VALIDATION OF SELF-DISTANCING TASK RESPONSES IN EXPERIENCED MEDITATORS AND MEDITATION NAÏVE INDIVIDUALS

A dissertation submitted
to Kent State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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July, 2017
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ACKNOWLEDGMENTS

For financial support of this project, I would like to acknowledge and thank the Mind & Life Institute Francisco J. Varela Research Grant, and the Kent State University Judie Fall Lasser Graduate Psychology Research Award.

I would like to express sincere gratitude, to my advisor, Dr. David Fresco, for his steady support and mentorship throughout my graduate career, and to Dr. Karin Coifman, for her continued support, collaboration, and assistance in data analysis in this investigation. I would also like to thank my post-baccalaureate mentor, Dr. Moshe Bar, without whom I may never started down this career path in clinical psychological research.

Very much thanks to my research assistant, Joe Siebert, for the critical role he played in participant recruitment and coordination of the current investigation, and to the rest of my team of research assistants: Anthony Gonzalez, Justin Leiter, Lindsay Lloyd, and Benjamin Siglow for their diligent efforts in data collection. Thank you as well to my dissertation committee members for their thoughtful, constructive critiques and suggestions.

I could not have accomplished this work without the love and support of my parents, Scott and Debbie, and my partner, Jeremy.
INTRODUCTION

Background and significance

In recent years, mindfulness-based practices that cultivate conscious awareness of present moment experiences have been increasingly integrated into psychotherapeutic interventions. Indeed, many prevalent third-wave therapy approaches, including Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn & Hanh, 2009), Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002), Dialectical Behavior Therapy (DBT; Linehan, 1987), Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), and Emotion Regulation Therapy (Mennin & Fresco, 2014; Renna, Quintero, Fresco, & Mennin, 2017), contain elements of mindfulness as part of their treatment approach for a wide range of psychological disorders. The prevalence of mindfulness-based interventions reflects the theory that mindfulness practices help to counteract perceptual, cognitive, and emotional biases that contribute to the development and maintenance of a range of psychological disorders, and promote healthier, more adaptive ways of relating to self-relevant emotional information (Hölzel et al., 2011; Vago & Silbersweig, 2012).

Healthy, adaptive responding to self-relevant emotional information entails allocating attentional and cognitive resources to the source of the information (e.g., threat) in order to coordinate a contextually appropriate response (Phillips, Drevets, Rauch, & Lane, 2003). In high-threat situations, for example, an appropriate response is automatic and involves little or no higher cognitive intervention (e.g., avoiding a snake in one’s path without stopping to consider if it is venomous) (Öhman & Mineka, 2001). However, if the threat becomes irrelevant, an
adaptive response is to flexibly disengage and redirect attention to other aspects of present moment experience, such as the pursuit of goals or rewards (Bonanno & Burton, 2013).

By comparison, many forms of psychopathology are associated with biases in emotional processing that increase the likelihood individuals will orient attention to negative, self-relevant emotional information, and have difficulties disengaging attention from that material once it enters the field of awareness (Goeleven, De Raedt, Baert, & Koster, 2006; Gotlib & Joormann, 2010; Joormann, 2004; Joormann & Gotlib, 2006). These difficulties can prolong and intensify cognitive and physiological responses to negative events (i.e., as in depression: (Joormann, 2010; Joormann & Gotlib, 2008), and exacerbate perseverative thinking processes such as brooding rumination and excessive worry, which are known to elevate risk for the development of most mood and anxiety disorders (Mennin & Fresco, 2013; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

An implicit goal of many cognitive therapies is to counteract biased processing of emotional information by teaching individuals to become better observers of their own internal experiences (Beck, Rush, Shaw, & Emery, 1979; Mennin, Ellard, Fresco, & Gross, 2013; Teasdale, 1999; Wells, 2002). The mental act of observing one’s own thoughts, emotions, and sensations has frequently been termed “meta-awareness,” or “decentering.” Both terms describe the complex phenomenological experience of becoming aware that thoughts and emotions are mental events that are distinct from the self (e.g., “I am not my thoughts.”). However, the term “decentering” additionally refers to the experience of viewing mental events with an attitude of acceptance and non-judgment, as subjective and transient, rather than accurate reflections of reality, or “me” (Bernstein et al., 2015; Safran & Segal, 1990; Teasdale, 1999). For example, the thought, “I’m a failure,” might instead be viewed as, “I notice I’m thinking I’m a failure.” This
current conceptualization of decentering is derived from clinical psychologist Jean Piaget’s, original term “decentration,” which describes the skill to consider multiple perspectives of a situation or object simultaneously rather than fixating on a single attribute (Piaget, 1969). According to Piaget, normal acquisition of decentration during early childhood is linked to a gradual reduction in egocentrism, as well as increases in attentional flexibility and the development of short-term memory capacity.

The process of decentering is thought to decrease reactivity to emotional experiences by fostering an attitude of willingness to remain in contact with unpleasant experiences, and by decreasing the likelihood of engaging in forms of experiential avoidance that function to control or suppress unwanted emotions (e.g., Ayduk & Kross, 2008; Kross & Ayduk, 2008; Kross & Ayduk, 2009; Kross, Ayduk, & Mischel, 2005; Mennin & Fresco, 2013; Teasdale, 1999; Wisco & Nolen-Hoeksema, 2011). Additionally, decentering is thought to facilitate adaptive emotional processing and the ability to “work with” emotional information in more effective ways (Desbordes et al., 2014). Critically, research suggests that natural decentering abilities can be enhanced using cognitive therapy methods that emphasize monitoring internal experiences (Beck et al., 1979; Fresco, Moore, et al., 2007; Fresco, Segal, Buis, & Kennedy, 2007; Mennin & Fresco, 2013). However, the capacity may be more optimally cultivated via mindfulness meditation training, wherein individuals practice repeatedly monitoring experiences as they arise in awareness, and shifting to an observing, decentered perspective on them with an attitude of curiosity, acceptance, and non-judgment (Segal et al., 2002; Teasdale, 1999; Teasdale et al., 2002).
Assessment of mindfulness and decentering

In light of the rapidly growing interest in mindfulness-based approaches in clinical treatments, numerous researchers have attempted to operationalize mindfulness and decentering as psychological constructs, and to develop instruments that can be used to investigate their roles in treatment (Baer, Walsh, & Lykins, 2009; Bishop et al., 2004). Accordingly, there are many descriptions of mindfulness and decentering in the clinical literatures; however, defining and measuring these multifaceted and elusive constructs has been challenging. For example, it has been difficult to distinguish them from one another and from other related constructs (Baer et al., 2009; Bernstein et al., 2015; Desbordes et al., 2014; Grossman & Van Dam, 2011).

Currently, the primary means of assessing practice-related gains in mindfulness and decentering is via self-report questionnaires. Indeed, at least eight scales have recently been developed to operationalize dispositional mindfulness using various conceptualizations of skills exercised during concentrative and receptive mindfulness practices (for review, see Baer et al., 2009; Sauer et al., 2013). Of these scales, the Five Facet Mindfulness Questionnaire (FFMQ) may be the most advantageous, as it was developed using factor-analytic integration of items from five previously developed mindfulness scales. The FFMQ is comprised of five different facets reflecting skills associated with mindfulness: observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience (Baer, Smith, Hopkins, Krieter, & Toney, 2006). It has been widely used to evaluate a dispositional, trait-like capacity to be mindful in daily activities, and its facets have been consistently associated with level of meditation experience and symptomatic improvements (Baer, 2011).

At least two self-report questionnaires have also been recently developed to assess skills associated with decentering, of which the Experiences Questionnaire has been most widely used
(EQ: Fresco, Moore, et al., 2007). Relevant items were shown to load onto a single factor of *decentering*, which has shown good concurrent and discriminant validity (Fresco, Moore, et al., 2007), and which has been positively associated with self-reported mindfulness (Carmody, Baer, Lykins, & Olendzki, 2009; Tanay, Lotan, & Bernstein, 2012) and negatively associated with depression symptoms, depressive rumination, and experiential avoidance (Fresco, Moore, et al., 2007). EQ decentering was also predictive of longer time to relapse in individuals with major depressive disorder following acute treatment with cognitive therapy (Fresco, Segal, et al., 2007) and prophylactic treatment with MBCT (Bieling et al., 2012). Furthermore, generalized anxiety disorder (GAD) patients treated with MBSR (Hoge et al., 2015) or emotion regulation therapy (ERT; Mennin, Fresco, Ritter, & Heimberg, 2015) evidenced gains in EQ decentering, and EQ gains were associated with temporal mediation of treatment gains with respect to GAD symptoms, worry, depression symptoms, functional impairment, and quality of life (Mennin, Fresco, Heimberg, & O’Toole, Under review). Finally, a recent investigation demonstrated that brain activity, suggestive of lower self-referential mental activity at pre-treatment, predicted increases in decentering over the course of ERT in individuals with GAD with or without Major Depressive Disorder (Fresco, Roy, Adelsberg, et al., 2017).

Despite their economical advantages and wide use, self-report measures of mindfulness and decentering have a number of methodological and conceptual limitations, which have been discussed in detail elsewhere (Grossman, 2011). In general, questionnaires are not well-suited to evaluating treatment outcomes because they are prone to the effects of demand characteristics and expectations of progress (Lilienfeld, Ritschel, Lynn, Cautin, & Latzman, 2014; Carmody et al., 2009; Grossman, 2011). Additionally, individuals often have difficulty introspecting and reporting on their use of skills in daily activities, which can result in inconsistencies between
self-reported versus actual skill use (Veenman, Prins, & Verheij, 2003; Veenman & Spaans, 2005). Self-report measures of mindfulness in particular, have been criticized for missing critical aspects of the theoretical and experiential nature of the construct of mindfulness, which was originally derived from Buddhist traditions, and for a lack of coherence in their definitions of the construct (Desbordes et al., 2014; Grossman, 2008; Grossman & Van Dam, 2011). Moreover, the functioning of items and scales seems to vary depending on the level of meditation experience of the respondents (Baer et al., 2008; Lilja, Lundh, Josefsson, & Falkenström, 2013). For instance, the FFMQ was positively associated with indices of psychological adjustment in experienced meditators; whereas, the FFMQ observing subscale was shown to be associated with maladaptive cognitive styles in non-meditating samples (e.g., thought suppression and absent-mindedness) (Baer et al., 2008).

There appear to be conceptual issues with self-report measures of decentering as well. For example, definitions of decentering portray a multi-faceted construct; however the construct is often measured as a single dimension (Fresco, Moore, et al., 2007; Gecht et al., 2014). Indeed, the EQ items were originally developed to capture three facets of decentering: the capacity to view one’s self as not synonymous with one’s thoughts, the ability not to habitually react to one’s negative experiences, and the capacity for self-compassion (Fresco, Moore, et al., 2007). Accordingly, a recent factor-analysis using a German translation of the EQ, suggested that a two-factor solution—distinguishing the ability to adopt a distanced perspective from the capacity to have an accepting self perception—provided a better fit to the available data as compared to the single-factor solution (Gecht et al., 2014).

Considering the methodological and conceptual limitations of self-report measures of mindfulness and decentering, investigators have called for objective measures—that may be used
in combination with self-report methods—to advance knowledge of specific processes thought to be enhanced by mindfulness-based therapeutic interventions. Thus, in a recent investigation, we developed a behavioral “self-distancing” task to assess skills cultivated in mindfulness practices and associated with adaptive emotional processing. Specifically, we attempted to capture the capacity to mentally manipulate emotional material away from the self (self-distance), as self-distancing is thought to be: 1) a theoretically important facet of decentering, 2) a skill that is exercised in mindfulness-based interventions, and 3) an important element of adaptive emotional processing (Vago & Silbersweig, 2012). Here, we provide an overview of this recent foundational validation study, including task design and methodological considerations that are germane to the current investigation.

Self-distancing task concept and design

In the self-distancing task, participants viewed images of objects with negative and neutral valences. Negative objects were selected for having content that is considered threatening or unpleasant (e.g., spider, razor blade), whereas neutral objects had no affective valence (e.g., paperclip, picture frame). Participants were asked to evaluate the size of each object relative to their own hands (e.g., would this spider fit in your hand?) or relative to a standard shoebox (e.g., would this spider fit in a shoebox?). Participants were told that they should respond as quickly and accurately as possible, but that to accurately evaluate the size of the objects, they should visualize the objects in their own hands or in the shoebox.

Critically, the ability to accurately evaluate whether an object would fit in one’s own hand or in a shoebox was presumed to require mental manipulation of objects toward or away from the self. Specifically, in the “hand” condition, participants had to mentally “pull” the
objects into their hands in order to evaluate the relative size of the objects, whereas in the
“shoebox” condition, participants had to mentally “push” the objects into the shoebox in order to
evaluate their relative size (i.e., create distance from, or “let go” of the objects). The mental act
of pulling negative objects toward the self—into one’s own hand—simulated decreased distance
from threat; this task should be unpleasant because it is inconsistent with fundamental threat
avoidance motivations (Chen & Bargh, 1999; Rinck & Becker, 2007). By contrast, pushing
negative objects away from the self—into the shoebox—increased distance from threat; this task
should not be unpleasant because it is consistent with natural motivations to self-distance from
negative stimuli (Chen & Bargh, 1999; Rinck & Becker, 2007). Thus, we conceptualized the
“hand” condition as a “high-threat” context and the shoebox condition as a “low-threat” context.

We tested several hypotheses using this conceptualization of the hand condition as “high
threat” and the shoebox as “low threat.” At the mean-level, we hypothesized that individuals
would have greater difficulty evaluating the size of negative objects in the “hand” condition,
versus the shoebox condition. This hypothesis was derived from theories suggesting that
accurately evaluating the size of objects requires higher-order cognitive operations (i.e., mental
manipulation), which are impeded in high-threat contexts to a greater extent than in low-threat
contexts (Öhman & Mineka, 2001). Indeed, in high-threat contexts, evolutionary accounts
suggest that the odds of avoiding potential harm are increased by responding quickly, and
reflexively without higher-level thought, and that it can be difficult or impossible to cognitively
over-ride automatic defensive reactions to negative stimuli (Öhman & Mineka, 2001).
Conversely, in low-threat contexts, automatic reactions to negative stimuli should be more easily
countered, and thus mental manipulation and evaluation should be less difficult. For neutral
stimuli, we did not expect that the hand/shoebox manipulation would have a marked effect on the
ability to evaluate neutral stimuli, because for most individuals, neutral stimuli are not threatening or unpleasant.

According to this framework, the majority of individuals should have difficulty with the mental manipulation/evaluation task in the high-threat/hand context, resulting in low variability in performance measures (Öhman & Mineka, 2001). However in the low-threat/shoebox context, individuals were expected to vary in the capacity to create distance from or detach from emotional material based on a number of factors, including the presence of psychopathology (e.g., depression, c.f. Gotlib & Joorman, 2010), but more importantly the ability to decenter or distance from the content (Fresco, Moore, et al., 2007). As a result, there should be a larger amount of individual variability in the ability to perform the mental manipulation/evaluation task in the low-threat versus high-threat context.

Critically, we hypothesized that individual variability in the low-threat/shoebox context would be partially explained by levels of self-reported mindfulness and decentering skills. Specifically, we hypothesized that higher (versus lower) levels of decentering and mindfulness would facilitate evaluating the size of objects in the shoebox/low-threat condition, because self-report measures of mindfulness and decentering theoretically measure the capacity to observe and create distance from emotional material. Furthermore, we expected that the “distanced-perspective” subscale of the EQ would be a particularly powerful predictor of performance in the shoebox/low-threat condition, as this scale specifically assesses the ability to self-distance (Gecht et al., 2014). To test these overarching hypotheses, we assessed the ease/difficulty with which individuals were able to perform the size evaluation using two indicators of performance: response times (RTs) and accuracy (i.e., ability to evaluate whether objects would fit in the hand/shoebox).
In experimental research, accuracy is often treated as an extraneous variable, and incorrect trials are removed to prevent their negative impact on the results (e.g., Prinzmetal, McCool, & Park, 2005). However, in the self-distancing task, accuracy was a key variable of interest, as the ability to accurately judge the relative size of objects is thought to depend on mental manipulation and evaluation abilities. Determining the accuracy of responses requires generating response norms, because trials vary in whether the size-evaluation is a clear-cut “Yes” or “No.” For example, while it is relatively easy to determine whether a spider would fit in one’s hand, it is less obvious as to whether a snake would fit in one’s hand. This “ambiguity problem” has two important consequences. First, it necessitates generating response norms to statistically determine the “correct” response for each trial before we are able to determine the “correctness” of individual responses. In the foundational investigation, we generated these norms in a sample of psychologically healthy individuals to ensure that “normal” responses were not affected by symptoms of psychopathology\(^1\). Thus, our measure of accuracy is a construct (i.e., “correctness”) rather than a concrete measurement; it reflects the proportion of participant responses that correspond to the responses of healthy, normal individuals, and provides an index of general mental manipulation and evaluation abilities. A second consequence of the “ambiguity problem” is that it represents a potential confound that could complicate interpretation of RTs. More ambiguous trials could produce longer RTs. Therefore, if participants are more confused about whether objects would fit in their hands versus in the shoebox, we would be unable to conclude

\(^1\)In the foundational investigation, to normalize responses to stimuli, we conducted an item analysis to statistically determine the “correct” response for each trial (i.e., “yes,” “no,” “I don’t know”). Specifically, we examined the distribution of responses to each stimulus as a function of the condition in which the stimulus appeared (i.e., hand or shoebox). We calculated the modal response for each trial. The modal response was taken to indicate the “correct” response for that trial. These norms were later used to determine “correctness” of responses in the Study 2, therein, as well as in the current investigation.
that a reduction in RTs in the shoebox condition was due to our manipulation of interest rather than response ambiguity. Thus, it is critical to ensure that levels of response ambiguity are similar across conditions, prior to testing more specific hypotheses. Finally, as low levels of accuracy may also reflect lack of engagement in the task and obscure genuine effects of task conditions on RT, it is necessary to control for accuracy when examining RTs.

**Foundational investigation (Shepherd, Coifman, Matt, & Fresco, 2016)**

In the foundational investigation, we conducted two studies (Study 1 and Study 2). In Study 1, we generated response norms in a small group of healthy individuals (used to compute the correctness of responses in Study 2), and found that levels of ambiguity were similar across conditions. In Study 2, we recruited a larger, naturalistic sample of individuals who were not prescreened for mental health, and who represented a range of functioning. Participants in Study 2 completed the self-distancing task in addition to self-report measures of mindfulness (FFMQ; Baer et al., 2006), decentering (EQ; Fresco, Moore, et al., 2007), and depression (QIDS-SR16; Rush et al., 2003). For parsimony in predicting experimental variables, we created a composite score of FFMQ mindfulness by summing the four scales that were previously shown to load on to an overarching mindfulness factor in non-meditating samples (Baer et al., 2008). With regard to the EQ, we calculated the single factor decentering scale (Fresco, Moore, et al., 2007), and the “distanced perspective” scale from the factor analysis of Gecht and colleagues (2014). We also evaluated self-reported depression symptoms, because depression has consistently been associated with general executive impairments linked to difficulties with mental manipulation of emotional material (Gotlib & Joormann, 2010; Joormann, Levens, & Gotlib, 2011; Mathews & MacLeod, 2005). Therefore, we expected that depression symptoms would explain variability in
mental manipulation abilities beyond what could be accounted for by mindfulness and decentering.

After ruling out potentially problematic effects of ambiguity and verifying that our valence manipulation was successful (i.e., that participants reported more negative affect in response to negative versus neutral trials), we tested the mean-level predictions described above, to establish internal validity of responses. Results suggested that our manipulations were successful. As expected, we found that RTs were longer for negative compared with neutral objects, but the effect of object valence on RTs varied as a function of context (i.e., hand vs. shoebox). Specifically, the difference in RTs to negative versus neutral objects was smaller in the shoebox (low-threat) context versus the hand (high-threat) context. We found a similar pattern of results with respect to correctness: correctness was higher for negative compared with neutral objects, and the effect of valence on correctness was smaller in the low-threat context. In essence, individuals were slower yet more accurate in judging the size of negative vs. neutral objects in the high-threat context, suggesting that stimulus valence had a larger impact on mental manipulation in that context. Furthermore, in terms of RTs, the discrepancy between the high and low-threat contexts was bigger in individuals who had higher levels of overall correctness (i.e., whose size evaluation responses were more consistent with the responses of psychologically healthy individuals). In other words, at higher levels of correctness, the interaction of object valence and context was more pronounced. This finding is consistent with our expectation that it would be more difficult to detect and measure manipulation effects in individuals who had low levels of accuracy (i.e., who were not engaged in the task, or struggled with instruction comprehension).
Taken together, these findings were consistent with the hypothesis that individuals would have greater difficulty manipulating and evaluating the size of negative objects in the high-threat relative to the low-threat context: the high-threat context was expected to impede mental manipulation and evaluation to a greater extent than the low-threat context (Öhman & Mineka, 2001). Indeed, the act of bringing negative objects closer to the body was thought to be inconsistent with fundamental motivations to avoid harm, and to be more disruptive to higher-level cognitive processes such as mental manipulation and evaluation; whereas pushing objects away from the self was consistent with natural distancing motivations and thus was expected to be less disruptive (Heuer, Rinck, & Becker, 2007; Rinck & Becker, 2007).

The results of the foundational investigation also largely supported our overarching hypothesis that individuals with higher levels of mindfulness and decentering/distancing would demonstrate a greater capacity to manipulate emotional material away from the self; that is, they would show smaller differences in RTs to negative versus neutral objects in the low-threat context, relative to individuals with lower levels of mindfulness and decentering/distancing. Indeed, after controlling for individual differences in factors affecting general mental manipulation and evaluation abilities (i.e., correctness and depression), mindfulness predicted smaller effects of object valence in the low-threat, but not the high-threat context. Furthermore, we observed the same pattern of results for the distanced perspective facet of the EQ. However, contrary to expectations, the full-scale decentering measure was not a statistically significant predictor of task responses, even though the effect size approached conventions for a medium effect. We suspected that this null result reflected a weaker association of the accepting self-perception factor items to task responses. Indeed, performance on the self-distancing task might depend more heavily on the capacity to adopt a distanced perspective, rather than on aspects of
self-perception. These findings may also provide support for the multifaceted definition of
decentering suggested by Bernstein and colleagues (2015). However more research is needed to
further understand these relationships, particularly in light of ongoing efforts to resolve and
validate the definition and measurement of decentering with instruments such as the EQ (e.g.,
Fresco, Moore, et al., 2007; Gecht et al., 2014).

Our findings were also consistent with theory and research indicating that mindfulness is
associated with better abilities to mentally manipulate emotional material in conscious
awareness, without becoming stuck in recursive patterns of self-referential thinking (Hölzel et
al., 2011; Teasdale, 1999; Vago & Silbersweig, 2012). Indeed, meditation experience has been
associated with superior working memory (Chambers, Lo, & Allen, 2008; Jha, Stanley,
Kiyonaga, Wong, & Gelfand, 2010; van Vugt & Jha, 2011), cognitive flexibility, and attentional
control (Hodgins & Adair, 2010; Jha, Krompinger, & Baime, 2007; Moore & Malinowski,
2009), which have all been linked to mental manipulation abilities (Joormann et al., 2011).

Accordingly, one of the goals of mindfulness-based practices is to increase mental
flexibility and reduce biased processing of affective stimuli through the cultivation of
metacognitive capacities, including decentering and “equanimity” (Vago & Silbersweig, 2012).
Equanimity refers to “an even-minded mental state or dispositional tendency toward all
experiences or objects, regardless of their affective valence (pleasant, unpleasant, or neutral) or
source,” which is not easily attained and typically depends on meditation practice (for review
see, Desbordes et al., 2014). Thus, an important question for future research is whether
individuals who have long-term/significant meditation practice would demonstrate better self-
distancing skills, perhaps due to their superior abilities to work with emotional material in
awareness.
Indeed, if more experienced meditators—who have developed a greater capacity for mindfulness, decentering, and equanimity—are better able to mentally manipulate emotional material than non-meditators, they should demonstrate minimal differences in RTs and correctness to negative and neutral stimuli, at least in the low-threat context of the self-distancing task. However, it is an open question as to whether experience in meditation would predict RT effects in the high-threat context as well; if experienced meditators are better able to disengage attention from emotional material when needed, they could demonstrate better mental manipulation and evaluation abilities in the high-threat context too (Desbordes et al., 2012; Ortner et al., 2007; Vago & Nakamura, 2011).

Current investigation

An important next step in validating the self-distancing task is to examine the relationship of meditation experience to performance, and to further explore the cognitive characteristics of individuals whose performance indicates a greater capacity for mental manipulation of emotional material. Thus, in the current investigation, we compared self-distancing performance, as well as a range of other measures of cognitive function, in two groups of individuals: experienced meditators with at least 1000 hours of meditation experience, and meditation naïve individuals with no meditation experience.

We defined meditation experience according to the definition of Lutz and colleagues (2008): “a set of regulatory and self-inquiry mental training regimes cultivated for various ends, including the training of well-being and psychological health” (Chambers et al., 2008; Lutz, Slagter, Dunne, & Davidson, 2008). While this broad definition recognizes commonalities among traditions and styles of meditation and allowed us to be inclusive in recruitment, it does
not acknowledge the considerable diversity that exists among traditions of practice. The conceptual framework of Dahl and colleagues (2015) suggests that a broad range of traditional and contemporary meditation practices can be grouped into three families: those that target attention regulation and meta-awareness (“attentional” practices), perspective taking and reappraisal (“constructive” practices), and self-inquiry (“deconstructive” practices) (Dahl, Lutz, & Davidson, 2015). Therefore, we asked participants to provide a detailed accounting of the types of meditation practices they have performed in their lifetimes to characterize the nature of their training according to this three-family framework.

Experience in meditation has been associated with a variety of general cognitive advantages that are likely associated with mental manipulation and self-distancing abilities (e.g., working memory and attentional control). Although evidence indicates that training in mindfulness may increase executive control processes (Jha et al., 2007; Jha et al., 2010; van Vugt & Jha, 2011), individuals drawn to develop a committed practice in meditation, may have different pre-dispositional characteristics that cause them to be more interested in and/or inclined to benefit from meditation. Therefore, in the current investigation, we evaluated key variables that might be expected to covary with meditation experience to elucidate differences between meditation experienced and naïve participants. Specifically, we employed commonly used self-report measures to evaluate mindfulness and decentering, rumination and worry, symptoms of depression, anxiety, and stress, behavioral inhibition and activation, and the “Big Five” dimensions of personality (i.e., neuroticism, extraversion, openness to experience, agreeableness, conscientiousness), as well as commonly used behavioral response measures of general intelligence and executive control (e.g., verbal comprehension, perceptual reasoning, working memory, attention, and response inhibition).
Preliminary group difference hypotheses

Consistent with previous research, we anticipated that experienced meditators would report lower levels of depression compared to meditation naïve individuals (e.g., Lykins & Baer, 2009). However, because symptoms of depression are known to have a significant negative impact on cognitive task performance (e.g., Mathews & MacLeod, 2005), we controlled for group differences in depression by equating the groups on levels of depression before comparing their performance on performance measures. In addition, we recruited individuals who were roughly equivalent in age, as age is known to be associated with slowing in response times (e.g., Der & Deary, 2006).

Prior to examining group differences in self-distancing task performance, we additionally examined differences between experienced meditators and meditation naïve individuals in self-report measures of mindfulness and decentering, rumination and worry, behavioral inhibition and activation, and dimensions of personality, as well as behavioral response measures of executive control and intelligence. While these contrasts were essentially exploratory, theory and previous research suggest meditation experience is associated with numerous advantages on measures of executive functioning, mental health, and well-being (e.g., Desbordes et al., 2014). Thus, we expected meditators to demonstrate higher scores on measures of executive control (i.e., attention, response inhibition, working memory), lower scores on measures associated with negative emotionality (i.e., depression, anxiety, stress, rumination, worry, behavioral inhibition, neuroticism), and higher levels of traits suggestive of equanimity (e.g., mindfulness, decentering, openness to experience).
**Self-distancing task hypotheses**

**Preliminary validation hypothesis**

In the first stage of validation, we attempted to rule out potentially problematic effects of ambiguity. In addition, we tested the influence of another potential confound, which was not examined in the foundational investigation. Specifically, we sought to address our concern that individuals might be systematically faster to respond “Yes” vs. “No,” which would result in faster RT in conditions with a greater proportion of “Yes” responses, independent of valence and context manipulation effects. Toward this end, we examined the balance of “Yes” responses across context and valence conditions.

*Ambiguity hypothesis:* Consistent with results of the foundational investigation, we did not expect levels of ambiguity to vary as a function of context or valence manipulations across all participants.

*Response type hypothesis:* The proportion of “Yes” responses provided by participants will not vary as a function of context or valence manipulations across all participants.

**Primary validation hypotheses**

In the second stage of self-distancing task validation, we examined the interactions of valence (negative, neutral) and context (hand, shoebox) on negative affect, correctness, and RT between groups (experienced meditators, meditation naïve individuals). The following hypotheses stem from our conceptualization that, for most individuals, a task involving mental manipulation of emotional stimuli should be more difficult in the hand (high-threat) context versus the shoebox (low-threat) context. Critically however, individuals with superior abilities to self-distance or detach from emotional material (i.e., experienced meditators) should be better
able to mentally manipulate emotional material in the shoebox (low-threat) context, when compared to their less adept counterparts (meditation naïve individuals).

**Negative affect hypotheses:** Overall, we expected participants to demonstrate higher levels of negative affect, to negative versus neutral trials; however, this difference between negative versus neutral trials would be smaller in the shoebox (low-threat) context compared with the hand (high-threat) context. In addition, we predicted meditation experience would moderate the interaction between valence and context on negative affect: experienced meditators (versus meditation naïve individuals) would demonstrate smaller differences in negative affect to negative versus neutral trials in the shoebox (low-threat) context.

**Correctness hypotheses:** Overall, we expected participants to demonstrate higher levels of correctness, to negative versus neutral trials; however, this difference between negative versus neutral trials would be smaller in the shoebox (low-threat) context compared with the hand (high-threat) context. In addition, group would moderate the interaction between valence and context on correctness: experienced meditators (versus meditation naïve individuals) would demonstrate smaller differences in correctness to negative versus neutral trials in the shoebox (low-threat) context.

**Response time (RT) hypotheses:** Overall, we expected participants to demonstrate longer RTs to negative versus neutral trials; however, this difference between negative versus neutral trials would be smaller in the shoebox (low-threat) context compared with the hand (high-threat) context. Furthermore, we expected that the interaction of valence by context on RT would be stronger in individuals who demonstrated higher levels of correctness, because low levels of correctness were expected to obscure genuine effects of task conditions on RT. Finally, group would moderate the interaction between valence and context on RT: experienced meditators
(versus meditation naïve individuals) would demonstrate smaller differences in RT to negative versus neutral trials in the shoebox (low-threat) context.
METHOD

Participants

All participants completed an online screener questionnaire (Qualtrics software; http://www.qualtrics.com) prior to being enrolled in the study to obtain an estimate of lifetime meditation experience. Participants who reported a history of regular meditation practice were asked additional questions about the types of meditation they typically perform, for how long they typically practice in a given day, for how many months and years they have been practicing, whether there were any gaps in their practice, as well as how many meditation retreats they attended (see “Estimation of Meditation Experience” below). Participants with at least 1000 hours of lifetime meditation experience were invited to participate in the study as part of the “experienced meditator” group. Meditation naïve individuals reported no history of meditation practice. All participants were required to be able to understand, read, and speak in English, had normal, or corrected to normal vision and hearing.

Meditation naïve participants consisted of 32 adults (68.8% female; 75% Caucasian; mean age = 46.53, SD = 12.10, age range = 27-65 years), recruited from Northeast Ohio communities via advertisements on local bulletin boards, via online volunteer websites (e.g., Craigslist), and via word of mouth.

Experienced meditator participants consisted of 22 adults (50% female; 86% Caucasian; mean age = 56.09, SD = 12.54, age range = 26-72 years) recruited from the following
organizations: Jewel Heart Cleveland, the Cleveland Shambhala Meditation Center, the Akron-Canton Shambhala center, the Cleveland Zazen Group, and through word of mouth.

Procedure

Upon arrival to the laboratory, participants were seated in a quiet room, where they provided written, informed consent, and filled-out computerized questionnaires assessing demographic information, mindfulness and decentering, rumination and worry, personality, and depression, anxiety, and stress symptoms (Qualtrics software; http://www.qualtrics.com). Participants then completed all tasks in the order they are listed below, and were compensated and debriefed.

Measures

Estimates of Cronbach’s alpha (Cronbach, 1951) for all measures are reported in Table 1.

Symptom scales

The following scales were administered on the day of testing to evaluate clinically significant symptoms of depression and anxiety.

The Depression, Anxiety, and Stress Scale (DASS-21; Henry & Crawford, 2005). The DASS-21 is a 21 item self-report measure that assesses depression, anxiety, and stress in the past week. It is based on a dimensional rather than a categorical conceptualization of psychological disorder. Response options range from 0 to 3, where 0 indicates the absence of the symptom. Published scores are available for conventional cut-off scores (normal, mild, moderate, severe).
Negative Affect

Negative affect was assessed at five points over the course of the self-distancing task using items selected from the Positive and Negative Affectivity Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The negative affect scale of the PANAS consists of 10-items. Participants rate the extent to which they are currently experiencing a range of negative emotions from “very slightly or not at all” (1) to “very much” (5). For brevity in the current study, we selected six items from the PANAS based on having the highest factor loadings onto negative affect (Crawford & Henry, 2004) (i.e., upset, guilty, hostile, irritable, jittery, scared). Participants responded using a likert-type scale from “not at all” (1) to “extremely” (5). Items were summed to create composite negative affect scores.

Mindfulness

Trait mindfulness was assessed using the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). The FFMQ is a 39-item questionnaire, assessing five facets: observing, describing, acting with awareness, non-judging of internal experience, and non-reactivity to internal experience. Participants rate their agreement with statements on a 5-point Likert-type scale.

Decentering

Decentering was measured using the Experiences Questionnaire, Decentering subscale (EQ; Fresco, Moore, et al., 2007). The EQ-Decentering subscale consists of 11 items. Participants rate the frequency with which they have various experiences on a 5-point Likert-type scale ranging from “never” (1) to “all the time” (5). A recent re-examination of the factor
structure of EQ-Decentering suggested a 2-factor structure: *distanced perspective* (4 items) and *accepting self-perception* (4 items) (Gecht et al., 2014). The *distanced perspective* factor is said to assess the capacity to view experiences objectively, with healthy psychological distance (e.g., ‘I can separate myself from my thoughts and feelings’), and the *accepting self-perception* factor is thought to reflect aspects of self-awareness, acceptance and compassion (e.g., ‘I can treat myself kindly’) (Gecht et al., 2014).

**Rumination**

The *Ruminative Response Scale* (RRS; Nolen-Hoeksema & Morrow, 1991) is a 22-item self-report measure of depressive rumination, or passively and repetitively focusing on sad mood. In the current study, a 25-item version was used, consisting of the original 22 items, plus three additional items appended by Treynor et al. (2003), to derive *brooding* and *pondering* factors. Participants rate the frequency with which they engage ruminative thoughts and behaviors on 4-point Likert-type scale.

**Worry**

The *Penn State Worry Questionnaire* (PSWQ; Meyer et al., 1990) is a 16-item self-report measure that assesses the extent to which individuals tend to engage in excessive and uncontrollable worry (e.g., “Once I start worrying, I can’t stop”). Participants rate their agreement with the items on a 5-point, Likert-type scale.

**Personality**

The *NEO Five-Factor Inventory* (NEO-FFI; McCrae & Costa, 2004) is a 60-item self-report inventory that assesses five domains of personality: *Neuroticism, Extraversion, Openness*
to experience, Agreeableness, and Conscientiousness. Participants rate their agreement with the items on a 5-point, Likert-type scale ranging from “Strongly Disagree” to “Strongly Agree.”

The Behavioral Inhibition/Behavioral Activation Scales (BIS/BAS; Carver & White, 1994) assess two general motivational systems that underlie behavior and affect: a behavioral inhibition system (BIS) and a behavioral activation system (BAS). The BIS/BAS scales consist of 20 items, rated on a 4-point scale. The measure yields four scale scores, one BIS score and three BAS scores (Drive, Reward Responsiveness, and Fun Seeking).

Estimation of meditation experience

A rough estimate of self-reported lifetime meditation experience was estimated based on the procedures of Hasenkamp and colleagues (Hasenkamp & Barsalou, 2012). Specifically, participants were asked to report the frequency and duration of their current practice according to the following dimensions: days/week (A), hours/day (B), and years at this frequency (C). These variables were coded according to the specifications below. We also asked participants what styles of meditation they regularly practiced and if their practice was variable (i.e., if there was another time that they had practiced a different style or at a different frequency). If yes, they repeated variables A, B, and C, for the previous practice to yield the values D, E, and F (as below). They were also asked to list any meditation retreats they attended, as well as the number of days attended and hours/day of practice for each of the retreats. The number of retreat-days were multiplied by the hours/day practiced and summed over the number of retreats to yield the value R. Total lifetime hours were then calculated as follows: days/week (assign value A, and D if present); hours/day (assign value B, and E if present); years at this frequency (assign value C, and F if present) Retreats (assign value R): (days × hours/day, summed over retreats). The
formula for estimated lifetime hours was: hours = \[A \times 52 \times B \times C\] + \[D \times 52 \times E \times F\] + R (with D, E, and F included only if there were values).

Self-distancing Task

Stimuli

Stimuli consist of 144 color images of objects, previously rated and standardized for negative and neutral emotional valence. Negative stimuli are objects with unpleasant or threatening content (e.g., spider, knife), whereas neutral stimuli are objects without any obvious emotional salience (e.g., roll of tape, picture frame). Object images have a resolution of 384 × 384 pixels and are presented on a white background. A list of image names can be found in Appendix A.

Apparatus

Stimulus presentation and response collection was performed using E-Prime (version 2.0, Psychology Software Tools, Pittsburgh, PA), controlled by a Dell desktop computer with screen resolution of 1280 × 800. Response times (RTs) are collected using a keyboard that has a 2-millisecond (ms) resolution for detecting keypress responses.

Design

The self-distancing task has a 2 (valence: neutral, negative) x 2 (context: hand, shoebox) within-subjects, blocked design (Figure 1). Participants see four blocks of images of objects (2

Stimulus selection and valence normalization procedures are described in detail by (Shenhav, Barrett, & Bar, 2013). Stimulus images were viewed by independent raters who provided valence ratings on a 7-point Likert scale ranging from very unpleasant to very pleasant (centered on neutral): negative (M = 2.18, SD = 0.39), neutral (M = 4.16, SD = 0.45).
negative, 2 neutral). Each block consists of 36 object images. Before each block of images, participants are given one of two instructions to follow for all subsequent object images in the block: 1) decide whether each object would be small enough to fit inside the palm of your hand, or 2) decide whether each object would be small enough to fit inside a standard shoebox. An exemplar of a standard shoebox is provided for reference. Participants view each image sequentially and each image remains onscreen until they indicate a response by keypress (“yes,” “no,” “don’t know”), or until ten seconds elapse. The time from stimulus onset to the keypress response is recorded for each trial. Participants are instructed to respond as quickly and accurately as possible. They are told that their performance on the task will improve if they imagine the objects in their own hand or in the shoebox before making a judgment. For each participant, negative or neutral images are randomly ordered and assigned to the hand or the shoebox condition. Thus, a particular stimulus image could appear either in the hand condition or the shoebox condition for a given participant, depending on its random assignment. No participant sees the same image twice. Participants complete eight practice trials prior to the start of the experiment (four neutral/hand trials, four neutral/shoebox trials). At baseline, and after each block, participants are prompted to rate their current level of negative affect using a modified version of the Positive and Negative Affectivity Schedule (PANAS; Watson et al., 1988) described above. Levels of self-reported negative affect following negative versus neutral stimulus blocks are used to evaluate the overall effect of stimulus valence on affect.
Figure 1. *Self-distancing Task Design*

Note. Figure depicts a blocked, 2 (valence: neutral, negative) x 2 (context: hand, shoebox), counterbalanced, factorial design. Each block consisted of 36 object images. Note that hand and shoebox images are shown for illustrational purposes; object images were displayed on a white background. Objects were randomly assigned to condition between participants and no participant saw the same image twice.

Attention Network Test (ANT)

*Apparatus*

Stimulus presentation and response collection was performed using E-Prime (version 2.0, Psychology Software Tools, Pittsburgh, PA), controlled by a Dell desktop computer. Participants viewed the computer screen at a distance of 65 cm, and RTs were collected using a keyboard with a 2 ms resolution for detecting keypress responses.

*Stimuli and Design*

The Attention Network Test (ANT; Fan, McCandliss, Sommer, Raz, & Posner, 2002) was used to measure three components of attention: alerting, orienting, and executive control.
(c.f. Tripartite Model of Attention; Petersen & Posner, 2012). Alerting refers to maintaining a vigilant state of preparedness, orienting is selection of information from sensory inputs; and executive control refers to the resolving of conflicting responses (i.e., prioritizing competing tasks and responses; c.f., conflict monitoring; Jha et al., 2007) (Fan et al., 2002; Jha et al., 2007).

The ANT is a combination of a flanker task and a cued reaction time experiment, developed by Fan and colleagues, which has also been described in detail elsewhere (Fan et al., 2002; Fossella, Posner, Fan, Swanson, & Pfaff, 2002). The ANT design is depicted in Figure 2, which was reproduced from Jha and colleagues (2007). A fixation cross is presented in the center of the background screen for the duration of the experiment, and participants are instructed to maintain fixation on the central cross throughout all trials. All trials (except no-cue trials) begin with the presentation of a cue for 100 ms. The offset of the cue is followed by a 400 ms delay. All trials end with a target that appears 1.068° above or below fixation. The target remains on screen until a response is made, or until 1,700 ms have elapsed. The intertrial interval (ITI) varies randomly from 400 to 1,600 ms between trials. The ITI is 100ms longer for no-cue trials than cue trials, to equate the duration of the trial types. Target stimuli consist of an array of five arrows. Participants are asked to indicate the direction of a central arrow that is flanked by four arrows (two on each side of center) that either point in the same direction as the center arrow (congruent) or in the opposite direction (incongruent). The arrows are preceded by cues that provide information about the timing and location of the upcoming targets. Specifically, the arrows are preceded by one of three types of cues: center cues, double cues, and spatial cues. 1) In center-cue trials, one asterisk appears over the central fixation point; 2) In double-cue trials, asterisks are simultaneously presented at their target positions above and below fixation; 3) in spatial-cue trials, one asterisk appears at the location of the forthcoming target. All cues are
temporally informative in that they indicate that the target arrow stimulus will appear soon. The spatially informative cue is 100% predictive of the location of the upcoming target, and is equally likely to occur above or below the center fixation point. There is also a no-cue condition, which is temporally uninformative, in that it does not provide any information about the upcoming target (only the fixation cross is presented for the duration of the cuing period). Thus, this is a 4 (cue type: no cue, double cue, center cue, spatial cue) by 2 (target type: congruent, incongruent) within-subjects design. Each participant completes 24 practice trials prior to beginning the experiment, and 288 experimental trials (72 per cue condition). Trial types are randomly presented. Testing sessions lasted approximately 20 minutes.

As the ANT is a speeded response task, it provides two indicators of performance: response time (RT) and error rate (ER). RT and ER scores for each of the three attention networks can be calculated. All analyses are performed on RT scores for correct trials only. Error rates are presented as percentage correct. RT measures are calculated using the following subtractions for correct trials only. For the alerting network score RT in the double cue condition (temporally informative) is subtracted from RT in the no cue condition (temporally uninformative). For the orienting network score, RT in the spatial cue condition (spatially informative) is subtracted from RT in the central cue condition (spatially uninformative). For the executive control/conflict monitoring network score, RT in the congruent flanker condition is subtracted from RT in the incongruent flanker condition.
Figure 2.

*Attention Network Test Design*

*Note.* Figure reproduced from Jha et al. (2007), depicting trial sequence and timing for the Attention network test.

*Go/No-go*

*Apparatus*

Stimulus presentation and response collection were performed using E-Prime (version 2.0, Psychology Software Tools, Pittsburgh, PA), controlled by a Dell desktop computer. Participants viewed the computer screen at a distance of approximately 65 cm, and RTs were collected using a keyboard that had a 2 ms resolution for detecting keypress responses.
Stimuli and Design

The Go/No-go task is a well-established test that measures the rate of accidental responses to a rare target stimulus, as well as the tendency to respond (or not respond) during the task (i.e., response bias) (Garavan, Ross, Murphy, Roche, & Stein, 2002; Wright, Lipszyc, Dupuis, Thayapararajah, & Schachar). Thus, it is possible to evaluate rates of correctly inhibiting responses while also correctly responding to targets more generally. A stream of letters (X’s and Y’s) is visually presented serially in an alternating pattern. One letter appears every 1,000 ms, for 600ms, followed by a 400 ms blank screen. Participants press a button to respond when the stimuli are presented in an alternating pattern and withhold responding when the alternating pattern is broken. For example, participants would respond to each letter except the fifth in the following sequence: X Y X Y Y X). No-go trials occur randomly 10% of the time. The entire Go/No-go task consists of 250 letters containing 225 Go trials and 25 No-go trials. Participants completed a 60 second practice block of the task with six no-go trials, prior to beginning the experiment. Mean reaction time, number of omission errors (missed response targets), and number of commission errors (incorrectly responding to nonresponse targets) are calculated. Higher numbers of commission errors indicate greater motor impulsivity.

Weschler Adult Intelligence Scales (WAIS-IV)

The Wechsler Adult Intelligence Scale IV (WAIS-IV; Wechsler, 2008) is the standard in the assessment of general intelligence in older adolescents and adults. We administered three subtests of the WAIS-IV to evaluate specific aspects of executive functioning: Matrix Reasoning, Vocabulary, and Letter-Number Sequencing. The WAIS-IV subtests were
administered and scored exactly according to the procedures described above and specified in the WAIS scoring manual (Pearson, 2008).

In the Matrix Reasoning subtest, respondents view an incomplete matrix or series and select the response option that completes the matrix or series. Responses to each item are scored 0 (incorrect) or 1 (correct); the maximum raw score is 26, with higher scores indicating higher abilities. Matrix Reasoning is an indicator of the Perceptual Reasoning scale; assesses fluid intelligence, broad visual intelligence, classification and spatial ability, knowledge of part-whole relationships, simultaneous processing, and perceptual organization.

In the Vocabulary subtest, respondents define words that are presented visually and orally. Responses are scored from 0-2 based on the accuracy of the definition; the maximum raw score is 66, with higher scores indicating better performance. Vocabulary is a subtest of the Verbal Comprehension Scale; it assesses word knowledge and verbal concept formation. Because the Vocabulary subtest requires the examiner to score responses according to a subjective scoring system, responses were audiotaped and reviewed for secondary verification of the fidelity of the examiner’s ratings.

In the Letter-Number Sequencing subtest, respondents read a sequence of numbers and letters and recall the numbers in ascending order and the letters in alphabetical order (length of arrays of letters and numbers range from two to nine). Responses to each item are scored 0 (incorrect) or 1 (correct); the maximum raw score is 30, with higher scores indicating higher abilities. Letter-Number Sequencing is a subtest of the Working Memory Scale; it assesses sequential processing, mental manipulation, attention, concentration, memory span, and short-term auditory memory.
RESULTS

We interpreted the significance of all statistical tests using *p*-values and effect sizes. Effect sizes for independent samples *t*-tests were calculated as Cohen’s *d*, effect sizes (Cohen, 1992) were calculated as Cohen’s *f* for ANOVAs. As recommended by Cohen (1992), *d* effect sizes were interpreted as small = .20, medium = .50, large = .80; *f* effect sizes were interpreted as small = .10, medium = .25, large = .40. To adjust for family-wise error rates, we used a Bonferroni correction when interpreting the significance of group differences.

*Initial treatment of data*

We calculated an overall “correctness” score for each participant, which represented the percentage of total responses that matched the response norms of the sample of psychologically healthy individuals used in the foundational investigation (Shepherd et al., 2016). Higher correctness scores indicated that responses were more consistent with responses of healthy normal individuals and were taken to indicate better mental manipulation abilities. We identified one meditation naïve participant whose correctness score (< 14% correct) was more than two standard deviations below the sample mean correctness. This participant likely did not comply with or understand task instructions, and thus was removed from the sample to minimize his negative impact on the results. To remove bias from our estimates of RT, we also removed one experienced meditator whose mean RT was more than two standard deviations above the overall mean RT for all participants (e.g., Ratcliff, 1993). We also conducted an independent samples *t*-
test to examine group differences in levels of depression, which revealed that meditation naïve
individuals reported significantly higher levels of DASS-21 depression symptoms ($M = 3.97$, $SD$
$= 5.34$) compared with experienced meditators ($M = .85$, $SD = 1.50$), $t(36.87) = -3.07$, $p < .01$, Cohen’s $d = .80$. Because symptoms of depression are known to have a significant negative
impact on cognitive task performance, we removed five meditation naïve participants who
reported clinically significant symptoms of depression as assessed by the DASS-21 (i.e., scores
greater than 9; Henry & Crawford, 2005). The excluded individuals ($n = 7$) were significantly
younger ($M = 38.14$, $SD = 7.11$) than the included individuals ($M = 52.34$, $SD = 12.91$), $t(13.1) =$
$4.31$, $p < .01$.

After excluding the above participants, the final sample included 20 experienced
meditators (50% female; 85% Caucasian; mean age = 57.35, $SD = 12.38$, age range = 26-72
years) and 26 meditation naïve participants (69.2% female; 73.1% Caucasian; mean age = 48.48,
$SD = 12.16$, age range = 27-65 years). Of the experienced meditators, 60% reported having a
professional degree, 25% had a four-year college degree, 10% had one to three years of college,
and 5% were high school graduates. Of the meditation naïve participants, 42% reported having a
professional degree, 31% had a four-year college degree, 23% had one to three years of college,
and 4% were high school graduates.

Experienced meditators had an average of 5066 hours of lifetime meditation experience
($SD = 3948$ hours) or an average of 21 years of experience ($SD = 15$ years). Meditators reported
practicing the following range of meditation styles, which we categorized here according to the
family of skills they involve as defined by Dahl and colleagues (2015): those that target attention
regulation and meta-awareness (“attentional” practices), perspective taking and reappraisal
(“constructive” practices), and self-inquiry (“deconstructive” practices).
Fifty-five percent of meditators said a substantial portion of their practice involved *Mindfulness Training* (attentional and deconstructive skills), 50% regularly practiced *Meditative Contemplation* (deconstructive skills), 40% practiced *Mind Training* (*Tonglen*, *Loving Kindness*, etc.) (constructive skills), 30% practiced *Zen Meditation* (attentional, constructive, and deconstructive skills), 30% practiced *Transcendental Meditation* (attentional skills), 25% practiced *Shamatha* (attentional skills), 25% practiced *Sadhana* (attentional skills), 15% practiced *Mahamudra* (deconstructive skills), 10% practiced *Vipassana* (deconstructive skills), 10% practiced *Ngondro* (uncategorized), and 35% regularly practiced another uncategorized style (e.g., *Shambhala Tantra*, *Yogic Meditation*).

*Tests of preliminary group difference hypotheses*

*Self-report measures*

Cronbach’s alphas for all self-report measures were in the range of acceptable to excellent, except for behavioral inhibition (BIS/BAS) and Anxiety (DASS-21), which were in the range of poor. All alphas are reported in Table 1. We used independent samples t-tests to examine group differences in self-report measures of mindfulness (FFMQ), decentering (EQ), rumination (RRS), worry (PSWQ), depression, anxiety, and stress (DASS-21), behavioral inhibition and activation (BIS/BAS), and personality (NEO-FFI). Results of these comparisons are reported in Table 1. Experienced meditators reported significantly higher levels of EQ *decentering* (single factor; large effect), and decentering facets: *distanced perspective* (large effect) and *accepting self-perception* (medium to large effect); as well as higher levels of FFMQ facets of mindfulness: *non-reacting*, *observing*, and *non-judging* (large effects). Meditators also reported higher levels of *acting with awareness* (medium to large effect) and *describing* (trend-
level, medium effect); however the group differences in *acting with awareness* and *describing* scores did not survive a Bonferonni correction of $p < 0.05/5$. On the NEO-FFI, experienced meditators also reported lower levels of *neuroticism* (large effect) and higher levels of *openness to experience* (medium to large effect); however the group difference in *openness to experience* did not survive a Bonferonni correction of $p < 0.05/5$. On the BIS/BAS scales, experienced meditators also reported lower levels of *behavioral inhibition* and *reward responsiveness* (medium effects) when compared to their meditation naïve counterparts. Experienced meditators and meditation naïve individuals did not significantly differ on any other dimensions of personality, rumination, worry, or symptom levels; however there was a nonsignificant trend for experienced meditators to have fewer symptoms of depression and stress, as indicated by DASS-21 scores (medium effects). Zero-order correlations between all self-report measures are presented in Table 5.
Table 1.

**Self-report Measure Means for Experienced Meditator and Meditation Naïve Groups**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Experienced meditator</th>
<th>Meditation naïve</th>
<th>t</th>
<th>df</th>
<th>Cohen’s d</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 20)</td>
<td>(n = 26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression (DASS-21)</td>
<td>.85 (1.50)</td>
<td>1.88 (2.07)</td>
<td>-1.89†</td>
<td>44</td>
<td>.57</td>
<td>.77</td>
</tr>
<tr>
<td>Anxiety (DASS-21)</td>
<td>1.45 (1.57)</td>
<td>1.58 (2.06)</td>
<td>- .23</td>
<td>44</td>
<td>.07</td>
<td>.58</td>
</tr>
<tr>
<td>Stress (DASS-21)</td>
<td>2.25 (2.31)</td>
<td>3.50 (2.55)</td>
<td>-1.72†</td>
<td>44</td>
<td>.51</td>
<td>.71</td>
</tr>
<tr>
<td>Brooding (RRS)</td>
<td>7.25 (2.77)</td>
<td>7.69 (2.90)</td>
<td>- .52</td>
<td>44</td>
<td>.16</td>
<td>.86</td>
</tr>
<tr>
<td>Pondering (RRS)</td>
<td>8.85 (4.33)</td>
<td>9.19 (3.32)</td>
<td>-.30</td>
<td>44</td>
<td>.09</td>
<td>.87</td>
</tr>
<tr>
<td>Worry (PSWQ)</td>
<td>33.37 (9.56)</td>
<td>36.36 (11.67)</td>
<td>- .91</td>
<td>42</td>
<td>.28</td>
<td>.89</td>
</tr>
<tr>
<td>Decentering (EQ)</td>
<td>44.75 (5.59)</td>
<td>38.92 (6.25)</td>
<td>3.28**</td>
<td>44</td>
<td>.98</td>
<td>.89</td>
</tr>
<tr>
<td>Distancing (EQ)</td>
<td>14.80 (1.88)</td>
<td>12.81 (2.83)</td>
<td>2.72**</td>
<td>44</td>
<td>.83</td>
<td>.74</td>
</tr>
<tr>
<td>Accepting (EQ)</td>
<td>16.80 (2.44)</td>
<td>14.85 (2.77)</td>
<td>2.95*</td>
<td>44</td>
<td>.75</td>
<td>.80</td>
</tr>
<tr>
<td>Observing (FFMQ)</td>
<td>32.60 (5.04)</td>
<td>27.96 (5.47)</td>
<td>2.95**</td>
<td>44</td>
<td>.88</td>
<td>.89</td>
</tr>
<tr>
<td>Describing (FFMQ)</td>
<td>33.10 (5.42)</td>
<td>29.81 (6.27)</td>
<td>1.87†</td>
<td>44</td>
<td>.56</td>
<td>.93</td>
</tr>
<tr>
<td>Acting Aware (FFMQ)</td>
<td>31.55 (3.73)</td>
<td>28.19 (5.97)</td>
<td>2.20*</td>
<td>44</td>
<td>.68</td>
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<td>Non-judging (FFMQ)</td>
<td>34.40 (5.38)</td>
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<td>Neuroticism (NEO-FFI)</td>
<td>22.20 (5.83)</td>
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<td>.83</td>
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<td>Extraversion (NEO-FFI)</td>
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<td>36.81 (6.41)</td>
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<td>Drive (BAS)</td>
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*Note.* † = p ≤ .1, * = p ≤ .05, ** = p ≤ .01, *** = p ≤ .001. Standard deviations appear in parentheses.
Wechsler Adult Intelligence Scale (WAIS-IV)

To examine group differences in the three WAIS subtests, we ran three independent samples t-tests: one for each subtest, using raw scores as dependent variables and group as the independent variable. Results of these comparisons are reported in Table 2. Experienced meditators did not differ from meditation naïve individuals on working memory or perceptual reasoning; however, we observed a trend for experienced meditators to have superior verbal comprehension (medium effect).

Table 2.

Wechsler Adult Intelligence Scale (WAIS-IV) Means for Experienced Meditator and Meditation Naïve Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Experienced meditator (n = 20)</th>
<th>Meditation naïve (n = 26)</th>
<th>t</th>
<th>df</th>
<th>Cohen’s d</th>
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</thead>
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<tr>
<td>Letter-Number Sequencing</td>
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<td>Matrix Reasoning</td>
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<td>.77</td>
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<td>.23</td>
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<td>Vocabulary</td>
<td>51.21 (6.80)</td>
<td>46.96 (7.76)</td>
<td>1.91†</td>
<td>43</td>
<td>.58</td>
</tr>
</tbody>
</table>

Attention Network Test (ANT)

To examine group differences in ANT performance, we ran six independent samples $t$-tests: one with RT difference scores as the dependent variable and one with ER difference scores as the dependent variable for each of the attention networks (alerting, orienting, and conflict monitoring), with group as the independent variable. Results of these comparisons are reported in Table 3. There were no differences between groups in accuracy for any subsystem of attention; however, we observed the following results with regard to RT. Experienced meditators (versus meditation naïve individuals) reported smaller alerting subsystem difference scores, indicating that experienced meditators were more responsive to alerting cues (medium to large effect). There were no significant differences between groups in orienting subsystem difference scores. Additionally, there were no significant group differences in conflict monitoring; however, experienced meditators demonstrated a tendency toward smaller conflict monitoring subsystem difference scores (medium effect), suggesting they were somewhat less susceptible to interference by incongruous cues compared to meditation naïve individuals.
Table 3.

Attention Network Test Difference Score Means for Experienced Meditator and Meditation Naïve Groups

<table>
<thead>
<tr>
<th>Measure</th>
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<th>t</th>
<th>df</th>
<th>Cohen’s d</th>
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<tr>
<td></td>
<td>(n = 20)</td>
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<tr>
<td>Alerting</td>
<td>Meditation naïve</td>
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<tr>
<td></td>
<td>(n = 26)</td>
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<tr>
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<tr>
<td>Reaction Time</td>
<td>33.74 (22.85)</td>
<td>49.88 (22.18)</td>
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<td>44</td>
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<tr>
<td>Orienting</td>
<td>Error Rate</td>
<td>-.006 (.015)</td>
<td>-.006 (.014)</td>
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<td></td>
<td>Reaction Time</td>
<td>53.27 (31.10)</td>
<td>53.63 (24.42)</td>
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<td>Conflict</td>
<td>Error Rate</td>
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<tr>
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<td>Reaction Time</td>
<td>111.02 (35.47)</td>
<td>132.68 (50.02)</td>
<td>-1.64</td>
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*Note. * = p ≤ .05. Standard deviations appear in parentheses. Reaction time (RT) and Error rate means are presented as difference scores. Error rates are calculated as percentage correct. RT is calculated using the following subtractions for correct trials only. Alerting = No cue condition (temporally uninformative) minus double cue condition (temporally informative). Orienting = Central cue condition (spatially uninformative) minus spatial cue condition (spatially informative). Conflict monitoring = Incongruent flanker condition minus congruent flanker condition.
Go/No-go

To examine group differences in Go/No-go performance, we ran two independent samples t-tests with errors of commission and errors of omission as dependent variables, and group as the independent variable. Results of these comparisons are reported in Table 4. Experienced meditators did not differ from meditation naïve individuals in errors of commission, indicating the groups were similar in motor impulsivity. Experienced meditators tended to produce fewer errors of omission as indicated by an effect size approaching conventions for a medium effect, however the group difference was not statistically significant.

Table 4.

Go/No-Go Error Rate Means for Experienced Meditator and Meditation Naïve Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Experienced Meditator (n = 20)</th>
<th>Meditation Naïve (n = 26)</th>
<th>t</th>
<th>df</th>
<th>Cohen’s d</th>
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<td>Commission Errors</td>
<td>11.75 (5.53)</td>
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<tr>
<td>Omission Errors</td>
<td>26.75 (8.90)</td>
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<td>-1.57</td>
<td>42.52</td>
<td>0.45</td>
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</table>

Note. Standard deviations appear in parentheses.
Table 5.

Zero-order Correlations Between Measures

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<th>5</th>
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**Note.** N = 46 for all correlations. † = p ≤ .1, * = p ≤ .05, ** = p ≤ .01, *** = p ≤ .001. ANT alerting, orienting, and conflict monitoring scores are RT difference scores, calculated using the following subtractions for correct trials only. Alerting = No cue condition (temporally uninformative) minus double cue condition (temporally informative). Orienting = Central cue condition (spatially uninformative) minus spatial cue condition (spatially informative). Conflict monitoring = Incongruent flanker condition minus congruent flanker condition.
Tests of self-distancing task responses

Test of preliminary validation hypothesis

First, we examined the distribution of responses for response “ambiguity” (i.e., uncertainty with regard to whether a stimulus object would or would not fit in the hand or shoebox). We calculated an ambiguity score for each stimulus depending on the condition in which it appeared (i.e., hand or shoebox). This score represents the percentage of total responses that were inconsistent with the modal, “correct” responses of healthy individuals, determined in the foundational investigation (Shepherd et al., 2016). Higher scores indicate higher levels of ambiguity. Second, we examined the proportion of “Yes” responses in each condition to confirm that responses were balanced across conditions.

Ambiguity hypothesis: Consistent with results of the foundational investigation, we did not expect levels of ambiguity to vary as a function of context or valence manipulations across all participants.

Test of ambiguity hypothesis: Ambiguity scores were subjected to a 2 × 2 repeated measures analysis of variance with context (hand, shoebox) and valence (negative, neutral) as within-subject factors. Mean ambiguity was 28.55% (SD = 27.71) for the “neutral/hand” condition, 38.90% (SD = 33.87) for the “neutral/shoebox” condition, 14.65% (SD = 17.36) for the “negative/hand” condition, and 21.77% (SD = 26.66) for the “negative/shoebox” condition. Contrary to expectations, we observed main effects of valence, $F(1,71) = 15.96, p < .001$, Cohen’s $f = .47$, and context, $F(1,71) = 37.13, p < .001$, $f = .72$ on ambiguity. Specifically, ambiguity was greater for neutral objects ($M = 33.73\%, \ SE = 3.51$) relative to negative objects ($M = 18.21\%, \ SE = 2.46$), and ambiguity was greater in the shoebox condition ($M = 30.33\%, \ SE = 2.76$) relative to the hand condition ($M = 21.60\%, \ SE = 2.04$). There were no interactions of
valence × context on ambiguity scores, $F(1,71) = 1.33, p = .25, f = .14$. These findings indicate that levels of ambiguity were associated with the manipulations of interest, and represented a confound in interpreting effects of valence and context manipulations on dependent variables (i.e., RT, correctness, and negative affect). Therefore, prior to testing more specific hypotheses, we elected to remove trials for which responses were deemed highly ambiguous to control for problematic effects of ambiguity.

We used the following procedure to control for ambiguity. First, we identified stimuli with greater than 40% ambiguity (i.e., greater than 40% of responses were inconsistent with the modal response). A 40% threshold was also used to identify ambiguous trials in the foundational investigation. This procedure resulted in removal of approximately 33% of trials (13 trials from the “neutral/hand” condition, 26 trials from the “neutral/shoebox” condition, 1 trial from the “negative/hand” condition, and 9 trials from the “negative/shoebox” condition). After removing ambiguous trials for each participant, the effects of valence and distance were no longer significant: the $2 \times 2$ rmANOVA revealed no main effects of valence, $F(1,46) = 1.78, p = .19, f = .20$, and context, $F(1,46) = .00, p = .97, f = .00$, and no interactions of valence × context on ambiguity scores, $F(1,46) = .24, p = .63, f = .10$. The mean ambiguity was 18.19% ($SD = 15.91$) for the “neutral/hand” context, 16.97% ($SD = 16.91$) for the “neutral/shoebox” condition, 13.54% ($SD = 14.79$) for the “negative/hand” condition, and 14.61% ($SD = 17.54$) for the “negative/shoebox” condition.

Response type hypothesis: We did not expect the proportion of “Yes” responses to vary as a function of context or valence manipulations across all participants.

Test of response type hypothesis: We calculated the percentage of “Yes” responses given in each condition, and “Yes” response percentages were then subjected to $2 \times 2 \times 2$ mixed-
design analysis of variance with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor. The ANOVA revealed significant main effects of valence, $F(1, 44) = 99.45, p < .001, f = 1.50$, and context, $F(1, 44) = 21.20, p < .001, f = .69$, and a significant valence $\times$ context interaction, $F(1, 44) = 5.42, p = .03, f = .35$. The percentage of “Yes” responses was generally higher for neutral ($M = 47.59, SE = 1.43$) vs. negative ($M = 38.43, SE = 1.21$) objects, and generally higher in the shoebox ($M = 47.02, SE = 1.30$) vs. hand ($M = 39.00, SE = 1.70$) context. However, the effect of valence on “Yes” responses was greater in the shoebox, $t(45) = 6.87, p < .001$, vs. hand context, $t(45) = 2.75, p < .01$. There were no two-way interactions of valence $\times$ group, $F(1, 44) = .01, p = .91, f = .00$, or context $\times$ group, $F(1, 44) = .01, p = .93, f = .00$, and no three-way interaction of valence $\times$ context $\times$ group, $F(1, 44) = .04, p = .85, f = .03$.

Overall, these results revealed an imbalance of response types across conditions, indicating that “Yes” and “No” responses should be examined separately for correctness and RT. The pattern of “Yes” responses across conditions was similar for meditators and meditation naïve individuals. Condition means are displayed in Figure 3.
Figure 3.

Percentage of “Yes” Responses for Experienced Meditator and Meditation Naïve Groups

Note. Percentage “Yes” responses by valence and context conditions for meditation naïve individuals (A) and experienced meditators (B). Error bars represent Standard Errors.

Tests of primary validation hypotheses

In stage two of self-distancing task response validation, we examined the interactions of valence (negative, neutral) and context (hand, shoebox) on negative affect, correctness, and RT, between groups (experienced meditators, meditation naïve individuals).

Negative Affect

Negative affect hypotheses: Overall, we expected participants to demonstrate higher negative affect to negative versus neutral trials; however, this difference between negative and neutral trials would be smaller in the shoebox (low-threat) context compared with the hand (high-threat) context. In addition, we predicted group would moderate the interaction between valence and context on negative affect: experienced meditators (versus meditation naïve individuals) would demonstrate smaller differences in negative affect to negative versus neutral trials in the shoebox (low-threat) context.

Tests of negative affect hypotheses: The four negative affect ratings were subjected to 2 × 2 × 2 mixed-design analysis of variance with context (hand, shoebox) and valence (negative,
neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor.

Consistent with expectations, the mixed-design ANOVA revealed a significant interaction of context $\times$ valence, $F(1,45) = 7.57, p < .01, f = .40$, indicating that the effect of valence on negative affect varied by context. Paired-samples t-tests revealed that the effect of valence was significant in the hand/high-threat context, $t(45) = 2.43, p < .05, d = .42$, where participants reported higher levels of negative affect following negative object blocks ($M = 6.93, SD = 1.79$) relative to neutral object blocks ($M = 6.35, SD = .77$). However the effect of valence was not significant in the shoebox/low-threat context, $t(45) = -2.22, p = .83, d = .03$, where there was no difference in negative affect following negative object blocks ($M = 6.39, SD = 1.47$) compared with neutral object blocks ($M = 6.43, SD = .72$). There was a main effect of context, such that negative affect was generally higher in the hand ($M = 6.64, SE = .17$) versus shoebox ($M = 6.41, SE = .14$) context, $F(1,44) = 5.50, p < .05, f = .35$. There was no main effect of valence, $F(1,44) = 2.05, p = .16, f = .22$. Contrary to expectations, the effects of valence and context on negative affect did not vary with meditation experience. In other words, there were no significant two-way interactions of group with valence, $F(1,44) = .02, p = .90, f = .00$, or group with context, $F(1,44) = .07, p = .80, f = .05$, and there was no significant three-way interaction of group $\times$ valence $\times$ context, $F(1,44) = .01, p = .91, f = .00$. Means and standard errors for both groups are presented in Figure 4.
Figure 4.

*Negative Affect Means for Experienced Meditator and Meditation Naïve Groups*

Note. Mean negative affect by valence and context conditions for meditation naïve individuals (A) and experienced meditators (B). Error bars represent Standard Errors. Negative affect was measured using selected items from the Positive and Negative Affectivity Schedule presented after each condition block.

**Correctness**

After removing the ambiguous trials according to the procedures described above, we recalculated “correctness” scores. The mean correctness for the whole sample was 84% correct ($SD = 7.43$). Condition means and standard errors are displayed in Figure 5.

**Correctness hypotheses**: Overall, we expected participants to demonstrate higher levels of correctness, to negative versus neutral trials; however, this difference between negative versus neutral trials would be smaller in the shoebox (low-threat) context compared with the hand (high-threat) context. In addition, we predicted group would moderate the interaction between valence and context on correctness: experienced meditators (versus meditation naïve individuals) would demonstrate smaller differences in correctness to negative versus neutral trials in the shoebox (low-threat) context.
Tests of correctness hypotheses: Correctness was subjected to a $2 \times 2 \times 2$ mixed-design ANOVA with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor. We predicted there would be a significant three-way interaction of context $\times$ valence $\times$ group on correctness (i.e., the interactional effects of context and valence on correctness would vary by group).

Contrary to predictions, the mixed design ANOVA revealed no significant two-way interaction of context $\times$ valence, $F(1,44) = .29, p = .60, f = .08$, indicating that the effect of valence on correctness did not vary by context. Furthermore, there was no significant three-way interaction of valence $\times$ context $\times$ group, $F(1,44) = .70, p = .41, f = .13$, indicating that the interactional effects of valence and context on correctness did not vary with meditation experience.

However, the ANOVA did reveal a main effect of valence, $F(1,44) = 9.76, p < .01, f = .47$, which was in the predicted direction. Specifically, mean correctness was greater for negative objects ($M = 85.88, SE = 1.04$) relative to neutral objects ($M = 82.40, SE = 1.48$), indicating that participants were better able to judge the relative size of negative versus neutral objects. There was no main effect of context, $F(1,44) = .02, p = .88, f = .03$, indicating that participants were equally adept at judging the size of objects in the hand and shoebox trials. Finally, there was no two-way interaction of valence $\times$ group, $F(1,44) = .43, p = .52, f = .10$, indicating that the difference in correctness to negative versus neutral trials did not vary with meditation experience, and there was no two-way interaction of context $\times$ group, $F(1,44) = .30, p$

3Prior to removing ambiguous trials, we observed main effects of valence and context on correctness. Specifically, correctness was higher for negative objects vs. neutral objects, and higher for the hand context vs. the shoebox context. There were no other significant main effects or interactions of valence, context, and group.

4Removing individuals who endorsed DASS-21 depression symptoms greater than 2, did not significantly affect the results of the correctness hypothesis test.
59, \( f = .08 \), indicating that the difference in correctness to hand and shoebox trials on correctness did not vary with meditation experience.

Figure 5.

*Correctness Means for Experienced Meditator and Meditation Naïve Groups*

*Note.* Correctness scores by valence and context conditions for meditation naïve individuals (A) and experienced meditators (B). Correctness scores are calculated as percentages. Error bars represent Standard Errors.

Tests of correctness hypotheses by response type: Given the observed imbalance in response types across conditions (i.e., proportion of “Yes” responses), we conducted additional tests of correctness hypotheses for “Yes” and “No” responses separately. Specifically, we examined all trials for which an individual gave a particular response (i.e., "Yes" or "No") and computed the proportion of those trials that were correct (i.e., “correctness scores”).

“Yes” responses. Correctness scores were subjected to 2 × 2 × 2 mixed-design analysis of variance with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor. The ANOVA revealed no main effects of valence, \( F(1, 44) = .30, p = .59, f = .08 \), or context, \( F(1, 44) = .37, p = .55, f = .09 \), and no significant valence × context interaction, \( F(1, 44) = .02, p = .90, f = .00 \). There were also no two-way interactions of valence × group, \( F(1, 44) = .04, p = .84, f = .03 \), or
context × group, $F(1, 44) = .14, p = .71, f = .05$, and no three-way interaction of valence × context × group, $F(1, 44) = 2.45, p = .12, f = .24$. Together, results indicating that correctness did not vary by context, valence, or group for trials in which participants responded “Yes.”

Condition means are displayed below in Figure 6a and 6b.

“No” responses. Correctness scores were subjected to $2 \times 2 \times 2$ mixed-design analysis of variance with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor. The ANOVA revealed no main effects of valence, $F(1, 44) = 1.27, p = .27, f = .17$, or context, $F(1, 44) = .06, p = .81, f = .00$, and no significant valence × context interaction, $F(1, 44) = .03, p = .86, f = .03$. There were also no two-way interactions of valence × group, $F(1, 44) = .64, p = .43, f = .12$, or context × group, $F(1, 44) = .06, p = .81, f = .03$. However, there was a significant three-way interaction of valence × context × group, $F(1, 44) = 7.68, p < .01, f = .42$, indicating that the effects of valence and context on correctness for “No” responses varied between meditators and meditation naïve individuals. Specifically, in the hand context, there was no difference between meditation naïve individuals ($M = .00, SD = .06$) and experienced meditators ($M = .03, SD = .09$) in correctness difference scores, $t(44) = 1.35, p = .19$; however, in the shoebox context, the difference in correctness to negative minus neutral objects was greater for meditation naïve individuals ($M = .04, SD = .16$) than for experienced meditators ($M = -.02, SD = .07$), $t(44) = -2.04, p < .05$. Condition means are displayed below in Figure 6c and 6d.
Figure 6.

Correctness Means by Response Type for Experienced Meditator and Meditation Naïve Groups

Note. Mean correctness for “Yes” responses for (A) meditation naïve individuals and (B) experienced meditators. Mean correctness for “No” responses for (C) meditation naïve individuals and (D) experienced meditators.

Response time (RT)

For all RT analyses, we used median RTs, as they are less sensitive to outliers than arithmetic means (Heuer et al., 2007).

Response time (RT) hypotheses: Overall, we expected participants to demonstrate longer RTs to negative versus neutral trials; however, this difference between negative versus neutral trials would be smaller in the shoebox (low-threat) context compared with the hand (high-threat) context. Furthermore, we expected that the interaction of valence by context on RT would be stronger in individuals who demonstrated higher levels of correctness, because low levels of correctness were expected to obscure genuine effects of task conditions on RT. Finally, group
would moderate the interaction between valence and context on RT: experienced meditators (versus meditation naïve individuals) would demonstrate smaller differences in RT to negative versus neutral trials in the shoebox (low-threat) context.

Tests of RT hypotheses: Median RTs were subjected to a $2 \times 2 \times 2$ mixed-design ANCOVA with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, group (experienced meditators, meditation naïve) as a between-subjects factor, and correctness as a covariate. Condition means and standard errors are displayed in Figure 7.

Contrary to expectations, the ANCOVA did not reveal a significant two-way interaction of context $\times$ valence, $F(1,43) = .11, p = .74, f = .05$, indicating that the effect of valence on RT did not vary by context. There was also no interaction of valence $\times$ context $\times$ correctness (covariate), $F(1,43) = .19, p = .67, f = .06$, indicating that the interactional effects of context and valence on RT did not vary with levels of correctness. Furthermore, there was no three-way interaction of valence $\times$ context $\times$ group, $F(1,43) = .86, p = .36, f = .14$, indicating that the interactional effects of valence and context on RT did not vary with meditation experience.

Additionally, we did not observe any main effects of valence, $F(1,43) = .32, p = .58, f = .08$, or context, $F(1,43) = .71, p = .40, f = .13$. There were no two-way interactions of valence $\times$ group, $F(1,43) = .36, p = .55, f = .09$, valence $\times$ correctness, $F(1,43) = .18, p = .68, f = .06$, context $\times$ group, $F(1,43) = .08, p = .78, f = .04$, or context $\times$ correctness, $F(1,43) = 1.0, p = .32, f = .15$. In sum, results indicate that RT did not vary as a function of valence and context, and the

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5 Prior to removing ambiguous trials, there were no significant main effects or interactions of valence, context, and group on RT.

6 We observed a significant main effect of context on RT if individuals who endorsed DASS-21 depression symptoms greater than 2 were excluded from the sample (i.e., excluding $n = 2$ experienced meditators and $n = 8$ meditation naïve individuals): participants responded more slowly in the shoebox vs. hand context.

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relationship between valence and correctness on RT did not vary as a function of correctness or group.

Figure 7.
Response Time Means for Experienced Meditator and Meditation Naïve Groups

Note. Median response time by valence and context conditions for meditation naïve individuals (A) and experienced meditators (B). Means are adjusted for correctness. Error bars represent Standard Errors.

Tests of RT hypotheses by response type: Given the observed imbalance in response types across conditions (i.e., proportion of “Yes” responses), we conducted additional tests of RT hypotheses for “Yes” and “No” responses separately. We examined all trials for which an individual gave a particular response (i.e., “Yes” or “No”) and calculated the median RT for those trials.

“Yes” responses. Median RTs were subjected to $2 \times 2 \times 2$ mixed-design analysis of variance with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor. The ANOVA revealed significant main effects of valence, $F(1, 44) = 14.54, p < .001, f = .57$, and context, $F(1, 44) = 10.13, p < .01, f = .48$, and a trending valence x context interaction, $F(1, 44) = 3.51, p = .07, f = .28$. Participants generally took longer to respond to negative ($M = 1378, SE = 61$) vs.
neutral objects ($M = 1217, SE = 56$), and longer to respond in the hand context ($M = 1372, SE = 63$) vs. the shoebox ($M = 1222, SE = 55$) context. However, the difference in RT to negative vs. neutral objects was smaller in the shoebox ($M = 96, SE = 45$) vs. the hand condition ($M = 222, SE = 65$). There were no two-way interactions of valence $\times$ group, $F(1, 44) = .16, p = .69, f = .06$, or context $\times$ group, $F(1, 44) = .30, p = .59, f = .08$, and no three-way interaction of valence $\times$ context $\times$ group, $F(1, 44) = 2.07, p = .16, f = .22$, indicating that the effects of valence and context on RT for “Yes” responses were similar for meditators and meditation naïve individuals. Condition means are displayed below in Figure 8a and 8b.

“No” responses. Median RTs were subjected to $2 \times 2 \times 2$ mixed-design analysis of variance with context (hand, shoebox) and valence (negative, neutral) as within-subject factors, and group (meditation naïve, experienced meditator) as a between-subjects factor. The ANOVA revealed no significant main effects of valence, $F(1, 44) = .57, p = .46, f = .11$, or context, $F(1, 44) = .07, p = .80, f = .04$, and no significant valence $\times$ context interaction, $F(1, 44) = .02, p = .89, f = .00$. There were also no two-way interactions of valence $\times$ group, $F(1, 44) = .08, p = .78, f = .04$, or context $\times$ group, $F(1, 44) = .09, p = .77, f = .04$, and no three-way interaction of valence $\times$ context $\times$ group, $F(1, 44) = .00, p = .99, f = .00$. Together, results indicate that RT did not vary by valence, context, or group, for trials in which participants responded “No.” Condition means are displayed below in Figure 8c and 8d.
Figure 8.

*Response Time Means by Response Type for Experienced Meditator and Meditation Naïve Groups*

Note. Median RT for “Yes” responses for (A) meditation naïve individuals and (B) experienced meditators. Median RT for “No” responses for (C) meditation naïve individuals and (D) experienced meditators.
DISCUSSION

As mindfulness-based interventions (e.g., MBCT, MBSR, DBT, ACT) increase in popularity, there is a growing need for more objective measures of mindfulness and decentering that can be used to evaluate and compare their benefits with other psychotherapeutic interventions. In a previous investigation, we developed a self-distancing task to capture the capacity to mentally manipulate emotional material away from the self (self-distance), as self-distancing is thought to be: 1) a theoretically important facet of decentering, 2) a skill that is exercised in mindfulness-based interventions, and 3) an important element of adaptive emotional processing. The foundational study provided preliminary support that self-distancing task responses were associated with self-reported mindfulness and decentering abilities in the predicted manner. The current investigation represented a next step in validating self-distancing task responses by examining whether the responses of individuals with substantial meditation experience were comparable to those of individuals with high levels of self-reported mindfulness in the foundational study.

In the current investigation, we compared self-distancing task responses in long-term meditators and meditation naïve control participants, ensuring that control participants were well matched to the long-term meditators on characteristics that might bias responses (i.e., age and levels of depression). In addition, we obtained a range of measures of cognitive, emotional, and intellectual functioning to better characterize group differences and identify correlates of self-distancing task performance. We found that experienced meditators and meditation naïve
individuals differed on several dimensions of cognitive, emotional, and executive functioning; however, examination of self-distancing task responses revealed that responses largely were not associated with meditation experience. Self-distancing task results additionally revealed imbalances across conditions in response ambiguity and type (i.e., proportion of “Yes” and “No” responses), which required removing a large number of trials post-hoc, and conducting trial item analysis to minimize confounding variables. Below, we discuss implications of the observed meditation group differences, consider possible explanations for the observed self-distancing task results, and suggest future directions for further task refinement and response validation.

**Group differences**

In a preliminary group comparison, we found that experienced meditators demonstrated lower levels of depression compared with meditation naïve individuals. This observation is consistent with results of numerous studies suggesting that experience in mindfulness meditation is associated with lower levels of psychopathology (for review, see Baer, 2003), and that mindfulness-based interventions can reduce rates of depressive relapse in individuals with a history of recurrent Major Depressive Disorder (Piet & Hougaard, 2011; Teasdale et al., 2000). However, as depression was previously shown to negatively impact performance on the self-distancing task (Shepherd et al., 2016), and to be associated with general executive impairments more broadly (Gotlib & Joormann, 2010; Joormann et al., 2011; Mathews & MacLeod, 2005), we removed individuals with high levels of depression from the meditation naïve sample. As a result, depression symptoms for both groups were in the normal, non-depressed range of scores (Henry & Crawford, 2005), suggesting the group differences we observed in other self-report and behavioral measures are not likely attributable to differences in depression.
Results of other self-report measure comparisons indicated that experienced meditators and meditation naïve individuals did not differ in terms of their tendency to engage in negative self-referential thinking (i.e., rumination and worry), which is linked to the development and maintenance of many forms of psychopathology (Mennin & Fresco, 2013; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). However, as expected, experienced meditators generally had a higher dispositional, trait mindfulness and decentering. In particular, experienced meditators reported higher levels of facets of mindfulness (observing, non-reacting, and non-judging) and decentering (distanced perspective and accepting self-perception). To a lesser extent, experienced meditators reported higher levels of mindful acting with awareness and describing; however, neither subscale rose to the level of statistical significance when controlling for multiple comparisons. These findings are consistent with the numerous studies documenting associations between self-report measures of mindfulness and meditation training (for review, see Baer et al., 2009), decentering and mindfulness (Carmody et al., 2009; Tanay et al., 2012), and treatment with mindfulness-based interventions (Bieling et al., 2012; Hoge et al., 2015; Mennin et al., 2015). Relatively weaker findings for the FFMQ acting with awareness and describing scales could suggest that those facets have less predictive validity in distinguishing meditators from non-meditators. Accordingly, Baer and colleagues (2007) found that experienced meditators scored higher than non-meditating comparison samples on all FFMQ facets, except acting with awareness. Furthermore, the weaker relationship with the describing facet may reflect the notion that many meditation practices do not strongly emphasize labeling of experiences (Baer et al., 2009).

In addition, we found that experienced meditators differed in terms of personality characteristics, which are thought to be relatively stable, enduring traits of individuals.
Specifically, meditators reported a tendency to have lower neuroticism, to be less responsive to rewards, to be less behaviorally inhibited, and to be slightly more open to experiences when compared with their meditation naïve counterparts. Measures of behavioral inhibition and neuroticism are believed to reflect higher anticipation of and sensitivity to the occurrence of negative events, whereas reward responsiveness reflects higher levels of anticipation of and sensitivity to the occurrence of positive events (Carver & White, 1994; Smits & Boeck, 2006); openness to experience describes the tendency to be open to feelings, new ideas, and to have flexibility in thinking (Smits & Boeck, 2006). These differences are consistent with previous research demonstrating higher levels of openness to experience in experienced meditators compared with meditation naïve controls, and showing that the amount of meditation experience was negatively associated with neuroticism (van den Hurk et al., 2011).

Taken together, the self-reported traits of meditators appear to be consistent with conceptualizations of skills exercised in various forms of contemplative practices, (e.g., “equanimity,” or the ability to view experiences with an attitude of openness and acceptance, and maintain an even-minded mental state toward experiences or objects, regardless of their affective valence or source) (Baer, 2003; Desbordes et al., 2014). Although we cannot conclude on the basis of these data whether such traits predispose individuals to be interested in meditation, reflect benefits of meditation, or both, recent evidence indicates that personality characteristics can change over the course of adulthood due to factors other than age (i.e., social demands and experiences) (Specht, Egloff, & Schmukle, 2011), and thus may be sensitive to training in meditation.

In terms of WAIS-IV indicators of intellectual functioning, meditators demonstrated a trend toward superior verbal comprehension, but did not differ from meditation naïve individuals
in terms of working memory or perceptual reasoning abilities. Meditators’ small advantage in verbal comprehension may reflect the slightly higher number of college-educated individuals in the experienced meditator group (i.e., 85% of meditators had a college degree vs. 73% of meditation naïve). However, the finding that the groups did not differ in working memory capacity is somewhat surprising given reports of higher working memory capacity in practitioners as demonstrated by other researchers (Chambers et al., 2008; Jha et al., 2010; van Vugt & Jha, 2011), and that working memory capacity is linked to executive control of attention, which is explicitly cultivated in many forms of meditation practice (Engle, 2002; Joormann et al., 2011). It is possible that the measure of working memory used herein is not sensitive enough to group differences; however, additional studies are needed to clarify the relationship between meditation experience and working memory capacity.

With regard to executive attention as measured by the ANT, meditators demonstrated advantages in alerting capacity (reduced RT difference scores for cued versus no-cue trials), as well as a marginal advantage in conflict monitoring (i.e., reduced flanker interference in RT), compared to their meditation naïve counterparts; however, there were no differences between the groups in orienting system scores. The superior alerting performance of meditators indicates they were able to maintain a vigilant state of preparedness even when no warning of target onset was provided; whereas, their superior conflict monitoring performance indicates meditators were better able to resolve conflicting visual information and prioritize among competing responses (Fan et al., 2002; Jha et al., 2007). These findings are consistent with previous studies demonstrating superior conflict monitoring and alerting abilities in individuals with experience in concentrative meditation techniques relative to inexperienced control participants (Baijal, Jha, Kiyonaga, Singh, & Srinivasan, 2011; Jha et al., 2007; MacLean et al., 2010). Additionally, our
results are also consistent with others, in that differences in orienting scores have not frequently been observed in comparisons of experienced meditators and naïve controls (Baijal et al., 2011; Jha et al., 2007), perhaps suggesting that orienting skills are not bolstered with long-term meditation training, or the orienting ANT measure is not sensitive to meditation-related differences.

Our ANT results also are consistent with suggestions that meditation experience is associated with advantages in “bottom-up” and “top-down” attentional capacities. The alerting system has been associated with activation of ventral frontoparietal neural pathways involved in “bottom-up” or “receptive” attentional processes, whereas conflict monitoring and orienting have been associated with activation of dorsal frontoparietal neural pathways implicated in “top-down” or voluntary control of attention (Corbetta & Shulman, 2002; Fan, McCandliss, Fossella, Flombaum, & Posner, 2005; Lutz et al., 2008). It has been suggested that advantages in top-down attention stem from training in concentrative practices, in which attention is restricted to a specific object (e.g., the breath); whereas advantages in “bottom-up” attention may stem from “receptive” meditation practices, in which attention is maintained on present moment experience, in an open and readied state, so as to be aware of any mental events or physical sensations that arise in awareness, without any effort to orient or control the focus of attention (for review see Lutz et al., 2008). Indeed, experienced meditators in the current investigation reported regularly practicing a range of concentrative and receptive practices. However, as we were not able to test causal hypotheses in the current investigation, additional longitudinal research is needed to elucidate if and how different forms of meditation alter the function of attentional networks.

Attentional skills training was the most prevalent type of training; however many practitioners also acknowledged significant experience in constructive practices (i.e., practices that emphasize perspective-taking and reappraisal skills) and deconstructive practices (i.e., practices that emphasize self-inquiry) (Dahl et al., 2015).
With regard to the Go/No-go paradigm, experienced meditators did not significantly differ from meditation naïve individuals in their ability to withhold an impulsive or habitual motor response (i.e., rates of accidental responses to a rare target stimulus). This result is somewhat surprising given that meditation experience has been previously shown to predict increased ability to suppress impulsive motor responses on response inhibition tasks (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011; Kozasa et al., 2012; Sahdra et al., 2011). Furthermore, when instructed to ignore distractor stimuli, experts in concentrative meditation practices have evidenced more neural activation of regions involved in response inhibition compared to novices (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007). One explanation for the lack of group differences in the current investigation is that meditation naïve individuals demonstrated a marginally greater tendency toward non-responsiveness during the task, which could be indicative of a response bias. Specifically, meditation naïve individuals may have been less attentive in general or adopted a strategy of responding to fewer trials overall, which would reduce their likelihood of incorrectly responding and would minimize the appearance of group differences in incorrect responses. It is also possible that the likelihood of observing differences in impulsivity errors would have been more pronounced had the duration of the testing session been lengthened with additional trial runs.

Taken together, the group differences we observed suggest that the experienced meditators in the current investigation differed from meditation naïve individuals in a manner consistent with what has been observed in previous research. Meditators demonstrated a greater capacity for mindfulness and decentering, as well as aspects of equanimity, including greater receptive attention, openness, non-reactivity to inner experience, lower neuroticism, sensitivity to punishment, and responsiveness to rewards. As this study used a cross-sectional design that
involves comparing relatively disparate groups of individuals, we cannot definitively attribute the observed differences exclusively to meditation experience. However, previous experimental and quasi-experimental investigations suggest that meditation training of novices is associated with increases in many of the qualities of equanimity that we observed here (for review see Desbordes et al., 2014). Furthermore, the capacity for equanimity is not believed to be a naturally occurring characteristic of individuals, but one that is cultivated through sustained, repeated meditation practice (Desbordes et al., 2014). Future studies employing longitudinal designs would facilitate stronger inferences about the impact of experience, and future studies using participant samples with more homogeneous training experiences would enable us to generate more specific hypotheses about the types of practices that might underlie the observed findings.

Self-distancing task

Our preliminary manipulation check analyses revealed that two key assumptions of the self-distancing task design were violated. First, we found that levels of response ambiguity were not equal across conditions: participants were less sure about the size of objects in the shoebox condition compared with the hand condition, and less sure about the size of neutral objects versus negative objects. This observation was unexpected, as levels of stimulus “ambiguity” did not systematically vary by condition in the foundational investigation (Shepherd et al., 2016). Second, we found that there was an imbalance in response type across conditions such the proportion of “Yes” responses was greater for neutral objects versus negative objects, and greater for shoebox trials versus hand trials. To equate task conditions on ambiguity and response type, we elected to remove a substantial portion of trials that were deemed ambiguous (approximately
33%), and to examine the effects of context, valence, and group on RT and correctness separately for “Yes” vs. “No” responses in the second stage of analysis.

In the second stage of analysis, we tested hypotheses stemming from our basic conceptualization that, for most individuals, a task involving mental manipulation of emotional stimuli should be more difficult in a high-threat scenario (i.e., the “hand” context) versus a low-threat scenario (i.e., the “shoebox” context); and individuals with superior mindfulness and decentering skills (i.e., experienced meditators) would be better able to manipulate emotional material in the low-threat scenario, when compared to their less adept counterparts (i.e., meditation naïve individuals).

The pattern of results for negative affect was consistent with our overarching prediction that judging the size of negative objects compared to one’s own hand would elicit more distress than judging the size of negative objects relative to a shoebox. Specifically, negative affect was higher following negative object trials relative to neutral object trials in the hand (high-threat) condition, whereas there was no difference in negative affect following negative compared with neutral object trials in the shoebox (low-threat) condition. However, contrary to our prediction that meditators would report lower levels of negative affect in the low-threat condition, negative affect did not differ between experienced meditators and meditation naïve individuals. These results suggest that meditators and naïve individuals experienced similar levels of negative affect across conditions. Nevertheless, the extent to which our manipulations elicited negative affect or other expectations about affect is unclear, as self-report measures of affect are vulnerable to validity concerns relating to individual differences in the capacity to identify emotional states, as well as demand characteristics (e.g., expectations, desirability) (e.g., Barrett, 1996; Linden, Paulhus, & Dobson, 1986). In addition, it is possible that the pattern of negative affect we
observed is confounded by imbalances in response ambiguity and type, as affect ratings were collected following condition blocks of trials and thus could not be subjected to the post-hoc trial removal and analysis by response type described above. Thus, future work is needed to replicate this pattern of results, while better controlling for ambiguity and response type imbalances. Moreover, in future studies, it would be useful to obtain psychophysiological measures of arousal and affect valence to corroborate self-report ratings.

With regard to the effects of threat context and affective valence on correctness, across all participants we observed a main effect of valence on correctness, which was in the predicted direction. Specifically, individuals were more accurate in judging the size of negative versus neutral objects, suggesting that negative object valence facilitated accuracy. This result is consistent with the foundational investigation, wherein correctness was higher for negative versus neutral trials; however, in the original study, we also observed a significantly smaller effect of valence on correctness in the low versus high-threat context (Shepherd et al., 2016). It is possible that the accuracy advantage observed in both studies for negative objects stems from the relatively greater salience of negative affective material. Indeed, individuals might have allocated greater attention to negative objects and processed the objects more deeply, which could account for the relative increase in accuracy compared to neutral objects.

Interestingly, our analysis of correctness by response type revealed that responses of experienced meditators and meditation naïve individuals differed for “No” responses in particular. Specifically, the difference in correctness to negative and neutral objects was larger for meditation naïve individuals compared with experienced meditations in the shoebox context. The groups did not differ in the hand context. This pattern suggests that meditation naïve individuals (versus experienced meditators) might have processed negative objects more
carefully when determining they would not fit in the shoebox, which could indicate heightened attention or sensitivity to negative affective material therein. Moreover, this pattern is consistent with our overarching hypothesis that meditators would demonstrate smaller effects of valence on correctness in a low-threat context.

When examining RT and controlling for correctness across all response types, we did not find the predicted relationship between valence, context, and meditation experience. However, when further examining trials by response type, we found that the effects of context and valence were in the predicted direction for “Yes” responses in particular, albeit at a trending level of statistical significance. As expected, participants were generally slower to respond to negative versus neutral objects, and the difference in RT to negative versus neutral objects was smaller in the low-threat (shoebox) context compared with the high-threat (hand context). In general, participants were also faster to respond to objects in the low- versus high-threat contexts.

Despite that meditation experience group was not a statistically significant predictor of context and valence effects, the RT means for each group suggest that the trending interaction of valence and context was largely driven by the meditator group, with meditators demonstrating more slowing for negative versus neutral objects in the high- vs. low-threat context. Meditation naïve individuals by contrast, appeared to demonstrate less contextual dependency in RT (i.e., the effect of valence appeared similar in the high- and low-threat contexts). These apparent differences suggest that meditators were slower when providing “Yes” responses to negative objects in the high- versus low-threat context, which could reflect a more careful approach to evaluating negative stimuli in the high-threat context. Nevertheless, more work is needed to further identify factors impacting the speed of responses, and whether meditation experience could be associated with greater sensitivity to cues signaling threat.
Meditators’ RT responses for “Yes” trials reflect the overall pattern observed in the foundational investigation for a normative college-aged sample, wherein, individuals were generally slower to respond to negative versus neutral trials, and this difference (i.e., effect of valence) was smaller in the shoebox context versus the hand context (Shepherd et al., 2016). However, we did not replicate the foundational study finding that higher levels of self-reported mindfulness and distancing skills were associated with smaller effects of valence on RT in the shoebox context. The power of the current study to detect group differences was limited by its small sample size, as well as a relatively small valence manipulation effect size. Accordingly, the observation that there were no significant effects of valence on RTs regardless of response type, suggests a need to increase the strength of the valence manipulation. This could be achieved by including more evocative stimuli, such as disgusting or noxious stimuli that elicit strong avoidance reactions (Oaten, Stevenson, & Case, 2009). Increasing the number of trials may also serve to increase the strength of manipulations and power to detect effects.

Summary and future directions

In the current investigation, we observed differences between experienced meditators and meditation naïve individuals on key dimensions of cognitive, emotional, and executive functioning, which appear to reflect skills practiced in various forms of meditation, and which are consistent with previous research examining the longitudinal impact of meditation experience. Generally, experienced meditators did not significantly differ from meditation naïve individuals in self-distancing task responses; however visual inspection of means suggested that meditators’ responses might have been more sensitive to the threat context (i.e., high- versus low-threat). Nevertheless, additional work is needed to substantiate these emerging patterns and to determine whether self-distancing task responses are associated with individual differences.
related to meditation practice. In addition, more work is needed to identify the nature of the mental processes involved in the self-distancing task, and to further validate responses according to individual difference characteristics.

In its present form, the self-distancing task may continue to be useful for differentiating individual differences in mindfulness and decentering in relatively healthy non-meditators (e.g., the college student sample studied in the foundational investigation); however, the current findings suggest that its utility for distinguishing the effects of long term meditation are limited. As several researchers have suggested, there are likely fundamental differences between naturally occurring mindfulness skills versus those acquired with significant lifetime meditation experience (e.g., Lutz et al., 2008). Therefore, it would be helpful to further examine whether self-distancing task responses are sensitive to longitudinal practice-related changes, or perhaps whether task responses are sensitive to treatment-related changes in individuals with symptoms of depression or other forms of psychopathology associated with cognitive and emotional biases.

Future efforts to refine and elucidate the correlates of task performance could include: obtaining larger participant samples to increase power to detect effects, increasing the magnitude of valence effects by using more emotionally evocative stimuli and increasing the number of stimuli, developing more comprehensive norms for correctness and ambiguity of responses to ensure that norms are representative of range of demographics, and further examining the role of mental imagery and other individual difference variables in performance (e.g., cognitive flexibility and emotion regulation capacities). Obtaining psychophysiological measures of arousal and affect valence would also alleviate concerns regarding the use of self-report measures of negative affect.
Future studies should also continue to test basic presumptions of our task conceptualization. For example, we presumed that (a) the size judgment task requires mental transformation/manipulation of objects to correctly judge subtle spatial relationships between objects (i.e., object-hand, object-shoebox), and (b) that participants imagined bringing the stimulus objects into their own hands (i.e., pulling the objects toward the self) or putting the objects into a shoebox (i.e., pushing the objects away from the self). These presumptions are rooted in research and theory suggesting that humans naturally use imagery to make judgments about the appearance of an object when it is transformed, especially when considering subtle spatial relations and what would happen if a physical object moves in a particular way (Kosslyn, Brunn, Cave, & Wallach, 1984). However, individuals likely vary in their use of mental imagery as a strategy depending on a number of factors that could impact the power of our manipulations, including the subtlety of the size difference, level of motivation or effort, and capacity or tendency to use mental imagery (Kosslyn et al., 1984). In the current investigation, correctness scores served as our primary index of mental manipulation proficiency. However, future studies could separately assess the capacity for performing tasks involving mental imagery as a potential covariate of performance outcomes, using standardized scales and behavioral performance measures to evaluate mental imagery abilities and the ability to spatially transform objects in the “mind’s eye” (Cui, Jeter, Yang, Montague, & Eagleman, 2007).

In sum, despite its limitations, this investigation represents a much-needed effort to develop behavioral measures of self-distancing, as there continues to be a pressing need for objective indicators of skills cultivated in mindfulness and decentering practices. We hope that this work will stimulate additional research on self-distancing and decentering, as we anticipate
that future inquiry in this area will be beneficial in deepening our collective understanding of the effects and mechanisms of a variety of mindfulness-based interventions.
REFERENCES


training predicts improvements in self-reported adaptive socioemotional functioning.

*Emotion, 11*(2), 299.


APPENDICES

Appendix A: Self-distancing task stimulus image names

*Negative valence*

Head (1), head (2), dead fox, knife, mace, missile, ant, army helicopter, sharp arrow, sharp axe, barracuda fish, bat (animal), bear, bear trap, bee, bomb (1), bomb (2), brass knuckles, cockroach (1), cockroach (2), giant water bug, bullet, cannon, chainsaw, crab, crossbow, crowbar, dentist chair, detonator, dog head, dynamite, flail, fly, spider (1), spider (2), spider (3), gasmask, grenade, guillotine, pistol, rifle, shotgun, uzi, icepick, lance, lion, mace, machete, moray eel, ninja star, noose, poison, razor, reptile, crocodile, scary fish, scorpion, shark, sickle, skull, snake (1), snake (2), stretcher, syringe, tank, tiger, vulture, wasp (1), wasp (2), barbed wire, wolf.

*Neutral valence*

Extensioncord, head3, head4, abacus, barrel, basket, battery, bell (1), bell (2), bench, binoculars, blanket, book, bottle, button, tree, cart, cigar, clipboard, compass, document cover, dresser, duct tape, fan, flashlight, folding chair, goldfish, handbag, dummy head, house, humidifier, jar (1), jar (2), jeans, kleenex, lightbulb, lightswitch, magnet, massager, metal table, newspaper, owl, package, padlock, pager, pen, phone, picture frame, pastic bin, pretzel, radiator, radio, robot, rock, rope, rubberband ball, rubiks cube, rug, sack, scissors, snap, speaker, table, tank, thermostat, truck part, tupperware, typewriter, wall socket, pocketwatch, t-shirt, yoyo.