.g., Gross, 1998, 2014; Lin & Wicker, 2007; Salkovskis & Campbell, 1994; Wegner et al., 1987). For example, Wegner et al. (1987) first empirically revealed that participants taught to focus on a neutral mental image (e.g., a red Volkswagen) experienced fewer intrusions of a suppressed neutral thought (i.e., a thought regarding white bears) than did those who were not taught any strategy. In addition, Lin and Wicker (2007) demonstrated that participants who focused on a mental image of a neutral but familiar scene (i.e., a kitchen) experienced fewer thought intrusions and less anxiety toward a story regarding a fatal traffic accident than did participants without a designated strategy. This evidence indicates that the FNS is a promising candidate for managing daily worries.

However, the evidence that effectiveness of the FNS depends on users' mental resources or working memory capacities (WMCs) could limit its application in worry control. As Ju and Lien (2016) reported, when the FNS was applied to suppress a neutral thought, the participants' thought control failures decreased as their WMCs increased. This result indicates that continuously representing and focusing on a mental object, even one that is emotionally neutral and easy to imagine, exerts mental resources to some degree. As known, when mental capacities are insufficient or expended, the mind is likely to wander (McVay & Kane, 2010). During mind wandering, personal concerns, including one's worries, are usually the default content of consciousness and thus easily enter the mind (Klinger et al., 2018). To the best of our knowledge, no study has empirically examined whether the WMC-dependent FNS is effective for worry control.

Focused-positive-distractor strategy

The FPS could be a promising method for worry control because it can provide an emotional uplift and activate a network of mental representations opposite to negative thoughts, which might reduce the occurrence of worrisome thoughts (Beevers et al., 1999). Indeed, people often recall positive memories to improve their mood (Josephson, 1996). However, the evidence regarding the FPS is limited and

mixed. Inconsistencies have been identified across studies that have used different positive distractors to control various types of thoughts among different populations.

Two general types of positive distractors were used in previous research: positive memories and imaginary positive events. Harvey and Payne (2002) reported that for those with sleep difficulty, imagining an interesting and relaxing situation is more helpful for reducing sleep onset latency and the discomfort associated with presleep worries than focusing on unspecified distractors. However, retrospective self-ratings indicated no differences occurred in the frequencies of worrisome thoughts among those who adopted these two strategies. By contrast, Eagleson et al. (2016) found that thinking of a positive image unrelated to a worry or an imagined positive outcome about the worry significantly decreased the worry, anxiety, and the frequency of negative thought intrusions among patients with generalized anxiety disorder after a 1-week training program.

For countering obsessive thoughts, patients with obsessive–compulsive disorder found focusing on an enjoyable memory useful, but healthy controls did not (Najmi et al., 2009). However, in a study conducted on undergraduates with obsessive–compulsive tendencies, Watson and Purdon (2008) found that those who distracted themselves with pleasant memories did not outperform, in terms of reducing obsessive thoughts and unpleasant feelings, those who distracted themselves with neutral thoughts or external sounds and those not taught any strategy. Wang et al. (2018) further found that for ordinary undergraduate students, focusing on memories specifically about the fulfillment of a sense of autonomy was helpful in reducing the unwanted thought intrusion of a negative concept (i.e., violence), and the effectiveness was mediated by the level of satisfaction that the users felt for such memories.

However, most of the aforementioned studies either lacked a suitable control group or had a small research sample. In addition, no study has considered participants' mood states, which might have an influence on the effect of FPS. As some studies have indicated, improving mood by recalling a happy memory is difficult for people with dysphoric mood (Conway et al., 1991; Joormann & Siemer, 2004; Joormann et al., 2007). Whether the effect of the FPS on worry control depends on WMCs has not been examined, either. Therefore, although the FPS seems to be a promising strategy, more investigations on this topic are needed.

Focused-breathing strategy

The FBS is a basic meditation skill and a key component of standardized mindfulness-based interventions. Specifically, it emphasizes the redirection of attention to one's breaths and being aware of the physical sensation of breathing in and out. In a broad sense, the FBS can thus be regarded as a focused-distraction strategy in which physical activity and bodily sensation instead of mental events are used as distractors. Mindfulness interventions usually consist of multiple elements, including the FBS, the explicit teaching of mindful attitudes (e.g., acceptance and nonjudgment), mindful yoga, group support, or therapeutic skills (e.g., Kabat-Zinn, 1982, 1990; Seagal et al., 2002). As a whole, mindfulness interventions are beneficial for reducing negative emotional responses (e.g., Arch & Craske, 2006; Broderick, 2005; for a review, see Leyland et al., 2019); repetitive negative thoughts, including worry and rumination (Chambers et al., 2007; Delgado et al., 2010; Ramel et al., 2004); and mind wandering (Mrazek et al., 2013; Rahl et al., 2017). However, few studies have directly examined the effect of the FBS alone on reducing thought intrusions and the emotions associated with it.

Among them, Salkovskis and Reynolds (1994) reported that practicing the FBS for a short time was effective in reducing thoughts regarding cigarette craving. Ju and Lien (2016) showed that 6-min practice of FBS could effectively reduce intrusions of an unwanted neutral thought. Furthermore, they found its effectiveness is independent of individuals' WMCs, which implies FBS alone could be a suitable strategy for reducing bothersome thoughts, especially for people with limited mental capacities. In addition, Ainsworth et al. (2017) reported that compared with the practice of muscle relaxation, the performance of 10-min focused breathing by participants before worry induction resulted in fewer subsequent negative thought intrusions but not subjective anxiety.

Contradictorily, Feldman et al. (2010) found that compared to progressive muscle relaxation and loving-kindness meditation, practicing the FBS for 15 min combined with the instructions regarding mindful attitude (i.e., being nonjudgmental and open toward occurring thoughts) resulted in even more repetitive depressive or worrying thoughts rated retrospectively for undergraduate students. However, their negative feelings were found to be independent of the occurrence of negative thoughts compared to the other two conditions, indicating that an increase in depressive or worrying thoughts did not necessarily elicit or accumulate negative reactions. This decoupling has been regarded as a crucial mechanism of mindfulness intervention for alleviating the worry symptoms over time (Hoge et al., 2015). Note that the decoupling cannot be attributed solely to the FBS in the abovementioned study because mindful attitude instructions were also provided.

Based on the studies reviewed above, though some contradictory evidence was found, FBS seems to be a useful strategy for worry control, but whether FBS alone can decouple negative emotions from worry intrusions and whether its effectiveness is still independent of WMC for

controlling negative thoughts such as worry need further examination.

Current study

To compare the effectiveness of FBS, FPS, and FNS in worry control, a between-participant design and a thought suppression paradigm were adopted in this study. University students without a history of mental disorders were recruited and randomly assigned to one of the three strategy conditions to control for their ages, educational backgrounds, and daily experiences. Two individual difference factors, namely participants' WMCs and the depressive tendency, were also measured to control the participants' mental capacities and current mood states across the groups. Participants beyond the range of mild depression (Beck Depression Inventory-II > 19) were excluded to reduce the heterogeneity of mood states further in the research sample.

A potential useful distractor for each strategy was selected based on previous studies. For the FNS, the mental image of a blue sports car used in Ju and Lien (2016) was selected as a distractor due to the ease of imaging it and its rarity in Taiwan to reduce the influence of familiarity or personal experiences. For the FPS, individuals' positive memories rather than imaginary events or outcomes were adopted as distractors because vividly personal experiences might require less effort to maintain consciously than do imaginary ones (Conway et al., 2003). For the FBS, a technique derived from the East Asian tradition of movement-based contemplation was used as the distractor (Ju & Lien, 2016; also see Teng & Lien, 2016, 2022). In particular, participants were guided to focus on their breathing and be aware of the associated bodily sensation, with their eyes looking downward and inward in a relaxed manner (for additional details, see the method section). This skill is helpful for reducing mind wandering and repetitiveness of certain thoughts (Ju & Lien, 2016; Teng & Lien, 2022). Unlike the FBS used in Feldman et al. (2010), the FBS used in this study did not involve any explicit instructions on mindful attitudes.

These three strategies were assessed in terms of four indices, namely, their effectiveness in reducing worry intrusions and negative emotion, in decoupling negative emotions from worry intrusion, and their demands on mental efforts. To reduce potential memory bias, the self-caught method rather than retrospective ratings was used to measure the degrees of worry intrusion during the worry control session. The participants' efficacy of emotion regulation was determined by evaluating their emotional states reported before and after the application of the three strategies. Similar to Feldman et al. (2010), the association between the frequency of worry intrusion and the subsequent emotional state was gauged to determine whether these strategies could decouple negative emotions from worrisome thoughts. In addition, whether the tendency for worry intrusions for each strategy group would be predicted by participants' WMCs was examined to reveal how mentally demanding each strategy would be. Finally, the influence of participants' tendency toward depression on the reduction of worry intrusions for each strategy was also explored.

Because maintaining a mental image in consciousness is supposed to be more effortful than focusing on a positive personal experience or a dynamically changing physical process or sensation is, the FNS group might find it easier to fall into mind wandering, most likely to involve one's current concerns such as one's worries, due to the failure of executive control. As a result, we predicted that the number of worry intrusions would be more for the FNS group than it would be for the FPS and the FBS groups. Corollary, participants' performance regarding worry intrusion would be negatively correlated with their WMC for the FNS group but independent of WMC for the FBS and FPS groups. In other words, we predicted that the FBS and FPS would be more efficient in reducing worry intrusions with less effort than would the FNS would be.

In addition, because distraction from an emotion-charging stimulus is generally conducive to mitigating negative emotional reactivity (Gross, 1998, 2014), we predicted that all three strategies would be useful for regulating the negative emotions associated with worry. Because worrying thoughts are usually associated with negative feelings, we predicted that the more worry intrusions occurred in general, the more negative the emotion would be, except for the FBS group. It is because we predicted that the adopted FBS could decouple negative emotional reactivity from worry intrusions by ceasing the process of deliberate thinking and thus diminishing the following thoughts and feelings related to worry.

Methods

Participants

One hundred and two undergraduate and graduate students[1] from National Taiwan University and National Taiwan Normal University were recruited online or from introductory psychology courses for 150 NTD (approximately 5 USD) or course credits in return. They were randomly assigned to one of three conditions: the FBS, FPS, or FNS condition. One participant was excluded from the

[1] An additional 22 students with Beck Depression Inventory-II scores of 20–42 were excluded to maintain homogeneity within and between groups.

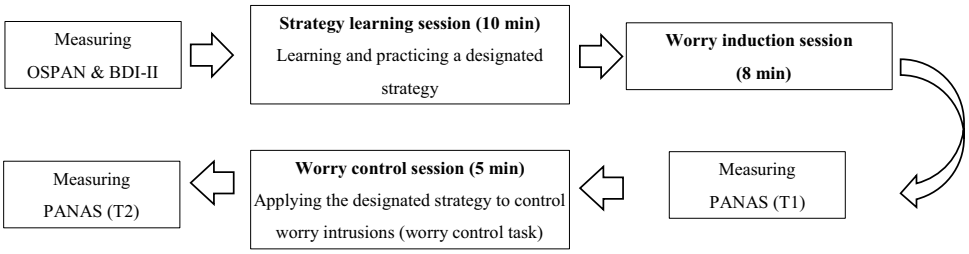

Fig. 1 The general procedures of the experiment

statistical analysis for not following the instructions of the assigned strategy. Thus, the data of 101 participants (34 from the FBS group, 34 from the FPS group, and 33 from the FNS group) were included in the following analysis. Among them, 35.6% ($n = 36$) were men. Their mean age was 20.27 (ranging from 18 to 28).

Study design

An experiment with a multiphase between-participant design was conducted. The numbers of worry intrusions measured in the worry control sessions for the three groups were compared. In addition, the participants' emotional states were measured at two time points: before (Time 1; T1) and immediately after (Time 2; T2) a worry control session. We examined the degree to which the participants' emotional states differed across the groups and time. Two individual difference variables, namely participants' WMCs and depressive tendency, were also measured and controlled across the groups.

Procedures

All participants individually underwent the following procedures in a quiet room. After providing informed consent, the participants in each group performed the operation span (OSPAN) task to measure their WMCs and the Beck Depression Inventory-II (BDI-II) to measure their tendencies of depression, which took no more than 20 and 10 min, respectively. Then, the participants were taught the strategy they had been assigned, and then they practiced focusing on the designated distractor by themselves for 5 min. After the first 2-min practice, the participants took a break to make sure they could follow the instructions and then continued to practice for another 3 min. Learning and practicing the strategy required approximately 10 min. The instructions for each strategy are as follows:

"*Sit upright with your eyes closed, and try to breathe as slowly and deeply as possible. Concentrate on your breathing for as long as you can, and feel the air coming through your nose and filling up your chest. Every time you notice that your attention has shifted away from your breathing, remind yourself to take a deep breath, redirect your attention to your breathing, and keep your eyes looking inward and downward when exhaling.*"
[the FBS group]
"*Sit upright with your eyes closed, and try to recall an event that made you happy. Concentrate on the event that you just recalled for as long as you can. Every time you notice that your attention has shifted away from the event, remind yourself to redirect your attention back to it. If you recall something else relevant to the event, please make sure that your attention is on the event that you just recalled and not on other events.*"
[the FPS group]
"*Sit upright with your eyes closed, and try to imagine a particular blue sports car. Concentrate on that blue sports car for as long as you can. Every time you notice that your attention has shifted away from the car, remind yourself to redirect your attention back to it. If you imagine something else with the car, please make sure that your attention is on the car and not on other objects.*"
[the FNS group]

Subsequently, the participants were subjected to a worry induction session with a duration of approximately 8 min. During this session, the participants were asked to recall their most worrying event in the past month and spend 3 min briefly writing down the contents of this event on a piece of paper. They next had to answer, "How worried were you about the event?" Participants responded according to a 5-point scale ranging from 1 (*not at all*) to 5 (*extremely*). Then, a worry control task was conducted in which the participants were asked to apply the designated strategy to prevent themselves from thinking about the worry for 5 min. The participants completed the Positive and Negative Affect Scale (PANAS) before and after the worry control task to record their current emotional states. The total experiment time was approximately 60 min. Figure 1 depicts the above-mentioned procedures.

Measures

Worry control task

The worry control task used in this study is a revised version of the thought suppression task (Ju & Lien, 2016; Salkovskis & Campbell, 1994). The participants were instructed to apply the strategy taught to them (i.e., the FBS, FPS, or FNS) to avoid thinking about the most worrying event they had recalled in the worry induction session. Every time the participants became aware that they were thinking about the most worrying event, they pressed a handheld counter once and redirected their attention to the designated target again. The number of times that the participants pressed the counter was recorded as their frequency of worry intrusions.

Ratings for emotional states

The PANAS (Watson et al., 1988) was used to measure the participants' emotional states. This scale comprises 10 items that reflect positive states (e.g., "interested" and "inspired") and another 10 that reflect negative states (e.g., "irritable" and "distressed"). The participants were asked to indicate their feelings for each item of the PANAS on a 5-point scale ranging from 1 for *very slightly* to 5 for *extremely*. The possible total scores on the positive and negative subscales of the PANAS range from 10 to 50. The PANAS exhibits satisfactory discrimination between its positive and negative subscales, and each subscale has satisfactory internal consistency. The Cronbach's α values for the positive and negative subscales were 0.89 and 0.85, respectively (Watson et al., 1988).

In addition, participants also rated how calm and relaxed they were, which are usually incompatible with worry.

Beck depression inventory-II

A Chinese version of the BDI-II (Beck et al., 1996) was used to measure the participants' tendency toward depression. The BDI-II consists of 21 items that assess the severity of depressive symptoms in the prior 2 weeks on a 4-point scale ranging from 0 to 3. A total score within 0–13, 14–19, 20–28, and 29–63 represents a normal state, mild depression, moderate depression, and severe depression, respectively. This inventory has high internal consistency (Cronbach α equals 0.93 for college students) and test–retest reliability of 0.75 (Beck et al., 1996).

Operation span task

OSPAN is a commonly used individual difference index for cognitive capacity or executive functions originally developed by Turner and Engle (1989). A Chinese version of the OSPAN task adapted by Jen and Lien (2010) was used in this study to measure WMCs.

The participants were asked to memorize several two-character Chinese terms (the primary task) while performing mental arithmetic operations during the task. In each trial, the participants were asked to adhere to the following instructions: (a) read out an equation appearing on a computer screen (e.g., 9 – 5 = 4), (b) verify the accuracy of the equation orally, then read out and try to remember a two-character Chinese term (e.g., 學生, which means "student") appearing on the screen after the verification. These steps were repeated several times during the trial until a recall instruction appeared on the screen. The participants then had to recall as many terms as they could in any order. The number of terms to be memorized in each trial gradually increased from two to seven, three trials for each level of difficulty. Eighty-one to-be-remembered terms were displayed in this task. A participant's WMC score was calculated as the total number of terms that they correctly recalled during the task.

Data analysis

To compare the effectiveness of strategies in reducing worry intrusions and whether it would be predicted by individuals' mental capacities (i.e., WMC scores) and the depressive tendency (i.e., BDI-II scores), a negative binomial regression model was conducted. The analysis is commonly used for over-dispersed count data (e.g., Coxe et al., 2009) such as the self-captured numbers of worry intrusions in our study. Group, two individual difference factors (WMC and BDI-II scores), and the two two-way interactions between the group and the individual difference factors were used as predictors of worry intrusions in the regression model. Group was dummy coded and the FNS group was set as the reference group for interpretation purposes. Simple slope analyses were further conducted when interaction effects reached significance.

To test how the participants' emotional states changed for each of the adopted focused-distraction strategies, we performed a mixed-design analysis of variance to examine the effects of time (T1 and T2) and group (the FBS, FPS, and FNS groups) on four emotional states: positive emotions, negative emotions, relaxation, and calmness. Post hoc analyses were performed with Bonferroni correction on p values when necessary.

To investigate whether the three focused-distraction strategies could decouple the subsequent emotional state from worry intrusions, we performed a partial correlation analysis to examine the relationship between the number of worry intrusions and the emotional ratings at T2 while controlling the emotional ratings at T1.

Table 1 Group characteristics

	Group means (SDs)		
	FBS (N = 34)	FPS (N = 34)	FNS (*N* = 33)
Age	20.71 (2.54)	19.71 (1.34)	20.39 (1.90)
Gender (Female/Male)	21/13	23/11	21/12
BDI- II	9.38 (4.51)	10.03 (4.72)	9.00 (4.81)
WMC	62.18 (5.95)	62.65 (7.35)	62.91(8.12)
Worry degree	3.56 (0.75)	3.62 (0.65)	3.64 (0.70)

FBS Focused-Breathing Strategy, *FPS* Focused-Positive-distractor Strategy, *FNS* Focused-Neutral-distractor Strategy, *WMC* Working Memory Capacity, *BDI-II* Beck Depression Inventory-II

Table 2 Results of negative binomial regression analysis for the prediction of worry intrusions

Predictor	b	SE_b	95% *CI*	*p*
Group (FBS)	−6.00	2.07	[−10.05, −1.95]	.004**
Group (FPS)	−4.85	1.82	[−8.41, −1.29]	.008**
BDI-II	0.06	0.03	[0.01, 0.11]	.003**
WMC	−0.05	0.02	[−0.08, −0.02]	.025*
FBS × BDI-II	−0.01	0.05	[−0.10, 0.08]	.79
FPS × BDI-II	−0.01	0.04	[−0.09, 0.07]	.80
FBS × WMC	0.08	0.03	[0.02, 0.15]	.009**
FPS × WMC	0.07	0.03	[0.02, 0.12]	.009**

* $p < .05$; ** $p < .01$; *FBS* Focused-Breathing Strategy, *FPS* Focused-Positive-distractor Strategy, *FNS* Focused-Neutral-distractor Strategy; Group was dummy recoded as FBS and FPS separately, and FNS served as the reference category. *CI* Confidence Interval, *WMC* Working Memory Capacity, *BDI-II* Beck Depression Inventory-II

Negative binomial regressions were estimated using R program (R Core Team, 2018). The following simple slope analyses and figures were produced with the required packages (Kassambara, 2020; Lüdecke, 2018; Searle et al., 1980; Wickham, 2009). Analysis of variance and correlations were conducted with IBM SPSS (IBM Corp., 2015).

Results

As Table 1 shows, no differences were observed across the three groups in terms of sex distribution ($\chi^2(2) = 0.27$, $p = 0.88$), age ($F(2, 98) = 2.25$, $p = 0.11$), WMC ($F(2, 98) = 0.09$, $p = 0.91$), mean BDI-II scores ($F(2, 98) = 0.42$, $p = 0.66$), and degree of worry ($F(2, 98) = 11$, $p = 0.89$). Any difference found among groups thus cannot be attributed to the above variables. In addition, because there was no gender difference across key variables, we conducted no additional analyses of gender.

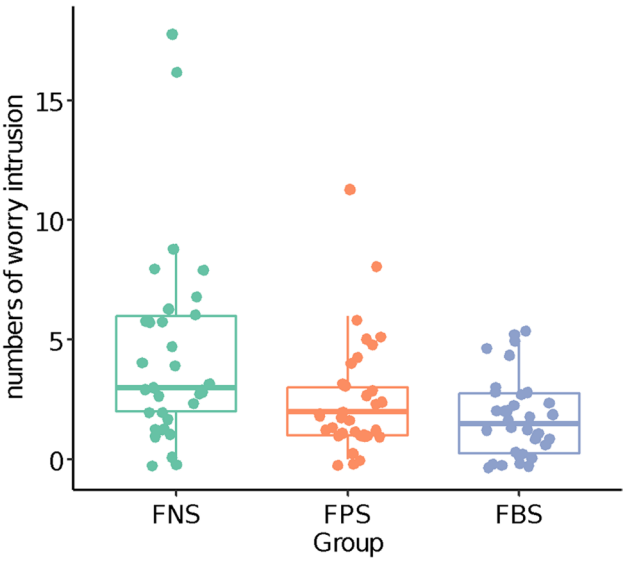

Fig. 2 Boxplot of numbers of worry intrusions across three groups. Each dot is the number of intrusions reported by each participant

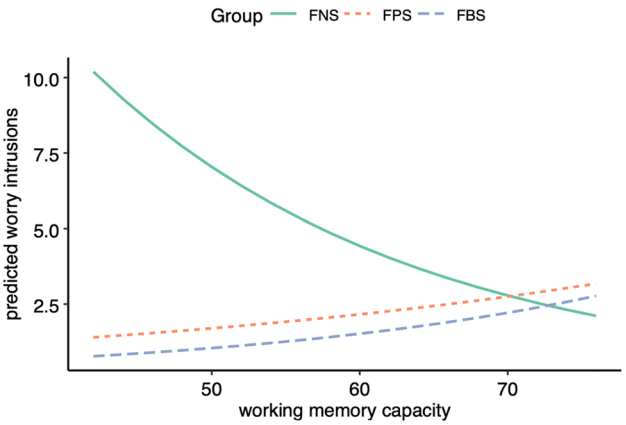

Fig. 3 Numbers of worry intrusions predicted by working memory capacity for each group in the negative binomial regression model

Which strategy can reduce worry intrusions more with less effort and does the tendency of depression predict the effectiveness of the adopted strategy?

The results of negative binomial regression on worry intrusions are listed in Table 2 with unstandardized regression coefficients. As Fig. 2 depicts, compared to the FNS group ($M = 4.33$, $SD = 4.11$), the FBS group ($M = 1.76$, $SD = 1.62$) and FPS group ($M = 2.50$, $SD = 2.40$) reported fewer worry intrusions ($b = -6.0$, $SE_b = 2.07$, $p < 0.01$, 95% confidence interval [CI] = [−10.05, −1.95] for the FBS group and $b = -4.85$, $SE_b = 1.82$, $p < 0.01$, and 95% CI = [−8.41, −1.29] for the FPS group).

The model also revealed that WMC was a negative predictor of worry intrusions for the FNS group ($b = -0.05$,

Table 3 Mean ratings for the different emotional states at T1 and T2

	Positive emotional state			Negative emotional state			Relaxation			Calmness		
	T1	T2	*p*	T1	T2	*p*	T1	T2	*p*	T1	T2	*p*
FBS	28.35 (6.55)	28.21 (7.50)	*1.0*	17.91 (5.98)	13.24 (4.53)	$<.01^{**}$	3.41 (1.05)	4.06 (0.78)	$.02^{*}$	3.44 (0.99)	4.24 (0.70)	$<.01^{**}$
FPS	26.56 (5.47)	28.47 (6.56)	*.22*	21.29 (6.65)	15.88 (5.88)	$<.01^{**}$	2.79 (1.12)	3.76 (0.96)	$<.01^{**}$	3.24 (1.13)	3.88 (0.88)	$<.01^{**}$
FNS	28.36 (6.31)	28.21 (6.81)	*1.0*	20.76 (7.56)	15.82 (5.51)	$<.01^{**}$	2.94 (1.09)	3.70 (0.98)	$<.01^{**}$	2.97 (1.05)	3.70 (0.92)	$<.01^{**}$

$^{*}p<.05$; $^{**}p<.01$; The values in parentheses are the standard deviations. *FBS* Focused-Breathing Strategy, *FPS* Focused-Positive-distractor Strategy, *FNS* Focused-Neutral-distractor Strategy, *T1* before the worry control session; *T2* after the worry control session

$SE_b = 0.02$, $p < 0.05$, 95% CI = [−0.08, −0.02]), which indicated the effectiveness of the FNS depended on mental capacity. Furthermore, the relationships between WMC and worry intrusions for the FBS and FPS groups were significantly different from that of the FNS group (FBS: $b = 0.08$, $SE_b = 0.03$, $p < 0.01$, 95% CI = [0.02, 0.15]; FPS: $b = 0.07$, $SE_b = 0.03$, $p < 0.01$, 95% CI = [0.02, 0.12]). As Fig. 3 shows, simple slope analyses indeed revealed that WMC could only negatively predict worry intrusions in the FNS group ($b = -0.046$, $SE = 0.016$, $z = -2.931$, $p = 0.003$) but not in the FBS or the FPS group ($ps > 0.18$). These results indicate that the FBS and the FPS require less cognitive control or top-down effort to reduce worry intrusions than does the FNS.

Although we did not recruit patients with clinical depression, our results indicated that the BDI-II score was a positive predictor of worry intrusions for the FNS group ($b = 0.06$, $SE_b = 0.03$, $p < 0.01$, 95% CI = [0.01, 0.11]), and this relationship was not different for the FBS group ($b = -0.01$, $SE_b = 0.05$, $p = 0.79$, 95% CI = [−0.10, 0.08]), nor for the FPS group ($b = -0.01$, $SE_b = 0.04$, p = 0.80, 95% CI = [−0.09, 0.07]). These results indicate that the higher the depression level of a participant, the more likely they were to experience worry intrusions, irrespective of the focused-distraction strategy they adopted and its effectiveness.

Which strategy is better for emotion regulation?

Table 3 lists the ratings of the four emotional states for the two time points across the three groups. Analysis of variance results showed no interactive effect existed between Group and Time on any emotional state: for positive emotions, $F(2, 98) = 2.38$, $p = 0.098$; for negative emotions, $F(2, 98) = 0.17$, $p = 0.84$; for calmness, $F(2, 98) = 0.18$, $p = 0.84$; for relaxation, $F(2, 98) = 0.72$, $p = 0.49$). In other words, the changes in emotional states with time were not different across the strategy groups.

There were main effects of time on negative emotions, $F(1, 98) = 92.73$, $p < 0.01$, $\eta^2 = 0.49$; calmness, $F(1, 98) = 51.77$, $p < 0.01$, $\eta^2 = 0.35$; and relaxation, $F(1, 98) = 49.71$, $p < 0.01$, $\eta^2 = 0.34$, but not on positive emotions, $F(1, 98) = 1.45$, $p = 0.23$ $\eta^2 = 0.02$. These results indicate that negative emotions decreased and that calmness and relaxation increased from T1 to T2 regardless of groups.

Group exerted main effects on negative emotions, $F(2, 98) = 3.09$, $p = 0.05$, $\eta^2 = 0.06$; calmness, $F(2, 98) = 3.28$, $p = 0.04$, $\eta^2 = 0.06$; and relaxation, $F(2, 98) = 3.16$, $p = 0.05$, $\eta^2 = 0.06$, but did not exert a main effect on positive emotions, $F(2, 98) = 0.18$, $p = 0.84$. A post hoc test indicated that compared with the FPS group, the FBS group reported a lower degree of negative emotions, FBS: $M = 15.57$, $SD = 4.83$; FPS: $M = 18.59$, $SD = 5.85$; $t(66) = -2.26$, $p = 0.078$, and a higher degree of relaxation, FBS: $M = 3.74$, $SD = 0.79$; FPS: $M = 3.28$, SD = 0.91; $t(66) = 2.27$, $p = 0.076$, at a marginally significant level. Moreover, the FBS group felt calmer ($M = 3.84$, $SD = 0.73$) than did the FNS group ($M = 3.33$, $SD = 0.80$); $t(65) = 2.55$, $p = 0.036$).

Could any of the adopted strategies decouple negative emotional reactivity from worry intrusions?

No partial correlation was observed between worry intrusions and emotional state at T2 for the FBS and FNS groups when controlling for the emotional state at T1, which indicates that when using the FBS and FNS for worry control, an increase in the number of worry intrusions does not lead to more negative emotions or less calmness and relaxation (Table 4). On the contrary, for the FPS group,

Table 4 Partial correlation between worry intrusions and the emotional states at T2 with control for the emotional state at T1

	Worry intrusions		
	FBS	FPS	*FNS*
Emotional state at T2			
Negative	−.02	$.61^{**}$	.01
Positive	−.01	.17	.23
Relaxed	−.22	$-.52^{**}$	−.12
Calm	−.16	$-.58^{**}$	−.04

$^{*}p<.05$; $^{**}p<.01$; *FBS* Focused-Breathing Strategy, *FPS* Focused-Positive-distractor Strategy, *FNS* Focused-Neutral-distractor Strategy, *T1* before the worry control session, *T2* after the worry control session

worry intrusions were positively correlated with negative emotions, $r(32) = 0.61$, $p < 0.01$, and negatively correlated with both relaxation, $r(32) = -0.52$, $p < 0.01$, and calmness, $r(32) = -0.58$, $p < 0.01$. These results indicate that the FBS and FNS decoupled emotional reactivity from worry intrusions, whereas the FPS did not.

Discussion

Our study aimed to identify efficient strategies for managing daily worry by comparing the effectiveness of three focused-distraction strategies, namely the FBS, FPS, and FNS, in controlling worry intrusions and reducing negative emotions. We also examined the dependency of these strategies on mental resources and investigated whether they could decouple negative emotions from worry intrusions. In sum, there were five main findings. First, the FBS and FPS were more effective in reducing worry intrusions than was the FNS. Second, the number of worry intrusions was independent of the participants' WMCs for the FBS and FPS groups; however, these variables were negatively correlated for the FNS group. This finding indicates that the use of the FBS and FPS requires fewer cognitive resources or less top-down control than does the FNS. Third, the participants' negative emotions were significantly reduced after the worry control session regardless of the adopted strategy. Fourth, decoupling of negative emotional reactivity from worry intrusions was observed for the FBS and FNS groups; while the number of worry intrusions positively predicted the subsequent negative emotions for the FPS group. Fifth, the depressive tendency was a positive predictor of worry intrusions for all the strategy groups.

The first two findings support our prediction that the FBS and FPS had better effects on reducing worry intrusions with less mental effort, compared to the FNS. These results cannot be attributed to participants' age, gender, WMCs, and tendencies of depression because the three groups exhibited no difference in these factors as reported in the result section. Our findings also generalized the effectiveness of the FBS and the FPS we adopted from reducing the intrusion of a neutral thought (Ju & Lien, 2016) and an impersonally negative concept (Wang et al., 2018), respectively, to personal worries for university students. Note that this is also the first finding showing that the FPS with a positive memory is superior to the FNS in controlling negative thoughts. Recall that previous studies did not obtain a positive effect of FPS with a pleasant memory in reducing obsessive thoughts among nonclinical populations (Najmi et al., 2009; Watson & Purdon, 2008). Determining whether the FPS is more suitable for reducing personal worries than it is for obsessive thoughts and why, if so, requires more investigation.

For the first time, the effectiveness of the FBS and FPS in reducing worry intrusion was found to be independent of users' WMCs. In other words, the FBS and FPS could be efficient methods of daily worry control regardless of the user's mental capacity. This feature of the FBS and FPS is crucial for preventing the intrusion of unwanted thoughts because, as previously mentioned, it is likely to decrease the possibility of one's mind wandering due to the failure of executive control (McVay & Kane, 2010), during which a suppressed thought is likely to occur (Ju & Lien, 2016; Wegner, 1994, 1997). The finding is also in line with Magee et al. (2019), who found that the use of self-generated or self-relevant distractions is subjectively more successful in suppressing thoughts and consumes fewer cognitive resources compared to the use of self-irrelevant ones. This result cannot be merely caused by the superior WMC of the participants in this study because the frequency of worry intrusions was negatively predicted by WMC for the FNS group and no group differences in the participants' mental capacities were observed.

Even so, we still found that the worry intrusions generally increased as the participants' tendencies toward depression increased, regardless of the strategy used. Brewin and Smart (2005) reported a similar relationship between the tendency of depression and intrusive thoughts. Unlike ours, they did not specify the distractors used for thought control. Wenzlaff et al. (1988) suggested that individuals in a low-mood state tend to distract themselves with negative thoughts and thus might increase the probability of thought suppression failure. However, our results showed that the benefits of applying effective strategies, even using a positive distractor, were still weakened as the users' depression levels increased. More studies with a relatively long time of practice are thus required to clarify the use of these strategies for those with higher depression tendencies or clinical populations.

The finding that temporarily concentrating on either a positive or an emotionally unrelated distractor (i.e., breathing or a mental image) could soothe negative emotions adds a new piece of evidence showing that the distraction strategies are generally adaptive for emotion regulation (e.g., Morrow & Nolen-Hoeksema, 1990; Wong & Moulds, 2009; for a review, see Webb et al., 2012). One might argue that the negative emotions may naturally decrease with time. However, because worry or current concerns often occupy the mind for a relatively long time and prolong a negative emotional state instead of mitigating it (Newman et al., 2013, p. 281), the rapid up-regulation of emotion observed after the use of the strategies found in our study is unlikely to be solely due to the time factor.

Our result further revealed that focusing on breathing could decouple negative emotional reactivity from worry intrusion for the first time. In other words, negative emotions

did not accumulate as worrying thoughts reoccurred during the application of the FBS, which is a "nonreactivity" feature in the mindfulness research domain. Studies have found that one's self-rated nonreactivity tendency is inversely related to worry symptoms in both clinical and nonclinical populations (Desrosiers et al., 2013; Fisak & Von Lehe, 2012). In addition, an increase in awareness and nonreactivity is considered the underlying mechanism of mindfulness intervention to reduce worry for people with generalized anxiety disorder (Hoge et al., 2015). However, to our knowledge, only Feldman et al. (2010) has reported a similar decoupling phenomenon in thought control regarding the use of an FBS strategy, combined with explicit teaching about mindful attitudes such as being nonjudgmental toward repetitive negative thoughts. Our finding thus implies that the FBS could achieve "nonreactivity" through a relatively simple, effortless, and non-cognitive route.

To our surprise, we also found the decoupling effect in the FNS group. We speculate that this might be related to the cognitively demanding nature of the FNS. As Van Dillen and Koole (2007) suggested, a demanding task might keep the mind busy, thus preventing mood-congruent processing and further negative feelings. To achieve this state, the task difficulty must match one's ability to some degree; otherwise, one's mind is likely to wander toward other thoughts due to the breakdown of executive control. If so, the underlying mechanism of the decoupling phenomenon would be different from FBS, which did not exert much burden on cognitive resources, and would require additional studies to clarify.

By contrast, for the FPS group, the emotional negativity increased as the number of worry intrusions increased. As research has shown, emotional contrast would result in additional uncomfortable feelings (Manstead et al., 1983). It is thus likely that a positive memory would make negative worrisome thoughts even more unbearable and elicit negative emotions. This result is in line with the claim that those with dysphoria can rarely soothe their emotions by simply recalling a positive memory because the contrast between the positive memory and the dysphoric feelings would lead to further distress (Joormann & Siemer, 2004; Joormann et al., 2007).

Our findings have several practical implications. First, they indicate that the FBS and FPS are promising worry-control methods for those with low WMCs or deficits in top-down control due to excessive worry, which has practical value in clinical settings. Second, our study provides evidence that different types of simple attention distraction strategies help manage recent worries in some ways. People can thus select suitable strategies for their situation based on the advantages and disadvantages that we revealed in this study. Moreover, all three strategies are easy-to-instruct and thus promising for online teaching, particularly in need in times of pandemic (Cincidda et al., 2021).

Some limitations are also worth noticing. For instance, we used unstandardized regression coefficients which might have been impacted by the different measurement scales across instruments in our study. Also, because the subjects of worry reported by our participants were mainly related to academic achievement and interpersonal relationships, could our findings apply to other subjects such as financial crises or life-threatening events (e.g., the COVID-19 pandemic) remains to be examined. In addition, whether the effectiveness of these three strategies applies to people with different traits deserves further research because studies have revealed that personality traits, such as neuroticism, could be associated with the level of self-report worry (e.g., Ongaro et al., 2021; Sebri et al., 2021). Finally, to apply these strategies outside the laboratory and help people manage their worries during a challenging time, more studies should focus on the relative long-term effect of these worry-control strategies and their potential rebound effects on worry intrusion after intentionally controlling worries.

Author contributions All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by Ling-Chen Wu in consultation with the other two authors. The manuscript was mainly written by the first author and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

References

Ainsworth, B., Bolderston, H., & Garner, M. (2017). Testing the differential effects of acceptance and attention-based psychological interventions on intrusive thoughts and worry. *Behaviour Research and Therapy, 91*, 72–77. https://doi.org/10.1016/j.brat.2017.01.012

Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy, 44*(12), 1849–1858. https://doi.org/10.1016/j.brat.2005.12.007

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*(5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck depression inventory-II. *San Antonio, 78*(2), 490–498. https://doi.org/10.1037/t00742-000

Beevers, C. G., Wenzlaff, R. M., Hayes, A. M., & Scott, W. D. (1999). Depression and the ironic effects of thought suppression: Therapeutic strategies for improving mental control. *Clinical*

Psychology: Science and Practice, 6(2), 133–148. https://doi.org/10.1093/clipsy.6.2.133

Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy, 21*(1), 9–16. https://doi.org/10.1016/0005-7967(83)90121-3

Brewin, C. R., & Beaton, A. (2002). Thought suppression, intelligence, and working memory capacity. *Behaviour Research and Therapy, 40*(8), 923–930. https://doi.org/10.1016/s0005-7967(01)00127-9

Brewin, C. R., & Smart, L. (2005). Working memory capacity and suppression of intrusive thoughts. *Journal of Behavior Therapy and Experimental Psychiatry, 36*(1), 61–68. https://doi.org/10.1016/j.jbtep.2004.11.006

Broderick, P. C. (2005). Mindfulness and coping with dysphoric mood: Contrasts with rumination and distraction. *Cognitive Therapy and Research, 29*(5), 501–510. https://doi.org/10.1007/s10608-005-3888-0

Brosschot, J. F., Van Dijk, E., & Thayer, J. F. (2007). Daily worry is related to low heart rate variability during waking and the subsequent nocturnal sleep period. *International Journal of Psychophysiology, 63*(1), 39–47. https://doi.org/10.1016/j.ijpsycho.2006.07.016

Chambers, R., Lo, B. C. Y., & Allen, N. B. (2007). The impact of intensive mindfulness training on attentional control, cognitive style, and affect. *Cognitive Therapy and Research, 32*(3), 303–322. https://doi.org/10.1007/s10608-007-9119-0

Cincidda, C., Pizzoli, S. F. M., Oliveri, S., & Pravettoni, G. (2021). Regulation strategies during Covid-19 quarantine: The mediating effect of worry on the links between coping strategies and anxiety. *European Review of Applied Psychology*, 100671.https://doi.org/10.1016/j.erap.2021.100671.

Coles, M. E., & Heimberg, R. G. (2005). Thought control strategies in generalized anxiety disorder. *Cognitive Therapy and Research, 29*(1), 47–56. https://doi.org/10.1007/s10608-005-1647-x

Conway, M., Howell, A., & Giannopoulos, C. (1991). Dysphoria and thought suppression. *Cognitive Therapy and Research, 15*(2), 153–166. https://doi.org/10.1007/bf01173205

Conway, M. A., Pleydell-Pearce, C. W., Whitecross, S. E., & Sharpe, H. (2003). Neurophysiological correlates of memory for experienced and imagined events. *Neuropsychologia, 41*(3), 334–340. https://doi.org/10.1016/s0028-3932(02)00165-3

Coxe, S., West, S. G., & Aiken, L. S. (2009). The analysis of count data: A gentle introduction to poisson regression and its alternatives. *Journal of Personality Assessment, 91*(2), 121–136. https://doi.org/10.1080/00223890802634175

Davey, G. C. (1994). Worrying, social problem-solving abilities, and social problem-solving confidence. *Behaviour Research and Therapy, 32*(3), 327–330. https://doi.org/10.1016/0005-7967(94)90130-9

Delgado, L. C., Guerra, P., Perakakis, P., Vera, M. N., Reyes del Paso, G., & Vila, J. (2010). Treating chronic worry: Psychological and physiological effects of a training programme based on mindfulness. *Behaviour Research and Therapy, 48*(9), 873–882. https://doi.org/10.1016/j.brat.2010.05.012

Desrosiers, A., Klemanski, D. H., & Nolen-Hoeksema, S. (2013). Mapping mindfulness facets onto dimensions of anxiety and depression. *Behavior Therapy, 44*(3), 373–384. https://doi.org/10.1016/j.beth.2013.02.001

Eagleson, C., Hayes, S., Mathews, A., Perman, G., & Hirsch, C. R. (2016). The power of positive thinking: Pathological worry is reduced by thought replacement in Generalized Anxiety Disorder. *Behaviour Research and Therapy*, 78(Supplement C), 13–18. https://doi.org/10.1016/j.brat.2015.12.017.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7*(2), 336–353. https://doi.org/10.1037/1528-3542.7.2.336

Feldman, G., Greeson, J., & Senville, J. (2010). Differential effects of mindful breathing, progressive muscle relaxation, and loving-kindness meditation on decentering and negative reactions to repetitive thoughts. *Behaviour Research and Therapy, 48*(10), 1002–1011. https://doi.org/10.1016/j.brat.2010.06.006

Fisak, B., & Von Lehe, A. C. (2012). The relation between the five facets of mindfulness and worry in a non-clinical sample. *Mindfulness, 3*(1), 15–21. https://doi.org/10.1007/s12671-011-0075-0

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271–299. https://doi.org/10.1037/1089-2680.2.3.271

Gross, J. J. (2014). Emotion regulation: conceptual and empirical foundations.https://doi.org/10.1080/21662630.2014.953321.

Harvey, A. G., & Payne, S. (2002). The management of unwanted pre-sleep thoughts in insomnia: Distraction with imagery versus general distraction. *Behaviour Research and Therapy, 40*(3), 267–277. https://doi.org/10.1016/s0005-7967(01)00012-2

Hayes, S., Hirsch, C., & Mathews, A. (2008). Restriction of working memory capacity during worry. *Journal of Abnormal Psychology, 117*(3), 712–717. https://doi.org/10.1037/a0012908

Hoge, E. A., Bui, E., Goetter, E., Robinaugh, D. J., Ojserkis, R. A., Fresco, D. M., & Simon, N. M. (2015). Change in decentering mediates improvement in anxiety in mindfulness-based stress reduction for generalized anxiety disorder. *Cognitive Therapy and Research, 39*(2), 228–235. https://doi.org/10.1007/s10608-014-9646-4

Howell, A., & Conway, M. (1992). Mood and the suppression of positive and negative self-referent thoughts. *Cognitive Therapy and Research, 16*(5), 535–555. https://doi.org/10.1007/bf01175140

IBM Corp. Released (2015). IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

Jen, C.-H., & Lien, Y.-W. (2010). What is the source of cultural differences?–Examining the influence of thinking style on the attribution process. *Acta Psychologica, 133*(2), 154–162. https://doi.org/10.1016/j.actpsy.2009.10.011

Joormann, J., & Siemer, M. (2004). Memory accessibility, mood regulation, and dysphoria: Difficulties in repairing sad mood with happy memories? *Journal of Abnormal Psychology, 113*(2), 179–188. https://doi.org/10.1037/0021-843X.113.2.179

Joormann, J., Siemer, M., & Gotlib, I. H. (2007). Mood regulation in depression: Differential effects of distraction and recall of happy memories on sad mood. *Journal of Abnormal Psychology, 116*(3), 484–490. https://doi.org/10.1037/0021-843X.116.3.484

Josephson, B. R. (1996). Mood regulation and memory: Repairing sad moods with happy memories. *Cognition and Emotion, 10*(4), 437–444. https://doi.org/10.1080/026999396380222

Ju, Y. J., & Lien, Y. W. (2016). Better control with less effort: The advantage of using focused-breathing strategy over focused-distraction strategy on thought suppression. *Consciousness and Cognition, 40*, 9–16. https://doi.org/10.1016/j.concog.2015.12.002

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry, 4*(1), 33–47. https://doi.org/10.1016/0163-8343(82)90026-3

Kassambara, A. (2020). ggpubr: "ggplot2" based publication ready plots (Version 0.4.0) [R package]. https://CRAN.R-project.org/package=ggpubr

Klinger, E., Marchetti, I., & Koster, E. (2018). Spontaneous thought and goal pursuit : From functions such as planning to dysfunctions such as rumination. In K. Fox & C. Christoff (Eds.), *The Oxford handbook of spontaneous thought : Mind-wandering, Creativity, Dreaming, and Clinical Disorders* (pp. 215–232). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190464745.013.24

Leyland, A., Rowse, G., & Emerson, L. M. (2019). Experimental effects of mindfulness inductions on self-regulation: Systematic review and meta-analysis. *Emotion, 19*(1), 108–122. https://doi.org/10.1037/emo0000425

Lin, Y. J., & Wicker, F. W. (2007). A comparison of the effects of thought suppression, distraction and concentration. *Behaviour Research and Therapy, 45*(12), 2924–2937. https://doi.org/10.1016/j.brat.2007.08.004

Llera, S. J., & Newman, M. G. (2010). Effects of worry on physiological and subjective reactivity to emotional stimuli in generalized anxiety disorder and nonanxious control participants. *Emotion, 10*(5), 640–650. https://doi.org/10.1037/a0019351

Lüdecke, D. (2018). ggeffects: Tidy data frames of marginal effects from regression models. *Journal of Open Source Software*, 3(26), 772. https://doi.org/10.21105/joss.00772.

Magee, J. C., Dreyer-Oren, S. E., Sarfan, L. D., Teachman, B. A., & Clerkin, E. M. (2019). Don't tell me what to think: Comparing self- and other-generated distraction methods for controlling intrusive thinking. *Journal of Obsessive-Compulsive and Related Disorders*, 23.https://doi.org/10.1016/j.jocrd.2017.12.003.

Manstead, A. S. R., Wagner, H. L., & MacDonald, C. J. (1983). A contrast effect in judgments of own emotional state. *Motivation and Emotion, 7*(3), 279–290. https://doi.org/10.1007/bf00991678

McVay, J. C., & Kane, M. J. (2010). Does mind wandering reflect executive function or executive failure? Comment on Smallwood and Schooler (2006) and Watkins (2008). *Psychological Bulletin, 136*(2), 188–197. https://doi.org/10.1037/a0018298

Morrow, J., & Nolen-Hoeksema, S. (1990). Effects of responses to depression on the remediation of depressive affect. *Journal of Personality and Social Psychology, 58*(3), 519–527. https://doi.org/10.1037//0022-3514.58.3.519

Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., & Schooler, J. W. (2013). Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychological science*, *24*(5), 776–781. https://doi.org/10.1177/0956797612459659.

Najmi, S., Riemann, B. C., & Wegner, D. M. (2009). Managing unwanted intrusive thoughts in obsessive-compulsive disorder: Relative effectiveness of suppression, focused distraction, and acceptance. *Behaviour Research and Therapy, 47*(6), 494–503. https://doi.org/10.1016/j.brat.2009.02.015

Newman, M. G., Llera, S. J., Erickson, T. M., Przeworski, A., & Castonguay, L. G. (2013). Worry and generalized anxiety disorder: A review and theoretical synthesis of evidence on nature, etiology, mechanisms, and treatment. *Annual Review of Clinical Psychology, 9*, 275–297. https://doi.org/10.1146/annurev-clinpsy-050212-185544

Oathes, D. J., Ray, W. J., Yamasaki, A. S., Borkovec, T. D., Castonguay, L. G., Newman, M. G., & Nitschke, J. (2008). Worry, generalized anxiety disorder, and emotion: Evidence from the EEG gamma band. *Biological Psychology, 79*(2), 165–170. https://doi.org/10.1016/j.biopsycho.2008.04.005

Ongaro, G., Cincidda, C., Sebri, V., Savioni, L., Triberti, S., Ferrucci, R., Poletti, B., Dell'Osso, B., & Pravettoni, G. (2021). A 6-month follow-up study on worry and its impact on well-being during the first wave of COVID-19 pandemic in an Italian sample. *Frontiers in Psychology, 12*, 703214. https://doi.org/10.3389/fpsyg.2021.703214

Ragan, K., Pugh, L., Degnan, A., & Berry, K. (2016). Associations between coping, thought control and psychological distress. *The Cognitive Behaviour Therapist, 9*, E16. https://doi.org/10.1017/s1754470x1600012x

Rahl, H. A., Lindsay, E. K., Pacilio, L. E., Brown, K. W., & Creswell, J. D. (2017). Brief mindfulness meditation training reduces mind wandering: The critical role of acceptance. *Emotion, 17*(2), 224–230. https://doi.org/10.1037/emo0000250

Ramel, W., Goldin, P. R., Carmona, P. E., & McQuaid, J. R. (2004). The effects of mindfulness meditation on cognitive processes and affect in patients with past depression. *Cognitive Therapy and Research, 28*(4), 433–455. https://doi.org/10.1023/b:cotr.0000045557.15923.96

R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available online at https://www.R-project.org/

Salkovskis, P. M., & Campbell, P. (1994). Thought suppression induces intrusion in naturally occurring negative intrusive thoughts. *Behaviour Research and Therapy, 32*(1), 1–8. https://doi.org/10.1016/0005-7967(94)90077-9

Salkovskis, P. M., & Reynolds, M. (1994). Thought suppression and smoking cessation. *Behaviour Research and Therapy, 32*(2), 193–201. https://doi.org/10.1016/0005-7967(94)90112-0

Searle, S. R., Speed, F. M., & Milliken, G. A. (1980). Population marginal means in the linear model: An alternative to least squares means. *The American Statistician, 34*(4), 216–221. https://doi.org/10.2307/2684063

Sebri, V., Cincidda, C., Savioni, L., Ongaro, G., & Pravettoni, G. (2021). Worry during the initial height of the COVID-19 crisis in an Italian sample. *The Journal of General Psychology, 148*(3), 327–359. https://doi.org/10.1080/00221309.2021.1878485

Szabó, M., & Lovibond, P. F. (2002). The cognitive content of naturally occurring worry episodes. *Cognitive Therapy and Research, 26*(2), 167–177. https://doi.org/10.1023/A:1014565602111

Teng, S.-C., & Lien, Y.-W. (2016). What Confucius practiced is good for your mind: Examining the effect of a contemplative practice in Confucian tradition on executive functions. *Consciousness and Cognition, 42*, 204–215. https://doi.org/10.1016/j.concog.2016.03.016

Teng, S.-C., & Lien, Y.-W. (2022). Propensity or diversity? Investigating how mind wandering influences the incubation effect of creativity. *PLoS ONE, 17*(4), e0267187. https://doi.org/10.1371/journal.pone.0267187

Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language, 28*(2), 127–154. https://doi.org/10.1016/0749-596x(89)90040-5

Van Dillen, L. F., & Koole, S. L. (2007). Clearing the mind: A working memory model of distraction from negative mood. *Emotion, 7*(4), 715–723. https://doi.org/10.1037/1528-3542.7.4.715

Wang, D., Chatzisarantis, N. L., & Hagger, M. S. (2018). Why distractors with need-supportive content can mitigate ironic effects of thought suppression. *Motivation and Emotion, 42*(2), 214–224. https://doi.org/10.1007/s11031-017-9653-3

Watson, C., & Purdon, C. (2008). Attention training in the reduction and reappraisal of intrusive thoughts. *Behavioural and Cognitive Psychotherapy, 36*(1), 61–70. https://doi.org/10.1017/s1352465807003773

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063–1070. https://doi.org/10.1037//0022-3514.54.6.1063

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin, 138*(4), 775–808. https://doi.org/10.1037/a0027600

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*(1), 34–52. https://doi.org/10.1037/0033-295x.101.1.34

Wegner, D. M. (1997). Why the mind wanders. In J. D. Cohen & J. W. Schooler (Eds.), *Scientific approaches to consciousness* (pp. 295–315). Lawrence Erlbaum Associates Inc.

Wegner, D. M., Schneider, D. J., Carter, S. R., 3rd., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53*(1), 5–13. https://doi.org/10.1037//0022-3514.53.1.5

Wenzlaff, R. M., Wegner, D. M., & Roper, D. W. (1988). Depression and mental control: The resurgence of unwanted negative thoughts. *Journal of Personality and Social Psychology, 55*(6), 882–892. https://doi.org/10.1037//0022-3514.55.6.882

Wickham, H. (2009). Getting started with qplot. In: *ggplot2*. Use R. Springer. https://doi.org/10.1007/978-0-387-98141-3_2.

Wong, Q. J., & Moulds, M. L. (2009). Impact of rumination versus distraction on anxiety and maladaptive self-beliefs in socially anxious individuals. *Behaviour Research and Therapy, 47*(10), 861–867. https://doi.org/10.1016/j.brat.2009.06.014