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ORIGINAL PAPER

# The Effects of a Mindful Listening Task on Mind-Wandering

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**Abstract** Mind-wandering has been linked to reductions in mood as well as performance decrements on a variety of tasks, including reading comprehension. The present study sought to evaluate whether the attention training technique (ATT) could induce an elevated state of mindful awareness capable of moderating the negative affective and behavioral consequences of mind-wandering in a nonclinical sample. Participants randomly assigned to receive the ATT ($n = 21$) reported significantly more mindful state awareness and more positive mood from preinduction to postinduction relative to those assigned to an active placebo ($n = 22$). Furthermore, participants who received the ATT exhibited substantially fewer instances of off-task thinking measured covertly during a word-by-word text progression task than did those who received the placebo. These findings collectively represent the first empirical validation of the ATT as a mindfulness inductor and attest to its capacity to effect meaningful reductions in mind-wandering frequencies and significant elevations in mood after only a single application. Implications of these results for current theory and clinical practice are discussed.

**Keywords** Mind-wandering · Mindfulness · Attention training technique (ATT) · Reading comprehension

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## Introduction

Mind-wandering has been defined as "a shift in the focus of attention away from the here and now and towards one's private thoughts and feelings" (Smallwood et al. 2007, p. 818). Interest in the mind-wandering construct has exploded in the recent past. In their comprehensive meta-analysis on the subject, Randall et al. (2014) reported that over half of the experiments selected for inclusion in their study were published in just the last 3 years. Such research has consistently demonstrated that mind-wandering is a ubiquitous (Mrazek et al. 2012a) and frequently occurring (Killingsworth and Gilbert 2010) phenomenon consistently linked to decrements in task performance (Randall et al. 2014) and increases in subjective dysphoria (Deng et al. 2014). Consequently, the costs of mind-wandering may be substantial for individual and society alike.

Mindfulness is an ancient concept with a rich history. Though admittedly reductionistic, one definition of mindfulness is that it is a state of nonjudgmental awareness of the present moment (Brown et al. 2007). While mindfulness as a construct often incorporates more subtle qualities of attention and attitude when discussed within the context of the larger spiritual traditions in which it has been most rigorously elaborated, this more limited conceptualization of mindfulness is consistent with its usage in the literature on clinical psychology (see, for example, Linehan 1993). Given the theoretical antithesis between mindfulness and mind-wandering (Mooneyham and Schooler 2013), it seems reasonable to assume that applied mindfulness may counteract the negative consequences of mind-wandering. Indeed, the research literature is rife with experimental evidence in accord with this

prediction. For example, meditators who participated in a 10-day, intensive mindfulness retreat demonstrated significant improvements on measures of working memory and sustained attention relative to their baseline scores (Chambers et al. 2008), indicating that mindfulness meditation is capable of inducing meaningful cognitive gains in a limited time frame. In fact, the single application of an 8-min mindful breathing exercise has been shown to be efficacious in reducing the frequency of mind-wandering episodes during a vigilance task compared to active control conditions (Mrazek et al. 2012b). Consequently, though benefit does seem to be correlated positively with frequency and duration of practice (Kuyken et al. 2013), even state-like transitions into mindful awareness are apparently capable of inducing meaningful alterations in mind-wandering frequency. While the empirical evidence demonstrating the salutary effects of mindfulness has not been unilaterally positive—for example, researchers recently demonstrated that participants in a mindfulness condition were significantly more likely to fabricate false memories compared with those in a behavioral placebo control (Wilson et al. 2015)—the literature generally supports the conclusion that mindfulness meditation is a safe and effective intervention, linked experimentally to improvements in task performance and theoretically to elevations in subjective mood.

Numerous studies have observed a significant correlation between mind-wandering and dysphoria. Some maintain that depreciations in mood tend to precede off-task thinking (Poerio et al. 2013; Smallwood et al. 2009; Smallwood and O'Connor 2011; Smallwood et al. 2007); others assert that off-task thinking tends to precede depreciations in mood (Killingsworth and Gilbert 2010; Mooneyham and Schooler 2013). The debate over the causal prepotency of mind-wandering and dysphoria is unlikely to be resolved conclusively. However, if attention and affect are indeed reciprocally influential, then attentional regulation may help to resolve emotional problems in much the same way that emotional regulation has been shown to resolve attentional problems (Carriere et al. 2008).

One method of attentional regulation that has shown clinical promise is the attention training technique (ATT; Wells 2007), which seeks to address one of the risk factors associated with psychological dysfunction: self-focused attention (SFA). Such a locus of attention is subject to maintaining a positive feedback loop capable of both amplifying otherwise harmless thoughts or sensations to distressing proportions and preventing an individual from attending to neutral or positive cues in the environment that could serve to disconfirm metacognitive distortions (Wells and Matthews 1996). In this way, SFA may be conceptualized as a kind of guarded hypervigilance of the self, a form of self-regard qualitatively antithetical to the warm attitude of acceptance associated with self-compassion (Holas and Jankowski 2013). If the maladaptive cycle of rumination supported by self-focused attention was interrupted, the cognitive resources that would otherwise be fruitlessly expended could then be marshaled in the service of more functional coping strategies likely to induce symptom alleviation.

Taken as a whole, the literature suggests that the ATT is an effective intervention in the treatment of many psychological disorders, including major depressive disorder (Papageorgiou and Wells 2000), generalized anxiety disorder (Wells 2000), panic disorder (Wells 1990), schizophrenia (Levaux et al. 2011; Valmaggia et al. 2007), and hypochondriasis (Papageorgiou and Wells 1998). Most of these studies, however, employed a case study methodology. While such an approach suggests that the ATT is well-tolerated and effective in clinical settings, case studies are subject to low reliability and generalizability. More recently, a pair of adequately powered, controlled trials has indicated that the ATT is also efficacious in lowering the frequency of self-reported intrusive thoughts in participants with a history of trauma (Callinan et al. 2014; Nassif and Wells 2014), suggesting that the technique may contribute to posttraumatic stress disorder symptom reduction when applied in conjunction with other methods. Furthermore, the mechanism through which the ATT has been hypothesized to exert its therapeutic effect, mitigation of maladaptive SFA levels, has been empirically validated. In a recent controlled trial, Fergus et al. (2014) observed that participants in an ATT condition exhibited increases in self-reported external locus of attention compared with participants assigned to mindfulness-based progressive muscle relaxation (MB-PMR). This finding builds on a previous study in which participants exposed to the ATT reported significantly more neutral focus than did those administered progressive muscle relaxation relative to their respective pre-induction attentional loci (Sharpe et al. 2010). Such studies also imply an important conceptual distinction between the psychological dimensions and the physical dimensions of personhood. As defined by Wells, self-focused attention is associated with the former construct. Consequently, both attenuation of attentional perseverance on the psychological self and accentuation of attentional perseverance on the physical self have been linked with reductions in psychopathological symptoms—presumably because both reduce levels of SFA under the current definition.

The ATT is a brief, listening exercise. However, the technique has been reconceptualized more than once since its introduction according to the putative mechanisms of action identified by its investigators. For example, the ATT has been variously labeled a form of attentional training (Wells 1990), a tool for improving metacognitive flexibility (Papageorgiou and Wells 2000), and a neurobehavioral intervention (Fergus and Bardeen 2016). However, in no explication of either the theory or effectiveness of the ATT has the technique been considered a mindfulness inductor. This is somewhat surprising given both the content of the technique (i.e., paying

attention to auditory stimuli) and the instructions given to participants (i.e., "The aim is to practice focusing your attention no matter what you might become aware of." [Wells 2009, p. 61]). Indeed, the practice of becoming increasingly aware of sensations present in the here-and-now is an essential hallmark of mindfulness meditation (Brown and Ryan 2003). Though Wells (2002) has identified both mindfulness meditation and attention training as pathways to state mindfulness, he is careful to maintain a conceptual boundary between the two categories. Consequently, the ATT has yet to be empirically validated as a mindfulness technique.

Furthermore, the effectiveness of the technique could be assessed across a broader spectrum of domains: both clinical and subclinical. Recent studies have indicated that the ATT is tolerated well by nonclinical participants and may be effective in reducing subclinical anxiety (Fergus et al. 2014), intrusive thoughts (Callinan et al. 2014), and impulsive self-gratification in children (Murray et al. 2016). Such findings suggest that the technique may be appropriate for addressing other subclinical issues, such as maladaptive mind-wandering. If mind-wandering presupposes an internal locus of attention (Smallwood and Schooler 2006) and the ATT has been shown effective in attenuating SFA (Fergus et al. 2014), then it is reasonable to predict that administration of the ATT should lead to reductions in mind-wandering frequency. Though one study to date has corroborated this expectation (Levaux et al. 2011), its case study methodology and clinical sample substantially restrict the generalizability of its findings. Reproduction of these results utilizing a more robust design would be necessary before the ATT could claim efficacy in this regard. Furthermore, as SFA has been implicated in the perpetuation of negative affect in both the attention training literature (Wells and Matthews 1996) and the mind-wandering literature (Mooneyham and Schooler 2013), an intervention expressly designed to increase external locus of attention, such as the ATT, should reduce subjective levels of dysphoria. Finally, given that excessive self-focus has been implicated in impoverished mental models (Smallwood et al. 2008) and deficits in memory consolidation (Smallwood et al. 2007), a technique that facilitates greater external focus, like the ATT, should improve performance on tasks known to require higher-order cognitive processing, such as reading comprehension. In a recent article, Mrazek, Franklin, Phillips, Baird, and Schooler collectively lament that "little progress has been made in establishing empirically validated strategies that dampen mind wandering's disruptive influence" (2013, p. 776).

The present study sought to address this gap in the research literature by examining whether a single application of the ATT could induce increases in mindfulness as revealed by alterations in participants' cognition, affect, and behavior. Three experimental hypotheses were formulated. Compared to participants in the control condition, participants in the experimental condition were expected to experience (1) higher levels of mindful awareness, (2) more positive subjective mood, and (3) more mindful reading behavior.

## Method

### Participants

Forty-three participants were recruited for the study at a major research university in the Pacific Northwest. Participants were undergraduate students enrolled in the Institute of Neuroscience and the Department of Human Physiology (79 %) and doctoral candidates completing their dissertation research (21 %). The former received course credit for their participation; the latter, a small stipend for their time. There was no attrition. Participants were predominantly female (77 %) and Caucasian (72 %); the mean age was 22.3 years old (SD = 3.47). The vast majority (95 %) professed little to no experience (fewer than ten sessions) with mindfulness meditation.

### Procedure

At the onset of the experiment, a fair coin was flipped to determine the treatment level of the initial participant block. The treatment level of the subsequent blocks alternated regularly thereafter. Thus, participants were randomly assigned to either the Experimental (ATT; $n = 21$) or the Control (UAI; $n = 22$) condition.

Each group was greeted by the principal investigator and conducted through an informed consent procedure, in which participants were given information on the experimental protocol as well as afforded an opportunity to ask questions and receive answers. Those who chose to continue their involvement in the study ($n = 43$, 100 %) indicated their consent to do so both verbally and in writing. Participants then completed the demographic questionnaire and the first administration of the Mindful Attention Awareness Scale-State (MAAS-S) and the Affect Range Scale (ARS).

Next, participants were led into the laboratory and conducted through the attention induction appropriate to their condition. During this time, participants were seated comfortably in chairs arranged in a row and facing one side of the laboratory; the principal investigator stood behind the chairs for the duration of the procedure, out of the participants' direct line of sight. Participants completed the second administration of the MAAS-S and the ARS immediately following their respective inductions.

Once these surveys were collected, participants were instructed to move their chairs forward 4 ft so that they were sitting directly in front of a computer terminal. Each terminal was separated by partitions on either side, creating a semiprivate cubicle for each participant. The principal investigator

then oriented the participants to the word-by-word text progression task (MWRA). Participants were afforded as much time to read the story as necessary.

## Measures

**Attention Training Technique** The attention training technique (ATT) is a 12-min listening exercise. Its purpose, communicated as a rationale before its application, is to promote a sense of self-efficacy in the metacognitive control of mental processes by facilitating a shift from a self-focus to an external locus of attention (Wells 2009).

The ATT is comprised of three stages: a selective attention exercise, an attention switching exercise, and a simultaneous attention exercise. The stimuli utilized were a mixture of organic (i.e., the researcher's voice, ambient noises) and mechanical (i.e., the beat of a metronome, a recording of a singing bowl) sounds. The present study implemented the technique as designed by Wells with two important alterations. First, the procedure was administered to small groups (up to five participants), rather than to successive individuals. Second, the ATT was administered in a single application, rather than in multiple applications over time. Both the rationale and the application of the technique were rehearsed and standardized.

**Unfocused Attention Induction** The unfocused attention induction (UAI) is a 12-min activity designed to encourage a state of consciousness in which sustained attention to a single external stimulus or internal cognitive object is unlikely. Participants are requested to think about whatever comes to mind for the duration of the activity.

**Mindful Attention Awareness Scale** This is a brief, self-report questionnaire designed to measure participants' current experience of mindful attention to the present moment using a 7-point Likert scale (Brown and Ryan 2003). Lower total scores correspond to higher levels of state mindfulness. The MAAS-S has been validated for use with undergraduate populations and has excellent internal consistency (Cronbach's $\alpha = .92$).

**Affect Range Scale** The Affect Range Scale (ARS) is a single-item, 21-point Likert scale designed to determine participants' current affective state. Responses ranged from extremely negative (−10: "The worst I've ever felt") to extremely positive (+10: "The best I've ever felt"), with a neutral median (0: "Neither good nor bad").

**Mind Wandering Reading Algorithm** Developed by Franklin et al. (2011), the Mind Wandering Reading Algorithm (MWRA) is a software program designed to detect the incidence of off-task thinking during a word-by-word reading exercise. By measuring subtle differences in text progression rate, the MWRA is able to identify the likely incidence of mind-wandering in subjects when their reading rates fail to slow during relatively difficult text passages.

Participants read a narrative presented one word at a time on a computer screen. In order to progress to the next word in the narrative, participants were instructed to depress the space bar. The amount of time that elapsed between consecutive depressions was considered the "reaction time" for the word currently presented on the screen; "reading rate" was a running average of consecutive reaction times across specified continua. Reading rate was measured both globally, as participants' average reaction time for the entire narrative up to that point and, locally, as participants' average reaction time for a running subsection of the last ten consecutive words. "Fast" reading was defined as a local reaction time (LRT) less than .55 times the global reaction time (GRT); "slow" reading was defined as an LRT more than 1.3 times the GRT and less than 1.75 times the GRT.

Text difficulty was established by first assigning three categorical values to every word in the narrative. Words were classified in terms of their word length (long = 1/short = 0; long: four letters or more), number of syllables (many = 1/few = 0; many: two syllables or more), and familiarity (low = 1/high = 0; low: missing from or indicated as "unfamiliar" in the Medical Research Council Psycholinguistic Database). These values were then used to calculate an average difficulty score, between 0 and 1, for every word in the text. "Difficult" passages were identified as running subsections of ten consecutive words with a cumulative average difficulty score of .45 or above.

If participants' reaction times failed to slow ($1.3GRT < LRT < 1.75GRT$) during difficult text passages (running subsection difficulty score $\geq .45$), readers were probably engaging in off-task thinking. The rationale for this prediction was predicated on the assumption that difficult passages contain relatively more complicated visual, phonological, and semantic information that should collectively increase participants' processing times due to the elevated cognitive load, which, in turn, should lengthen participants' reaction times during those narrative subsections. If this did not occur, it was supposed that readers were not attending properly to the text and, consequently, mind-wandering.

The researchers tested the validity of these assumptions by programming the MWRA to issue a thought probe to subjects during periods of fast or slow reading. The probe, a single question on a 5-point Likert scale (5 = "completely on unrelated concerns"), was designed to ascertain subjects' locus of thought when engaging in "abnormal" reading behavior. By combining the algorithm's mind-wandering predictions with the probe-caught data, the researchers found that reading rate tended to increase during periods of off-task thinking. Furthermore, they discovered that the MWRA was able to identify mind-wandering episodes with significant accuracy

($p = .01$, $d = .71$). In fact, the algorithm was able to predict participants' locus of attention 72 % of the time ($p < .001$, 95 % CI = 66.4–77.0 %). Consequently, the MWRA was selected as a measure of mind-wandering frequency by virtue of its substantial criterion validity and its proven ability to reliably detect incidences of mind-wandering covertly.

The present study retained the operational definitions of fast and slow reading as well as the definition of a difficult text passage formulated by Franklin et al. (2011). However, "mind-wandering" was defined more conservatively in the present study. Whereas the previous researchers considered a mind-wandering episode to have occurred whenever participants' LRTs failed to slow to a certain rate relative to their GRTs during difficult text passages (mind-wandering episode: LRT < 1.3GRT or 1.75GRT < LRT), the principal investigator only considered a mind-wandering episode to have occurred whenever participants' LRTs were unusually fast or unusually slow relative to their GRTs (mind-wandering episode: LRT < .55GRT or 1.75GRT < LRT). For example, participants reading difficult passages at their average overall reading rate would be classified as mind-wandering under the previous, but not the current definition. The more restrictive definition of mind-wandering utilized in the present study should be less sensitive to the incidence of mind-wandering episodes, thereby mitigating the risk of false positives. It also conceptualizes mind-wandering as occurring on a continuum, which is consistent with the explicit thought probes utilized by the makers of the MWRA to validate its sensitivity to the phenomenon (Franklin et al. 2011). Figure 1 graphically demonstrates the capacity of the MWRA to discern mindful reading from mind-wandering.

The text utilized by the MWRA was a shortened version (5129 words) of "The Red-Headed League" by Conan-Doyle (1892/2001).

### Data Analyses

Given the stated hypotheses of the study, repeated measures analyses of variance (rANOVA) were selected to determine potential treatment × time interaction effects with respect to both MAAS-S and ARS scores. Since the MWRA was only administered to each participant once, an analysis of variance (ANOVA) was selected to evaluate between-group differences on this measure. All analyses were conducted using the Statistical Package of the Social Sciences (SPSS).

## Results

The random assignment process was successful. Difference of means $t$ tests revealed no significant between-group differences on any of the demographic variables or on preinduction ARS scores; however, between-group differences on preinduction MAAS-S scores were significant. Participants in the control condition initially presented as substantially more mindful than did participants in the experimental condition, $t(41) = -1.98$, $p = .05$. Consequently, preinduction MAAS-S scores were included as covariates in subsequent analyses.

Given the vast number of words (360) that conformed to the original definition of difficult as defined in the "Method" section (i.e., text difficulty ≥ 0.45), frequency of mind-wandering episodes was calculated using the following procedure. First, the original 5129-word text was divided into blocks every 250 words. This resulted in the creation of 21 nearly-equal blocks of 250 words each (the 21st block containing the final 129 words), 20 of which contained at least one difficult word. Then, a random number generator was used to select one difficult word to serve as a representative data point from among all the difficult words in each of the 20 eligible text blocks. In this way, frequency of mind-wandering episodes was recalibrated as a continuous numerical variable with a range of 0 to 20. Given the relatively small sample size of the present study, such a transformation allowed for the effective utilization of the MWRA data.

All post-induction-dependent variables were subjected to a multivariate analysis of covariance (MANCOVA), with preinduction MAAS-S scores as covariates. The MANCOVA revealed significant between-group differences on the set of all post-induction-dependent variables, Wilks' $\Lambda = 0.66$, $F(4, 37) = 4.84$, $p = .003$, $\eta_p^2 = .34$. No assumptions regarding homogeneity of error variances were violated. This finding provided justification for subsequent analyses to determine the unique contribution of each of the dependent variables to the overall between-group difference. Given that the study's experimental hypotheses included specific directions of change, one-tailed tests were utilized to assess the accuracy of these predictions.

First, an analysis of covariance (ANCOVA) test using preinduction MAAS-S scores as covariates revealed significant between-group differences on postinduction MAAS-S scores in the hypothesized direction, $F(1, 40) = 12.69$, $p < .001$, $\eta_p^2 = .24$. That is, postinduction state mindfulness scores were significantly lower in the experimental condition than in the control condition, indicating increased mindfulness, when controlled for preinduction state mindfulness scores. No assumptions regarding the homogeneity of error variances were violated. Figure 2 presents these data visually.

Next, a 2 × 2 (treatment × time) repeated measures ANCOVA (rANCOVA) was conducted to determine the effect of these independent variables on ARS scores using preinduction MAAS-S scores as covariates. Although the main effect of time on ARS scores was not significant, the rANCOVA revealed both a significant main effect of treatment, Wilks' $\Lambda = 0.93$, $F(1, 40) = 2.88$, $p = .05$, $\eta_p^2 = .07$, and a significant treatment × time interaction, Wilks' $\Lambda =$

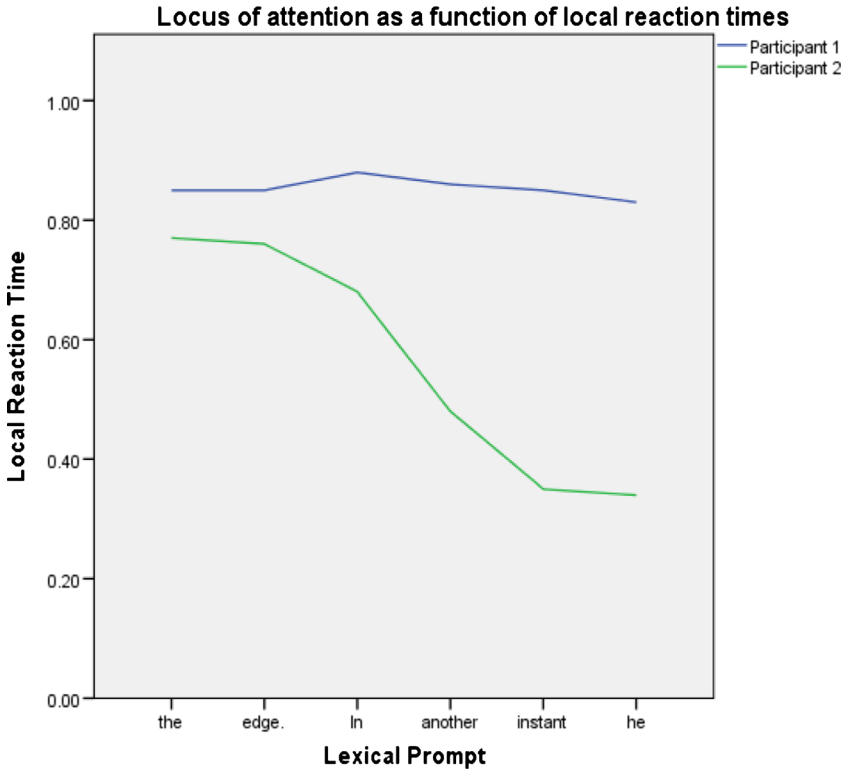


**Fig. 1** Locus of attention as a function of local reaction times. This figure illustrates how the Mind Wandering Reading Algorithm (MWRA) identifies a mind-wandering episode (MWE). When a reader's local reaction time (LRT) is unusually fast or unusually slow relative to that reader's global reaction time (GRT) when presented with a lexical prompt of sufficient difficulty (difficulty score ≥.45), then that reader is assumed to be engaged in mindless reading (MWE: LRT < .55GRT or 1.75GRT < LRT). In the above figure, the *y*-axis represents LRT as a percentage of GRT for two representative participants. Of the six lexical prompts presented, "another" and "instant" exceed the "difficult" threshold (scores of .46 and .50, respectively). Consequently, the MWRA would identify participant 1 as reading mindfully and participant 2 as mind-wandering during these data points

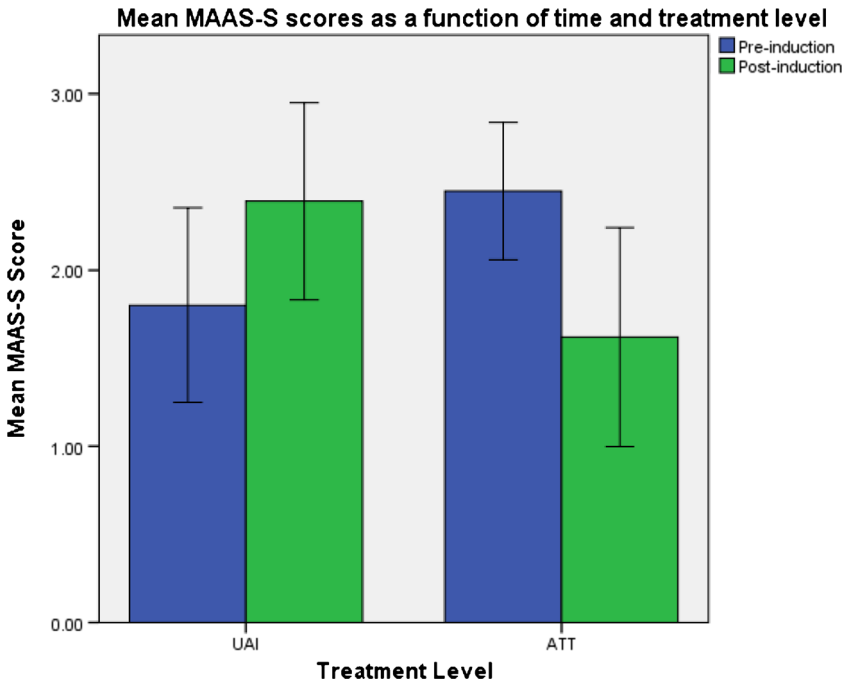


**Fig. 2** Mean MAAS-S scores as a function of time and treatment level. ANCOVA revealed a significant ($p < .001$) difference in mean postinduction Mindful Attention Awareness Scale-State (MAAS-S) scores between attention training technique (ATT) and unfocused attention induction (UAI) treatment levels when controlled for preinduction MAAS-S scores. *Bars* represent 95 % confidence interval values. Lower MAAS-S scores correspond to higher state mindfulness

0.88, $F(1, 40) = 5.44$, $p = .01$, $\eta_p^2 = .12$, on this dependent variable. This indicated that postinduction ARS scores not only were significantly higher in the experimental condition but also differentially changed across time relative to the control condition as well. No assumptions regarding either the homogeneity of covariance matrices or the homogeneity of variances (sphericity) were violated. Figure 3 presents these data visually.

Finally, an ANCOVA examining between-group differences on frequency of mind-wandering episodes during the reading task using preinduction MAAS-S scores as covariates returned nonsignificant results, $F(1, 40) = 1.43$, $p = .12$, $\eta_p^2 = .03$. However, follow-up analyses revealed that data collected from the experimental condition were sufficiently skewed (skewness = 1.35 [.50], kurtosis = 1.08 [.97]) to violate the assumption of normality required for a reliable ANCOVA analysis, Shapiro-Wilk = .83, $df = 21$, $p = .002$. As a result, an independent samples Mann-Whitney $U$ test was conducted. As a nonparametric test, the Mann-Whitney $U$ does not require within-group data to be normally distributed (Savage 1957). Mean rank between-group differences in frequency of mind-wandering episodes were significant, $U(41) = 154.50$, $Z = -1.87$, $p = .03$. This finding indicates that, as measured by the MWRA, substantially more participants in the experimental condition (median = 2) experienced low frequencies of mind-wandering episodes than did participants in the control condition (median = 5). Indeed, if the median number of mind-wandering episodes is utilized as a representative frequency for each of the groups, individuals who were administered the ATT exhibited 60 % fewer abnormal reading patterns indicative of mind-wandering during difficult text passages than did those who were not. Figure 4 presents these data visually.

## Discussion

The data collected over the course of the experiment were consistent with the study's primary hypotheses. Participants in the experimental condition reported significantly higher levels of state mindfulness than did participants in the control condition following their respective inductions. These findings offer empirical support for the ATT as a method capable of inducing significant elevations in state mindfulness. Such a conclusion is made all the more impressive given the brief duration of the technique, the single application of the procedure, and the relative inexperience of the participants involved. Furthermore, the effect size observed in the present study was medium-to-large (Cohen 1988), indicating that a substantive modification had occurred. Consequently, it appears as though the single administration of the ATT is sufficient to provoke meaningful elevations in mindful

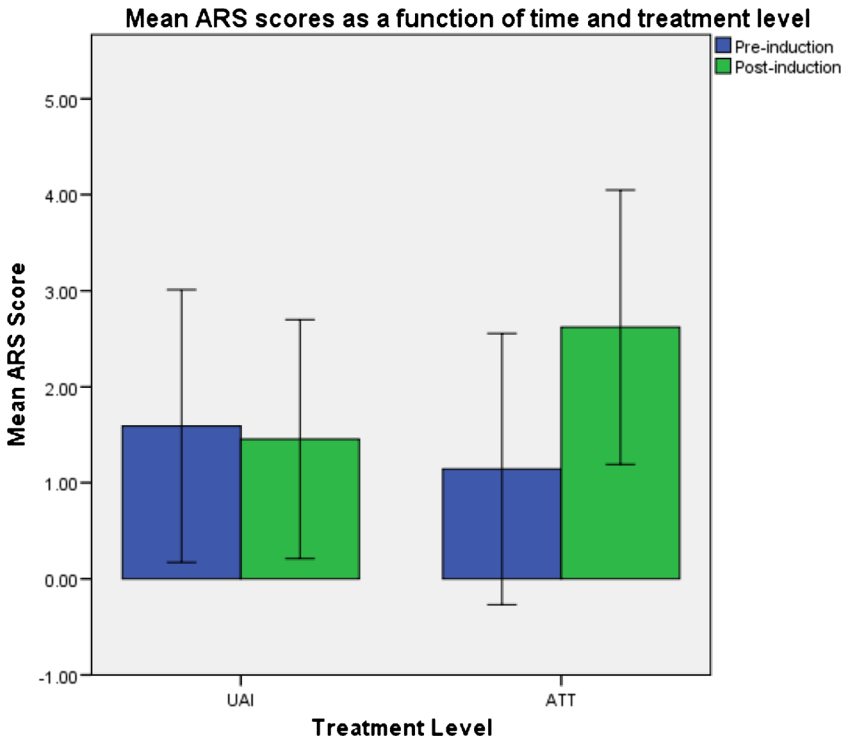


**Fig. 3** Mean ARS scores as a function of time and treatment level. rANCOVA revealed a significant main effect of treatment ($p = .05$) and a significant treatment × time interaction effect ($p = .01$) using preinduction mindfulness levels as covariates, indicating that mean Affect Response Scale (ARS) scores changed differentially between attention training technique (ATT) and unfocused attention induction (UAI) treatment levels from preinduction to postinduction. *Bars* represent 95 % confidence interval values. Higher ARS scores correspond with more positive affect

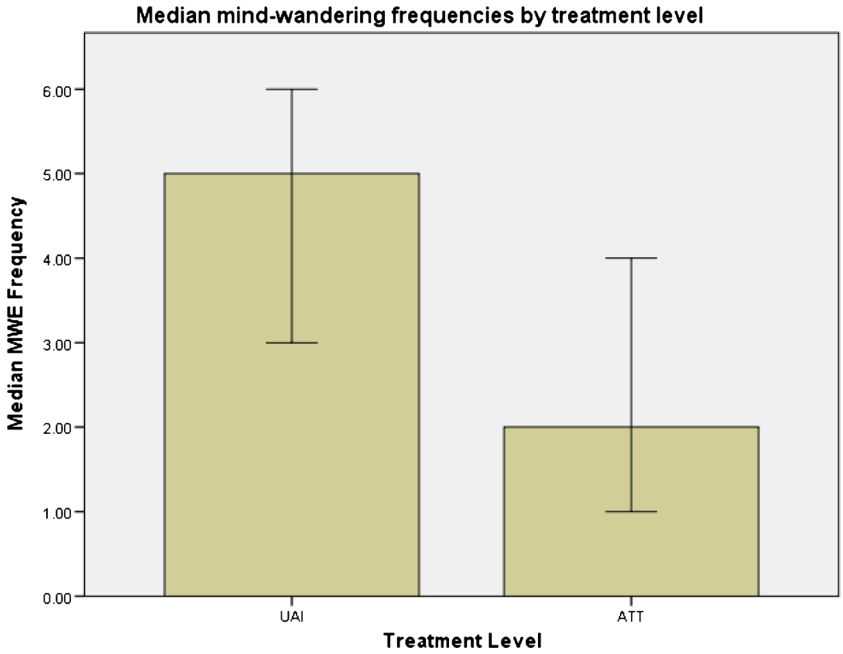


**Fig. 4** Median MWE frequencies by treatment level. Mean rank differences in mind-wandering episode (MWE) frequencies between unfocused attention induction (UAI) and attention training technique (ATT) treatment levels were statistically significant ($p = .03$). *Bars* represent 95 % confidence interval values

awareness in novice practitioners. Additionally, the technique appears to accord with the operational definition of mindfulness offered by Brown et al. (2007). That is, the ATT encourages (1) nonjudgmental ("It doesn't matter if thoughts or feelings come into your mind," [Wells 2009, p. 61]), (2) awareness ("Try to be aware of all the sounds both inside and outside the room," [Wells 2009, p. 62]), and (3) of the present moment ("Try to hear everything simultaneously," [Wells 2009, p. 62]). This conceptual alignment—in conjunction with the finding that participants who underwent the ATT reported higher levels of state mindfulness compared with both their own preinduction levels and the postinduction levels of participants who underwent a behavioral placebo—collectively makes a cogent argument for the ATT's classification as a mindfulness inductor.

Analysis of the differences in ARS scores similarly returned significant findings. Participants in the experimental condition reported more positive affect than did those in the control condition as a result of their exposure to the ATT, a finding strengthened by the disordinal between-group change across time. Furthermore, the observed effect size of the interaction was small-to-medium (Cohen 1988), suggesting that changes in affect were subjectively meaningful. Such a result provides further empirical support for the existence of a causal relationship between mindful awareness and positive affect, a relationship long recognized within the context of many spiritual and meditative traditions (Shonin et al. 2014).

Additionally, the observation of significant and differential change in mood between conditions across time attests to the effectiveness of the ATT in inducing more positive emotional states over and above simply "taking a break." This may be due to the relationship between nondirected idleness and default network activation (Christoff et al. 2009), itself associated with mind-wandering (Mason et al. 2007), which has in turn been linked with depreciations in subjective well-being (Smallwood et al. 2007). On the other hand, it may indicate some active component of the ATT itself. That participants felt better after only 12 min of listening mindfully to ambient sounds provides some indication of the power that attention wields over emotions. This is consistent with the model of cognition within which the ATT was developed, which maintains that excessive self-focus, a specific locus of attention, is an essential element undergirding manifestations of emotional dysfunction (Wells 2009).

Finally, data analysis revealed significant between-group differences in the frequency of mind-wandering episodes. This finding indicates that participants who completed a brief mindful listening task were less likely to experience task-unrelated thoughts while reading difficult narrative passages than were participants who underwent a behavioral placebo. Furthermore, the intervention-duration to task-duration ratio was sufficiently low (approximately 1:4) to support the conclusion that the ATT may be a convenient way for individuals to focus their concentration prior to moderately long text-based exercises.

These results are relevant beyond the specific hypotheses of the present study. The empirical validation of the ATT as an intervention capable of reducing the incidence of mind-wandering is a direct response to a call for additional strategies

that can serve precisely this function (Mrazek et al. 2013). Additionally, given the present study's demonstration that the ATT is an effective inductor of mindful awareness, these findings collectively extend the conclusions of Fergus et al. (2014), who recently established that the technique operates according to its putative mechanism: the reduction of SFA levels. The results presented herein regarding the ATT's effect on attention, however, are arguably more robust, as they are derived from both multi-method assessments (i.e., self-report surveys and behavioral analyses) and validated, multi-item measures (i.e., the MAAS-S). It appears as though the ATT may achieve its therapeutic effect not merely by encouraging an external locus of attention but by inducing a heightened state of mindful awareness as well. Finally, although the present study may be the first to empirically link the ATT with mindfulness, it is far from the first to demonstrate the connection between mindfulness and mind-wandering. Indeed, the conclusions presented herein conform to the theory-based observation that "mindfulness may well be the antidote to mind wandering" (Mooneyham and Schooler 2013, p. 16). However, in light of evidence that not all populations respond positively to interventions explicitly designed to facilitate mindful awareness (Crane and Williams 2010), the present results suggest that the ATT may be a useful alternative pathway to this beneficial state of mind.

The findings of the present study also provide additional support for the growing consensus that mood is significantly affected by fluctuations in attention. Though temporal precedence is not a monolithic factor (Ruby et al. 2013), there is evidence to suggest that mind-wandering may reliably precede increases in dysphoria. The present study has determined that the logical inverse is also a valid proposition, that is not mind-wandering (mindfulness) may reliably precede not unhappiness (elevated mood). This conclusion extends the results of previous studies, which have identified significant correlative relationships between mindfulness and subjective well-being (Lyvers et al. 2014). Demonstration of the causal effect of state mindfulness on mood may help to substantiate the effectiveness of mindfulness-based interventions in treating affective dysregulation (Lynch et al. 2006).

The present study is not without its limitations. Foremost among them is the study's small sample size and, thus, its modest power. Notwithstanding this liability, however, the present study does represent an improvement over the samples of previous research assessing the ATT as independent variable (median = 23, ten studies) and may, therefore, be considered a meaningful contribution to the extant literature. Replication of the mindfulness-inducing properties of the ATT using a larger sample and independent researchers is encouraged.

Furthermore, though the MWRA has previously been validated as a highly specific, covert detector of both on-task and off-task thinking while reading, it does suffer from a few intrinsic liabilities that limit the generalizability of the present study's conclusions. First, the MWRA is a specific, though not entirely sensitive measure of mind-wandering. Indeed, it was designed to detect off-task thinking at its most unambiguous: as extremely abnormal response patterns during the most linguistically complex narrative passages. The capacity of the MWRA to identify participants' locus of attention during periods of reduced cognitive effort is necessarily limited. Additionally, as a word-by-word text progression exercise, the MWRA is not entirely ecologically valid as a reading task. The unusual format of the activity may have introduced potentially confounding elements into the experimental procedure. For example, as unfamiliar stimuli tend to increase the allocation of attentional resources (Mason et al. 2007), the novelty of the MWRA itself may have induced higher than average rates of on-task thinking. The possibility remains that the allocation of attention during a more traditional reading task may be qualitatively different than that observed during the MWRA. It is also conceivable, if unlikely, that reading rates assessed by the MWRA might have systematically differed between conditions for reasons other than attentional allocation (e.g., boredom versus excitement at reading certain passages). Further investigation of the ATT with other behavioral measures of attention is recommended.

Finally, the participants who constituted the sample restrict the generalizability of the study's conclusions. Though large-scale experience-sampling studies (Killingsworth and Gilbert 2010) have returned the finding that mind-wandering is ubiquitous across major demographic variables, it cannot therefore be assumed that incidence rates are identical across gender, ethnicity, and socioeconomic status. Indeed, differential mind-wandering frequencies have already been observed between young adults and old-old adults (75–85 year-olds), with the latter cohort reporting significantly fewer probe-caught episodes during a vigilance task (Zavagnin et al. 2014). Given the finding that dysphoria is associated with higher incidence rates of mind-wandering (Smallwood et al. 2009) and the epidemiological data that indicate prevalence rates of depression are elevated among historically disempowered populations like women (American Psychiatric Association 2013), it would be surprising if rates of mind-wandering were identical across demographics. As research has ascertained that the content of off-task thinking is most often related to everyday concerns (Kane et al. 2007), then disadvantaged individuals would presumably also exhibit higher rates of mind-wandering—not as a consequence of their specific identities *per se*, but as a result of the stress associated with navigating a potentially antagonistic dominant culture (Williams and Greenleaf 2012). In fact, research has already demonstrated that mind-wandering incidents increase in the wake of stereotype threat (Mrazek et al. 2011). As a result, data collected from this relatively privileged, predominantly Caucasian sample of university students cannot be taken to represent behavior typical across humanity.

Results of the present study suggest multiple pathways of further inquiry. For example, though the data indicate that the single application of a brief mindfulness exercise is sufficient to induce significant elevations in mood and mindful awareness in participants relative to a behavioral placebo, a repeated measures design could subsequently be utilized to determine whether these improvements can be intensified by spaced rehearsal. Although previous research utilizing such a design has determined that the gains attributable to the ATT tend to aggregate over time, these studies focused on the amelioration of psychopathological symptoms within a clinical population (e.g., Valmaggia et al. 2007). Nonclinical populations, presumably closer to optimal levels of functioning, may encounter a ceiling effect with respect to the ATT's capacity to influence mood and mindfulness not commonly observed in clinical populations.

Finally, given the observed ability of the ATT to induce elevations in mindful awareness—which is associated with greater focus, consistent attention, and task perseverance (Brown et al. 2007)—experimental examination of the technique's efficacy in ameliorating attention deficit hyperactivity disorder (ADHD) symptoms seems warranted. The ATT has already demonstrated the ability to positively influence the symptom constellations of disorders in several different diagnostic categories. Where attention training capable of attenuating the symptoms of ADHD as well, then individuals unwilling or unable to tolerate the side effect profiles of psychopharmacological interventions would have recourse to a medically safe, no-cost, and empowering alternative to treatment as usual.

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**Compliance with Ethical Standards**

**Conflict of Interest** The authors declare that they have no conflict of interests.

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