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Emily L. Polak
University of Miami, epolak@miami.edu

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UNIVERSITY OF MIAMI

IMPACT OF TWO SESSIONS OF MINDFULNESS TRAINING ON ATTENTION

By

Emily L. Polak

A DISSERTATION

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy

Coral Gables, Florida

June 2009

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IMPACT OF TWO SESSIONS OF MINDFULNESS TRAINING
ON ATTENTION

Emily L. Polak

Approved:

Sheri Johnson, Ph.D. Associate Professor of Psychology	Terri A. Scandura, Ph.D. Dean of the Graduate School
Michael E. McCullough, Ph.D. Professor of Psychology	Heather Henderson, Ph.D. Assistant Professor of Psychology
Jutta Joormann, Ph.D. Assistant Professor of Psychology	David Loewenstein, Ph.D. Professor of Psychiatry

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The effect on two sessions of mindfulness training on attentional efficiency was examined. 150 novice meditators were randomly assigned to mindfulness training, relaxation training, or a neutral task and were tested before and after participation. They were evaluated with performance measures of attentional efficiency and short-term memory as well as self-report measures of mindfulness and affect. Results indicated that mindfulness training was not related to better performance on any attention measure or a verbal memory measure as compared to relaxation and control groups. Possible reasons for the failure to find attentional benefits are explored and directions for future research are discussed.

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TABLE OF CONTENTS

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Chapter 1: Introduction

The ability to pay attention is essential for survival; from birth, humans spend all of their waking hours attending to competing stimuli. Although everyone has the ability to attend, individual differences exist in how well people pay attention. Evidence has recently emerged, however, that attentional functioning can be improved with training. Although much of attentional development is under genetic control, environmental forces can also exert an important influence. For example, it has been demonstrated that video game playing (Green & Bavelier, 2003) and exercise (Colcombe & Kramer, 2003) improve specific attentional subsystems. Mindfulness, a form of self-regulation of attention, is another practice that may have the potential to improve attentional abilities.

Mindfulness is a process that involves focusing one's attention on the present moment in a non-evaluative way (Kabat-Zinn, 2003). Mindfulness practices produce significant psychological and physiological benefits, positively impacting cardiovascular, cortical, hormonal, and metabolic function, in addition to producing important behavioral effects, such as alleviating symptoms of depression, anxiety, and drug dependency (for review see Kabat-Zinn, 2003). Despite the apparent value of mindfulness, however, few empirical studies have been conducted that examine the effect of mindfulness training on attention. The goal of this study, therefore, is to investigate whether the practice of mindfulness improves attention regulation.

Mindfulness practices originated as a form of Buddhist meditation. Meditation refers to practices that cultivate the ability to pay attention to some object of thought or awareness. It usually involves turning attention inward to the mind itself. Meditation practices are often divided into two categories: concentrative and receptive. Lutz, Slagter,

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Dunne, and Davidson (2008) refer to this distinction as focused attention (FA) and open monitoring (OM). Concentrative meditation emphasizes restricting attention to one particular stimulus. In this type of meditation, when extraneous stimuli enter awareness, they are considered a distraction and are immediately dismissed. Receptive meditation, on the other hand, involves attending to the entire field of awareness.

Because mindfulness falls within the category of receptive meditation, its practice entails bringing an attitude of curiosity, openness, and acceptance to the fluctuations of the mind. When experiencing a distracting thought or unpleasant emotion, one attempts to observe the experience and to refrain from reacting with judgment, avoidance, or elaboration (Bishop et al., 2004). As such, there are two principal components that characterize mindfulness meditation: the self-regulation of attention on immediate experience and an attitude of acceptance to whatever experiences occur (Bishop et al., 2004). It is the attitude of acceptance and non-judgment that distinguishes mindfulness from other forms of meditation.

The practice of mindfulness typically consists of sitting quietly and attempting to maintain attention on a particular focus, often the natural rhythm of one's own breath (Kabat-Zinn, 1990). When attention inevitably wanders to other thoughts or feelings, one attempts to acknowledge and observe them without judgment, and gently redirect the attention back to the breath. One repeats this process each time the mind wanders, and attempts to notice the thoughts, feelings, and sensations that arise in the stream of consciousness while doing so.

Substantial theory has been developed regarding the mechanisms involved in the benefits of mindfulness training. For example, Breslin, Zack, and McMain (2002)

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propose that through mindfulness, a shift occurs in which thoughts and feelings come to be observed as externally arising phenomena. The ability to step back from mental events has been referred to as "meta-awareness," "decentering" or "cognitive distancing" (Hayes, Strosahl & Wilson, 1999; Teasdale, Segal, & Williams, 1995). Through this process, individuals develop an awareness of the transience of thoughts and feelings and may learn not to take emotions and thoughts as true representations of reality or of the self, but simply as mental events. Viewing thoughts, emotions, and sensations without identifying with the experiences reduces their distress-evoking potential. Mindfulness approaches are thus thought to reduce emotional reactivity (e.g., aversion and attachment) to internal and external phenomena.

Further, mindfulness practices train individuals to become aware of habitual patterns of thinking at an early stage. As a result, people may learn to inhibit elaborative processing of thoughts, feelings, and sensations, resulting in a higher percentage of attentional resources becoming available to process information in the present (Bishop et al., 2004). This cognitive inhibition may allow individuals to experience situations in a less biased manner, minimizing the effects of filters or models built up from previous experience. It has been hypothesized that this skill increases cognitive flexibility by making it easier for individuals to choose between various responses (Wenk-Sormaz, 2005).

The Burgeoning of Mindfulness Research

Though various forms of meditation have been practiced since ancient times, in the last half-century there has been a surge of research suggesting that meditation has substantial mental and physical effects. Meditation has been shown to induce a set of

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physiological changes known as the relaxation-response, which includes decreased heart rate, respiratory rate, blood pressure, and oxygen consumption (Benson, Greenwood, & Klemchuk, 1975). The parasympathetic nervous system becomes activated, consequently reducing stress-related somatic arousal. This decrease in experienced stress appears related to decreased cortisol and catecholamine levels (Cahn & Polich, 2006). Further, the impact of meditation on cardiovascular, cortical, hormonal, metabolic, and behavioral changes have been explored in recent years, though with substantial variability in methodological rigor (Ospina et al., 2007). Mindfulness research, however, is a more recent development.

In the 1980s, mindfulness techniques were first applied to reduce the suffering of medical patients with chronic pain. This idea eventually evolved into a clinical program known as Mindfulness-Based Stress Reduction (MBSR). MBSR uses mindfulness meditation as a self-regulatory approach to stress reduction and emotion management to facilitate coping with chronic physical and psychiatric disorders. Kabat-Zinn, the creator of the MBSR program, defined mindfulness as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145).

To date, hundreds of research studies of mindfulness-based interventions provide evidence suggesting the value of mindfulness practice. In medical populations, mindfulness training predicts improvements compared to baseline measures or wait list controls in chronic pain, psoriasis, high blood pressure, serum cholesterol levels, and blood serum cortisol, as well as symptoms of numerous psychiatric conditions, including panic disorder, depressive relapse, disordered eating, and suicidal behavior (for review

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see Kabat-Zinn, 2003). MBSR has also been found to affect the immune system, with meditators showing an increase in antibody titers to an influenza vaccine compared with those in a wait-list control group (Davidson et al., 2003). Self-reported psychological benefits include heightened perception, auditory acuity, increased clarity of thought, openness to experience, empathy, self-confidence, and self-discipline (Murphy & Donovan, 1997). Decreased susceptibility to distraction has also been reported (Valentine & Sweet, 1999).

Neuropsychological research has provided further evidence of the benefits of mindfulness meditation. MBSR has been found to increase left-sided anterior activation in the brain, a pattern associated with positive affect and prefrontal cortical activity, which is centrally involved in emotion regulation (Davidson et al., 2003). Additional research has found links between this activation and more adaptive responding to negative, stressful events (Aftanas & Golosheykin, 2005).

Mindfulness practices have been incorporated into several interventions used in medical and mental health settings, including dialectical behavior therapy for borderline personality disorder (Linehan & Kehrer, 1993), mindfulness-based cognitive therapy for depression (Segal, Williams, & Teasdale, 2002), acceptance and commitment therapy (Hayes, Strosahl & Wilson, 1999) and relapse prevention for substance abuse (Parks, Anderson, & Marlatt, 2001). Although no dismantling studies have been conducted to date, these interventions have incorporated mindfulness training as a set of skills that can be practiced to reduce vulnerability to cognitive reactivity and improve distress tolerance (Huss & Baer, 2007; Linehan, Comtois, Murray, et al., 2006).

Numerous studies reveal that MBSR also improves well-being and reduces stress in

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non-clinical samples. For example, a study of medical and pre-medical students revealed reductions in state and trait anxiety and psychological distress among those participating in an 8-week mindfulness-based intervention compared with a waitlist control group (Shapiro, Schwartz, & Bonner, 1998). An 8-week MBSR intervention in college undergraduates also revealed decreased stress and increased forgiveness among participants compared to controls (Oman, Shapiro, Thoreson, Plante, & Flinders, 2008). Further, a measure of mindfulness levels as a trait has been found to correlate with lower intensity and frequency of negative affect (Brown and Ryan, 2003).

In addition, research has begun to differentiate mindfulness from relaxation training and other forms of meditation. Significant differences in EEG pattern were also observed over numerous cortical sites when comparing relaxation, mindfulness meditation, and concentration meditation (Dunn, Hartigan, & Mikulas, 1999). Further, to compare the efficacy of mindfulness meditation with relaxation interventions, Jain et al. (2007) examined the effects of a one-month mindfulness meditation versus somatic relaxation training in students reporting distress. They found that compared with a no-treatment control, brief training in mindfulness meditation and somatic relaxation both reduced distress and improved positive mood states. However, only the mindfulness group demonstrated significant decreases in both distracting and ruminative thoughts and behaviors compared with the control group. This research suggests that mindfulness is a practice with unique cognitive effects above and beyond the effects of relaxation. As a result, recent research has begun to clarify how mindful attention regulation produces these results by exploring the neuronal bases of attention.

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The Neuropsychology of Attention

Attention underlies awareness of the world and the voluntary regulation of thoughts and feelings. Attention can be conceptualized as the process of controlling the prominence of various stimuli within consciousness (Toates, 2006). Posner and Rothbart (2007) propose that attention consists of three functionally distinct neural networks: alerting, orienting, and executive attention. Each of these networks is associated with discrete structures and chemical modulators in the brain.

Alerting involves establishing a condition of responsiveness to incoming stimuli and has been associated with the right frontal and parietal regions of the right hemispheres and the locus coeruleus. The use of warning signals before targets has been used experimentally as a way to measure alertness. Warning signals are thought to influence alertness by increasing activity of norepinephrine (Fosella, Posner, Fan, Swanson, & Pfaff, 2002).

Orienting is the process of choosing which material to focus on from the gamut of sensory input. Orienting encompasses both the ability to sustain attention over prolonged periods of time and to selectively attend to certain stimuli, i.e., to select target items while ignoring distractions. This system has been associated with posterior brain regions, including the superior parietal lobe, the temporal parietal junction, the frontal eye fields, and the superior colliculus. Orienting can be measured by presenting a cue indicating where in space a person should attend, thereby directing attention to the cued location (Fosella et al., 2002).

Finally, executive attention consists of various mechanisms involved in supervising and resolving conflict among thoughts, feelings, and behaviors, such as

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deliberately ignoring a salient stimulus. Executive attention entails a specific type of attentional flexibility known as switching, which involves fluidly shifting attention from one point of focus to another. Executive control is thought to involve the anterior cingulate, lateral prefrontal cortex, and the basal ganglia. This network is often studied experimentally through tasks that involve cognitive conflict, such as the Stroop task or a flanker task. In the Stroop task, names of colors are presented to participants in different color ink, e.g. the word “BLUE” may be printed in red ink. Individuals are asked to state the color of the ink while ignoring what the word says. A flanker task, in which a central target stimulus, such as an arrow, may be congruent or incongruent with surrounding stimuli (flankers), has also been shown to activate the executive attention network and provides a means of partitioning the contributions of the various brain systems involved in attention (Fosella et al., 2002).

Technological advances provide additional support for the existence of these three attentional networks. More specifically, the effect of meditation and mindfulness on the underlying attentional networks has been a recent focus of study using functional magnetic resonance imaging (fMRI). In one study, participants meditated by passively observing their breathing and silently repeating Sanskrit phrases during inhalations and exhalations. Results revealed significant signal changes in neural structures involved in attention such as the hippocampus, temporal lobe, anterior cingulate cortex, and striatum during tasks (Lazar et al., 2000).

Mindfulness and Attention: Theory

While the value of mindfulness for stress reduction is well-established, its cognitive benefits are not as well documented. Bishop and colleagues (2004) proposed a

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conceptualization of the ways in which attention regulation would be involved in mindfulness practice. They proposed four types of attention regulation to be involved in mindfulness: *sustained attention* to maintain awareness of current experience, *attention switching* to bring attention back to the present moment when it has wandered, *inhibition of elaborative processing* to avoid dwelling or ruminating on thoughts or feelings that are outside of the present moment, and *non-directed attention* to enhance awareness of present experience, uninfluenced by assumptions or expectations.

While this type of categorization is useful conceptually, it is perhaps more practical to consider how these types of attention would map on to the three discrete attention networks identified by neuropsychological research. For example, mindfulness involves the attempt to direct attention to one point of focus, such as the breath, refrain from reacting with judgment, avoidance, or elaboration when the mind wanders, and shift attention back to the focus point. Sustained attention, attention switching, and inhibition of elaborative processing thus seem to fall within the domain of executive function. It therefore seems likely that mindfulness practice would improve executive functioning.

Ambiguity exists, however, regarding the attentional subsystems affected by mindfulness training. At times, theorists have argued that orienting and executive attention fall within the same voluntary, dorsal attentional system while alerting is part of a separate stimulus-driven, ventral system (Jha, Krompinger & Baime, 2007). There is also controversy among researchers whether sustained attention and non-directed attention should each fall within the domain of orienting or executive attention. As such, it is unclear whether the orienting subsystem should be expected to change as a result of brief mindfulness training.

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Attention Research

Non-experimental research. Valentine and Sweet (1999) examined mindfulness non-experimentally by comparing meditators who were members of a non-profit Buddhist center with non-meditating second-year students at a college of further education. They classified the meditators as either short-term (24 months or less of meditation experience) or long-term (25 months or more of meditation experience) and as either receptive/mindful or concentrative meditators. This study measured attention using Wilkins' Counting Test, which is an auditory counting task measuring sustained attention. The first task presented the stimuli at a relatively slow rate for about 18 minutes and compared the performance of each group. The second task assessed sustained attention when stimuli were presented at a much faster rate than on the four previous trials. Participants were typically surprised by the sudden change of speed. Superior attentional performance was observed in all meditators compared with controls as well as in long-term meditators compared with short-term meditators on both tasks. Thus, in addition to being better able to sustain attention, mindfulness meditators were affected less by the unexpected change in target speed, suggesting that mindfulness facilitates better awareness of the present moment.

Schmertz and Anderson (2006) reported mixed results when attempting to measure the relationship between self-report mindfulness scores and performance on various tasks of attention, including measures of sustained attention (the Paced Auditory Serial Addition Test [PASAT; Gronwall & Sampson, 1974]; the Conner's Continuous Performance Test II [CPT-II; Conners', 2000]), selective attention (a computerized, cued, single-trial Stroop Task [Cohen et al., 1999]; the Delis-Kaplan Executive Functioning

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System [D-KEFS] Color-Word Interference Test [Delis, Kaplan, & Kramer, 2001]), and attention switching (D-KEFS Inhibition/Switching Condition). A significant association was found between two of three mindfulness measures with the CPT-II, but no relationship was found with the PASAT. Self-report mindfulness was not, however, related to selective attention or attention switching.

Experimental research. Studies examining the effects of mindfulness training on attention performance have also yielded mixed results. Specifically, five sets of findings speak to the issue of change in attentional abilities after mindfulness training (See Table 1). Anderson, Lau, Segal, and Bishop (2007) examined the four types of attention regulation proposed by Bishop and colleagues (2004): sustained attention, attention switching, inhibition of elaborative processing, and non-directed attention. Healthy adults were tested before and after random assignment to an eight-week Mindfulness-Based Stress Reduction (MBSR) course or a wait-list control. Sustained attention was measured using the Vigil Continuous Performance Test computer program (The Psychological Corporation), in which participants were instructed to press the spacebar as quickly as possible when they saw the letter "K" over a 12-minute time period. The other three measures of attention were tasks designed by the experimenters. Attention switching was measured through a task requiring participants to alternate between two stimulus-response modes from trial to trial, as compared to blocks in which the same task is performed on every trial. A Stroop paradigm (Stroop, 1935) was used to measure inhibition of elaborative processing. Finally, non-directed attention was measured through an object detection task. The MBSR course was not associated with improvements in sustained attention, switching, or inhibition relative to the control group.

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Non-directed awareness was the only attention-related index associated with improvements in mindfulness after MBSR. Of note, the course was also associated with greater improvements in emotional well-being and mindfulness.

The authors explained their findings by arguing that mindfulness may be more closely associated with changes in the quality of awareness of present moment experience than with basic attentional abilities. However, the measures of attention used in this study may have contributed to the null results. For instance, an emotion Stroop task was used to measure cognitive inhibition. The authors cite the well established reliability of the Stroop interference measure, but substantial evidence exists that the emotion Stroop is not as reliable as the traditional Stroop measure (Gotlib et al., 2004). The Stroop task is problematic as a measure of attentional control because it requires verbal production, which can introduce error. Also, participants can easily "cheat" on the test by blurring their eyes to prevent themselves from reading the words.

Other research, however, suggests that mindfulness has attentional benefits. In one such study, Chambers, Lo, and Allen (2008) examined the impact of an intensive period of mindfulness training on cognitive and affective function. A non-clinical group of 20 novice meditators were assessed before and after participation in a 10-day intensive mindfulness meditation retreat and their performance compared to a no training control group. Participants were assessed on working memory using the Digit Span Backward (DSB) subscale of the Wechsler Adult Intelligence Scale-3rd edition (WAIS-III) to provide an index of sustained attention and attention switching using the Internal Switching Task (IST), a new experimental task created for this study. The mindfulness

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training was related to significant improvements in the measures of working memory and sustained attention, but not attention switching (Chambers et al., 2008).

Further, Napoli, Krech, & Holley (2005) found that compared to a control group, first, second, and third graders who participated in a mindfulness training program showed improvements on several measures of attention. The Attention Academy Program (AAP) met 12 times over a 24-week period for 45 minutes during students' physical education class period. Students participated in exercises designed to facilitate being in the moment, such as attending to the breath, body scans, and movement and sensorimotor awareness activities. Attention was assessed using the Test of Everyday Attention for Children (TEA-Ch), which utilizes five subtests measuring sustained and selective attention (Manly et al., 2001). In particular, while students in the experimental group did not perform better on tests of sustained attention, they did show an increase in selective attention, as well as a reduction in test anxiety and a reduction in problem behaviors as rated by their teachers.

Jha, Krompinger, and Baime (2007) examined the effects of mindfulness practice on the three attention networks (alerting, orienting, and conflict monitoring) using the Attention Network Test (ANT, Fan, McCandliss, Fossella, Flombaum, & Posner, 2005). Attentional efficiency was assessed before and after an eight-week MBSR course administered to meditation-naïve participants, a one-month intensive mindfulness retreat attended by experienced meditators, and an eight-week no treatment control group. Results of the study indicate that the retreat group showed better conflict monitoring at baseline than participants in the control and MBSR groups, suggesting that executive attention improves with long-term exposure to mindfulness meditation. An interesting finding was that orienting scores improved in the MBSR group at Time 2 to levels that

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were higher than those displayed by either the control or retreat participants. This is surprising because one would expect orienting scores to increase in both meditation groups. Finally, the retreat group displayed improved alerting at Time 2 compared to control and MBSR groups. The authors concluded that mindfulness training may enhance the functioning of each of the attentional subsystems at various points in the course of mindfulness training.

Tang et al. (2007) also reported noteworthy findings from a study of undergraduate Chinese students randomly assigned to 5 days of 20-minute meditation practice with the integrative body–mind training (IBMT) or a control group given training in Progressive Muscle Relaxation (PMR) on the ANT. IBMT comes from traditional Chinese medicine and incorporates aspects of other meditation training, such as body relaxation, breathing adjustment, and mental imagery in addition to mindfulness training. Compared with the control group, the experimental group showed greater improvement in conflict scores on the ANT as well as lower anxiety, depression, anger, and fatigue. They also showed higher vigor, a significant decrease in stress-related cortisol, and an increase in immunoreactivity. While this study provides valuable data about the impact of relatively brief meditation training on attentional performance compared to a relaxation control group, the intervention was not strict mindfulness training, as noted above.

Brief Intervention Research

In addition to focusing on attentional indices as the outcome, a main goal of the current study was to examine if changes would occur after brief mindfulness training. Research has established the effectiveness of an eight-week format for mindfulness

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interventions on various outcomes (Kabat-Zinn, 2003) and improvements in attention have been found from meditation training in as short as five training sessions (Tang et al., 2007). Only a few studies, however, have investigated whether significant effects can be produced from two sessions of mindfulness training among persons with no prior meditation experience. Before mindfulness training could be employed in public settings such schools and workplaces, it is important to understand more precisely how much training is necessary to produce its benefits. Research on short interventions is therefore necessary before such training can be widely applied.

Arch and Craske (2006) provide data suggesting that emotion regulation capacities are enhanced after only one exposure to the practice of mindfulness meditation. Specifically, the authors compared three groups in an undergraduate population: a 15-minute focused breathing exercise (that served as a proxy for mindfulness meditation), an unfocused attention group, and a worry group. The focused breathing group was told to practice focusing on the present and deliberately letting go of intrusive thoughts. Participants in the unfocused attention group were instructed to "let their minds wander." Finally, the participants in the worry group were instructed to deliberately worry. Participants were shown pictures from the International Affective Picture System (IAPS, Lang, Bradley, & Cuthbert, 1999) before the induction and twice after the induction. At each time point, participants were shown three sets of slides: one positive, one neutral, and one negative. Individuals who participated in the focused breathing induction maintained consistent, moderately positive responses to 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

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before it. The focused breathing group also reported the least emotional volatility across all slide types, particularly the negative slides, compared to the other groups. Further, significantly more participants in the focused breathing group were willing to view all of the slides than in the unfocused attention group; this trend was also evident when comparing the focused breathing and the worry group, although results were not significantly different. In sum, Arch and Craske found that a one-time 15-minute breathing induction was associated with less negative emotional responses to neutral and emotionally-valenced external stimuli and more willingness to remain in contact with aversive external stimuli.

Additionally, two studies by Wenk-Sormaz (2005) found that brief mindfulness training resulted in deautomatization (i.e., decreased automatic responding) in a healthy population compared to rest and cognitive control groups. Deautomatization was assessed through Stroop interference and word production tasks. In the first study, which entailed three 20-minute sessions, those in the meditation group had lower Stroop interference than controls. In the second study, which consisted of only one 20-minute session, participants in the meditation group were able to produce more atypical responses than controls when they believed it was optimal to do so. Mindfulness practice thus led to a reduction in Stroop interference and more flexible word production. This research provides initial evidence demonstrating that even brief mindfulness training can improve attentional control by decreasing automatic responding.

Summary of Problem

As described above, findings regarding mindfulness and attention indices have been mixed. Research has provided some evidence that mindfulness practice is related to

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improved attention regulation and memory function (Valentine & Sweet, 1999; Jha et al., 2007). In addition, the tendency to react automatically can be reduced and emotion regulation capacities can be improved after brief training sessions (Arch & Craske, 2006; Wenk-Sormaz, 2005). Other studies, however, fail to find cognitive improvements as a result of mindfulness training (Anderson et al., 2007). As such, it is not possible to draw clear conclusions about the relationship between mindfulness and attention at this time.

The inconsistent findings to date are likely the result of methodological problems. For example, there has been a lack of standardized designs for assessing mindfulness effects across studies, an inconsistency of study populations, inadequate sample size to create sufficient power, and assessment of diverse attentional outcomes (See Table 1) (Cahn & Polich, 2006). Further, some studies have been observational in nature, comparing experienced meditators to novice meditators or non-meditators or examining differences in pre-existing levels of mindfulness (Valentine & Sweet, 1999; Schmertz & Anderson, 2006). Most important, reliable outcome measures of attention are lacking. Many attentional measures have been related to mindfulness inconsistently, are not validated, or are known to have poor reliability. Several studies have measured attention by examining subtypes of attention, such as sustained attention, selective attention, attentional switching, cognitive inhibition (Schmertz & Anderson, 2006; Anderson et al., 2007; Chambers et al., 2008; Napoli et al., 2005). Measures of these constructs, however, may not be sufficient to provide a thorough understanding of the basic neurological mechanisms of attention.

The proposed research attempted to build upon the findings of prior studies while minimizing their weaknesses through the use of the ANT, a well-validated, sophisticated

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measure of attention that operationalizes attention according to the neural networks identified by Posner and Rothbart (2007) and the Stroop, which has been shown to be sensitive to short-term meditation training effects (Wenk-Sormaz, 2005). This research also employed a standardized protocol of mindfulness training (an MBSR-derived script), and reliance on a non-clinical population without intellectual impairment (Baer, 2003; Kabat-Zinn, 2003).

The primary hypothesis of this study was that participation in the mindfulness intervention would lead to improved attentional control as compared to a relaxation and a neutral control group. A relaxation group was included to establish whether there are additional effects above and beyond those expected from any intervention that improves mood.

Hypothesis I. Mindfulness training would be related to better performance in executive attention, as indexed by the ANT and Stroop, as compared to the relaxation and control group.

Hypothesis II. Secondary analyses examined whether mindfulness training would be associated with better orienting or alerting, as indexed by the ANT, as compared to the relaxation and control group.

Hypothesis III. Supplemental analyses assessed whether mindfulness training would be related to better performance on a verbal memory task, as compared to the relaxation and control group

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Chapter 2: Methods

Participants

The sample consisted of 165 undergraduate students enrolled in introductory psychology classes at the University of Miami in Coral Gables, FL. They completed study procedures to receive research participation credit for their course.

Procedure

Session one. Participants were randomly assigned to one of three study groups: mindfulness, relaxation, or control. On their first visit, participants completed self-report measures of trait mindfulness and social desirability. Next, they completed the Attention Network Test (ANT) to establish baseline performance of the efficiency of the three attention networks, and a Stroop task to obtain an additional baseline measure of executive control. They then practiced their randomly assigned attention training (mindfulness, relaxation, or neutral) for 15 minutes. This entailed following the directions from an audio recording instructing them in mindfulness, relaxation, or a neutral task. After this practice, participants completed a two-item mood scale to assess changes in affect due to the training.

Session two. Within the next two days, participants returned to the lab for their second visit. Participants performed the same attention training from their initial visit for the first 15 minutes of the session and then completed the attention performance measures (the ANT and the Stroop) a second time. Participants then completed the verbal memory subtest of the Wide Range Assessment of Memory and Learning (WRAML) as a measure of short-term memory, in which the experimenter read a list of 16 words four

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times and asked participants to recall as many as possible after each reading. Finally, participants completed self-report measures of state mindfulness and affect.

Focused breathing group. 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. The induction was referred to as “focused breathing” rather than “mindfulness” because participants had no previous training in mindfulness meditation and may not have been familiar with the term “mindfulness.”

The aim of the focused breathing induction was to have participants direct their attention and awareness to whatever sensations they experienced in the present moment, with a particular focus on the experience of breathing. Participants were instructed to “attempt to be aware in each moment, with each breath” and “see if it is possible to just notice whatever feelings and sensations come up in any moment, and attempt to be there with whatever does come up, without judging it, without reacting to it, just being totally present with whatever your feelings are, and with your breath.”

Relaxation group. The relaxation instructions asked participants to focus their attention on relaxing and guided them to slowly tense and release one muscle at a time. For example, participants were instructed to “Shift your attention to your shoulders, slowly increasing tension by raising your shoulders up as if they were going to touch your ears. Hold this tension in your shoulders for one… two… three…four…, and then slowly release by dropping your shoulders until all tension has left them. Notice the feeling of relaxation in your shoulders… Breathe deeply in… and relax…”

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Control group. This induction asked participants to "make a mental list of all of the things you did and places you went yesterday." For example, participants were asked to "Think about what you did for lunch. What time was it? Did you go somewhere to eat? If so, how did you get there? What route did you take? Make a mental list of what foods you ate during your lunch." This group served as a distraction control for time.

Measures

The measures used in the study are provided in Appendix A. Self-report measures were included to assess mindfulness, affect, and social desirability while performance measures were used to assess attention and memory.

Cognitive outcome variables. The Attention Network Test (Fan et al., 2002) was included to measure the efficiency of the proposed attentional networks: alerting, orienting, and executive attention, and was the primary measure of attention. The ANT has been successfully used to measure the influence of behavioral interventions on each of the attention networks (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Mean reaction times are reported in milliseconds.

The ANT is a test of cued reaction time (RT) that has been used to measure ability to resolve mental conflict inducted by competing stimuli (Posner, 1980). Stimuli were presented via E-Prime (Psychological Software Tools). Participants viewed a 15.1 inch computer screen from a distance of 65 cm, and their responses were collected via two input keys on a mouse.

In each trial, a fixation cross appeared in the center of the screen, directing participants where to focus their attention. One of four possible cues conditions then occurred lasting 200 ms (see Figure 1). In no cue trials, participants were given no

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warning as to when the target would appear or where it would be located; this served as a control condition. In center cue trials, participants saw an asterisk appear in the center of the screen, and in double cue trials, participants saw two asterisks appear simultaneously both above and below the fixation cross. These two trial types provided a temporal cue alerting participants that the target was about to occur, but provided no information regarding where it would be located. The double cue condition did not provide any additional information above that provided by the center cue. As such, it was eliminated from a later version of the ANT and was not used in any analyses in the current study. Finally, in spatial cue trials, participants saw an asterisk appear either above or below fixation, thus alerting that the target was about to occur *and* orienting the participant to where on the screen it would be located. The four conditions were presented in random order, in equal proportions.

After a variable duration (300–800 ms), a horizontal row of five arrows was presented. The central arrow was the target and participants were asked to press a button indicating whether the central arrow pointed left or right. As with other Flanker tasks (Eriksen & Eriksen, 1974), the target was pointing in the same direction as the other arrows in congruent trials. In incongruent trials, the target arrow was pointing in the opposite direction as the other arrows. The congruent vs. incongruent trials were presented in a randomly determined order in equal proportions. Participants were given 2000 ms to respond. After the participant responded (or 2000 ms passed), the target and flankers disappeared. The inter-trial-interval (ITI) varied randomly between 400-1600 ms across trials. In sum, the experimental design consisted of two within-subject factors: cue

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condition (none, center, double, or spatial) and target condition (congruent or incongruent).

The experiment contained four blocks. The first block was for practice and consisted of 12 trials. The other three blocks were experimental blocks and each consisted of 96 trials, resulting in a total of 300 trials. The ANT took approximately 25 minutes in total. RT was recorded for each trial, and the efficiency of each of the attentional networks was calculated. Only correct trials were included in the RT analyses. Four participants with a 50% error rate or higher were excluded from analyses. The remaining participants had a low error rate, which did not differ across groups (M = 9.35, SD = 10.70, $F(2, 148) = 1.28$, $p = .28$). Trials in which a person did not respond within 2000 ms were excluded as well. Extreme RTs, i.e., those that fell beyond three standard deviations of the mean, were also excluded.

Executive control was measured by subtracting the mean RT of all congruent flanking trials from the mean RT of all incongruent flanking trials (Conflict efficiency = RT [incongruent] – RT [congruent]). The extra time needed to resolve the conflict between the central arrow and incongruent flankers thus provided a measure of the efficiency of the executive attention network.

Alerting was measured by comparing RTs on cued versus uncued trials. That is, alerting, the improvement in reaction time resulting from temporal cuing, was measured by subtracting the mean RT on cued trials from the mean RT on uncued trials (Alerting efficiency = RT [no-cue] – RT [center -cue]).

Orienting was measured by comparing RTs on trials in which spatial cues indicated where the stimulus would occur compared to those in which the cue appeared at

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the center of the screen. Orienting efficiency was calculated by subtracting the mean RT when presentation of the cue was at the location of the target from the mean RT when the cue occurred at fixation (Orienting efficiency = RT [center-cue] – RT [spatial-cue]).

Test-retest correlations for the efficiency of each attention network were reported in previous research (Fan, McCandliss, Sommer, Raz, & Posner, 2002). The test-retest correlation for raw RT was .87, the alerting network was .52, the orienting network was .61, and the executive control network was .77. In the current study, correlations were conducted between scores from blocks one and two of session one on the ANT. Of the three attention networks, none of the scores reached acceptable reliability estimate thresholds: executive control $r(150) = .61$, $p < .01$; alerting $r(150) = .34$, $p < .01$; orienting $r(150) = .37$, $p < .01$. Correlations of network scores from sessions one and two were marginal: executive control $r(149) = .59$, $p < .01$; alerting $r(149) = .43$, $p < .01$; orienting $r(149) = .32$, $p < .01$. ANT error rates were relatively low ($M = 9.3$ out of a total of 300 trials, $SD = 11$).

A Stroop task (Stroop, 1935) was included to provide an additional measure of executive control. Stimuli in this task were color words displayed in color, and participants were instructed to either read the word or name the color depending on the type of trial. The task of naming the color in which words are printed creates an interesting parallel to the practice of mindfulness, in which one is instructed to focus attention on typically overlooked phenomenon, such as breathing (Wenk-Sormaz, 2005).

At the beginning of each trial, participants heard an instructional cue (“color” or “word” presented auditorily by computer) followed by a stimulus presented on the screen. Participants were instructed to respond verbally to the stimulus, as designated by

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the cue, as quickly and accurately as possible. That is, they were asked to either name the ink color or read the word. Each stimulus remained on the screen until the participant responded. RT was automatically recorded by a voice-activated relay connected to the computer. Responses were also recorded for later coding of accuracy. Three colors and color words were used (red, green, and blue), presented in each of three conditions (congruent, neutral, and incongruent). Congruent stimuli consisted of one of the three color names presented in its own color. Incongruent stimuli consisted of a color name presented in one of the two remaining colors. Neutral stimuli were four colored "XXXX" for color naming trials and color words displayed in white for word reading trials. The task measures one's ability to inhibit the automatic response of reading when the required task is to name the color in which the word is printed.

Participants were presented with one practice block consisting of 12 trials and one experimental block consisting of 90 trials. The inter-trial interval was 2 seconds. The experimental trials were distributed equally across instructional cue (color naming, word reading) and conditions (congruent, neutral, incongruent). Instructional cue and condition were randomly ordered for each participant. RT data from congruent trials were subtracted from RT data from incongruent trials to provide a conflict monitoring measure. RT data from incorrect responses were removed from analyses. Stroop error rates were low ($M = 2.5$, $SD = 2.6$). Again, RTs that fell beyond three standard deviations of the mean were excluded. To measure test-retest reliability of the Stroop, difference scores from session one and session two were correlated. Scores on the Stroop task also did not reach acceptable thresholds for test-retest reliability, $r(151) = .20$, $p < .01$.

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Correlations of Stroop scores from sessions one and two were also low, $r(151) = .20$, $p < .05$.

The Wide Range Assessment of Memory and Learning (WRAML; Sheslow & Adams, 1990) was used to assess verbal memory. Although the primary goal of this study was to examine the effects of mindfulness on attention, the verbal memory subtest was administered to examine potential benefits of mindfulness practice on working memory. Participants were told that that would hear a long list of words and they should try to remember as many of them as possible. Then, the experimenter read a list of 16 words to participants at a rate of one word per second.

Immediately afterwards, participants were asked to state all the words they could remember in any order. The task was repeated 4 times using the same list of words. After each block, participants were told they would hear the same list again and when finished, they should try to repeat even more words if possible, including the words they said in earlier blocks. This task took about five minutes to complete. The total number of correctly remembered words across all four blocks (maximum score = 64) were summed as an index of verbal memory. Alpha reliability for this subtest has been reported as .92 (Hartman, 2007).

Control variables. The Cognitive and Affective Mindfulness Scale – Revised (CAMS-R) is a 12-item measure designed to assess trait mindfulness. This measure was completed before the experimental intervention to assess baseline trait-level mindfulness. It assesses four domains of mindfulness: ability to regulate attention, an orientation to present experience, awareness of experience, and an attitude of acceptance toward experience. This scale has consistently demonstrated adequate internal consistency (α =

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.74 - .85) (Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). In this study, reliability was acceptable (α = .70).

The 10-item Marlowe–Crowne Social Desirability Scale (MCSDS; Strahan & Gerbasi, 1972) was used to assess a self-presentation reporting bias. The Brief MCSDS is the most frequently used measure of social desirability bias. This measure was also completed before the experimental intervention to assess social desirability at baseline. The scale is reliable (α = .72 - .88) with correlations with the original MCSDS in the .80s and .90s (Beretvas, Meyers, & Leite, 2002). In this study, however, reliability was fair (α = .59). It is unclear why the reliability was so low for this sample.

Manipulation checks. The Toronto Mindfulness Scale (TMS; Lau et al., 2006) is a 13-item measure of two components of state mindfulness: intentional self-regulation of attention and an accepting, open approach to experience. This scale has consistently demonstrated adequate internal consistency (α = .86 - .87) (Lau et al., 2006). This measure was administered at the end of the second session as a manipulation check, to determine whether the intervention enhanced mindfulness as expected. Reliability for this measure in the current study was adequate (α = .80).

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a measure of one's current subjective experience of positive and negative affect. The original PANAS scale measures two broad factors—positive and negative affective valence—and consists of twenty words that are relatively pure markers of either positive or negative affect. The PANAS-X scale includes 60 affect words, which includes the two original scales as well as 11 content-specific factor-analytically derived scales: Fear, Sadness, Guilt, Hostility, Shyness, Fatigue, Surprise, Joviality, Self-Assurance,

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Attentiveness, and Serenity. A total of 46 items were used in the current study, including all 20 items from the original PANAS and an additional 26 items from each of the PANAS-X subscales with the exception of the shyness subscale (See Appendix A). Overall positive and negative affect and subscale scores were calculated. A mindfulness subscale was also calculated consisting of the following items: alert, attentive, relaxed, calm, content, jittery, sleepy, sluggish, with the last three items reversed scored. In this study, only the joviality, attentiveness, serenity, and mindfulness scales were examined.

Participants indicated how they felt at the end of the second session using a five-point Likert scale (1 = *very slightly or not at all*; 5 = *extremely*). This scale is psychometrically strong, with coefficient alphas for the positive and negative scales ranging in the mid- to upper .80s and for the 11 subscales between .72 and .93 (Watson, Clark, & Tellegen, 1988; Watson & Clark, 1994). In this study, reliability for the general positive and negative affect scales was adequate (α = .89 and α = .78, respectively) as was reliability as for the three subscales examined (joviality α = .82; attentiveness α = .80; serenity α = .77). Reliability for the mindfulness subscale was also acceptable (α = .72).

Analyses

Before conducting analyses, distributions were examined for outliers and normalcy. Potential confounds were considered and manipulation checks were conducted. Pre-existing individual differences in mindfulness were also assessed. Preliminary analyses examined if the intervention impacted mindfulness (as measured by the TMS) as expected. In addition, correlational analyses were conducted to examine if the cognitive and affective variables were related to one another in an expected manner.

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For correlational analyses, separate, parallel analyses were conducted to examine affect at the end of the first session (based on only two items) and then at the end of the second session (based on the 46 item PANAS).

As stated above, the primary hypothesis was that the mindfulness intervention would improve attention performance. To test this hypothesis, four parallel repeated-measures one-way ANOVAs were conducted to examine whether the groups differed on attentional performance. For these analyses, the three attention subsystems of the ANT and the Stroop task were dependent variables; the independent variables were group (mindfulness, relaxation, and control) and session (before and after the intervention). These dependent variables were examined separately because the executive control scales of the ANT and the Stroop were the primary outcome measures. A one way analysis of variance on short-term verbal memory function was also conducted. Finally, correlational analyses of mindfulness levels were also performed.

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Chapter 3: Results

All analyses were conducted using SPSS, version 15. Four participants were removed from analyses based on their low accuracy or poor response rate on the ANT and Stroop and one person was removed due to prior meditation experience. Further, eight individuals completed session one but failed to return for session two. A total of 152 individuals (116 female) were included in the final analyses, 50 in the mindfulness group, 50 in the relaxation group, and 52 in the control group. Before conducting analyses, univariate distributions were examined for normalcy and for outliers. RT distributions in the conflict monitoring (ANT and Stroop) and alerting (ANT) indices were leptokurtic. To normalize these scores, square root transformations were conducted. After transformations, conflict and alerting indices of kurtosis remained significant, despite a closer approximation to normalcy. Parallel analyses were conducted using the square root transformed data. Because findings were entirely parallel, for simplicity, analyses on non-transformed data are described here.

Baseline Group Differences in Gender, Social Desirability, and Mindfulness

Gender and baseline characteristics of participants are displayed by group in Table 2. No data were gathered regarding participant's age, race, or ethnicity. A chi-square analysis demonstrated that there were no group (mindfulness, relaxation, control) differences in gender, χ^2 (1, N = 152) = 40.03, $p < .01$. Two parallel analyses of variance (ANOVAs) on social desirability and trait mindfulness at baseline were conducted with group as the independent variable. There were no group differences on the social desirability scale, $F(2, 148) = 1.10$, $p = .34$. Trait mindfulness as indicated on the CAMS prior to the intervention, however, was significantly different across groups, $F(2,149)$ =

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4.49, $p < .05$. Univariate analyses revealed lower baseline mindfulness in the relaxation group than in the mindfulness and control groups. Baseline mindfulness did not relate to performance on any of the attention measures, and consequently was not included as a covariate in further analyses. Group means of the self-report measures at baseline are shown in Table 2.

Manipulation Checks

Mindfulness indices. ANOVAs were conducted to examine whether the first experimental session affected mindfulness as expected, with group as the independent variable and the two affect manipulation check items as dependent variables. At the end of the first session there were significant group differences on self-reported serenity, $F(2, 148) = 3.70$, $p = .03$ and a trend toward group differences on irritability, $F(2, 148) = 2.60$, $p = .08$. Tukey's HSD tests were used for all post-hoc analyses and revealed that participants in the mindfulness group reported feeling significantly more serene than participants in the control group. Further, there was a nonsignificant trend for participants in the mindfulness group to report less irritability than participants in the control group. In both instances, the relaxation group did not differ significantly from the mindfulness or control groups.

Group differences in mood were also assessed at the end of the second session by the TMS and the following PANAS scales: positive affect, negative affect, joviality, attentiveness, serenity, and mindfulness. The groups did not differ on the state mindfulness scale (TMS) post-intervention, $F(2, 134) = 1.11$, $p = .33$. Groups also did not differ on post-intervention measures of overall positive affect, $F(2,147) = .41$, $p = .67$, negative affect, $F(2,147) = .23$, $p = .79$, or serenity, $F(2,148) = .04$, $p = .96$. As shown in

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Table 3, group means were very low with little variability. However, group differences were found in the joviality and attentiveness subscales of the PANAS, $F(2, 148) = 3.02$, $p = .05$ and $F(2, 147) = 5.65$, $p < .01$, respectively. Post-hoc analyses revealed that participants in the mindfulness and relaxation groups reported feeling significantly more attentive than participants in the control group ($p < .05$) and participants in the relaxation group reported feeling significantly more jovial than participants in the control group ($p < .05$). As shown in Table 3, no other effects were significant.

Attention indices. Before conducting primary analyses of the ANT, Group x Session x Block ANOVAs were conducted to examine the effects of block or interactions of block with other variables on each of the three ANT variables. No significant effect of block and no significant interactions of block with other variables were found. As a result, subsequent analyses were collapsed across blocks for simplicity.

To determine whether error rates on the ANT improved with exposure to the task, paired-samples *t* tests were conducted to evaluate whether participants' accuracy rates improved from session one to session two. For these analyses, the number of errors on the ANT and the Stroop task were dependent variables; the independent variable was group. Participants made comparable numbers of errors across the two sessions on both the Stroop task, $t(150) = 1.62$, $p = .11$ and the ANT, $t(150) = -0.04$, $p = .97$. As shown in Tables 4 and 5, accuracy did not improve from exposure to the task.

To determine whether groups differed on the number of errors, separate ANOVAS were conducted for each index with group as an independent variable. There was no effect of group on error rates on either the Stroop, $F(2, 148) = .94$, $p = .39$, or the ANT, $F(2, 149) = 1.05$, $p = .35$.

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Primary Hypotheses: Group Differences on Cognitive Variables

Attention indices. To examine group differences in attention, four ANOVAs were conducted with the three attention subsystems of the ANT and the Stroop as dependent variables and group (mindfulness, relaxation, and control) and session (before and after the intervention) as independent variables. I hypothesized that there would be a significant Group x Session effect. Group means for each of the attention indices are shown by session in Table 4.

The efficiency of the executive control network was assessed through an ANOVA with the conflict monitoring network score as the dependent variable and group and session as independent variables. There was a significant main effect for session, $F(1,147) = 45.89$, $p < .01$, but not for group, $F(2,147) = 1.98$, $p = .14$, nor the interaction of Group x Session, $F(2,147) = 1.43$, $p = .24$. Reaction times decreased significantly from session one to session two in all three groups, suggesting improved performance with exposure to the task. Given the a priori prediction of better conflict monitoring performance for the mindfulness group than the relaxation group, a planned comparison was conducted which revealed that the mindfulness group did not perform significantly better than the relaxation group at session two, $t(96) = 1.24$, $p = .22$.

The executive control network was also assessed through an ANOVA with Stroop difference score as the dependent variable and group and session as independent variables. There were no significant effects for group, $F(2,148) = 1.54$, $p = .22$, session, $F(1, 149) = .02$, $p = .90$ or the interaction of Group x Session, $F(1, 149) = .36$, $p = .70$.

Alerting efficiency was measured through an ANOVA with the alerting network score as the dependent variable and group and session as independent variables. The

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effect of session was not significant, $F(1, 146) = 1.30$, $p = .26$, but there was a significant main effect of group, $F(2, 146) = 2.99$, $p < .05$ and a significant interaction of Group x Session, $F(2, 146) = 3.72$, $p < .05$. There were significant group differences in alerting performance during session one, $F(2, 147) = 3.16$, $p < .05$. Post hoc analyses reveal that the mindfulness group performed better on alerting than the control group during session one ($p < .05$). Further, the relaxation group performed significantly worse from session one to session two ($p < .05$), whereas the mindfulness and control groups did not (both *p's* > .05).

The efficiency of the orienting network was assessed through an ANOVA with the orienting network score as the dependent variable and group and session as independent variables. There were no significant effects of group, $F(2, 147) = 1.14$, $p = .32$, session, $F(1, 147) = .38$, $p < .54$, or the interaction of Group x Session, $F(2, 147) = 1.77$, $p = .17$.

Memory index. A one-way ANOVA was conducted with group as the independent variable and short-term memory performance as the dependent variable. This analysis revealed no significant group differences, $F(2, 149) = .03$, $p = .97$. Means (with standard deviations in parentheses) for mindfulness, relaxation, and control groups were 42.36 (7.28), 42.58 (7.29), and 42.25 (6.91).

Partial correlations of state mindfulness as predictors of changes in attentional performance. The analyses above examined whether the groups differed in attentional performance. Participants may have attained different degrees of mindfulness, however, that may not be reflected in these results. Partial correlation analyses were therefore conducted to determine if a relationship existed between mindfulness and attentional

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performance at session two, controlling for attentional performance at session one. The TMS and the mindfulness subscale of the PANAS measure were the independent variables and the three ANT scales and Stroop were the dependent variables. As shown in Table 6, participants who reported feeling more mindful at session two on the mindfulness subscale of the PANAS obtained higher scores on the measure of orienting, $r(133) = .19$, $p < .05$. Those who reported feeling more mindful, however, obtained lower scores on the measure of alerting, $r(132) = -.18$ $p < .05$. The other effects were not significant.

Partial correlations of predictors of changes in attentional performance within the mindfulness group. As exploratory analyses, potential predictors of better cognitive outcomes within the mindfulness group were explored. Partial correlations examining affect and mindfulness as predictors of attention indices after session two, controlling for baseline performance, are shown in Table 7. The CAMS, TMS, and the mindfulness, positive affect, and negative affect subscales of the PANAS measure were the independent variables and the three ANT scales and Stroop were the dependent variables. Participants in the mindfulness group who reported feeling more positive affect at the end of session two obtained lower scores on the measure of executive control on the ANT, $r(39) = -.33$, $p < .05$. None of the other 19 effects were significant.

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Chapter 4: Discussion

The principal objective of the present study was to investigate the effects of two sessions of mindfulness training on attention indices. It was hypothesized that the mindfulness manipulation would improve attentional performance as compared to relaxation and control groups. Specifically, it was hypothesized that the mindfulness training would improve executive control. Additional hypotheses, however, also investigated whether the intervention would be associated with better orienting, alerting, and short-term verbal memory. None of these hypotheses were supported. That is, mindfulness training was not related to better performance on any attention measure or the verbal memory measure. Rather, the alerting network score was the only attention index in which significant group differences were found. Participants in the relaxation group performed significantly worse in alerting across sessions whereas the performance of those in the mindfulness and control groups did not change. Further, while participants in the mindfulness group reported feeling significantly more serene than participants in the control group after the first day of training, the groups no longer differed in reported mindfulness at the end of session two.

The failure to find effects in the current study was surprising because previous research has found benefits of mindfulness training on sustained attention, selective attention, non-directed attention, executive control, orienting, and deautomatization (Valentine & Sweet, 1999; Jha, Krompinger, & Baime, 2007; Chambers, Lo, & Allen, 2008; Napoli, Krech, & Holley, 2005). Although the mindfulness training may not have worked as well as was hoped for most participants, some participants reported feeling increased mindfulness by the end of training. Analyses indicated, however, that increased

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mindfulness was related to better performance in only one of eight correlations conducted at the end of the second session. In sum, neither the mindfulness training nor individual differences in level of mindfulness attained were consistently related to attentional performance.

Study Innovations

Despite the null findings, the current study used an original approach that allowed for the examination of mindfulness in innovative ways. This approach, however, might have impaired the ability to detect group differences. For example, the current study attempted to use strong control groups by including both a no-treatment group and a relaxation group to differentiate the effects of relaxation from the additional components of awareness and non-judgment.

Another addition of the current study was its originality in considering a minimal training as a way to induce significant changes in attentional performance. Prior research on the attentional effects of mindfulness has included training as short as five days. Hence this is the first study to provide data on whether only two sessions of training can promote attentional improvements.

Explanation of the Null Findings

The mindfulness group did not perform significantly better than either the relaxation or control groups. Various factors could account for these null findings. First, however, it is important to note some explanations that cannot account for the results. For example, the problem was not one of power. The current study had 80% power to detect a significant group by time effect in ANOVAs with an effect size of $h_p^2 = 0.31$, which would be considered a moderate effect.

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The problem was also not one of control. Many previous studies have not included a control group, and when control groups have been included, they have been as varied as physical exercise, reading, learning, rest, worry, unfocused attention, or wait-list. Recent research though has some provided evidence suggesting that mindfulness training improves attentional efficiency more than a carefully constructed meditation-naïve no-treatment control group (Jha, Krompinger, & Baime, 2007) and a relaxation control group (Tang et al., 2007). Given that these studies involving tightly controlled comparison conditions still obtained effects, it is unlikely that the control groups were the sole explanation for the null findings. Indeed, it is notable that the mindfulness group did not even perform significantly better than the neutral control group that was asked to make a mental list of all of the things they did and places they went the previous day.

Further, a range of potential confounds were found not to be related to outcomes, including affect and social desirability. There was thus no clear confound that explained the findings. Indeed, even within the mindfulness group, no systematic predictors of outcome were identified other than positive affect. Several methodological limitations, though, help explain the absence of support for the model. These are discussed next.

Methodological limitations. One important consideration is whether the outcome measures were psychometrically adequate. Although the ANT was chosen because it is the most commonly used measure of attention and has been sensitive to the effects of brief behavioral interventions (Fan et al., 2005; Tang et al. 2007), test-retest reliabilities across blocks were not acceptable. Similarly, the original validation study indicated test-retest correlations for the alerting and orienting network were poor (Fan et

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al., 2002)—only conflict monitoring scores demonstrated acceptable reliability. A series of other studies have also indicated poor reliability of these indices (Redick & Engle, 2006). For example, in a study of children's attention, Rueda et al. (2004) did not find any significant correlations between the original network scores and their re-test scores approximately 6 months later. The ANT therefore seems to have serious psychometric problems.

Although the Stroop task has been sensitive to the effects of mindfulness practice in previous studies (Wenk-Sormaz, 2005), it did not reach acceptable thresholds for test-retest reliability in the current study. The validity of the Stroop has been questioned in the literature for other reasons as well. For example, it has been noted that error can be introduced by the reliance on a verbal response (MacLeod, 1991) and participants' ability to "cheat" on the test by squinting their eyes to prevent themselves from reading the words. It is therefore possible that the attention measures used were not psychometrically reliable and valid.

Further, the order of tasks may have interfered with the accuracy of the measures of whether mindfulness was achieved. At the end of session two, individuals in the mindfulness group did not report feeling more mindful than participants in the control group. On this visit, participants completed the training first, then completed the attention measures, and then measures of state mindfulness. It is therefore possible that participants initially felt more mindful after the training, but that any attentional benefits may have dissipated during completion of the tedious attention tasks in session two. In support of the interference of the attentional measures in assessing levels of mindfulness, more than a few participants reported feeling more serene and finding more benefit from the

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mindfulness training at the end of the first session (when they has just completed the mindfulness training) than at the end of the second session (when they completed the attention measures after the mindfulness training). It is thus unknown whether the intervention failed to produce expected increases in mindfulness or whether these just decayed by the time the state mindfulness measures were administered. The sequence of tasks, though necessary to assess functioning pre and post intervention, may have undermined the ability to monitor achievement of mindfulness. Nonetheless, there is little evidence that participants achieved the desired affective or mindfulness states from the two session practice. This would limit the ability to obtain expected differences in cognitive variables.

Several additional design factors may have also diminished the likelihood of finding effects. For one, the intervention may not have been fully understood by the participants. Participants were instructed to follow a pre-recorded set of instructions. The experimenter started the recording and then left the room. There was therefore no opportunity for participants to ask questions or clarify the instructions. Most mindfulness training courses involve live instruction with practice with substantial opportunities for questions and discussion. Further, motivation and effort during the training and lengthy attentional tasks might also have been low, resulting in less than optimal performance. Unfortunately a question was not included about the extent to which participants followed the instructions, so it is not possible to establish differences in compliance with the protocol. The time of day the training was administered also varied among participants and sessions.

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Conceptual limitations. Another plausible explanation is that the attentional advantages of mindfulness training might take longer to unfold than the two 15-minute training sessions used in this study. Previous research has found attentional benefits of meditation practice after as little as five days of training, though this training contained elements other than mindfulness (Tang et al., 2007). The only studies that have successfully used as short a training as the current study did not focus on attention, but rather on changes in emotion regulation capacities (Arch & Craske, 2006) and deautomatization (Wenk-Sormaz, 2005). The null findings in the current study shed light on the issue of how much training is necessary to produce cognitive gains. It may be that two sessions of training may not be sufficient to garner the depth of effects necessary to improve attentional functioning.

A final possibility is that mindfulness meditation may not have specific attentional advantages. There is disagreement about how best to conceptualize the cognitive processes involved in mindfulness as well as which particular cognitive functions should be expected to improve due to mindfulness training. As discussed in the introduction, Bishop and colleagues (2004) proposed four types of attention regulation: sustained attention, attention switching, inhibition of elaborative processing, and non-directed attention. There is evidence suggesting that mindfulness practice may improve the ability to sustain attention (Valentine & Sweet, 1999; Chambers, Lo, & Allen, 2008) and the ability to selectively attend (Napoli, Krech, & Holley, 2005). It is not clear though, how these processes map onto the attention networks described by Posner and Peterson (1990).

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Also noted in the introduction, Anderson et al. (2007) has suggested that mindfulness may impact *awareness* of present moment experience rather than *attention* performance. Awareness is conceptualized as the background observer in consciousness that is continually cognizant of the totality of one's experience. In contrast, attention is a process of focusing conscious awareness, providing heightened sensitivity to a limited range of experience. Ortner, Kilner, and Zelazo (2007) found that while a group that received mindfulness training experienced less emotional interference from unpleasant pictures than relaxation and no intervention control groups, there were no group differences in reaction time when exposed to neutral pictures, a simple measure of attentional control. This provides evidence that the mindfulness training may provide a different type of cognitive advantage than the type of attentional control investigated in this study.

Consistent with the notion that there may be other cognitive benefits of mindfulness practice, participants in the mindfulness and relaxation groups both reported feeling significantly more attentive than participants in the control group at the end of session two. Thus, while the current study fails to replicate recent reports of positive effects of mindfulness training on attentional control (Jha et al., 2007; Chambers, Lo, & Allen, 2008; Wenk-Sormaz, 2005), we do find positive effects of mindfulness on self-reported attentiveness, though indistinguishable from the effects of relaxation practice.

There were also indications that positive affect might have actually interfered with performance on the attention measures. The relaxation group felt the most jovial at the end of session two and was the only group to perform significantly worse on alerting across sessions. Further, participants in the mindfulness group who reported feeling more

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positive affect at the end of session two obtained lower scores on the measure of executive control on the ANT. Findings, then, suggest that as people were feeling more positively, alerting performance declined.

These results are intriguing given findings from affect research, in which negative affect relates to detail-oriented processing (Storbeck & Clore, 2005) and positive affect leads to greater cognitive flexibility (Ashby, Isen, & Turken, 1999). People placed in positive affect conditions have been found to perceive an interesting assigned task as richer and more varied than do control participants, but this effect does not occur if the task is perceived as dull (Kraiger, Billings, & Isen, 1989). As such, this study may be looking at the wrong kind of cognitive advantage, as the attention tasks were not inherently interesting, but quite boring. Given this study's findings, future research might want to focus on evaluating the effects of mindfulness training on other cognitive gains, such as non-directed awareness of present moment experience, and use outcome tasks with more intrinsic appeal.

Directions for Future Research

The current study highlights the fundamental need for measure development in the area of attention and cognitive inhibition. Future research could consider a number of unanswered questions. These include: Exactly which cognitive processes are affected by mindfulness training? Are there significant individual differences in attention training potential? Are there certain populations where such training is more appropriate or useful than others? How does mindfulness training affect brain development in children? How does it affect brain function when introduced as an adult? What other physiological systems are affected by increased mindfulness? Exactly how much training is necessary to produce its benefits? These are just some of the many questions that remain to be

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answered to truly understand the fundamental nature of mindfulness as well as the scope of its practical implications in the cognitive, emotional, and behavioral domains.

Conclusion

It has been hypothesized that the psychological benefits of mindfulness are achieved primarily through the development of a non-reactive state of observation of one's experiences. This leads to greater clarity and control over reactivity that normally leads to psychological distress. In turn, these effects have been found to lead to a greater degree of calmness and openness to both emotional and cognitive states as well as an improved ability to manage stress. Though this study did not find attentional improvements from mindfulness training, cognitive benefits have been identified in other studies of mindfulness training. Specifically, research has provided evidence that mindfulness practice can improve attention regulation and decrease automatic responding when practiced for longer periods of time. Further study is thus warranted to clarify precisely how much and what type of mindfulness training is necessary to produce its benefits, and the scope of such benefits.

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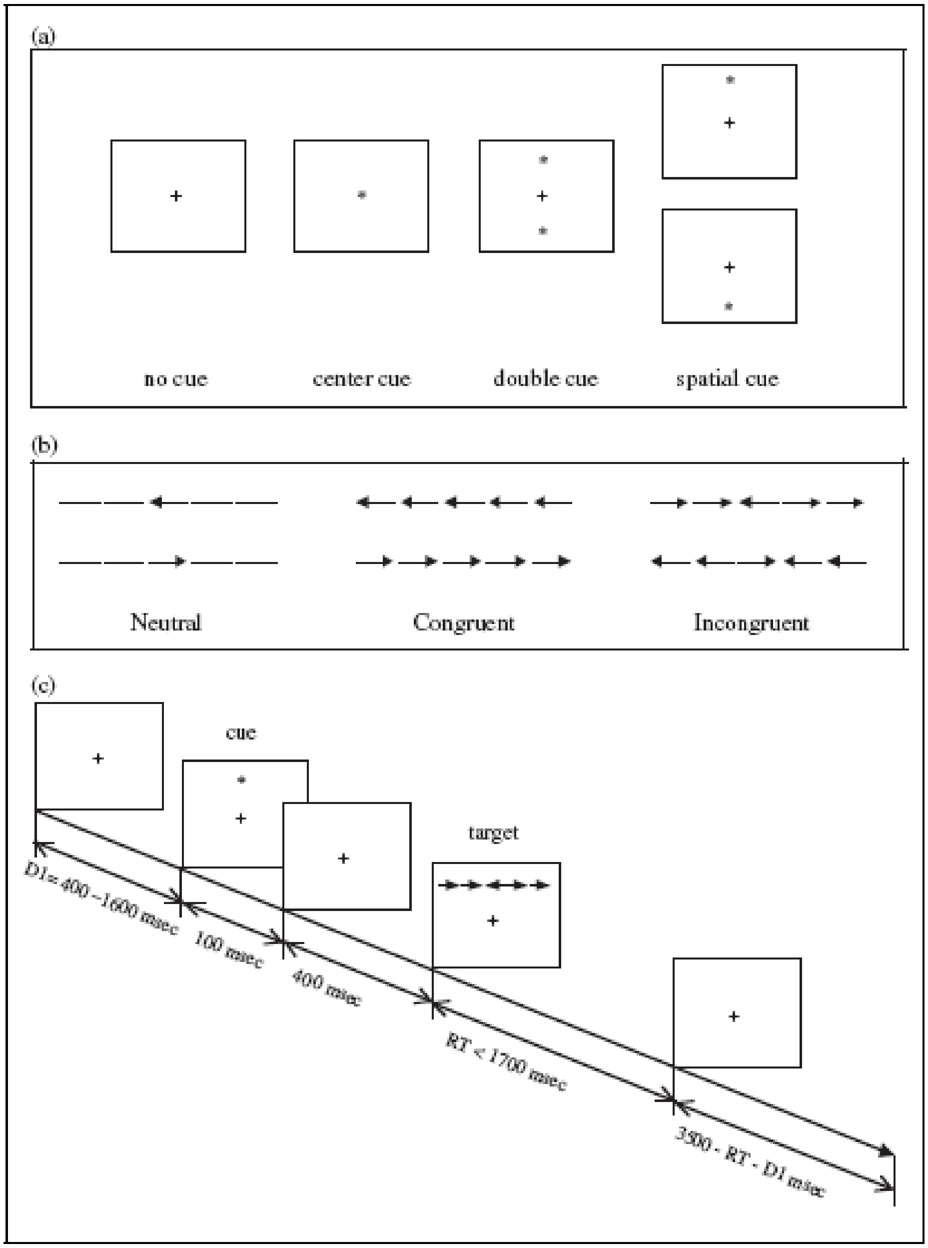

Figure 1. Schematic of attention network test. a) Cue conditions; b) Target conditions; c) Trial Sequence.

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Table 1

Experimental Studies of Mindfulness and Attention

Study	N	Participant Type	Mean Age	% Male	Intervention	Control	Random Assign	DV	Attention Outcome
Napoli et al. (2005)	194	First, second, & third graders	-	53	12 sessions over 24-week period, 45 min/session	Reading or other quiet activities	Yes	ACTeRS, TAS, TEA-Ch	Sustained – Y Selective - N
Anderson et al. (2007)	86	Adults with no meditation experience	39	-	8-week MBSR course	Wait-list	Yes	VCPT, Stroop, Switching task, Object detection task	Sustained – N Switching – N Inhibition – N Non-directed– Y
Jha et al. (2007)	51	L-t, MBSR, and non-meditators	24, 35	-	MBSR & 1 month intensive retreat	University students (*m* age 22)	No	ANT RT	T1 - Retreat – EA T2 - MBSR – Orient T2 - Retreat – Alert
Tang et al. (2007)	80	Undergrads	-	-	IBMT (5 days, 20 min/day)	PMR Training	Yes	ANT RT	EA – Y Orienting – N Alerting - N
Chambers et al. (2008)	40	Adults with no meditation experience	33	50	10 day intensive retreat	Wait-list and university students	No	DSB, IST	Sustained - Y Switching - N Working memory - Y

Notes. ACTeRS = ADD-H Comprehensive Teacher Rating Scale; TAS = Tellegen Absorption Scale; TEA-Ch = Test of Everyday Attention for Children; MBSR = Mindfulness-Based Stress Reduction; VCPT = Vigil Continuous Performance Test; ANT = Attention Network Test; IBMT = Integrative Body-Mind Training; PMR = Progressive Muscle Relaxation; DSB = Digit Span Backward, IST = Internal Switching Task

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Table 2

Mean (and Standard Deviation) of Baseline Participant Characteristics

	Group		
Variables	Mindfulness	Relaxation	Control
N	50	50	52
Gender (Male)	28%	24%	21%
Social Desirability	27.42 (3.68) [A]	26.82 (4.07) [A]	27.98 (4.04) [A]
Trait Mindfulness*	34.76 (4.76) [A]	32.08 (5.24) [B]	34.27 (4.27) [AB]

Note. An asterisk indicates a significant group difference, $p < .05$.
Within each row, differing alphabetical superscripts indicate significant differences, i.e., [A] is significantly different from [B], but [AB] is not different from either [A] nor [B].

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Table 3

Means (and standard deviations) of Manipulation Checks by Condition

Session	Variables	Mindfulness	Relaxation	Control
		Group		
One	Serenity*	3.86 (0.93) ^{A}	3.60 (1.13) ^{AB}	3.31 (0.97) ^{B}
	Irritability	1.42 (0.70) ^{A}	1.62 (1.07) ^{A}	1.86 (1.11) ^{A}
Two	Positive Affect	1.93 (0.54) ^{A}	1.88 (0.37) ^{A}	1.96 (0.48) ^{A}
	Negative Affect	2.71 (0.52) ^{A}	2.65 (0.57) ^{A}	2.64 (0.61) ^{A}
	Mindful Affect	2.23 (0.64) ^{A}	2.18 (0.60) ^{A}	2.26 (0.68) ^{A}
	Joviality*	2.35 (0.88) ^{AB}	2.60 (0.95) ^{A}	2.16 (0.87) ^{B}
	Attentiveness*	2.79 (0.85) ^{A}	2.92 (0.83) ^{A}	2.38 (0.84) ^{B}
	Serenity	2.80 (0.71) ^{A}	2.78 (0.67) ^{A}	2.81 (0.75) ^{A}

Note. An asterisk indicates a significant group difference, $p < .05$.
Within each row, differing alphabetical superscripts indicate significant differences, i.e., ^{A} is significantly different from ^{B}, but ^{AB} is not different from either ^{A} nor ^{B}.

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Table 4

Mean (and standard deviations) of Number of Errors, ANT Overall RT in ms, and Attention Network Difference Scores by Group and Session

Measure	Group	Session	Number of errors	RT	Attentional network scores		
					Alerting	Orienting	Conflict
ANT	Mindfulness	1	9.8 (14.1)	554 (79)	24 (16)	50 (23)	115 (42)
	Relaxation	1	8.2 (7.3)	550 (68)	24 (24)	60 (20)	98 (30)
	Control	1	9.9 (12.1)	543 (79)	33 (21)	52 (24)	108 (36)
	Mindfulness	2	11.0 (13.1)	529 (81)	23 (22)	53 (21)	93 (39)
	Relaxation	2	7.6 (8.0)	531 (68)	35 (29)	54 (18)	86 (25)
	Control	2	9.4 (10.3)	529 (85)	29 (24)	51 (20)	88 (29)

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Table 5

Mean (and standard deviations) of Number of Errors, Stroop Overall RT in ms, and Difference Scores by Group and Session

Measure	Group	Session	Number of errors	RT	Difference Scores
Stroop	Mindfulness	1	3.0 (3.1)	662 (162)	96 (74)
	Relaxation	1	2.7 (2.3)	632 (103)	96 (96)
	Control	1	2.6 (2.2)	636 (128)	72 (118)
	Mindfulness	2	2.6 (3.2)	631 (102)	85 (60)
	Relaxation	2	1.9 (2.0)	629 (88)	98 (61)
	Control	2	2.3 (2.8)	628 (105)	78 (81)

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Table 6

Partial Correlations between Mindfulness and Attentional Performance

Measure	Attentional network scores			
	Alerting	Orienting	Conflict	Stroop
State Mindfulness	-.177*	.194*	.092	.067
Toronto Mindfulness Scale	-.020	-.150	-.135	.062

Note. *denotes $p < .05$

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Table 7

Partial Correlations of Attentional Performance in the Mindfulness Group

Measure	Attentional network scores			
	Alerting	Orienting	Conflict	Stroop
CAMS	-.168	-.060	-.005	-.109
Toronto Mindfulness Scale	-.004	-.107	-.219	.177
State Mindfulness	.246	-.032	-.005	.040
Positive Affect	-.103	-.170	-.334*	.070
Negative Affect	-.084	-.004	-.231	.088

Note. * denotes $p < .05$

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References

Aftanas, L., & Golosheykin, S. (2005). Impact of regular meditation practice on EEG activity at rest and during evoked negative emotions. *International Journal of Neuroscience*, *115*, 893-909.

Anderson, N. D., Lau, M. A., Segal, Z. V., & Bishop, S. R. (2007). Mindfulness-based stress reduction and attentional control. *Clinical Psychology and Psychotherapy, 14*, 449-463.

Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy, 44*, 1849-1858.

Ashby, F. G., Isen, A. M., & Turken, U. (1999). A neuropsychological theory of positive affect and its influence on cognition, *Psychological Review, 106*, 529-550.

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*, 125-143.

Benson, H., Greenwood, M. M., & Klemchuk, H. (1975). The relaxation response: Psychophysiologic aspects and clinical applications. *International Journal of Psychiatry in Medicine, 6*, 87-98.

Beretvas, R. N., Meyers, J. L., & Leite, W. L. (2002). A reliability generalization study of the Marlowe-Crowne Social Desirability Scale. *Educational and Psychological Measurement*, *62*, 570-589.

Bishop, S. R., Lau, M., Shapiro, S., Anderson, N., Carlson, L., & Segal, Z. V., et al. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*, 230–241.

Breslin, F. C., Zack, M., & McMain, S. (2002). An information-processing analysis of mindfulness: Implications for relapse prevention in the treatment of substance. *Clinical Psychology: Science and Practice, 9*, 275-299.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822-848.

Cahn, B. R., & Polich, J. (2006). Meditation states and traits: EEG, ERP, and neuroimaging studies. *Psychological Bulletin, 132*, 180-211.

Chambers, R., Lo, B. C. Y., Allen, N. B. (2008). The impact of intensive mindfulness training on attentional control, cognitive style, and affect. *Cognitive Therapy and Research, 32*, 303-322.

www.manaraa.com

Colcombe, S. J., & Kramer, A. F. (2003). Fitness effects on the cognitive function of older adults: A meta-analytic study. *Psychological Science, 14*, 125-130.

Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S. F., Urbanowski, F., Harrington, A., Bonus, K., & Sheridan, J. F. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine, 65,* 564-570.

Dunn, B. R., Hartigan, J. A., & Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness? *Applied Psychophysiology and Biofeedback, 24*, 147-165.

Eriksen, B. A., & Eriksen, C. W. (1974). Effects of noise letters upon the identification of a target letter in a nonsearch task. *Perception and Psychophysics, 16*, 143-149.

Fan, J., McCandliss, B. D., Fossella, J., Flombaum, J. I., & Posner, M. I. (2005). The activation of attentional networks. *Neuroimage, 26*, 471-479.

Fan, J., McCandliss, B. D., Sommer, T., Raz, A., & Posner, M. I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience, 14*, 340-347.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavior Assessment*, *29*, 177-190.

Fossella, J., Posner, M. I., Fan, J., Swanson, J. M., & Pfaff, D. W. (2002). Attentional phenotypes for the analysis of higher mental function. *The Scientific World, 2,* 217-223.

Gotlib, I. H., Kasch, K. L., Traill, S., Joormann, J., Arnow, B. A., & Johnson, S. L. (2004). Coherence and specificity of information-processing biases in depression and social phobia. *Journal of abnormal psychology, 113*, 386-398.

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature, 423*, 534-537.

Hartman, D. E. (2007). Test review: Wide Range Assessment of Memory and Learning-2 (WRAML-2): WRedesigned and wreally improved, *Applied Neuropsychology, 14*, 138-140.

Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York: Guilford Press.

www.manaraa.com

Huss, D. B. & Baer, R. A. (2007). Acceptance and change: The integration of Mindfulness-Based Cognitive Therapy into ongoing Dialectical Behavior Therapy in a case of Borderline Personality Disorder with depression. *Clinical Case Studies, 6*, 17-33.

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., & Schwartz, G. E. R. (2007) A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine, 33*, 11-21.

Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience*, *7*, 109-119.

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Dell Publishing.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*, 144-156.

Kraiger, K., Billings, R. S., & Isen, A. M. (1989). The influence of positive affective states on task perceptions and satisfaction, *Organizational Behavior and Human Decision Processes, 44*, 12–25.

Lang, P.J., Bradley, M.M., & Cuthbert, B.N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8. University of Florida, Gainesville, FL.

Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., et al. (2006). The Toronto Mindfulness Scale: Development and validation. *Journal of Clinical Psychology, 62*, 1445-1467.

Lazar, S. W., Bush, G., Gollub, R. L., Fricchione, G. L., Khalsa, G., & Benson, H. (2000). Functional brain mapping of the relaxation response and meditation. *Neuroreport, 11*, 1581-1585.

Linehan, M., & Kehrer, C. A. (1993). *Borderline personality disorder*. In D.H. Barlow (Ed). Clinical handbook of psychological disorders: A step-by-step treatment manual (2nd ed.). (pp. 396-441). New York: Guilford Press.

Linehan, M., Comtois, K. A., Murray, A. M., Brown, M. Z., Gallop, R. J., Heard, H. L., Korslund, K. E., Tutek, D. A., Reynolds, S. K., & Lindenboim, N. (2006). Two-year randomized controlled trial and follow-up of Dialectical Behavior Therapy vs. therapy by experts for suicidal behaviors and Borderline Personality Disorder. *Archives of General Psychiatry, 63*, 757-76.

المنارة للاستشارات

www.manaraa.com

Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008) Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences, 12,* 163-169.

MacLeod, C. M. (1991). Half a century of research on the Stroop effect: An integrative review. *Psychological Review, 109*, 163-203.

Manly, T., Nimmo-Smith, I., Watson, P., Anderson, V., Turner, A., & Robertson, I. H. (2001). The differential assessment of children's attention: The Test of Everyday Attention for Children (TEA-Ch): Normative sample and ADHD performance. *Journal of Child Psychology and Psychiatry*, *42*, 1065-1081.

Murphy, M., & Donovan, S. (1997). *The physical and psychological effects of meditation*. Sausalito, CA: Institute of Noetic Sciences.

Napoli, M., Krech, P. R., & Holley, L. C. (2005). Mindfulness training for elementary school students. *Journal of Applied School Psychology, 21*, 99-125.

Oman, D., Shapiro, S. L., Thoreson, C. E., Plante, T. G., & Flinders, T. (2008). Meditation lowers stress and supports forgiveness among college students: A randomized controlled trail. *Journal for American College Health*, *56*, 569-78.

Ortner, C. N. M., Kilner, S. J., & Zelazo, P. D. (2007). Mindfulness meditation and reduced emotional interference on a cognitive task. *Motivation and Emotion, 21*, 271-283.

Ospina, M. B., Bond, T. K., Karkhaneh, M., Tjosvold, L., Vandermeer, B., Liang, Y., et al. (2007). *Meditation practices for health: State of the research.* Evidence Report/Technology Assessment No. 155. (AHRQ Publication No. 07-E010). Rockville, MD: Agency for Healthcare Research and Quality.

Parks, G. A., Anderson, B. K., & Marlatt, G. A. (2001). *Cognitive-behavioral alcohol treatment*. In N. Heather, T. J. Peters, & T. Stockwell (Eds.), International handbook of alcohol dependence and problems. (pp. 575-592). New York: John Wiley & Sons Ltd.

Posner, M. I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology, 41A*, 19-45.

Posner, M. I. & Peterson, S. E. (1990). The attention systems of the human brain. *Annual Review of Neuroscience, 13*, 25-42.

Posner, M. I., & Rothbart, M. K. (2007). Research on attention networks as a model for the integration of psychological science. *Annual Review of Psychology, 58*, 1-23.

Redick, T. S., & Engle, R. W. (2006). Working memory capacity and attention network test performance. *Applied Cognitive Psychology, 20*, 713 - 721.

المنارة للاستشارات

www.manaraa.com

Rueda, M. R., Fan, J., Halparin, J., Gruber, D., Lercari, L. P., McCandliss B. D. & Posner, M. I. (2004). Development of attention during childhood. *Neuropsychologia, 42*, 1029-1040.

Segal, Z. V., Williams, M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*, Guilford Press, New York.

Schmertz, S. K., & Anderson, P. L. (2006). The relation between self-report mindfulness and performance on tasks of attention. Poster presented at Association for Behavioral and Cognitive Therapies (ABCT).

Shapiro, S. L., Schwartz, G. E., & Bonner, G. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. *Journal of Behavioral Medicine, 21*, 581-599.

Sheslow, D., & Adams, W. (1990). *Wide range assessment of memory and learning: Administration manual.* Wilmington, DE: Jastak Assesment Systems.

Storbeck, J., & Clore, G. L. (2005). With sadness comes accuracy, with happiness, false memory: Mood and the false memory effect. *Psychological Science, 16*, 785–791.

Strahan, R., & Gerbasi, K. C. (1972). Short, homogenous versions of the Marlow–Crowne Social Desirability scale, *Journal of Clinical Psychology, 28*, 191–193.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 28,* 643-662.

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

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behavior, Research, and Therapy, 33*, 25-39.

Toates, F. (2006). A model of the hierarchy of behavior, cognition, and consciousness. *Consciousness and Cognition, 15*, 75-118.

Valentine, E. R., & Sweet, P. L. G. (1999). Meditation and attention: A comparison of the effects of concentrative and mindfulness meditation on sustained attention. *Mental Health, Religion, and Culture, 2*, 59-70.

www.manaraa.com

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 56,* 1063-1070.

Watson, D. & Clark, L. A. (1994). THE PANAS-X: Manual for the Positive and Negative Affect Schedule - Expanded Form. The University of Iowa.

Wenk-Sormaz, H. (2005). Meditation can reduce habitual responding. *Advances, 21*, 33-49.

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Appendix

Attention Network Test

Instructions

This is an experiment investigating attention. You will be shown an arrow on the screen pointing either to the left or to the right. Your task is to press the left arrow key on your keyboard when the central arrow points left and the right arrow key on your keyboard when the central arrow points right. On some trials, the central arrow will be flanked by two arrows to the left and two arrows to the right, for example:

← ← ← ← ← OR → → → → →

Your task is to respond to the direction only of the CENTRAL arrow. Use your left index finger for the left arrow key and your right index finger for the right arrow key. Please make your response as quickly and accurately as possible. Your reaction time and accuracy will be recorded.

There will be a cross ("+") in the center of the screen and the arrows will appear either above or below the cross. You should try to fixate on the cross throughout the experiment.

On some trials there will be an asterisk cue indicating either where or when the arrow will occur. If the cue is at the center or both above and below fixation it indicates only that the arrow will appear shortly. If the cue is only above or below fixation it indicates both that the trial will occur shortly and where it will occur. Try to maintain fixation at all times. However, you may attend when and where indicated by the cues.

The experiment contains four blocks. The first block is for practice and takes about two minutes. The other three blocks are experimental blocks and each takes about five minutes. After each block there will be a message "take a break" and you may take a short rest. After it, you can press the space bar to begin the next block. The whole experiment takes about twenty minutes. If you have any questions, please ask the experimenter. If you understand this instruction, you may start the practice session.

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Cognitive and Affective Mindfulness Scale (CAMS-R)

<u>Instructions</u>
People have a variety of ways of relating to their thoughts and feelings. For each of the items below, rate how much each of these ways applies to *yo*u.

1 Rarely/Not at all	2 Sometimes	3 Often	4 Almost Always

_______ 1. It is easy for me to concentrate on what I am doing.

_______ 2. I am preoccupied by the future.

_______ 3. I can tolerate emotional pain.

_______ 4. I can accept things I cannot change.

_______ 5. I can usually describe how I feel at the moment in considerable detail.

_______ 6. I am easily distracted.

_______ 7. I am preoccupied by the past.

_______ 8. It's easy for me to keep track of my thoughts and feelings.

_______ 9. I try to notice my thoughts without judging them.

_______ 1. I am able to accept the thoughts and feelings I have.

_______ 2. I am able to focus on the present moment.

_______ 3. I am able to pay close attention to one thing for a long period of time.

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Toronto Mindfulness Scale

Instructions

We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement and indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced just now?

1 = not at all   2 = a little   3 = moderately   4 = quite a bit   5 = extremely

_______ 1. I experienced myself as separate from my changing thoughts and feelings.
_______ 2. I was more concerned with being open to my experiences than controlling or changing them.
_______3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations.
_______4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things 'really' are.
_______5. I was curious to see what my mind was up to from moment to moment.
_______6. I was curious about each of the thoughts and feelings that I was having.
_______7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.
_______8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.
_______9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.
_______10. I remained curious about the nature of each experience as it arose.
_______11. I was aware of my thoughts and feelings without overidentifying with them.
_______12. I was curious about my reactions to things.
_______13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.

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Positive and Negative Affect Schedule

Instructions
Please indicate the number that best indicates **how much you feel each of these emotions right now, at this moment.**

1 Rarely/Not at all	2 A Little	3 Moderately	4 Quite a Bit	5 Extremely

_______ 1. Interested
_______ 2. Distressed
_______ 3. Excited
_______ 4. Upset
_______ 5. Strong
_______ 6. Guilty
_______ 7. Scared
_______ 8. Hostile
_______ 9. Enthusiastic
_______ 10. Proud
_______ 11. Irritable
_______ 12. Alert
_______ 13. Ashamed
_______ 14. Inspired
_______ 15. Nervous
_______ 16. Determined
_______ 17. Attentive
_______ 18. Jittery
_______ 19. Active
_______ 20. Afraid
_______ 21. Astonished
_______ 22. Dull
_______ 23. Quiet
_______ 24. Relaxed
_______ 25. Surprised
_______ 26. Elated
_______ 27. Sleepy
_______ 28. Still
_______ 29. Lonely
_______ 30. Passive
_______ 31. Content
_______ 32. Sluggish
_______ 33. Inactive
_______ 34. Sad
_______ 35. Euphoric
_______ 36. Fearful
_______ 37. Happy
_______ 38. Idle
_______ 39. Calm
_______ 40. Unhappy
_______ 41. Aroused
_______ 42. Satisfied
_______ 43. Rested
_______ 44. Peaceful
_______ 45. Serene
_______ 46. Frustrated

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Marlowe–Crowne Social Desirability Scale

Instructions
Please read each statement and indicate the extent to which you agree with each statement.

1 = not at all   2 = a little   3 = moderately   4 = quite a bit   5 = extremely

_______1. You are always willing to admit it when you make a mistake.
_______2. You always try to practice what you preach.
_______3. You never resent being asked to return a favor.
_______4. You have never been annoyed when people expressed ideas very different from your own.
_______5. You have never deliberately said something that hurt someone's feelings.
_______6. You like to gossip at times.
_______7. There have been occasions when you took advantage of someone.
_______8. You sometimes try to get even rather than forgive and forget.
_______9. At times you have really insisted on having things your own way.
_______10. There have been occasions when you felt like smashing things.

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Verbal Learning Task

<u>Instructions</u>
Trial 1
I will read you a long list of words. Try to remember as many of them as you can. Since it is a long list, you probably won't remember all the words. Just do the best you can. It doesn't matter in what order you repeat them. **Read the list.**
Now tell me all the words you can remember.

Trial 2
I am going to read the same list again. When I am finished, try to tell me even more words if you can. Tell me *the words you have already said* as well as any new ones you can remember. The order in which you repeat them does not matter.

Trial 3
I'm going to read the list again. Again, when I am finished, tell me all the words you can remember, including the words you have said before.

Trial 4
I'm going to read the list one last time. When I am finished, tell me all the words you can remember, including the words you have said before.

____ SAND	____ SAND	____ SAND	____ SAND
____ GAME	____ GAME	____ GAME	____ GAME
____ HAT	____ HAT	____ HAT	____ HAT
____ TREE	____ TREE	____ TREE	____ TREE
____ EAR	____ EAR	____ EAR	____ EAR
____ COMB	____ COMB	____ COMB	____ COMB
____ FLAG	____ FLAG	____ FLAG	____ FLAG
____ WOOD	____ WOOD	____ WOOD	____ WOOD
____ MAP	____ MAP	____ MAP	____ MAP
____ DOOR	____ DOOR	____ DOOR	____ DOOR
____ ICE	____ ICE	____ ICE	____ ICE
____ NAIL	____ NAIL	____ NAIL	____ NAIL
____ BOAT	____ BOAT	____ BOAT	____ BOAT
____ PAGE	____ PAGE	____ PAGE	____ PAGE
____ ANT	____ ANT	____ ANT	____ ANT
____ LAKE	____ LAKE	____ LAKE	____ LAKE

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