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ScienceDirect
Behaviour Research and Therapy 44 (2006) 1849–1858
BEHAVIOUR RESEARCH AND THERAPY
www.elsevier.com/locate/brat

Short communication

Mechanisms of mindfulness: Emotion regulation following a focused breathing induction

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Received 27 August 2005; received in revised form 12 December 2005; accepted 14 December 2005

Abstract

The current study investigated whether a 15 min recorded focused breathing induction in a normal, primarily undergraduate population would decrease the intensity and negativity of emotional responses to affectively valenced picture slides and increase willingness to remain in contact with aversive picture slides. The effects of the focused breathing induction were compared with the effects of 15 min recorded inductions of unfocused attention and worrying. The focused breathing group maintained consistent, moderately positive responses to the neutral slides before and after the induction, whereas the unfocused attention and worry groups responded significantly more negatively to the neutral slides after the induction than before it. The focusing breathing group also reported lower negative affect and overall emotional volatility in response to the post-induction slides than the worry group, and greater willingness to view highly negative slides than the unfocused attention group. The lower-reported negative and overall affect in response to the final slide blocks, and greater willingness to view optional negative slides by the focused breathing group may be viewed as more adaptive responding to negative stimuli. The results are discussed as being consistent with emotional regulatory properties of mindfulness.

Keywords: Emotion regulation; Behavioral willingness; Mindfulness

Introduction

Mindfulness has been described as ''bare attention, in which moment-to-moment awareness of changing objects of perception is cultivated'' (Epstein, 1995). Although scientifically defining the construct of mindfulness has been challenging (Bishop, 2002), it is thought to involve the cultivation of concentration, attention, and non-judging acceptance towards whatever one is experiencing in the present moment (Bishop et al., 2004).

Therapies in which mindfulness plays a central role have been developed to treat a range of psychological disorders including borderline personality disorder (Linehan, 1993; Linehan, Heard, & Armstrong,

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doi:10.1016/j.brat.2005.12.007

1993), recurrent depression (Ma & Teasdale, 2004; Segal, Williams, & Teasdale, 2002), and anxiety disorders (Kabat-Zinn et al., 1992; Miller, Fletcher, & Kabat-Zinn, 1995). Several studies also demonstrate the benefits of mindfulness-based practice in non-clinical samples. Results indicate lower levels of intensity and frequency of unpleasant affect for high trait-mindful individuals (Brown & Ryan, 2003) and reductions in state and trait anxiety and psychological distress for individuals participating in an 8-week mindfulness-based intervention, compared with a waitlist control group (Shapiro, Schwartz, & Bonner, 1998).

It has been hypothesized that mindfulness increases willingness to tolerate uncomfortable emotions and sensations (Eifert & Heffner, 2003; Levitt, Brown, Orsillo, & Barlow, 2004) and emotional acceptance (Hayes, Strosahl, & Wilson, 1999; Linehan, 1993; Segal et al., 2002), and decreases the impact and time needed to recover from negative emotional events (Kabat-Zinn, 1990), among others. Nevertheless, few studies have directly tested these proposed mechanisms of action (for a qualitative-based exception, see Mason & Hargreaves, 2001).

The current study investigates the immediate effects of a 15-min experiential "induction" of focused breathing using ongoing mindfulness of breath instructions. The induction is called "focused breathing" rather than "mindfulness" due to the fact that participants had no previous training in mindfulness and a true induction of mindfulness would likely require extensive training in mindfulness. Thus, the current study is an analogue of mindfulness, modeling the effects of first-time instruction. The effects of the focused breathing exercise were compared to the effects of unfocused attention and worrying. Instructing participants to "let their minds wander" through unfocused attention or to deliberately worry, provided appropriate contrasts to the deliberate letting go of intrusive thoughts and present-focused instructions for focused breathing. We hypothesized that a 15 min focused breathing induction in a normal, primarily undergraduate population would decrease the intensity and negativity of emotional responses to affectively valenced external stimuli and increase willingness to remain in contact with aversive external stimuli.

Method

Study design

Subjects were randomly assigned to one of three groups, and underwent three measurement periods of response to picture slides from the International Affective Picture System (IAPS, Lang, Bradley, & Cuthbert, 1999); one before the state of mind induction (Time 1), and two following the induction (Times 2 and 3). At each Time (1–3), participants viewed 3 blocks of slides; one each of positive, neutral, and negative slides. Each block was comprised of 5 slides shown for 5 s each with 1 s between. At Time 1, the slide order was fixed. At Times 2 and 3, the order was counterbalanced. Slides were not repeated. A detailed protocol manual ensured that the content of instructions was equivalent across the different participants.

Participants

Sixty participants completed the study. Participants were primarily undergraduate and graduate students at the University of California, Los Angeles, recruited through an Introduction to Psychology course subject pool and on-campus fliers. Potentially eligible Introduction to Psychology students (determined through pretesting, see eligibility criteria below) were contacted via phone and/or email, informed of their potential eligibility, and given information about the study and the option of participating. Students responding to the fliers were forwarded information about the study and its major eligibility requirements. Participants received either course credit or money ($10) for participation.

The demographics of the final sample was 69% female and 39% Asian, 26% White, 5% Black/African American, 3% Native American/Alaskan Native, 7% More than one race and 8% as Other (12% did not indicate). Of the total sample, 8% indicated Hispanic/Latino status, comprising approximately half of the individuals in the latter two categories ("More than one race" and "Other"). About 60% of the sample was 18 or 19 years of age, and the remainder fell between the ages of 20 and 25, with the exception of one marginally older participant.

Measures

Screening measures

To meet eligibility requirements, potential participants were 18 years or older, had not received treatment for a mental disorder(s) in the past 2 years or taken psychotropic medications, had no blood/injury/injection phobia, were not pregnant, had no cardiovascular or pulmonary condition(s) such as asthma or heart beat irregularities, and had no previous mindfulness or other formal meditation experience.

Additionally, the Hospital Anxiety and Depression Scale (HAD; Zigmond & Snaith, 1983) was used to screen out individuals with clinical levels of anxiety and depression. The HAD demonstrates reasonable internal consistency (+.30–+.76 Spearman correlations for individual items), Cronbach alphas ranging from .89 to .93, and low false positive (1% for depression, 5% for anxiety) and false negative (1% for both) reliability ratings. The ineligibility cutoff was a score of 11 or higher on either subscale (depression or anxiety), which corresponded with the HAD cutoff criteria (1983) for a "definite case" of clinical depression or anxiety.

Self-report measures

Social desirability confound. The 10-item Brief Marlow–Crowne Social Desirability Scale (M–C 1[10], Strahan & Gerbasi, 1972) was used to assess whether outcome was due to experimental condition or social desirability of the participants. Psychometrically, the M–C 1[10] is about as reliable as the original 33-item M–C scale, with correlations with the original M–C in the .80s and .90s.

Emotional responding measures. After each slide block at each Time, a single-question Affect Scale (Wolpe, 1990) asked participants to rate their emotional state on a scale of −50–+50, with −50 being the most negative/unpleasant emotional state and +50 being the most positive/pleasant emotional state (i.e. 9 total ratings). This scale, which is frequently utilized in IAPS research, assessed the emotional response of participants to the slides.

After each slide block at Time 3, the 10-item Short PANAS (Mackinnon et al., 1999) was employed to assess a broader range of participants' emotional states. Psychometric properties of the Short PANAS include Cronbach alphas of .78 for the Positive Affect subscale and .87 for the Negative Affect subscale, with little variation across different age groups and good factorial validity (Mackinnon et al., 1999).

Affect Scale and Short PANAS questions were viewed via the computer screen. To standardize the question-response time, participants were given 7.2 s to respond to each question via the computer keyboard. Prior to Time 1, participants practiced responding to the questions within the allotted 7.2 s.

Manipulation check. At the end of the study, participants completed a post-experiment questionnaire that inquired, on a 0–7 Likert scale, with 1 = very true, 4 = feel neutral about it, 7 = very untrue, the extent to which they followed the taped induction instructions.

Behavioral measure

After Time 3, participants viewed a series of the most negatively rated slides in the IAPS standardized system (Center for the Study of Emotion and Attention [CSEA-NIMH], 1999) which they could stop at any point. Participants were not told how long the slides would last, but only that they would stop on their own a few minutes after they began. The behavioral measure was the number of slides participants were willing to view.

Heart rate measure

Heart rate (beats per minute) was monitored throughout the experiment using the Polar E600 heart rate monitor, which calculated heart rate in 5 s intervals with a reported accuracy of plus or minus 1% or 1 bpm (Polar Electro Inc., 2002).

Setting

All sessions were conducted in an 8.75×8.75 foot research lab in the University of California Los Angeles Psychology Department. Participants were seated with their backs approximately 21 in away from a desk that supported a Dell Inspiron 4000 laptop computer, with an 11.25×8.5 in color screen, and two 6.5×3 in speakers. The experimenter left the room during the slide viewings and induction to reduce experimental demands on the participants.

Experimental groups

The recorded instructions for each induction lasted 15 min. The length of the instructions in each of the three inductions also was matched for beginning instructions of "Now we're going to do an exercise for 15 minutes. First, settle into a comfortable sitting position", and for providing instructions on what to do if one's attention wanders off (e.g. "bring your mind back" to the focus of the exercise).

Focused breathing

The recorded instructions for the Focused breathing induction were adapted from the sitting mindfulness meditation exercise used by Kabat-Zinn (1990) in his Mindfulness Based Stress Reduction program and subsequently by Segal et al.(2002) in Mindfulness Based Cognitive Therapy. The aim of the Focused breathing induction was to have participants direct their attention and awareness to whatever sensations they were experiencing in the present moment, with a particular focus on the experience of breathing. Participants were told to "focus on the actual sensations of breath entering and leaving the body. There is no need to think about the breath—just experience the sensations of it…When you notice that your awareness is no longer on the breath…gently bring your awareness back to the sensations of breathing."

Worry

The Worry induction instructions were adapted from Vasey & Borkovec's (1992) Catastrophizing Interview Technique. The Worry instructions asked participants to worry sequentially about six content domains proposed by Boehnke, Schwartz, Stromberg, and Sagiv (1998): Social Relations, Achievement, Money/Economics, Environment, Health, and Safety. The instructions used the Catastrophizing Interview Technique to have participants catastrophize about their principal worry or concern in each domain.

Unfocused attention

This induction asked participants to "simply think about whatever comes to mind. Let your mind wander freely without trying to focus on anything in particular." Variants of these instructions were repeated every 30–60 s for 15 min.

Results

All analyses were conducted in SPSS Version 11.5 or 12.0. Group was dummy coded and the focused breathing condition served as the reference group. Mixed models, also known as hierarchical linear models (HLM), were constructed to examine Group × Time differences in Affect Scale scores in response to slide blocks across Times 1–3. A mixed model was used because Affect Scale scores were measured at unevenly spaced time points (i.e. more than 15 min between Times 1 and 2, no break between Times 2 and 3).[1] In addition, mixed models can utilize subjects with occasional missing data points, thereby increasing power.[2] For other analyses, where noted, ANOVAs were used due to evenly spaced repeated measurement points or single measurement periods, and χ^2-analysis was used for dichotomous categorical variables. Statistical power was estimated using Sample Power 2.0 and was in the range of 55–60% across the various analyses. Hence,

[1]For the Affect scale scores, repeated measures ANOVA results are similar to those of the mixed model.

[2]Missing data were present when participants did not respond to Affect Scale or Short PANAS questions within the allowed 7.2 s. Across each individual scale item, one to eight (of 60) participants had missing data, less than 15% of total participants.

Table 1
Times 1–3 affect scale ratings[a]

	Focused breathing group	Unfocused attention group	Worry group
Neutral: Time 1	24.65 (4.32)	25.33 (4.60)	16.75 (3.98)
Neutral: Time 2	22.26 (20.44)	16.41 (18.53)	6.20 (22.52)
Neutral: Time 3	20.05 (18.68)	15.33 (20.71)	8.20 (14.31)
Positive: Time 1	36.35 (3.37)	32.78 (3.55)	26.65 (3.37)
Positive: Time 2	26.10 (15.59)	16.79 (26.47)	18.30 (16.69)
Positive: Time 3	30.50 (14.12)	21.22 (19.01)	19.55 (20.96)
Negative: Time 1	.76 (6.32)	−5.53 (7.48)	−20.10 (6.48)
Negative: Time 2	−8.19 (34.85)	−14.38 (31.30)	−33.00 (16.26)
Negative: Time 3	−11.85 (36.29)	−10.18 (28.11)	−25.35 (21.83)

[a]The number of subjects (n) with data points ranges from 15–20 per cell.

null results should be interpreted with caution. For occasional missing data, there were no differences on the Affect or PANAS Scales in data missing following negative vs. positive slides. Therefore, the affective valence of the picture slides does not appear to have affected whether participants responded to questions.

Preexisting and baseline differences

Univariate ANOVAS revealed no significant differences among groups for the anxiety or depression subscales or overall scores on the HAD or M–C 1[10].[3] Nevertheless, the Focused breathing group tended to report higher overall HAD scores than the other two groups, with means of 8.29(5.41), 6.05(3.98), and 5.60(4.06) for the Focused breathing, Unfocused attention, and Worry groups respectively; $F(2,57) = 2.05$; $p = .14$, $R^2 = .07$.

Univariate ANOVAS of Affect Scale responses were conducted for Group (Focused breathing, Unfocused attention, Worry) for each positive, neutral and negative slide blocks at Time 1. There were no significant group differences in Affect Scale responses to the neutral or positive slides at Time 1. Borderline group differences were found for the negative slides ($F(2,53) = 2.75$, $p = .07$, $R^2 = .09$). Therefore, Group was included as a predictor of the intercept/ main effect and of the Group × Time interaction in the mixed model analyses for the negative slides, whereas Group was included as a factor of the Group × Time interaction (i.e. slope) but not the intercept/ main effect in the Mixed Models for the positive and negative slides. See Table 1 for summary statistics on Affect Scale responses at Time 1.

HLM modeling affect of scale responses

The Mixed Model for the Neutral slides indicated a significant Group × Time[4] interaction $t(1, 55) = -2.39$, $p = .02$.[5] The Focused breathing vs. Unfocused attention and Focused breathing vs. Worry pairwise comparisons both were significant, $t(1, 34) = -3.596$, $p < .002$ and $t(1, 37) = -2.426$, $p < .05$, respectively, with the Focused breathing group rating the neutral slides significantly more positively after the induction than the Unfocused attention or Worry groups. The Unfocused attention vs. Worry pairwise comparison for Group × Time was non-significant. The main effect of Time was also non-significant. See Table 1 and Fig. 1 for a summary of these results.

The Mixed model for the positive slides indicated that neither the Group × Time interaction nor the main effect of Time was significant.

[3]When baseline HAD or M–C scores were included as a covariate in the Affect Scale and PANAS analyses below, they were non-significant. For parsimony, final models do not include them.

[4]In Mixed Models, the Group × Time interaction indicates a between group comparison on Affect Scale responses across Times 1–3.

[5]Although SPSS 11.5 mixed models did not provide an effect size, the effect size in a repeated measures ANOVA model with similar results indicated a partial eta^2 = .10 for the Group × Time interaction.

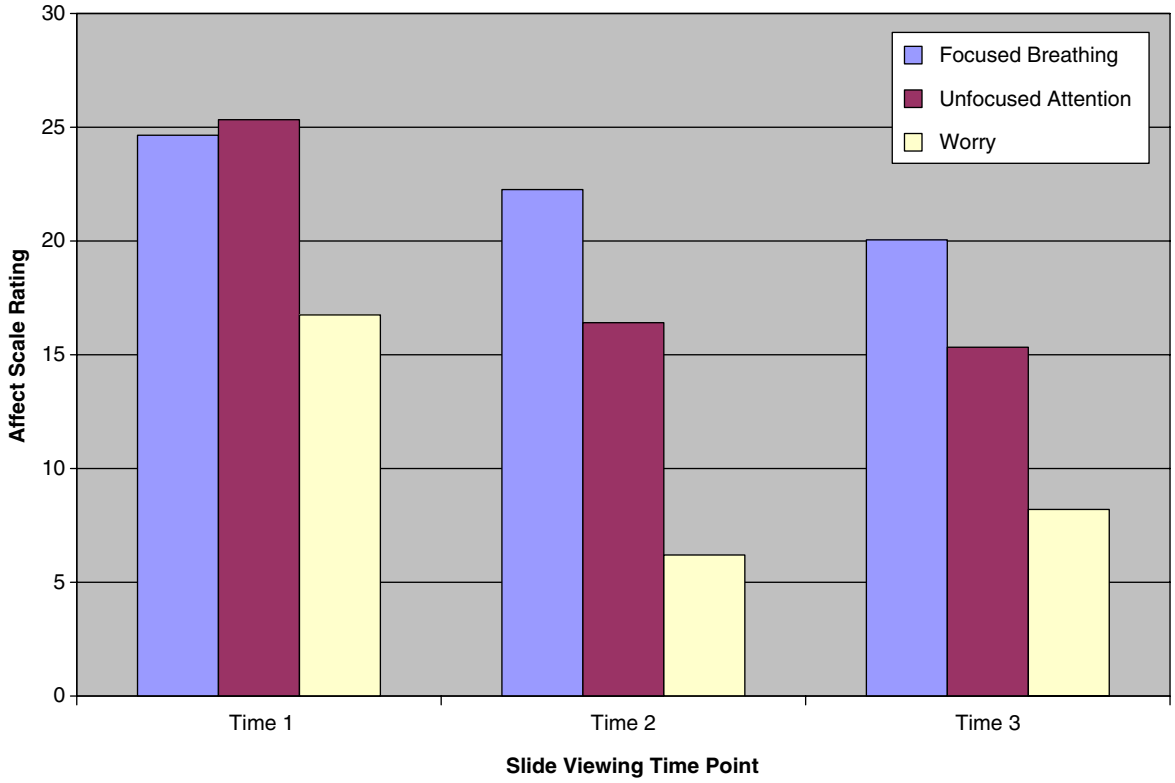

Fig. 1. Affect scale ratings for the neutral slides.

The Mixed Model for the negative slides indicated that the Group × Time interaction for Affect Scale responses was not significant. The main effect of Time-approached significance ($t(53) = -1.82$, $p = .08$), with Affect Scale responses becoming increasingly negative over time. The main effect of Group was significant, $t(56) = -2.39$, $p = .02$, reflecting significant differences in Time 1 Affect Scale responses to the negative slides discussed above.

PANAS scores at time 3

Due to evenly spaced measurement points, Short PANAS scores, assessed at Time 3, were analyzed via 3 × 3 repeated measures ANOVAS (Group [Focused breathing, Unfocused attention, Worry] × Slide Type [neutral, negative, positive]), for the Positive Affect (PA) subscale, Negative Affect (NA) subscale, and Total Short PANAS (PA + NA) scores. Summation scores (PA + NA) were examined as a measure of overall emotionality (see Fig. 2).

For the PA subscale, scores did not differ for Group × Slide Type for either the Focused breathing vs. Worry or Focused breathing vs. Unfocused attention comparisons, $F(2, 108) = .70$, $p =$ n.s., partial eta$^2 = .01$ and $F(2, 108) = 2.40$, $p = .10$, partial eta$^2 = .04$, respectively. PA scores differed significantly by Slide Type, $F(2, 108) = 12.34$, $p < .001$, partial eta$^2 = .19$, as anticipated, with highest PA scores for positive slides.

For the NA subscale, the Group × Slide Type interaction was significant for the Focused breathing vs. Worry comparison, $F(2, 110) = 3.88$, $p = .02$, partial eta$^2 = .07$, with the Focused breathing group showing a flatter, less varied profile in comparison with the Worry group particularly during the negative slides. The Focused breathing vs. Unfocused attention comparison showed a pattern of results in the same direction, but the effect was non-significant, $F(2, 110) = 1.71$, $p =$ n.s., partial eta$^2 = .03$. The main effect of Slide Type on NA was significant, $F(2, 110) = 55.72$, $p < .001$, partial eta$^2 = .50$, with highest ratings of NA for the negative Slides.

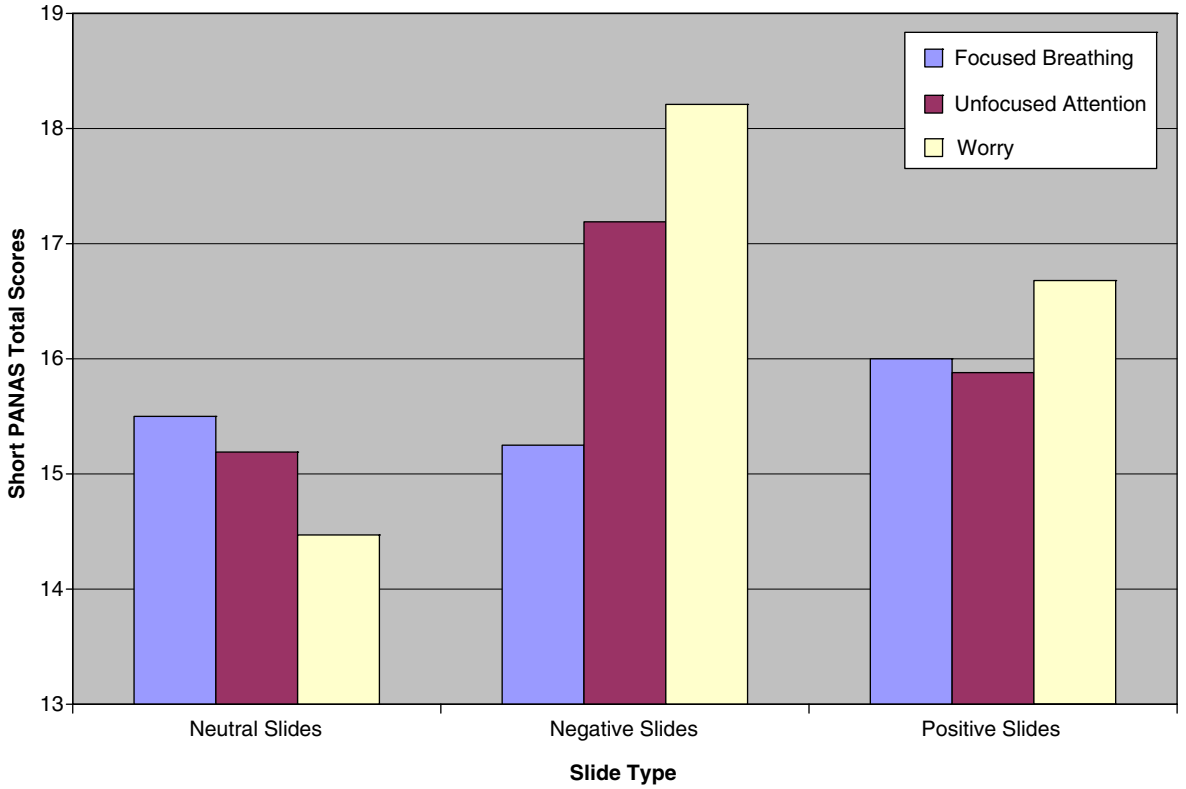

Fig. 2. Short PANAS total scores by slide type.

For total Short PANAS scores (PA + NA), the Group × Slide Type interaction was significant for the Focused breathing vs. Worry comparison, $F(2, 104) = 4.75$, $p = .01$, partial eta$^2 = .08$, with the Focused breathing group showing a flatter, less varied profile than the Worry group particularly during the negative slides. The Focused breathing vs. Unfocused attention comparison showed a non-significant pattern of results in the same direction, $F(2, 104) = 1.69$, $p =$ n.s., partial eta$^2 = .03$. The main effect of Slide Type was significant, $F(2, 104) = 7.56$, $p = .001$, partial eta$^2 = .13$, with scores generally highest for the negative slides. See Table 2 for group averages.

Willingness measure

Because 71.7% of participants viewed all 25 optional negative slides, a dichotomous variable was created based on whether participants viewed all 25 slides or not. Pairwise comparisons were made between the Focused breathing vs. Unfocused attention and Focused breathing vs. Worry groups. χ^2-analyses revealed that significantly more participants in the Focused breathing condition (85.7%) viewed all 25 slides than in the Unfocused attention condition (57.9%), $\chi^2 = 3.87$, $p < .05$. There was a similar but non-significant trend for participants in the Focused breathing group to view all 25 slides (85.7%) compared with the Worry (70.0%) group, $\chi^2 = 1.48$, $p =$ n.s.

Heart rate measure

Repeated measures ANOVA (Group [Focused breathing, Unfocused attention, Worry] × Slide Type [neutral, negative, positive]) found no Group × Slide interaction effects across any phase in the experiment.[6]

[6]Heart rate measurements were taken on subjects 11–60.

Table 2
Short PANAS scores after Time 3 slides[a]

Slide type	Mean (std. error): negative affect	Mean (std. error): positive affect	Mean (std. error): total PANAS
Neutral slides			
Focused breathing	5.35 (.47)	10.14 (3.83)	15.50 (4.41)
Unfocused attention	5.72 (.49)	9.71 (3.55)	15.19 (4.25)
Worry	5.75 (.47)	8.89 (4.00)	14.47 (4.56)
Grand mean	5.61 (.28)	9.60 (3.77)	15.05 (4.36)
Negative slides			
Focused breathing	7.20 (.85)	8.19 (2.62)	15.25 (4.44)
Unfocused attention	9.11 (.90)	8.12 (1.50)	17.19 (3.87)
Worry	9.85 (.85)	8.89 (3.38)	18.21 (4.70)
Grand mean	8.72 (.50)	8.40 (2.62)	16.84 (4.48)
Positive slides			
Focused breathing	4.85 (.54)	11.05 (4.74)	16.00 (5.10)
Unfocused attention	5.94 (.57)	10.18 (3.49)	15.88 (4.60)
Worry	6.55 (.54)	10.42 (3.24)	16.68 (3.37)
Grand mean	5.78 (.32)	10.58 (3.87)	16.20 (4.35)

[a]The number of subjects (n) with data points ranges from 16–20 per cell.

However, a main effect of Slide Type was found during each of the three sets of slides (i.e., Time 1–3), $F(2,90) = 17.00$, $p < .001$; $F(2,92) = 31.07$, $p < .001$; $F(2,90) = 5.01$, $p < .01$, respectively, indicating that in general, participants had the highest heart rates during the beginning neutral slides, followed by positive and negative slides. However, this trend reversed itself during the final (Time 3) block of slides, during which heart rate was highest for the negative and lowest for positive slides. It is unclear if these effects were due to emotion, attention, or slide sequence.

Manipulation check

The post-experiment questionnaire indicated no significant differences between Groups on the statement: "I attempted to follow the induction instructions." The overall mean of 5.63(1.40) indicated that participants viewed this statement as a "little untrue."

Discussion

This laboratory study provides initial data that are consistent with a profile of emotion regulatory capacities under conditions of mindfulness. Specifically, individuals who participated in a 15 minute focused breathing induction maintained consistent, moderately positive responses to the neutral slides before and after the induction, whereas the unfocused attention and worry groups responded significantly more negatively to the neutral slides after the induction than before it.

Responses to the Short PANAS, assessed only at Time 3, indicated significant focused breathing vs. worry group differences on the NA subscale and total PANAS (PA + NA) responses. The focused breathing vs. unfocused attention groups displayed a similar but non-significant pattern of results. We viewed total PANAS scores as a measure of overall reported emotional reactivity or volatility in response to the slides. Thus, the focused breathing group reported the most stable, least emotional volatility across slide types relative to the other groups, most significantly the worry group. The reduced volatility appears to have been most evident in responses to the negative slides.

In addition, the focused breathing group displayed greater willingness than the unfocused attention group to view highly negative slides during an optional block of 25 negative slides viewed approximately 10 minutes after the induction. A trend in the same direction was found in the comparison of the focused breathing and worry groups. With a larger sample and hence greater power, this pattern likely would have been significant.

These 25 slides were rated (Center for the Study of Emotion and Attention [CSEA-NIMH], 1999) as the most highly negative IAPS slides among the set available to the experimenter and participants were uninformed about the duration of the set of slides. Thus, the focused breathing induction lead to increased behavioral willingness and tolerance for remaining in contact with unpredictable, negative stimuli, and this effect was evident 10 minutes after the induction. Future studies are needed to elucidate whether this measure accurately reflects the willingness to tolerate negative stimuli, rather than boredom, fatigue, or lack of capacity to disengage from negative stimuli (e.g. Derryberry & Reed, 2002). However, the lower total affect and negative affect scores on the PANAS combined with greater numbers of negative slides viewed suggest that the focused breathing group may have displayed a stronger capacity to not become overwhelmed by the negative slides, viewing them as 'just pictures'.

The lower reported negative and overall affect in response to the slides at Time 3 (particularly for the negative slides) and the trend for greater willingness to view more very negative slides by the focused breathing group could be viewed as more adaptive responding to negative stimuli. Davidson et al. (2003) demonstrated that for normal adults, training in mindfulness meditation (for 8 weeks) was associated with greater left-sided anterior brain activation which in turn has been linked with "more adaptive responding to negative and/or stressful events. Specifically…faster recovery after a negative provocation" (p. 569). Although the current study investigates a single focused breathing induction and not intensive training in mindfulness, the results are consistent with faster recovery or less reactivity after exposure to negative slides. The minimal intensity or length of time for training in mindfulness that would be necessary to produce similar increases in left-sided anterior brain activation, and the long-term durability of such changes, remains to be tested.

Notably, differences were not observed with regard to the positive and negative slide Affect Scale ratings. Conceivably, the strongly valenced nature of the positive and negative slides largely overpowered more subtle group differences on a single affect rating scale. Alternatively, lack of differences may be due to the relatively low power due to limited cell size and will need to be reexamined in future studies. Differences in responses to negative and positive (as well as neutral) slides were found on the more extensive Short PANAS scale taken at Time 3. In addition the heart rate measure was insufficiently sensitive to distinguish among groups, or may have been restricted by inadequate statistical power. It is unclear if unexpected results in heart rate responses to the slides over time were due to attentional, affective, or sequential factors. Future research would be benefit from more sophisticated measures such as heart rate variability (Porges, 2003; Friedman & Thayer, 1998) which has been shown to more precisely depict the activity and flexibility of responding of the autonomic nervous system.

Although the focused breathing group was not distinguished from the unfocused attention and worry groups across every measure, the significant results are noteworthy given that the study was based on a 15 minute focused breathing induction with a sample that had no previous experience with mindfulness meditation. One question for future research is whether training in mindfulness would produce stronger effects following a brief induction. In addition, no instructions were given regarding how to approach the picture stimuli viewed after the induction. Thus, the results represent the spontaneous effects of a focused breathing induction rather than a deliberate effort to approach stimuli in a mindful or acceptance-oriented manner, as has been done in prior studies (Eifert & Heffner, 2003; Levitt et al., 2004). Our methodology arguably provides a more stringent test of the hypothesis that a focused breathing induction positively effects emotional regulation regardless of the intent or knowledge of the participant.

Limitations to the present study include the relatively small number of participants per group (20) and missing data, which resulted in limited power to demonstrate consistently significant findings. In addition, ceiling effects on the behavioral measure limited but did not eliminate the study's capacity to find behavioral correlates of the emotional effects of the inductions. The Affect Scale may have been a sensitive measure due to its broad, 100-point response scale, but also risked unreliability due to its basis on a single question. The brief laboratory nature of the study also precluded use of the Extended PANAS (rather than the Short PANAS), which includes ratings of a broader range of emotions such as "tranquility" and "contentment" which may be more able to capture the positive effects of focused breathing. In addition, participants in all groups indicated on a self-report measure that they did not place much effort in following the induction instructions. It is noteworthy that the current study found significant group differences in reported affect and overt behavior regardless of participants' reported low interest in following the instructions. Nevertheless,

greater engagement in the inductions may yield stronger, more consistent findings. Finally, this study compared the effects of a focused breathing induction to two inductions that represent the opposite of two theorized features of mindfulness states: the capacity to direct conscious attention towards the object(s) of focus in the present moment, and the capacity to limit ruminative thinking. A relaxation induction comparison is warranted to distinguish the effects of focused breathing from mere relaxation.

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