Published in final edited form as:
Behav Res Ther. 2013 December ; 51(12): 899–904. doi:10.1016/j.brat.2013.10.006.

Reappraisal and Mindfulness: A Comparison of Subjective Effects and Cognitive Costs

Shian-Ling Keng, M.A.[a], **Clive J. Robins, Ph.D.**[a,b], **Moria J. Smoski, Ph.D.**[b], **Jana Dagenbach, B.A.**[c], and **Mark R. Leary, Ph.D.**[a]

[a]Department of Psychology and Neuroscience, Box 90086, Duke University, Durham, NC 27708, USA

[b]Department of Psychiatry and Behavioral Sciences, Box 3026, Duke University Medical Center, Durham, NC 27710, USA

[c]Duke Interdisciplinary Initiative in Social Psychology, Erwin Mill Building 2024 West Main Street, Durham, NC 27705, USA

Abstract

The present study investigated the relative effects of mindfulness and reappraisal in reducing sad mood and whether trait mindfulness and habitual reappraisal moderated the effects. The study also compared the extent to which implementation of these strategies incurred cognitive resources. A total of 129 participants were randomly assigned to receiving training in mindfulness, reappraisal, or no training prior to undergoing an autobiographical sad mood induction. Results showed that mindfulness and reappraisal were superior to no training, and equivalent in their effects in lowering sad mood. Compared to mindfulness, reappraisal resulted in significantly higher interference scores on a subsequent Stroop test, reflecting greater depletion of cognitive resources. Higher trait mindfulness, but not habitual reappraisal, predicted greater reductions in sadness across conditions. The study suggests that although mindfulness and reappraisal are equally effective in down-regulating sad mood, they incur different levels of cognitive costs.

Keywords

emotion regulation; emotion regulation strategies; mindfulness; reappraisal; depression

Emotion regulation (ER) has been defined as processes through which individuals "influence which emotions [they] have, when [they] have them, and how these emotions are experienced or expressed" (Gross, 1998, p. 224). Disruptions in ER have been linked to greater symptoms of psychological disorders, including major depressive disorder (Nolen-

Corresponding Author: Shian-Ling Keng, Box 90086, Department of Psychology and Neuroscience, Duke University, Durham, NC 27708, USA; slk18@duke.edu; Tel: (1) 416-832-4527; Fax: (1) 416-595-6399.

Hoeksema, Wisco, & Lyubomirsky, 2008). Much research has examined specific forms of maladaptive ER strategies that predispose individuals towards developing psychological problems, but an equally valuable research direction is to identify and compare adaptive ER strategies. Two strategies of interest are reappraisal and mindfulness.

Reappraisal involves reformulating the interpretation of an emotion-inducing situation to reduce its emotional impact (Gross, 1998). It has been conceptualized as an antecedent-focused strategy, which refers to attempts to regulate emotional tendencies at or prior to the onset of emotions. When used as an antecedent-focused strategy, reappraisal is found to be more effective than suppression of emotion expression (Gross, 1998), rumination (Grisham, Flower, Williams, & Moulds, 2009), and distraction (McRae et al., 2010) in reducing distress. Additionally, reappraisal is associated with reduced sympathetic nervous system activation in response to mood induction (Gross, 1998; Ray, Wilhelm, & Gross, 2008). However, when used as an "online" regulation strategy, with instructions to regulate occurring after an emotional response has already begun, reappraisal is less effective than distraction at reducing sadness (Sheppes & Meiran, 2007) and results in greater sympathetic nervous system activation (Sheppes, Catran, & Meiran, 2009). Initiating reappraisal late as opposed to early (antecedent-focused reappraisal) in an emotional situation may pose greater self-control challenges as it requires individuals to override strong, well-established negative interpretations of the situation. In the context of clinical depression, online reappraisal may prove even more challenging given that depression is associated with negative interpretation bias (Miller & Norman, 1986).

Mindfulness has been defined as the awareness that arises through "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). Bishop et al. (2004) proposed that mindfulness encompasses two components: self-regulation of attention, and adoption of an attitude of curiosity, nonjudgment, and acceptance toward one's experiences. These aspects of mindfulness have been regarded as potentially effective antidotes against psychological distress, which often involves maladaptive tendencies to avoid, suppress, or over-engage with distressing thoughts and emotions (Hayes & Feldman, 2004).

Mindfulness has been shown to be an effective emotion regulation strategy. Instructions to practice mindfulness of thoughts and feelings following negative mood induction have been found to be more effective than rumination, suppression, or no instruction in alleviating subjective distress in healthy university students (Broderick, 2005), previously depressed individuals (Singer & Dobson, 2007), and currently depressed individuals (Huffziger & Kuehner, 2009). Brief mindfulness training has also been shown to be more effective than worry or control inductions (Arch & Craske, 2006; Erisman & Roemer, 2010) in down-regulating negative affect. In individuals with mood or anxiety disorders, instructions to accept emotions as they are resulted in lower negative affect and decreased heart rate in response to an emotional film clip compared to suppression (Campbell-Sills, Barlow, Brown, & Hofmann, 2006).

A small number of studies have directly compared the effectiveness of reappraisal and mindfulness. Studies have demonstrated a benefit for both mindfulness and reappraisal in

down-regulating subjective and physiological indicators of negative affect in nonclinical samples (Hofmann, Heering, Sawyer, & Asnaani, 2009; Wolgast, Lundh, & Viborg, 2011) with some studies finding a benefit for reappraisal over mindfulness (Hofmann, et al., 2009; Szasz, Szentagotai, & Hofmann, 2011). However, no studies have directly compared their effectiveness among depressed individuals – a population with whom interventions that utilize these regulation strategies as key techniques are commonly applied.

In addition to understanding the emotional consequences of employing reappraisal or mindfulness as regulation strategies, it is important to understand their cognitive benefits and costs. Strategies that involve more extensive cognitive processing may facilitate greater habituation to a stimulus, which may decrease long-term emotional reactivity to that stimulus (Thiruchselvam et al., 2011). However, a strategy that depletes cognitive resources may be more difficult to maintain or may leave an individual with fewer resources to manage interpersonal or planning aspects of emotional situation post-regulation. Suppression, for example, is found to result in greater impairment in memory compared to reappraisal (Richards & Gross, 2000). Optimal cognitive performance and self-regulation are crucial considering that emotions often arise when important goals are at stake (Richards & Gross, 2000). Reappraisal, when implemented as an antecedent-focused strategy, is found to result in better memory for emotional events (Richards & Gross, 2000; Richards et al., 2003) and improved social responsiveness (Butler et al., 2003). Reappraisal is also associated with reduced neurophysiological reactivity to previously reappraised stimuli, though only in non-depressed participants (Thiruchselvam et al., 2011). Reappraisal may also be associated with higher cognitive costs compared to other strategies, especially when implemented as an online strategy. Relative to distraction, online reappraisal results in greater impairment on performance on a subsequent Stroop task (Sheppes & Meiran, 2008), a measure of executive functioning. Reappraisal is also associated with increased pupil diameter and cardiac acceleration, physiological indices that reflect greater cognitive load (Urry, van Reekum, Johnstone, & Davidson, 2009). These findings suggest that reappraisal may have cognitive advantages as well as costs compared to other strategies.

Little is known regarding the extent to which mindfulness, when used as an ER strategy, consumes cognitive resources, but research on cognitive effects of brief mindfulness training may be relevant. Mindfulness training has been found to lead to improvements in orienting (the ability to direct attention towards a set of sensory inputs) and alerting (the ability to remain vigilant towards a range of potential sensory inputs) (Jha, Krompinger, & Baime, 2007), and in conflict monitoring (the ability to prioritize attention among competing cognitive demands; Tang et al., 2007; Wenk-Sormaz, 2005). Mindfulness training was also shown to buffer against decreases in working memory capacity during high stress periods (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). These findings suggest that mindfulness training may enhance or buffer against decreases in cognitive and attentional resources. No studies have yet examined the extent to which engaging in mindfulness as an ER strategy affects cognitive resources.

Thus far, it may seem as though mindfulness and reappraisal have been set up as a dichotomy. In reality, these two forms of ER strategies are not mutually exclusive. Garland, Gaylord, and Park (2009) proposed that the regulation of attention aspect of mindfulness is

an intrinsic process involved in reappraisal, as generating a new appraisal requires that one first disengages from the previous appraisal given to an event. Higher levels of trait mindfulness therefore may facilitate use of not only mindfulness as an ER strategy but also reappraisal. Habitual tendency to reappraise (habitual reappraisal) may also predict more effective ER. Greater habitual reappraisal has been associated with increased positive emotion, lower negative emotion, and better interpersonal functioning (Gross & John, 2003).

To date, no research has directly compared the effects of mindfulness and reappraisal on the experience of sadness among individuals with elevated depressive symptoms. This was the primary aim of the current study. Similarly, no studies have directly compared the cognitive costs of these strategies. It is plausible that mindfulness, which involves observing one's emotional and cognitive reactions nonjudgmentally, requires less executive resources than reappraisal, which involves actively attempting to change those reactions. We hypothesized that, compared to mindfulness, reappraisal would result in greater depletion of executive resources. Finally, the present study aimed to examine whether individual differences in trait mindfulness or habitual reappraisal predict greater effectiveness in down-regulating sad mood. We hypothesized that greater trait mindfulness would predict greater decreases in sadness in both mindfulness and reappraisal conditions.

Methods

Participants

A total of 129 participants were recruited and randomly assigned to receiving training in mindfulness (n = 43), reappraisal (n = 43), or to a no-instruction condition (n = 43). Potential participants were directed to an online survey and invited for participation if they fulfilled study criteria. Inclusion criteria were age between 18-55 years old and Beck Depression Inventory (BDI; Beck et al., 1979) scores of 10 to 29. Due to ethical concerns, participants were excluded and offered psychological services resources if they scored above 29 on the BDI or endorsed suicidal ideation, defined by a score of 3 on the suicidality item of the BDI. Participants were recruited from the Undergraduate Research Subject Pool and from the community, and received credits toward a course research requirement or twenty dollars, respectively, for their participation. This study was approved by Duke University's Institutional Review Board.

Procedure

Following completion of questionnaire measures and a practice Stroop task (see below), participants randomized to the reappraisal or mindfulness conditions received standardized verbal instructions in their assigned strategies lasting approximately 10 minutes. The instructions for the mindfulness condition, adapted from Singer and Dobson (2007), emphasized registering thoughts and emotions as they are without judging them and included a mindfulness experiential exercise. Instructions for the reappraisal condition were adapted from Grisham et al. (2009) and Ray et al. (2008). Participants were trained to reframe the meaning of an emotional event to reduce its emotional impact and engaged in an exercise involving reappraising a hypothetical situation. After training, participants rated the

perceived usefulness of their assigned technique. Participants assigned to the no instruction condition received no training.

Participants then underwent a mood induction procedure that involved simultaneous negative autobiographical recall (write and think about three events that made them feel lonely, sad, rejected or hurt) and mood suggestive music ("Adagio-G Minor" composed by Albinoni, played at half speed). Participants rated their mood on a Visual Analogue Scale (VAS) pre- and post-induction. Following induction, participants who were assigned to the mindfulness or reappraisal condition received instructions to apply their assigned strategy. Participants in the no training condition were instructed to simply "respond to their mood". Music continued to play in the background at this time. Participants were prompted to rate their mood on the VAS every thirty seconds, for five minutes. At the end of the mood regulation period, the music stopped and participants completed a Stroop task. Participants then rated the extent to which they engaged in various ER strategies during the regulation period.

Measures

Demographics—The demographic data form inquired participants' age, gender, ethnicity, education background, income, history of mental health treatment, and prior experience with mindfulness training.

Depressive Symptoms—The BDI was administered to assess symptoms of depression. Its internal consistency ranged between 0.73 and 0.92 for non-psychiatric samples and 0.76 and 0.95 for psychiatric populations (Beck, 1988).

Trait Mindfulness—The Southampton Mindfulness Questionnaire (SMQ; Chadwick et al., 2008) was used to measure trait mindfulness. In a community sample and a clinical sample, the SMQ demonstrated acceptable Cronbach's alphas of 0.89 and 0.82 respectively.

Habitual Reappraisal—Habitual reappraisal was measured by the Reappraisal subscale in the Emotion Regulation Questionnaire (Gross & John, 2003). Across four samples of undergraduate students, the internal consistency for the subscale averaged 0.79.

State Sadness—A VAS was used as a state measure of sadness. It consisted of a 0-100 scale with "neutral, no sadness" on one end and "sadness" on the other end of the scale. Participants were informed that 100 represents the saddest that they have ever felt, and were instructed to place a mark on the scale to indicate their degree of sadness.

Stroop Task—A computerized Color-Word Stroop task was employed to measure executive functioning and depletion of cognitive resources following the emotion regulation task (Chepenik, Cornew, & Farah, 2007). For each trial, participants were first presented with a 500 msec. fixation cross, followed immediately by a color word ("red", "yellow", "green", "blue"), or control text ("xxxx"). The color words always appeared in a color font other than their semantic meaning (incongruent trials). The control text was presented in each of the four colors. The ratio of control to incongruent trials was 1 to 3. Participants were instructed to say aloud as quickly and accurately as possible the color of the text. The

task was implemented in DirectRT with automatic scoring of vocal response latency. Trial order was randomized within 8-trial blocks. Stroop interference scores were calculated by dividing the difference between latencies for incongruent trials and control trials by the total of the latencies for both types of trials. Following Sheppes and Meiran (2008), response times shorter than 150 ms and longer than 3000 ms were deemed as outliers and excluded from analyses. A 32-trial practice phase was administered prior to regulation training to minimize learning effects, which may mask cognitive depletion effects. A 160-trial test phase was administered post-regulation to measure reduction in cognitive resources.

Data Analysis and Results

Manipulation check

Twenty-one participants (16.3%) reported a mood shift of less than 1 point (1 cm on a 10 cm line) in response to the mood induction procedure and were excluded from subsequent analyses. Groups did not differ significantly on the number of participants excluded on this basis. A 3 (group) × 2 (time, pre- vs. post-mood induction) ANOVA of sadness ratings demonstrated a significant main effect of time ($F(1, 89) = 393.55$, $p < .001$), no main effect of group, and no interaction. Mean ratings of sadness increased from 27.87 (SD = 22.59) to 74.55 (SD = 12.95) from pre- to post-mood induction.

Participants in the mindfulness and reappraisal conditions were considered adherent if they reported a minimum score of 4 on a 7-point scale on their respective manipulation check question. Eight (9%) of these participants were not adherent to the instructions. The groups did not differ in the proportion of non-adherent participants. This left a final sample size of 100 (reappraisal = 34; mindfulness = 32, no-instruction = 34). One-way MANOVA showed that there was a marginally significant effect of group on the degree of unpleasantness of events recalled during the mood induction procedure and in the level of sadness pre-regulation ($F(4, 178) = 2.41$, $p = .051$). Separate univariate ANOVAs revealed no significant group effects on either variable.

A one-way MANOVA of the effect of group on self-reported use of the five different ER strategies assessed (mindfulness, reappraisal, distraction, suppression, and rumination) during the regulation period was significant ($F(12, 186) = 5.08$, $p < .001$). Follow-up univariate ANOVAs revealed significant between-group differences only on mindfulness ($p < .001$) and reappraisal ($p < .001$). As expected, the mindfulness group reported significantly greater engagement in mindfulness (M = 5.59) than the reappraisal group (M = 4.74; $p = .006$) and the control group (M = 4.12; $p < .001$), and the reappraisal group engaged in reappraisal (M = 5.56) significantly more than the mindfulness group (M = 3.81; $p < .001$) and the control group (M = 3.62; $p < .001$).

Baseline differences across conditions

Table 1 presents demographic and clinical characteristics of the three groups. The sample's average age was 29 years (SD = 11.50, range 18-55). Sixty-nine percent of the sample (n = 69) was female. There were no group differences on any of the categorical baseline variables in chi-square tests, or on the continuous variables in a MANOVA. There were no between-group differences on perceived levels of enthusiasm and credibility of the experimenter. The

mindfulness and reappraisal groups did not differ significantly on perceived usefulness of their assigned technique.

Effects of condition on changes in sadness

Hierarchical Linear Models (HLM) were constructed to examine the effects of Time, Group, and the Group × Time interaction on sadness during the regulation period. The quadratic effect of Time (Time*Time) and its interaction with Group were also tested. -2 Log-likelihood (-2LL) was used as an index to compare the fit among different models.

Figure 1 shows changes in sadness ratings for the three groups. HLM revealed a significant linear trend of Time, $F(1, 97) = 161.89$, $p < .001$, a significant quadratic trend of Time, $F(1, 872) = 70.39$, $p < .001$, a non-significant effect of Group, $F(2, 872) = .47$, $p = .62$, a significant Group × Time (linear trend) interaction, $F(2, 872) = 4.31$, $p < .05$, and a significant Group × Time (quadratic trend) interaction, $F(2, 872) = 4.80$, $p < .01$. Given that the data were best described by a quadratic trend (determined by a smaller -2LL value), follow-up contrast analyses explored the interaction between Group and the quadratic trend of Time. Pairwise comparison of the mindfulness and control conditions showed a significant Group × Time interaction, $t(872) = 2.91$, $p < .01$, with sadness ratings reported by the mindfulness group decreasing significantly more quickly over time than those of the control group. The reappraisal vs. Control pairwise comparison demonstrated a significant Group × Time interaction, $t(872) = 2.41$, $p < .05$, with the reappraisal group reporting significantly quicker reductions in sadness than the control group. The mindfulness vs. reappraisal pairwise comparison for Group × Time was not significant.

Moderating effects of trait mindfulness and habitual reappraisal

The best-fitting model from the HLM analyses was run with trait mindfulness and its interactions with Time, Group, and the interaction of Time and Group entered as additional predictors to examine whether trait mindfulness predicted changes in sadness from pre- to post-regulation, and whether the changes varied by condition. There was no significant Mindfulness×Time×Group interaction, but a significant Mindfulness×Time interaction, $F(1, 871) = 6.00$, $p < .05$. Higher trait mindfulness was associated with greater decreases in sadness across conditions (Figure 2). The same analysis was run with habitual reappraisal and its relevant interaction terms entered as predictors in place of trait mindfulness. Neither the Reappraisal×Time×Group interaction nor the Reappraisal×Time interaction was significant.

Effects of condition on Stroop interference

Mean Stroop interference scores for the mindfulness, reappraisal, and control groups were .033 (.040), .059 (.038) and .054 (.037) respectively. ANOVA revealed a significant effect of group $F(2, 97) = 4.17$, $p < .05$. Post-hoc comparisons using the Bonferroni test showed that interference scores of the mindfulness group were significantly lower than those of the reappraisal group, $p < .05$ (Cohen's $d = 0.67$), and marginally lower than those of the control group, $p < .10$ (Cohen's $d = 0.54$). Scores of the reappraisal and control groups did not differ significantly. There was no significant correlation between Stroop interference scores and either changes in sadness from pre- to post-regulation or sadness at post-regulation,

suggesting that the interference effect cannot be attributed to residual mood or differences in mood ratings across groups.

Discussion

This study showed that mindfulness and reappraisal were superior to no training, and equivalent in their effects in lowering sad moods induced through negative autobiographical recall. The reappraisal group demonstrated significantly higher Stroop interference scores compared to the mindfulness group. Greater trait mindfulness, but not habitual reappraisal, predicted greater reductions in sadness across conditions.

The finding that mindfulness and reappraisal were each more effective than no instruction in reducing sadness is consistent with findings of previous research (Erisman & Roemer, 2010; Grisham et al., 2009; Gross, 1998; Ray et al., 2008; Singer & Dobson, 2007). The finding that both strategies resulted in comparable decreases in sad mood corresponds to Wolgast et al. (2011)'s finding, but differs from other studies' findings demonstrating an advantage for reappraisal over mindfulness (Hofmann et al., 2009; Szasz et al., 2011). The discrepancies in findings may arise in part from the fact that the acceptance instructions provided in these studies focused primarily on the attitudinal component of mindfulness - acceptance - rather than also the attentional component, as is the case in this study. It remains to be examined if more elaborate mindfulness or acceptance instructions are associated with a stronger intervention effect.

The finding that mindfulness is associated with reduced cognitive costs relative to reappraisal is consistent with traditional and contemporary accounts of mindfulness as a practice of relaxed, open awareness (Rosch, 2007; Salmon et al., 2004), as well as with recent research demonstrating that brief mindfulness training restores self-control under conditions of low resources (Friese, Messner, & Schaffner, 2012). This finding should however be interpreted with caution, given that the analysis did not control for baseline differences in Stroop performance. Although participants completed a practice test prior to the experimental manipulation, the data from this test were not collected. Future studies should control for baseline performance to enable more rigorous analyses. The fact that changes in sad mood were unrelated to Stroop interference suggests that the emotion regulation effects of mindfulness and reappraisal are independent of their cognitive consequences. This is consistent with previous research showing that induction of sad mood does not influence Stroop performance (Chepenik et al., 2007).

Higher trait mindfulness predicted greater decreases in sadness across conditions, consistent with a theoretical model in which mindfulness supports the ability to decenter from existing emotions or interpretations of an event, which may in turn facilitate more effective ER (Garland et al., 2009). The lack of moderating effect by habitual reappraisal is contrary to prediction, but consistent with a recent finding that habitual reappraisal did not interact with the subjective effects of reappraisal or acceptance instructions (Wolgast et al., 2011).

The study's strengths included use of a randomized experimental design and control for experimenter effects and participants' adherence to manipulation instructions. Further, the

sample is racially and ethnically diverse: Approximately half of the sample was Caucasians (53%), followed by Asians (22%), African Americans (15%), American Indians (6%), and Hispanics (4%). There are several limitations to the study. It is unknown the extent to which results of this laboratory study are generalizable to coping with negative situations in daily life. One way to examine the effects of an ER strategy in daily life is to employ an ecological momentary assessment approach. The training instructions provided also serve only as rough approximations of how mindfulness and reappraisal are actually taught in the context of psychotherapy, although effort was made to make the instructions as comprehensive as possible, e.g., by incorporating a practice component in the training instructions.

Another limitation of the study is its reliance on self-report methods to assess emotions. Future research should examine the effects of ER using multiple modes of assessment. Also, the study did not assess the extent to which previous experience with reappraisal (e.g., cognitive restructuring) might have impacted participants' experience during the study. Further, the focus of reappraisal training in this study was on developing positive interpretations of situations, as opposed to developing more neutral or realistic interpretations. Such focus might have made the task more difficult for participants in the reappraisal condition. Also, this study assessed cognitive performance *after*, as opposed to *during* implementation of a strategy. The findings thus speak to the cognitive benefits of a strategy after its implementation, but not in-the-moment consumption of cognitive resources by the strategy. Given that there may be conditions under which in-the-moment utilization of resources is most relevant (e.g., sporting performance), future research should assess cognitive effects of a strategy during its implementation. Lastly, the study recruited an analogue depressed sample (with an average BDI score slightly lower than the typical threshold for clinical depression (BDI = 17)), limiting its generalizability to a clinical sample.

This study points to several directions for future research. Future research should examine additional cognitive domains on which mindfulness and reappraisal may differ (e.g., memory for emotional events), beyond utilization of executive resources. It remains to be examined whether components of mindfulness (attentional vs. attitudinal components) may differentially impact emotion and cognitive performance. Future studies should also assess the practical or clinical benefits of minimizing consumption of cognitive resources by an ER strategy, e.g., by examining the effects of mindfulness versus other strategies on behavioral performance under stress-inducing situations, such as public speaking.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We gratefully acknowledge the assistance of the Duke Interdisciplinary Initiative in Social Psychology in the completion of this research project. We would also like to thank M. Zachary Rosenthal, Jeffrey Brantley, and Kathleen Sikkema for their helpful comments on an earlier version of this manuscript, and Michelle Van Dellen for providing statistical support. This project was supported by participant payment grants from Duke Interdisciplinary Initiative in Social Psychology and Aleane Webb Dissertation Research Award granted by Duke University

Graduate School to Shian-Ling Keng. Moria Smoski's effort on this project was supported by NIMH K23 MH087754.

References

Arch JJ, Craske MG. Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. Behaviour Research and Therapy. 2006; 44:1849–1858. [PubMed: 16460668]

Beck AT. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. Clinical Psychology Review. 1988; 8:77–100.

Beck, AT.; Rush, AJ.; Shaw, BF.; Emery, G. Cognitive Therapy of Depression. New York: Guilford; 1979.

Bishop SR, Lau M, Shapiro S, Carlson L, Anderson N, Carmody J, et al. Mindfulness: A proposed operational definition. Clinical Psychology: Science and Practice. 2004; 11:230–241.

Broderick PC. Mindfulness and coping with dysphoric mood: Contrasts with rumination and distraction. Cognitive Therapy and Research. 2005; 29:501–510.

Butler E, Egloff B, Wilhelm F, Smith N, Erickson E, Gross J. The social consequences of expressive suppression. Emotion. 2003; 3:48–67. [PubMed: 12899316]

Campbell-Sills L, Barlow DH, Brown TA, Hofmann SG. Effects of suppression and acceptance on emotional responses of individuals with anxiety and mood disorders. Behaviour Research and Therapy. 2006; 44:1251–1263. [PubMed: 16300723]

Chadwick P, Hember M, Symes J, Peters E, Kuipers E, Dagnan D. Responding mindfully to unpleasant thoughts and images: Reliability and validity of the Southampton mindfulness questionnaire. British Journal of Clinical Psychology. 2008; 47:451–455. [PubMed: 18573227]

Chepenik LG, Cornew L, Farah MJ. The influence of sad mood on cognition. Emotion. 2007; 7:802–811. [PubMed: 18039049]

Erisman SM, Roemer L. A preliminary investigation of the effects of experimentally induced mindfulness on emotional responding to film clips. Emotion. 2010; 10:72–82. [PubMed: 20141304]

Friese M, Messner C, Schaffner Y. Mindfulness meditation counteracts self-control depletion. Consciousness and Cognition. 2012; 21:1016–1022. [PubMed: 22309814]

Garland E, Gaylord S, Park J. The role of mindfulness in positive reappraisal. Explore (NY). 2009; 5:37–44. [PubMed: 19114262]

Grisham J, Flower K, Williams A, Moulds M. Reappraisal and rumination during recall of a sad memory. Cognitive Therapy and Research. 2009:1–8.

Gross J. Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. Journal of Personality and Social Psychology. 1998; 74:224–237. [PubMed: 9457784]

Gross J, John O. Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. Journal of Personality and Social Psychology. 2003; 85:348–362. [PubMed: 12916575]

Hofmann SG, Heering S, Sawyer A, Asnaani A. How to handle anxiety: The effects of reappraisal, acceptance, and suppression strategies on anxious arousal. Behaviour Research and Therapy. 2009; 47:389–394. [PubMed: 19281966]

Huffziger S, Kuehner C. Rumination, distraction, and mindful self-focus in depressed patients. Behaviour Research and Therapy. 2009; 47:224–230. [PubMed: 19166993]

Jha AP, Krompinger J, Baime M. Mindfulness training modifies subsystems of attention. Cognitive, Affective & Behavioral Neuroscience. 2007; 7:109–119.

Jha AP, Stanley EA, Kiyonaga A, Wong L, Gelfand L. Examining the protective effects of mindfulness training on working memory capacity and affective experience. Emotion. 2010; 10:54–64. [PubMed: 20141302]

Kabat-Zinn, J. Wherever You Go There You Are: Mindfulness Meditation in Everyday Life. New York, NY: Hyperion; 1994.

McRae K, Hughes B, Chopra S, Gabrieli JD, Gross J, Ochsner KN. The neural bases of distraction and reappraisal. Journal of Cognitive Neuroscience. 2010; 22:248–262. [PubMed: 19400679]

Miller IV, Norman W. Persistence of depressive cognition within a subgroup of depressed inpatients. Cognitive Therapy and Research. 1986; 10:211–224.

Nolen-Hoeksema S, Wisco B, Lyubomirsky S. Rethinking rumination. Perspectives on Psychological Science. 2008; 3:400–424.

Ray RD, Wilhelm F, Gross J. All in the mind's eye? Anger rumination and reappraisal. Journal of Personality and Social Psychology. 2008; 94:133–145. [PubMed: 18179323]

Richards JM, Butler EA, Gross J. Emotion regulation in romantic relationships: The cognitive consequences of concealing feelings. Journal of Social & Personal Relationships. 2003; 20:599–620.

Richards JM, Gross J. Emotion regulation and memory: The cognitive costs of keeping one's cool. Journal of Personality and Social Psychology. 2000; 79:410–424. [PubMed: 10981843]

Rosch E. More than mindfulness: When you have a tiger by the tail, let it eat you. Psychological Inquiry. 2007; 18:258–264.

Salmon P, Sephton S, Weissbecker I, Hoover K, Ulmer C, Studts JL. Mindfulness meditation in clinical practice. Cognitive and Behavioral Practice. 2004; 11:434–446.

Sheppes G, Catran E, Meiran N. Reappraisal (but not distraction) is going to make you sweat: Physiological evidence for self-control effort. International Journal of Psychophysiology. 2009; 71:91–96. [PubMed: 18625273]

Sheppes G, Meiran N. Better late than never? On the dynamics of online regulation of sadness using distraction and cognitive reappraisal. Personality and Social Psychology Bulletin. 2007; 33:1518–1532. [PubMed: 17933748]

Sheppes G, Meiran N. Divergent cognitive costs for online forms of reappraisal and distraction. Emotion. 2008; 8:870–874. [PubMed: 19102598]

Singer AR, Dobson KS. An experimental investigation of the cognitive vulnerability to depression. Behaviour Research and Therapy. 2007; 45:563–575. [PubMed: 16797484]

Szasz PL, Szentagotai A, Hofmann SG. The effect of emotion regulation strategies on anger. Behaviour Research and Therapy. 2011; 49:114–119. [PubMed: 21185551]

Tang YY, Ma Y, Wang J, Fan Y, Feng S, Lu Q, et al. Short-term meditation training improves attention and self-regulation. Proceedings of the National Academy of Sciences. 2007; 104:17152–17156.

Thiruchselvam R, Blechert J, Sheppes G, Rydstrom A, Gross JJ. The temporal dynamics of emotion regulation: An EEG study of distraction and reappraisal. Biological Psychology. 2011; 87:84–92. [PubMed: 21354262]

Urry HL, van Reekum CM, Johnstone T, Davidson RJ. Individual differences in some (but not all) medial prefrontal regions reflect cognitive demand while regulating unpleasant emotion. NeuroImage. 2009; 47:852–863. [PubMed: 19486944]

Wenk-Sormaz H. Meditation can reduce habitual responding. Alternative Therapy in Health and Medicine. 2005; 11:42–58.

Wolgast M, Lundh LG, Viborg G. Cognitive reappraisal and acceptance: An experimental comparison of two emotion regulation strategies. Behaviour Research and Therapy. 2011; 49:858–866. [PubMed: 21999941]

Highlights

- Mindfulness and reappraisal training showed equivalent effects in reducing sadness.
- Reappraisal resulted in greater depletion of cognitive resources than mindfulness.
- Greater trait mindfulness predicted more effective emotion regulation.

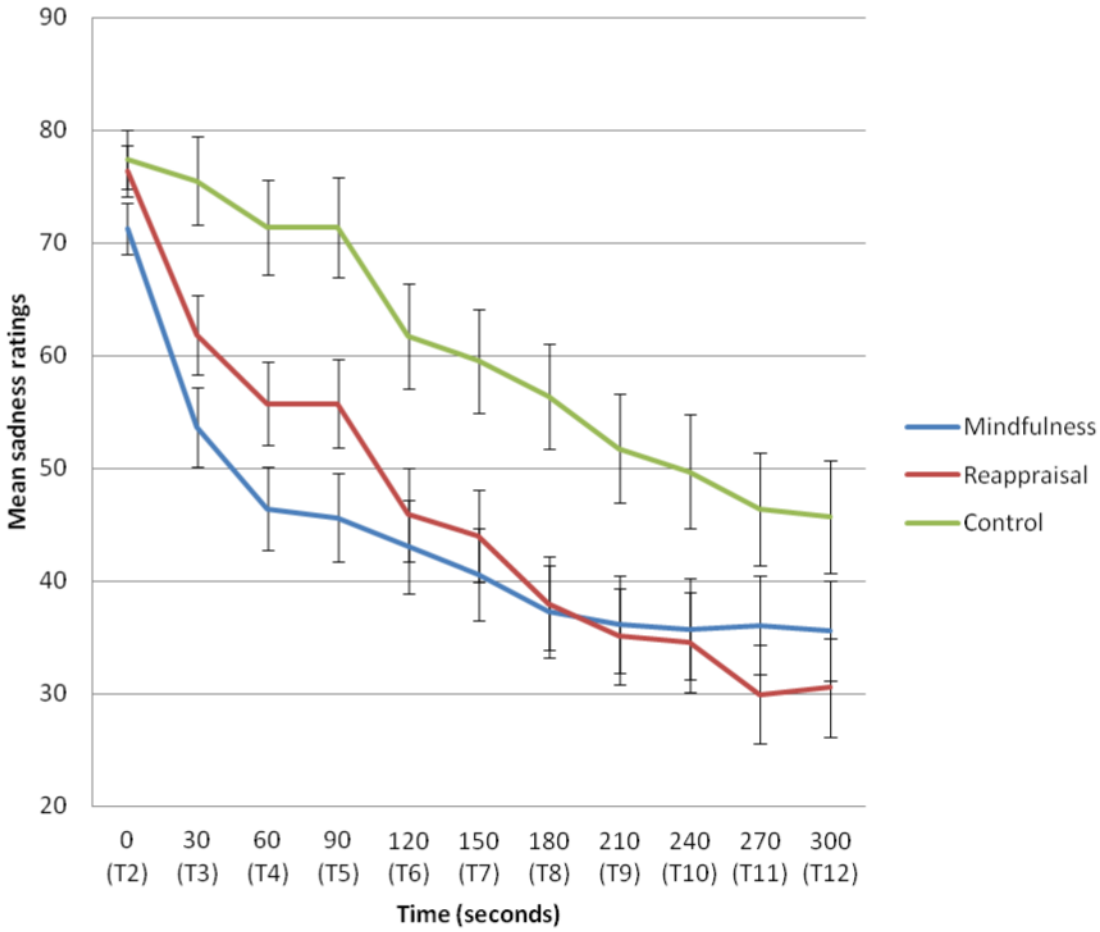

Figure 1.
Changes in sadness ratings from pre- through post-regulation across conditions.

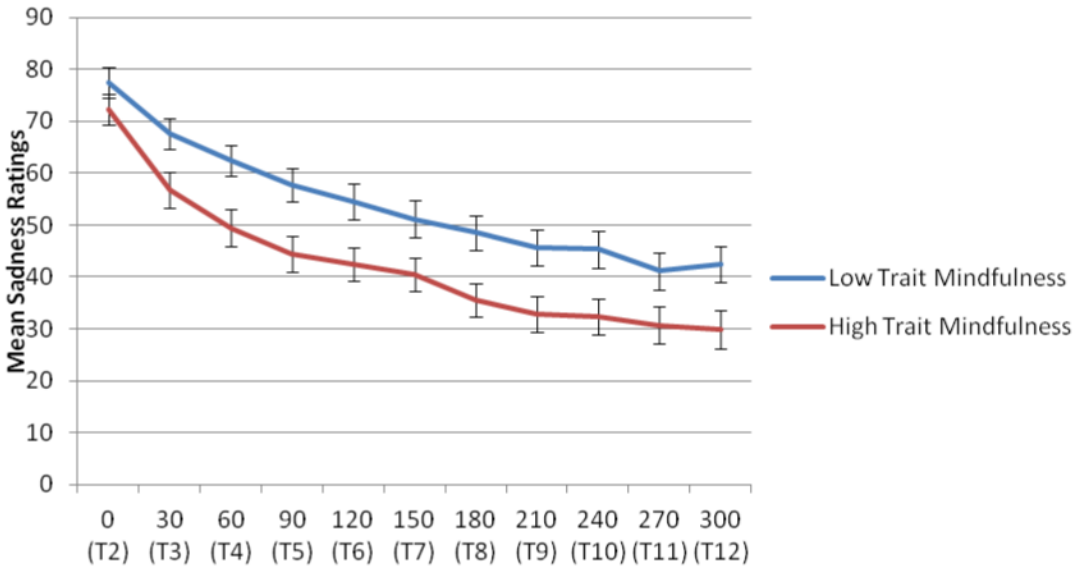

Figure 2.
Interaction between trait mindfulness and time across conditions.

Table 1
Sample characteristics across conditions

Variable	All Participants (n = 100)	Mindfulness (n = 32)	Reappraisal (n = 34)	Control (n = 34)
Female	69.00%	68.80%	67.60%	70.60%
Caucasian	53.00%	53.10%	50.00%	44.10%
Married/cohabiting	27.00%	25.00%	38.20%	17.60%
Employed	45.00%	46.90%	41.20%	47.10%
Currently in therapy	12.00%	9.40%	17.60%	8.80%
Previously in therapy	43.00%	46.90%	44.10%	38.20%
Taking psychotropic medications	19.00%	21.90%	14.70%	20.60%
Having taken psychotropic medications	34.00%	37.50%	35.30%	29.40%
Having practiced mindfulness exercises	43.00%	40.60%	50.00%	38.20%
Education (% with at least a college degree)	49.00%	53.13%	58.82%	35.29%
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**
Age	29.04 (11.49)	30.28 (12.47)	30.38 (11.98)	26.53 (9.83)
BDI	16.05 (4.98)	16.50 (4.91)	15.65 (4.50)	16.03 (5.59)
ERQ-R	28.81 (6.36)	28.19 (8.30)	29.41 (5.08)	28.79 (5.48)
ERQ-S	15.46 (5.59)	16.31 (5.53)	14.15 (6.29)	15.97 (4.79)
SMQ	42.47 (13.05)	41.78 (15.59)	40.21 (10.68)	45.38 (12.40)

Note. BDI = Beck Depression Inventory; ERQ-R = Emotion Regulation Questionnaire-Reappraisal Subscale; ERQ-S = Emotion Regulation Questionnaire- Suppression Subscale; SMQ = Southampton Mindfulness Questionnaire.