

**Accentuate the (Low Arousal?) Positive:
Effects of Mindfulness on Positive Emotional Responding**

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For my biggest fan—my mom—who didn't get the opportunity to go to college herself but,
I think, always envisioned two particular letters before my name.

Acknowledgments

Traditionally, a dissertation is written in the first-person singular form, using "I" instead of "we" to clearly indicate independence and autonomy. However, writing in this way did not come naturally for me because a dissertation is not done alone. First, I want to thank my dissertation committee, Drs. Jeff Larsen, Lowell Gaertner, Kristina Gordon, and Joan Rentsch. Their invaluable input made this project far better than it would have otherwise been. And although I take healthy pride in my writing and ideas, Jeff always reminds me that they can and perhaps should be at least a little sharper; thank you for pushing me, even when I prickled.

When you do a PhD, all your friends and family also do a PhD; they are inevitably included in the "we," too. (Granted, my wife is earning their own doctorate; they don't need mine!) I'm especially grateful for my wife, Cap's, generous patience and encouragement and for their understanding that my puzzled staring almost always meant "I'm thinking about my study." Without them, I may have eaten only a diet of gummy fruit snacks throughout writing this dissertation.

Finally, I could not title this project as I have without a nod to Bing Crosby and to my middle school chorus teacher, Mrs. Sylvia Showalter, for introducing me to the tune.

Here's to accentuating the positive.

Abstract

Historically, mindfulness literature has focused far more on negative than positive emotions, and results regarding mindfulness' influence on positive emotions are somewhat mixed. It is still unclear under what conditions mindfulness facilitates, reduces, or does not affect positive affective responding. A key likelihood of mindfulness practice is a fostering of the low-arousal positive affective (LoPA) state of peacefulness, while mindfulness practitioners warn against over-engagement with high-arousal positive affect (HiPA). Thus, mindfulness may be more likely to elicit LoPA than HiPA. However, few mindfulness studies even include measures of both LoPA and HiPA, and no study assesses how a mindfulness *induction* influences LoPA relative to HiPA in response to low- and high-arousal positive stimuli, which could clarify murky findings with increased experimental control. Additionally, the mindfulness literature focuses heavily on experience of emotion; however, mindfulness may more reliably exert influence on earlier aspects of affective processes such as how evocative stimuli are perceived, rather than on the typical measure of emotional experience. Therefore, this study builds upon prior research by discerning whether a brief mindfulness induction facilitates how calming more so than how exciting people find low- and high-arousal pleasant pictures, relative to a control induction. After a brief mindfulness or control induction, participants ($n = 253$) indicated how calming and exciting they perceived low- and high-arousal pleasant images. Data did not support the primary hypotheses; the mindfulness induction did not affect how calming and exciting people found the pictures. Additional analyses of individual differences yielded some, but not many, potentially interesting results. Future research can address methodological limitations such as the difficulty of practicing a brief mindfulness induction for novices, a non-ideal emotion induction, and a lack of participant engagement—all of which likely contributed to the null findings.

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Chapter 1: Introduction

To be mindful is to be aware of, accepting of, and nonjudgmental toward the present moment (Kabat-Zinn, 1990), a practice and state of being that is associated with positive health outcomes in the domains of pain, cancer, depression, heart disease, and more (see Grossman et al., 2004 for a meta-analysis). Some researchers suggest that these improved clinical outcomes are a result of the influence of mindfulness on emotional regulation processes (e.g., Baer, 2010; Hölzel et al., 2011). Mindfulness is thought to reduce reactivity to and/or promote recovery from negative affective experiences (Kabat-Zinn, 1990), a claim corroborated by recent reviews demonstrating that mindfulness is reliably associated with reduced negative affective responding (Jordan & Larsen, 2020; Khoury et al., 2015; Leyland et al., 2019; Schumer et al., 2018; Tomlinson et al., 2018). But how does mindfulness influence *positive* affective responding? Historically, mindfulness literature has focused far more on negative than positive emotions, and recent systematic reviews found that results regarding mindfulness' influence on positive emotions are somewhat mixed—yet suggest that mindfulness exerts asymmetric effects on negative and positive affective responding (Jiménez et al., 2020; Jordan & Larsen, 2020). It is still unclear why this is the case and under what conditions mindfulness facilitates, reduces, or does not affect positive affective responding. One possibility is that mindfulness may be more likely to increase certain types of positive affective responses than others; therefore, this dissertation focuses on beginning to answer this question.

In the remainder of Chapter 1, I assess current evidence for the influence of mindfulness on affective responding, overall, and highlight potential theoretical nuance in how I would expect mindfulness to impact *positive* affective responding. In Chapter 2, I review relevant literature examining how mindfulness influences low- and high-arousal positive affective

responding. In doing so, I also identify gaps wherein murky findings may be clarified to better discern whether mindfulness is more likely to increase low- than high-arousal positive affective responding. In Chapters 3 and 4, I present a study developed to discern whether a brief mindfulness induction facilitates how calming more so than how exciting people find low- and high-arousal pleasant pictures, relative to a matched control induction. This study suggests that a mindfulness induction may not affect perceptions of calmingness and excitingness, though some individual differences may play a role. Finally, in Chapter 5, I highlight that it is still unclear whether mindfulness influences low- versus high-arousal positive affective responses and make recommendations for future research.

Mindfulness and Emotional Responding

Due to the proposed mental and physical health benefits of mindfulness, there has been an exponential increase in psychological research on the topic within the past few decades, particularly on mindfulness interventions in randomized-controlled trials (Creswell, 2017). Most researchers adopt Kabat-Zinn's (1990) original Western- and psychological-oriented definition of what mindfulness entails: paying close attention to the present moment with an attitude of openness, curiosity, acceptance, and non-judgment—experiencing each moment just as it is, without seeking or avoiding any particular aspect of it. This concept has, in turn, been operationalized in many ways in psychological research, including as a trait, a state, and as a practice itself. In psychological research, mindfulness manipulations are generally divided into two categories. Mindfulness trainings or interventions are those that occur over the space of days (e.g., Creswell et al., 2014), weeks (e.g., Jones et al., 2018; Matos et al., 2017), or months (e.g., Koopmann-Holm et al., 2013; Lindsay et al., 2018) and are meant to increase levels of dispositional mindfulness or the likelihood that one will experience momentary mindfulness.

Mindfulness inductions are brief (i.e., lasting only minutes), one-time experimental manipulations of mindfulness done in the laboratory that are meant to temporarily increase levels of state mindfulness (e.g., Kiken & Shook, 2014; Remmers et al., 2016).

Because mindfulness has been operationalized using a variety of scales and manipulations, it is important to note that it may be the case that varying operationalizations of mindfulness tap into varying constructs. This is not a new hurdle for the mindfulness literature; the ability to define mindfulness consistently across studies, induce it in the laboratory, or capture the construct with a scale has been discussed and debated at length (e.g., Chiesa, 2013; Davidson, 2010; Grossman, 2011; Grossman & Van Dam, 2011; Sauer et al., 2013). I acknowledge this possibility yet assess evidence across varying operationalizations of mindfulness to understand its overall influence on emotional responding.

Moreover, different research designs within the mindfulness literature vary in the degree to which they are able to illustrate the precise nature of the relationship between mindfulness and emotional responding. For example, some studies assess how mindfulness influences natural occurrences of emotion in daily life (e.g., Koopmann-Holm et al., 2013; Lindsay et al., 2018), while others feature emotional inductions (e.g., Kiken & Shook, 2014; Remmers et al., 2016). While daily-life studies are informative for telling us how likely any given emotion is to occur, these types of studies may simply be measuring how mindfulness influences the type of situation one exposes themselves to, rather than how mindfulness influences emotional responding. Moreover, these studies do little to help us understand how brief, one-time inductions of state mindfulness influence emotional responding, since these daily-life studies tend to employ mindfulness scales and interventions. Studies with emotional inductions, on the other hand, are uniquely equipped to help us understand the nuances of how mindfulness influences specific

emotional responses in a given emotional episode; however, they tell us little about how likely these emotions are to occur in daily life. Again, these strengths and limitations are acknowledged, yet I assess relevant and available evidence across varying research designs.

Effects of Mindfulness on Negative Emotional Responding Are Fairly Clear

Much of the mindfulness literature is centered around the effects of mindfulness on negative emotional responding, and the results are fairly clear: mindfulness tends to *reduce* negative affect. Indeed, systematic reviews find that dispositionally mindful people experience less negative affect (Jordan & Larsen, 2020; Tomlinson et al., 2018). For example, trait mindfulness was associated with less negative affect after couples discussed a topic of conflict (Hertz et al., 2015) and after participants underwent a stressful social evaluative task (Brown et al., 2012). Additionally, according to recent reviews, mindfulness-based *intervention* programs reliably reduce negative affect (Jordan & Larsen, 2020; Khoury et al., 2015). For example, mindfulness interventions resulted in less behavioral hostility relative to controls during a marital conflict task (Kemeny et al., 2012) and less stress and anxiety after a demanding cognitive stressor (Balconi et al., 2019). Finally, reviews find that mindfulness *inductions* in the laboratory are also associated with reduced negative affect compared to control conditions (Jordan & Larsen, 2020; Leyland et al., 2019; Schumer et al., 2018). For example, a mindfulness induction resulted in less negative affect after participants recalled a sad event in their lives (Broderick, 2005) and after unfair feedback from a supervisor (Long & Christian, 2015).

Effects of Mindfulness on Positive Emotional Responding Are Much Less Clear

We know far less about the effects of mindfulness on positive emotions; a recent review found just 72 tests of the relationship between mindfulness and momentary positive emotion, relative to 191 tests of the relationship between mindfulness and momentary negative emotion

(Jordan & Larsen, 2020). What little research there is provides somewhat mixed results. Recent systematic reviews reveal mostly null relationships among mindfulness and positive affect in the current literature (Jiménez et al., 2020; Jordan & Larsen, 2020). For example, participants with varying mindfulness experience reported similar emotional intensity in response to positive images (Taylor et al., 2011), and participants who underwent a 15-min mindfulness induction and those in a control condition reported similar levels of happiness after watching an amusing film clip (Greenberg & Meiran, 2014).

But when mindfulness is associated with positive emotional responding, mindfulness more often *increases* than decreases positive emotions (Jiménez et al., 2020; Jordan & Larsen, 2020). For example, participants who underwent a brief mindfulness induction reported more intense positive emotion than those in control conditions in both undergraduate (Ramos Díaz et al., 2014) and clinical (Huffziger & Kuehner, 2009) samples. On the other hand, a few studies in recent reviews found that mindfulness *reduced* positive affect (Jiménez et al., 2020; Jordan & Larsen, 2020). For example, in one study, participants who underwent a brief mindfulness induction expressed less intense and fewer positive facial expressions relative to a no-instruction control during an amusing film clip (Lalot et al., 2014). In another couple of studies, participants reported less intense positive feelings to positive photos after a brief mindfulness induction (Wu et al., 2019), and participants who viewed positive photos mindfully reported less intense emotions than when viewing photos passively (Taylor et al., 2011).

Potential Nuance in the Relationship Between Mindfulness and Positive Emotion

It is not clear why mindfulness exerts these asymmetric effects on momentary positive and negative emotional responding—more often facilitating positive emotions and reducing negative emotions—and why results regarding mindfulness’ influence on positive emotions are

somewhat mixed. One possibility is that mindfulness simply enhances pleasant emotions and reduces unpleasant emotions. We generally want to feel good; therefore, we seek out the experience of positive affect and avoid unpleasant feelings (Tamir, 2016). Even the famous crooner Bing Crosby (1944) directs us to “accentuate the positive.” And the idea of experiencing increased positive emotion in a mindful state likely aligns with laypersons’ perceptions of mindfulness as a tool to improve psychological health and well-being—by enhancing pleasant feelings. This would explain why mindfulness may be more likely to facilitate positive than negative affective responding; it may increase experiences of pleasant and desirable emotions.

However, mindful practitioners such as Kabat-Zinn (1990) recommend that no experience should be sought or valued over others; all experiences are simply attended to, acknowledged, and subsequently released. Kabat-Zinn (1990) encourages this approach to the present moment whether the experience may be of a negative or positive event or emotion. Indeed, mindfulness practitioners warn that clinging to positive emotional responding can be just as maladaptive as clinging to negative emotional responding (Kabat-Zinn, 1990). Therefore, in attempting to reconcile these two seemingly opposing perspectives and to clarify the mixed evidence and asymmetric effects, I wondered whether there were unexplored—or at least under-explored possibilities—that may further elucidate the relationship between mindfulness and positive emotional responding.

A Question of Arousal. Jiménez et al. (2020) do not provide potential explanations in their review for why mindfulness seems to have varying effects on positive emotion. While the differences may be, at least partially, methodological in nature, a few researchers have suggested that mindfulness may be more likely to increase low-arousal positive affect (LoPA) than high-arousal positive affect (HiPA; Jones et al., 2018; Jordan & Larsen, 2020; Koopmann-Holm et al.,

2013; Rowland et al., 2018). To explore this possibility, I must first explain that, according to the circumplex model, affective reactions and states can be organized in terms of a two-dimensional structure (Russell, 1980).

Circumplex Model of Affect. Russell and Barrett (1999) define core affect as “the most elementary consciously accessible affective feelings and their neurophysiological counterparts” (p. 806). These irreducible feelings involve an integral blend of valence and arousal (Russell, 2003). Indeed, when people are asked the degree to which they feel various discrete emotions such as happiness and sadness, factor analyses of the resulting correlation matrices generally tend to reveal that affective states are situated along two orthogonal dimensions of valence and arousal (Remington et al., 2000; Russell, 1980). Valence describes the degree to which the feeling is pleasant or unpleasant, and arousal describes the degree to which the feeling involves activation (Russell, 1980). From this perspective, affective states can be placed within a two-dimensional circumplex structure (see Figure 1; Russell, 1980, p. 1167). For example, feelings of excitement fall within the upper right quadrant as both pleasant and high in arousal (i.e., HiPA), while feelings of calmness fall within the lower right quadrant as pleasant yet low in arousal (i.e., LoPA). Situating various positive emotions within the circumplex model may further clarify how mindfulness influences positive emotional responding.

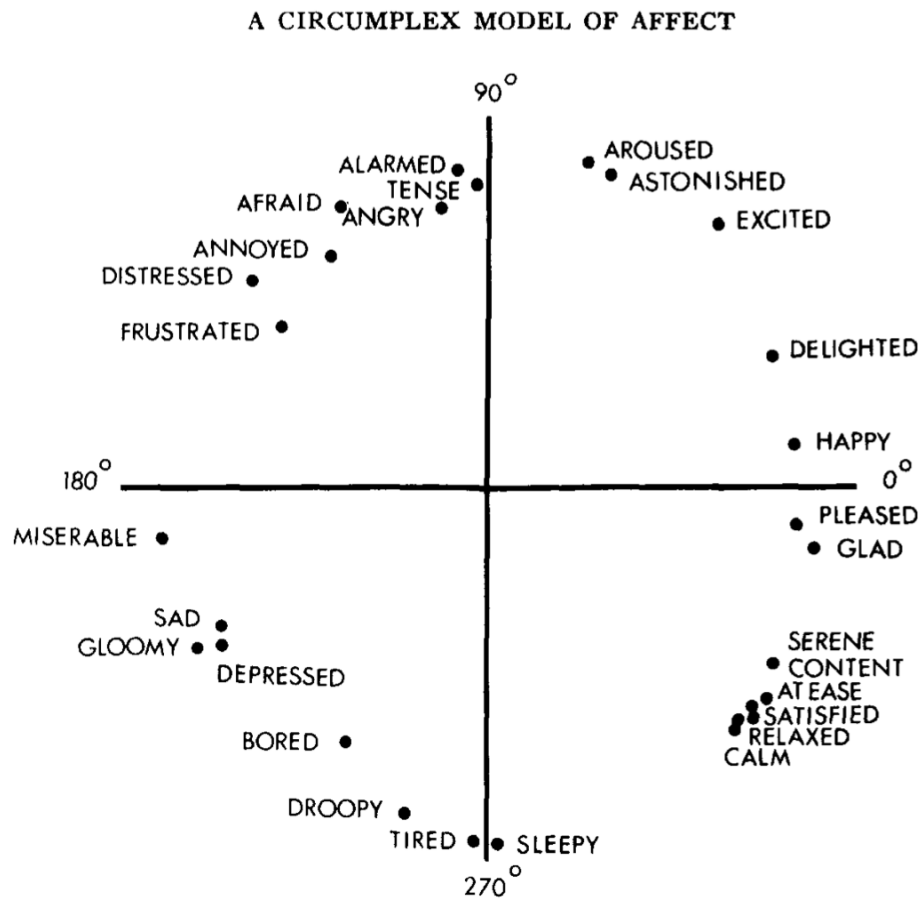


Figure 1. Circumplex Model of Affect

Note. From "A Circumplex Model of Affect," by J.A. Russell, 1980, *Journal of Personality and Psychology*, 39(6), p. 1167 (<https://doi.org/10.1037/h0077714>). Copyright 1980 by the American Psychological Association.

Chapter 2: Mindfulness and Low- Versus High-Arousal Positive Responding

The typical finding that ratings of emotional experience reveal largely orthogonal valence and arousal dimensions implies that low- and high-arousal positive emotions need not be strongly positively correlated (see Remington et al., 2000 for a review). This opens the possibility for mindfulness to have distinct effects on LoPA versus HiPA. A key likelihood of mindfulness practice is facilitation of the LoPA state of peacefulness (Kabat-Zinn, 1990). Moreover, the mental composure and nonreactivity that mindfulness practices foster intuitively align with these low-arousal positive affective states (Kabat-Zinn, 1990). On the other hand, mindfulness is *not* intended to foster HiPA. Buddhist and Hindu teachings from which Western mindfulness practices originate even warn against over-engagement with high-arousal positive emotions (Sedlmeier et al., 2012). Thus, mindfulness may be more likely to elicit LoPA than HiPA, a point also noted by several other researchers for the same reasons described above (Jones et al., 2018; Koopmann-Holm et al., 2013; Rowland et al., 2018).

Identifying the Relevant Evidence

Though some studies have investigated relationships between mindfulness and positive affect, most of those shed little light on whether mindfulness is more likely to increase LoPA than HiPA. For example, studies that differentiate between low- and high-arousal positive emotional stimuli are particularly useful, as we would most likely see any effects of mindfulness on LoPA when LoPA is elicited and any effects of mindfulness on HiPA when HiPA is elicited; however, the overwhelming majority of mindfulness studies do not (e.g., Arch & Craske, 2006; Kiken & Shook, 2014; Ortner et al., 2007; Parsons et al., 2019; Reva et al., 2014; Taylor et al., 2011; Watford & Stafford, 2015). Additionally, studies that include separate measures of low- and high-arousal positive emotional responding are *most* useful, in order to differentiate the

specific effects of mindfulness on each relative to the other; however, again, most do not do so. (see McManus et al., 2019 for a lament).

Still, a few studies induce and/or measure either low- *or* high-arousal positive emotional responding. Two studies found that a brief mindfulness induction alone resulted in participants reporting feeling more calmness, a LoPA state, relative to unfocused breathing conditions (Brunyé et al., 2013; Molet et al., 2013). However, in one of these studies, a brief mindfulness induction did not influence feelings of calm after a stressful math task any more than did control conditions, which indicates that mindfulness may not moderate the effects of negative emotion inductions on LoPA (Brunyé et al., 2013). In another study, the more mindful a participant was in any given moment, the more likely they were to report feelings of relaxation (Du et al., 2019). No study assesses how mindfulness influences LoPA, specifically, after a *positive* emotion induction.

There is slightly more evidence assessing specifically *high*-arousal positive responding. In these cases, we see almost exclusively null effects of mindfulness on emotional experience, either after the mindfulness induction itself (Edwards et al., 2018; Reynolds et al., 2015; Valim et al., 2019) or after viewing highly-arousing positive stimuli (Cosme & Wiens, 2015; Eddy et al., 2015; Nielsen & Kaszniak, 2006; Sze et al., 2010). But in one case, we see dampened HiPA. Beblo et al. (2018) had participants either focus on their emotions while watching a joyful film clip or watch the film clip passively; they found that participants who focused on their emotions while watching a joyful film reported lower arousal during a second viewing of the film, relative to those who had viewed it passively.

However, it is *most* relevant to compare how mindfulness influences low- versus high-arousal positive emotional responding in studies that assess both LoPA and HiPA within the

same study. These studies ideally feature both low- and high-arousal positive stimuli, such as two sets of images—one set that elicits low-arousal positive responding and another that elicits high-arousal positive responding. This allows for a direct comparison of responses to both low- and high-arousal positive situations when all else is held constant. For the same reason, it is *most* relevant to assess how mindfulness influences measures of both low- and high-arousal positive responding in the same study for, again, an important head-to-head comparison. Otherwise, we cannot answer the question of whether mindfulness is more likely to increase LoPA than HiPA. Therefore, below I detail studies that include these most relevant features.

Emotional Experiences

Only a handful of researchers have measured both LoPA and HiPA within the same study, and the results are mixed. I begin by reviewing null findings of the effects of mindfulness on emotional experience. As shown in Table 1, Rosenberg et al. (2015) implemented a 3-month mindfulness intervention with participants who had roughly 13 years of experience with mindfulness and compared this to a similar group of participants who did not undergo an intervention. All participants watched film clips of human suffering and reported on their experiences of LoPA and HiPA. No group differences were found, which is fairly unsurprising considering that LoPA and HiPA levels were reasonably low after watching a distressing film. Moreover, effects of a three-month intervention may be difficult to detect among groups of participants that have been meditating more than a decade.

Table 1. Overview of mindfulness studies that include separate measures of experience of low- and high-arousal positive affect

Author and year	Study #	Method		LoPA	HiPA	Additional information
		Mindfulness operationalization	Type of emotion measure			
Rosenberg et al. (2015)	1	Previous experience ($M = 13$ yrs) + 3-mo. mindfulness intervention vs Previous experience only ($M = 13$ yrs)	Standard in-lab questionnaire in response to film clips of human suffering	$t(55) = .08$	$t(55) = 1.63$	No differences between mindfulness intervention and control group in either LoPA or HiPA at preassessment or postassessment, as shown.
Koopman-Holm et al. (2013)	1	Previous mindfulness experience ($M = 4.28$ yrs) vs No mindfulness experience	Standard one-time questionnaire (unclear whether in-lab or online)	$F(1, 87) = 1.44$	$F(1, 87) = 1.23$	Mindfulness practitioners valued LoPA more ($\eta^2 = .10^*$); no difference in experiences of LoPA (shown). Mindfulness practitioners valued HiPA less ($\eta^2 = .05^*$); no difference in experiences of HiPA, as shown. No test for whether LoPA and HiPA are different.
	2	8-week mindfulness intervention vs Improvisational theatre class and No class	Standard online questionnaire pre-, during-, and post-manipulation	$F(1, 68) = .33$	$F(1, 68) = .66$	Mindfulness practitioners valued LoPA more ($\eta^2 = .10^{**}$); no difference in experiences of LoPA (shown). No difference in valuing or experiences of HiPA, as shown. No test for whether LoPA and HiPA are different.

Table 1 Continued.

Author and year	Study #	Method		LoPA	HiPA	Additional information
		Mindfulness operationalization	Type of emotion measure			
Lindsay et al. (2018)	1	8-week mindfulness intervention vs WLC	Daily diary at pre- and post-manipulation	$d = .75^{***}$	$d = .56^{***}$	Increase in LoPA from pre- to post-intervention (shown) and greater increase than WLC ($g = .56^*$). Increase in HiPA from pre- to post-intervention (as shown) and greater increase than WLC ($g = .73^{***}$); WLC decreased from pre to post. No test for whether LoPA and HiPA are different in either case.
	2	8-week mindfulness intervention vs Coping control	Daily diary at pre- and post-manipulation	$d = .67^{***}$	$d = .52^{***}$	Increase in LoPA from pre- to post-intervention (shown) and greater increase than control ($g = .70^{***}$). Increase in HiPA from pre- to post-intervention (as shown) but similar increase as control ($g = .40$). No test for whether LoPA and HiPA are different in either case.
Rowland et al. (2018)	1	6-week mindfulness intervention vs WLC	Ecological momentary assessment	$\beta = .01$ ($SE = .02$)	$\beta = .00$ ($SE = .02$)	No differences between mindfulness intervention and control group for either LoPA or HiPA, as shown.
	1	Trait mindfulness	Ecological momentary assessment	$\beta = .08$ ($SE = .05$)	$\beta = .06$ ($SE = .06$)	Though trait mindfulness generally did not predict LoPA or HiPA (shown), a single subscale of one of the two dispositional measures—Awareness of the KIMS—was associated with more LoPA [$\beta = .13^*$ ($SE = .06$)] and HiPA [$\beta = .16^*$ ($SE = .06$)].
	1	State mindfulness	Ecological momentary assessment	$\beta = .18^{***}$ ($SE = .02$)	$\beta = .14^{***}$ ($SE = .02$)	State mindfulness was also associated with not just greater LoPA and HiPA (as shown), but also with more persistent momentary states of LoPA ($b = .02^*$, $SE = .01$) but not HiPA.

Table 1 Continued.

Author and year	Study #	Method		LoPA	HiPA	Additional information
		Mindfulness operationalization	Type of emotion measure			
Jones et al. (2018)	1	1-wk mindfulness intervention vs WLC	Daily diary throughout manipulation	statistics not reported	statistics not reported	No Arousal x Valence interaction detected [$b = -.148$ ($SE = .150$)], so the statistical tests for the association among the mindfulness intervention and LoPA and HiPA were not conducted and/or reported in the text, figures, or tables.
	1	Time spent practicing mindfulness	Daily diary throughout manipulation	$b = .02^{**}$ ($SE = .01$)	statistics not reported	Time spent practicing mindfulness was only marginally associated with increased feelings of relaxation ($b = .01$, $SE = .01$, $p = .065$), another LoPA state. Time spent practicing mindfulness also did not predict any HiPA states, for which the statistical tests were not reported in the text, figures, or tables.
McManus et al. (2019)	1	Trait mindfulness	Standard one-time online questionnaire	$\beta = .30^{**}$ [95% CI .09, .54]	$\beta = -.01$ [95% CI -.23, .20]	When both LoPA and HiPA were in the model, HiPA no longer predicted mindfulness, as shown. Mindfulness was associated with both LoPA ($r = .32$) and HiPA ($r = .24$), and they were not differently correlated.
Matos et al. (2017)	1	2-wk mindfulness intervention vs WLC	Standard in-lab questionnaire pre- and post-manipulation	$d = .61^{***}$	statistics not reported	There was no Time x Group interaction for HiPA [$F(1,91) = 1.05$, $p = .307$, $\eta^2 = .01$], so the statistical tests for the association among the mindfulness intervention and HiPA at Time 1 versus Time 2 were not conducted.

Note. Studies shown in the order in which they are described in the text. WLC = Wait List Control. KIMS = Kentucky Inventory Mindfulness Scale.

Statistics that are most relevant and/or available are reported for each association.

* = $p < .05$, ** = $p < .01$, *** = $p < .001$; if no asterisk, then $p > .05$.

Similarly, Koopmann-Holm et al. (2013) found in an initial study that there were no differences in daily-life experiences of LoPA and HiPA among participants with and without mindfulness experience (see Table 1). In a second study, some subjects participated in an eight-week mindfulness intervention, while those in the control conditions participated in either an improvisational theatre class (active control) or no class (in-active control; Koopmann-Holm et al., 2013). Participants' daily-life experiences of LoPA and HiPA did not differ among the three conditions (Koopmann-Holm et al., 2013). However, interestingly, previous mindfulness experience and the mindfulness intervention increased the extent to which participants *valued* LoPA across both studies, and previous mindfulness experience was associated with *decreased* valuing of HiPA (Koopmann-Holm et al., 2013).

Other studies may provide evidence for the posited pattern that mindfulness is more likely to increase LoPA than HiPA. Lindsay et al. (2018) found across two daily-diary studies that an eight-week mindfulness intervention tended to facilitate both LoPA and HiPA. To start, the mindfulness intervention increased both LoPA and HiPA from before to after the intervention (Lindsay et al., 2018). It is unclear whether the mindfulness group's increases in LoPA from pre- to post-intervention were significantly greater than their increases in HiPA, but the pattern of results suggests this is plausible (Lindsay et al., 2018; see Table 1); this would align with the suggestion that mindfulness is more likely to increase LoPA than HiPA. Additionally, in some cases, Lindsay et al. (2018) found that pre- to post-intervention changes in LoPA and HiPA differed for the mindfulness and control groups. Increases in LoPA were significantly greater for the participants who underwent the mindfulness intervention than those who were in the wait-list control and active control conditions (Lindsay et al., 2018). The pattern of results was slightly different for HiPA. In the first study, the mindfulness intervention

increased HiPA more than did the wait-list control (Lindsay et al., 2018). The second study aligns more with expectations, as pre- to post-intervention increases in HiPA did not differ among mindfulness and control conditions (Lindsay et al., 2018).

Though Rowland et al. (2018) anticipated the claim that mindfulness may be more likely to increase LoPA than HiPA, they did not find that a mindfulness intervention alone influenced affective experiences in daily life. However, Rowland et al. (2018) did find that participants who were more mindful in any given moment reported higher average levels of both LoPA and HiPA states via ecological momentary assessment. It is unclear whether the mean levels were significantly greater for LoPA than for HiPA, but the pattern of results suggests this is possible (see Table 1). Moreover, Rowland et al. (2018) found that states of mindfulness were also associated with more persistent (i.e., longer lasting) LoPA states but not HiPA states.

Finally, a few other studies provide stronger evidence that mindfulness may be more likely to increase LoPA than HiPA. Like Rowland et al. (2018), Jones et al. (2018) also anticipated our claim that mindfulness may be more likely to increase LoPA than HiPA, but similarly did not find that a mindfulness intervention alone influenced affective experiences in daily life. Among participants in the mindfulness intervention group, however, those who spent more time practicing mindfulness reported more LoPA in their daily diary; on the other hand, practicing mindfulness was not significantly related to HiPA (Jones et al., 2018; see Table 1). Additionally, McManus et al. (2019) found that participants who were more dispositionally mindful reported more experiences of both LoPA and HiPA in daily life; however, importantly, LoPA predicted mindfulness ratings more so than did HiPA (see Table 1). Finally, perhaps the most compelling evidence comes from a study by Matos et al. (2017). They found that participants who underwent a two-week mindfulness intervention reported increases in LoPA,

while a wait-list control group did not; again, the mindfulness intervention did not significantly impact HiPA (see Table 1).

Overall, we find that these types of studies sometimes show that mindfulness is associated with increased experiences of LoPA in daily life. These same studies often find that mindfulness is either unrelated or possibly less strongly related to experiences of HiPA in daily life. Yet, despite assessing evidence across various types of studies, including both daily-life and laboratory studies, it is still difficult to determine whether mindfulness is more likely to increase LoPA than HiPA—a potentially missing piece in understanding how mindfulness exerts its influence on positive emotion. Few studies even include measures of both LoPA and HiPA. Moreover, the daily-life studies that *do* include both LoPA and HiPA measures (but no emotional induction) may simply be measuring how mindfulness influences the types of situations one exposes themselves to, rather than the responses people have to certain situations. No mindfulness study addresses this possibility by including both LoPA and HiPA *stimuli* and measures. Additionally, no study has yet assessed how a mindfulness *induction* influences LoPA relative to HiPA, which may help to clarify—or at least provide additional perspective on—murky findings with increased experimental control. Further, certainly no study has assessed how a mindfulness induction influences LoPA and HiPA experiences to low- and high-arousal positive stimuli, which would allow the cleanest assessment of how mindfulness influences LoPA relative to HiPA states when they occur.

Perception of Affective Quality

Up to this point, I have focused almost exclusively on the influence of mindfulness on *experiences* of low- and high-arousal positive emotion; the experience of emotion is by far the most common measure of the influence of mindfulness on emotion. However, the evidence is

messy and relatively sparse. In addition to the possibilities outlined above, another possibility for overall murkiness in how mindfulness influences low- versus high-arousal positive emotional responding may be that mindfulness more reliably exerts influence on *earlier* aspects of affective processes—that is to say, earlier aspects than the experience of emotion. One proposed possibility is that mindfulness influences how evocative stimuli are *perceived* which, in turn, would influence downstream affective reactions, such as experience (Hölzel et al., 2011). To understand these nuanced ways in which mindfulness may influence affective processes, I must first further explain the affective processes in question.

One common emotion theory posits that emotional episodes are made up of various and distinct processes and components (Russell, 2003). Any given emotional episode begins with some type of antecedent event of which we first determine its affective quality (Russell, 2003). This *perception of affective quality* (PAQ) is our determination of the event's potential to influence how we feel or our affective experience (i.e., its potential to influence our core affect). However, the PAQ of an evocative stimulus need not necessarily influence core affect (Russell, 2003). To illustrate, Russell (2003) explains that while someone may perceive a beautiful sunset to have positive affective qualities, depression may prevent the sunset from altering how they actually *feel*. Therefore, while the PAQ of an event is a representation of the extent to which we *expect* an event could influence our core affect, it is specifically distinguished from core affect itself (Russell, 2003).

Looking at how mindfulness influences antecedents to emotional experience, such as PAQ, may help to clarify the current mixed evidence of how mindfulness influences positive emotional responding. If mindfulness exerts its effects early in the affective process, assessing PAQ allows for a measure that is more proximal to an emotion induction than a measure of

experience or core affect. Indeed, actual experiences of positive emotion can be difficult to induce within an experimental context. This is especially the case when considering the relatively emotionally impoverished but straightforward stimuli, such as images, that are often used in experimental settings for their ability to increase internal validity. Therefore, PAQ could be a more sensitive measure than emotional experience to the nuanced effects of mindfulness on affective processing.

Limited Evidence of the Effect of Mindfulness on Perception of Affective Quality

Currently, studies that assess how mindfulness influences PAQ of emotional stimuli do not thoroughly differentiate between how participants perceive various low- and high-arousal positive stimuli—an important component to understanding whether mindfulness is more likely to increase LoPA than HiPA, as noted above. Researchers instead tend to simply note the average arousal level of all the stimuli combined, rather than for any given stimulus or stimulus group (Valim et al., 2019), or only use pleasant images that are very high in arousal (Lee et al., 2012; Leung et al., 2018). These studies may mask any effects of mindfulness on low- versus high-arousal positive responding by combining responses to stimuli of varying arousal levels. They also may not see effects because they are not eliciting any low-arousal positive responses. Therefore, it is not particularly surprising that these studies tend to reveal null relationships between mindfulness and PAQ of positive stimuli. Indeed, thus far we see null effects when assessing the relationship between PAQ of positive pictures and previous mindfulness experience (Lee et al., 2012), brief inductions of mindfulness (Valim et al., 2019) or mindfulness interventions (Leung et al., 2018).

Neural Evidence of the Effect of Mindfulness on Perception of Affective Quality

Thus far I have discussed evidence of how mindfulness influences relatively direct measures of affective processes (i.e., emotional experience, ratings of PAQ of evocative stimuli). Looking to more indirect measures of emotion, some studies use neural measures to understand how mindfulness influences perceptions of positive stimuli. If mindfulness is more likely to promote low-arousal than high-arousal positive responding, one would expect that mindfulness may be more likely to facilitate processing of low-arousal than high-arousal positive stimuli. This enhanced processing of low-arousal stimuli may appear, in turn, as enhanced neural responses to low-arousal positive stimuli more so than to high-arousal stimuli.

A handful of studies assess how mindfulness influences neural responses specifically to high-arousal positive stimuli. These researchers find both null effects (Cosme & Wiens, 2015; Leung et al., 2018) and effects of mindfulness enhancing neural responses to high-arousal positive stimuli (Eddy et al., 2015). However, these studies do not include low-arousal positive stimuli; therefore, I cannot evaluate the prediction with these particular data.

Studies that assess how mindfulness influences neural responses to both low- *and* high-arousal stimuli are most relevant; however, only two studies do so, and the evidence from these is mixed. Egan et al.'s (2018) findings do not align with expectations: a brief mindfulness induction increased neural responses to *all* photo stimuli relative to a control condition, regardless of affective content (i.e., to both low- and high-arousal positive and negative photos and to neutral photos). Importantly, there was no interaction for condition and stimulus category, meaning the mindfulness induction increased neural responses similarly for neutral and low- and high-arousal positive images (Egan et al., 2018). In the same study, trait mindfulness did not influence neural responses (Egan et al., 2018). Brown et al.'s (2013) findings do not necessarily

contradict the prediction; however, they provide little evidence of the suggestion that mindfulness may be more likely to enhance neural responses to low-arousal positive stimuli than to high-arousal stimuli. Participants high in trait mindfulness exhibited *dampened* neural responding to high-arousal positive stimuli; however, mindfulness did not influence responding to low-arousal positive stimuli (Brown et al., 2013). It is important to note that low-arousal positive stimuli did not elicit larger neural responses, overall, than did neutral stimuli; therefore, floor effects likely reduced any ability to see the effect of mindfulness on responding to low-arousal positive stimuli (Brown et al., 2013).

In sum, neural studies do little to clarify whether mindfulness is more likely to increase low- than high-arousal positive affective responding. Moreover, varying explanations of the mixed evidence highlight the ambiguity of these neural findings. Researchers have explained dampened neural responses as the tendency of mindfulness to reduce emotional processing in general (Brown et al., 2013), while researchers explain the overall enhanced neural responses as simply motivated attention to the task at hand and the stimuli itself rather than actual indicators of affective responding (Eddy et al., 2015; Egan et al., 2018). Direct ratings of PAQ of low- and high-arousal positive stimuli would clarify the extent to which mindfulness influences explicit emotional processes in low- and high-arousal situations—a point discussed above regarding the current limited understanding of how mindfulness influences positive emotional experiences.

Present Research

It remains unclear why mindfulness exerts asymmetric effects on negative and positive emotional responding and why evidence is somewhat mixed regarding how mindfulness influences positive emotion. One overarching possibility is that mindfulness may be more likely to increase low- than high-arousal positive emotional responding. A likely outcome of

mindfulness practice is facilitation of the LoPA state of peacefulness (Kabat-Zinn, 1990), while mindfulness practitioners warn against over-engagement with high-arousal positive emotions (Sedlmeier et al., 2012). Thus, mindfulness may be more likely to elicit LoPA than HiPA, a point also noted by several other researchers (Jones et al., 2018; Koopmann-Holm et al., 2013; Rowland et al., 2018).

This possibility is somewhat corroborated by correlational research (McManus et al., 2019), daily-life studies (Du et al., 2019; Jones et al., 2018; Lindsay et al., 2018; Matos et al., 2017; Rowland et al., 2018), and laboratory studies (Brunyé et al., 2013; Molet et al., 2013) that find some evidence of mindfulness facilitating low-arousal positive emotional experience. Additionally, mindfulness has generally not been associated with high-arousal positive emotional experience (Cosme & Wiens, 2015; Eddy et al., 2015; Edwards et al., 2018; Jones et al., 2018; Koopmann-Holm et al., 2013; Matos et al., 2017; Rosenberg et al., 2015; Sze et al., 2010; Valim et al., 2019) or possibly not as strongly associated with mindfulness as is low-arousal positive emotional experience (Lindsay et al., 2018; McManus et al., 2019). In one case, mindfulness even *reduced* high-arousal experience to positive stimuli, relative to a control condition (Beblo et al., 2018).

However, it is still difficult to determine whether mindfulness is more likely to increase LoPA than HiPA. Few mindfulness studies even include measures of both LoPA and HiPA to allow for a comparison. Those that do include measures of LoPA and HiPA do not assess how a mindfulness *induction* influences LoPA relative to HiPA, which could clarify murky findings with increased experimental control. Moreover, no mindfulness studies include both LoPA and HiPA *stimuli* and measures. Assessing how a mindfulness induction influences LoPA and HiPA

reactions to low- and high-arousal positive stimuli would allow the cleanest assessment of how mindfulness influences LoPA and HiPA states when they occur.

Further, one way that mindfulness may influence positive emotional responding is by influencing upstream emotional processing—specifically PAQ, or how we perceive stimuli’s ability to potentially change our own core affect. If mindfulness exerts its effects early in the affective process, assessing PAQ allows for a measure that is more proximal to an emotion induction than a measure of core affect or emotional experience. Moreover, assessing PAQ may be a more sensitive test of the nuanced effects of mindfulness on affective processing, considering it can be difficult to actually induce positive emotion with impoverished experimental stimuli such as images. These studies, thus far, have found null effects of mindfulness on PAQ. However, again, these studies have either not differentiated between responses to low- and high-arousal positive stimuli (Valim et al., 2019) or have only included high-arousal positive stimuli (Lee et al., 2012; Leung et al., 2018), which may be masking any effects of mindfulness on low- versus high-arousal PAQ. Therefore, we have yet to determine how a mindfulness induction specifically influences self-reported perceptions of low- relative to high-arousal positive emotional stimuli.

This study builds upon prior research by attempting to understand how a brief mindfulness induction influences how calming and exciting people perceive low- and high-arousal pleasant pictures, separately, within the same study. This study is the first to test whether a brief mindfulness *induction* would be more likely to facilitate a low-arousal than high-arousal affective reaction. Moreover, it is the first to test whether any conceptualization of mindfulness is more likely to elicit low- than high-arousal perceptions of affective quality (PAQ) of low- and high-arousal stimuli, respectively. I expected that participants would perceive positive images as

more calming after a mindfulness induction than after a control condition (H1a). Due to floor effects of calmingness of high-arousal positive pictures, effects of mindfulness on calmingness may be stronger for low-arousal than high-arousal positive images; therefore, I include it as a factor. Critically, I expected that this increase in calmingness ratings would be greater than any increase that may or may not occur for ratings of excitingness (H1b). Additionally, I explored whether dispositional mindfulness may moderate the effect of the brief mindfulness induction on PAQ, expecting those higher in dispositional mindfulness to exhibit stronger effects of the mindfulness induction (H2).

Chapter 3: Method

Participants were 253 adult, undergraduate students at the University of Tennessee, who had the option to participate in exchange for course credit. I pre-registered a sample size of 200 (after any data exclusion) based on both resources and a power analysis to obtain 95% power to detect between a small and medium effect size (0.18) for the primary prediction: Induction x Rating Type interaction (i.e., H1a, H1b). This power analysis was conducted in anticipation of performing a repeated measures mixed ANOVA, yet I analyzed the data using linear mixed effects models, as described below. The latter tends to be at least as or more powerful for detecting effects, due to the inclusion of each individual data point, rather than averaging across any data points; therefore, the current study has at least as much power as indicated here. Participants were recruited from the SONA psychology participant pool between January 29th and March 26th, 2020 and completed the study in exchange for course credit.

Procedure

I employed a 2 (induction: mindfulness, control) x 2 (image arousal: low, high) x 2 (rating type: calmingness, excitingness) mixed design with induction manipulated between subjects to understand the effects of a mindfulness induction on PAQ of positive images. Study procedures were approved by the Institutional Review Board and conducted online via Qualtrics. Dispositional mindfulness measures were completed in a separate screener survey beforehand that was not connected to this study and was neither qualifying nor disqualifying. All participants provided informed consent and were told that the study is composed of a series of computer tasks and self-report measures, including a concentration task in which they will listen to a recording and follow simple instructions. Finally, participants were told that they would be viewing images that will not be unsettling in any way.

After giving consent, participants were asked to acknowledge that they have a quiet environment, free of distractions and interruptions for the allotted time, before being able to commence the experiment. Hafenbrack et al. (2014) did this to help ensure the integrity of the experiment for those participating online. Participants were also told that they would be asked questions about the content of the audio; therefore, it is important to pay close attention. I did this to encourage engagement with the inductions, since I could not ensure that participants actually listened to the audio recording. I could only ensure via Qualtrics programming that they did not move past the screen until time equal to the length of the audio recording had passed. I also recommended that participants use headphones if they were able to do so.

Participants were then randomly assigned to either the mindfulness induction or control induction. The mindfulness and control inductions were developed by Hafenbrack et al. (2014) and consisted of a 15-minute audio recording by a professional mindfulness-meditation instructor. The mindfulness recording was adapted from Arch & Craske's (2006) script, which was originally adapted from materials by Kabat-Zinn (1990); therefore, it aligns well with conceptual definitions of mindfulness within Western psychology. Research has shown that this type of brief instructional exercise can successfully induce mindfulness in novice participants (e.g., Arch & Craske, 2006; Hafenbrack et al., 2014; Kiken & Shook, 2014; Long & Christian, 2015). Participants were led through an exercise in which they primarily were instructed to focus on the physical sensations of their breath. Aligning with mindfulness principles of acceptance and non-judgment, the recording assured them that whatever they notice in the present moment is allowable and that any distraction should be noticed and subsequently let go. Then, the attention should be returned to the sensation of the breath in the present moment. The recording

did not mention “mindfulness,” which may help to mitigate any related demand characteristics that could arise.

Similarly, the mind-wandering induction (control condition) was also developed by Hafenbrack et al. (2014) and consisted of an audio recording of the same 15-minute duration with the same instructor as in the experimental condition. However, the mind-wandering induction repeatedly instructed participants to think of whatever comes to mind. This type of induction has been used as a control condition in prior mindfulness experiments (Arch & Craske, 2006; Chan, 2019; Kiken & Shook, 2014; Winning & Boag, 2015) because it replicates a waking, baseline mental state (Mason et al., 2007). For this reason, the mind-wandering task was an ideal matched-control condition, controlling for any effects of listening to a 15-minute audio recording with this particular instructor while also facilitating a relatively normal mental state.

After the induction, participants then viewed low- and high-arousal positive images in a randomized order. Stimuli included 20 total images from the Nencki Affective Pictures (NAPS; Marchewka et al., 2014) database, for which valence and arousal ratings on a scale of 1 to 9 are available. Half of the images were low-arousal positive images, and half of the images were high-arousal positive images, all viewed in a randomized order [low arousal: $M = 2.57$, $SD = 0.36$; high arousal: $M = 5.96$, $SD = 0.35$; $t(18) = -21.18$, $p < .001$]. Low- and high-arousal ratings were equated on the valence dimension [valence of low: $M = 7.56$, $SD = 0.47$; valence of high: $M = 7.35$, $SD = 0.25$; $t(18) = 1.23$, $p = .24$]. Picture content consisted of various images of animals, people, landscapes, and objects. Low-arousal images tended to contain more landscapes, while high-arousal images tended to contain more people; this is simply the nature of low- and high-arousal positive images, respectively. Each image was viewed for 5 seconds. After 5 seconds

passed, the image remained on the screen, and participants rated it on low- and high-arousal perceived affective quality.

After the image-viewing task, as attention and manipulation checks, participants answered questions about the content of the inductions, the extent to which they entered a mindful state, and their previous experience with practicing mindfulness as described below. After the study, participants were debriefed. Study sessions lasted approximately 30 minutes.

Measures

Trait Mindfulness Measure. The 15-item Five-Facet Mindfulness Questionnaire (FFMQ-15; see appendix A; Baer et al., 2008; Gu et al., 2016) is the short form of a five-factor measure of trait mindfulness that assesses *Observing*, *Describing*, *Acting with Awareness*, *Non-judging* of inner experience, and *Non-reactivity* to inner experience. Participants rated the degree to which various statements (e.g., I criticize myself for having irrational or inappropriate emotions; I watch my feelings without getting lost in them) are generally true of themselves on a scale 1 (*never or very rarely true*) to 5 (*very often or always true*), with higher scores on each facet indicating higher trait mindfulness.

Induction Attention Check. The induction attention check, inspired by Iwamoto et al. (2020), is a question about the specific content of the audio exercise. See appendix B. Participants were told ahead of the induction that they would be required to answer questions about the content of the audio, so it would be important to listen closely; this tactic helped confirm that the participants actually listened to the audio exercises, since the online nature of the study otherwise made this difficult to determine. For the mindfulness induction, participants were asked a multiple-choice question: “Which of the following did the recording NOT ask you to do?” Three incorrect answer choices were instructions from the mindfulness audio (i.e., *Place*

your hand on your abdomen, Pay attention to the sensation of your breathing, Acknowledge the thoughts you may have). One correct answer was an instruction that the audio exercise did *not* ask them to do (i.e., *Hold your breath for 10 seconds*). For the control induction, participants were asked the same multiple-choice question; however, the answer choices differed. Three incorrect answer choices were instructions from the mind-wandering audio (i.e., *Settle into a comfortable sitting position, Let your mind wander freely, Think about whatever you want to think about*). One additional correct answer was an instruction that the audio exercise did *not* ask them to do (i.e., *Place your hand on your abdomen*).

State Mindfulness Measure / Manipulation Check. Following Hafenbrack et al. (2014), I measured state mindfulness by asking participants to report the extent to which they were absorbed in the present moment, focused on their breathing, focused on the physical sensations of breathing, and in touch with their body, using a five-point scale from 0 (*not at all*) to 4 (*very much*). See appendix C. Responses to these four questions were averaged. It was specifically intended as a manipulation check to discern whether participants were able to engage with the mindfulness induction and achieve a greater state of mindfulness than in the control condition.

Perception of Affective Quality Ratings. Participants were asked to what extent they found each image *calming* (low-arousal positive) and *exciting* (high-arousal positive) on a six-point scale from 0 (*not at all*) to 5 (*extremely*). I employed a single- rather than multiple-item intensity measure for low- and high-arousal positive affect, respectively, in order to reduce fatigue.

Previous Mindfulness Experience. Participants were asked to what extent they had previously practiced mindfulness, with answers including: *None* (0); *I have practiced*

mindfulness just a few times, so I am still quite inexperienced (1); I have practiced mindfulness more than a few times, so I have some experience but not a lot (2); I have practiced mindfulness quite a bit - far more than a few times - so I am quite experienced (3); I have spent a great deal of time regularly practicing mindfulness, so I am very experienced (4). See appendix D.

Data Exclusion

A total of 253 participants completed the study. However, due to the online nature of the study, participants were excluded based on parameters that were difficult to predict beforehand and were therefore not pre-registered. First, after participants completed the induction, I assessed how long it took participants to make ratings of the 20 images. Assuming the effects of a brief mindfulness induction are fleeting, participants were excluded if they took an inordinate amount of time on this picture viewing task. Participants spent an average of 319 ($SD = 276$) seconds or roughly 5 minutes on the picture viewing task itself, and I excluded those ($n = 9$) who spent a standard deviation longer than average on the image task (595 seconds) or about twice as long as average. Again, because of the online nature of the study and the concentration required for the mindfulness induction, I excluded participants who noted repeated and direct interruptions ($n = 10$), such as going to the bathroom, continual phone notifications, or people talking directly to them. I also assessed notably odd answers to the picture viewing task that would indicate a severe lack of engagement. I paid particular attention to participants whose responses resembled straightlining. In doing so, I removed participants who rated 15 or more photos with the same extreme rating (either 5 or 0) on both calming and exciting ($n = 3$).

Per the pre-registered analysis plan and like (Hafenbrack et al., 2014) I then removed data from any participant who failed to indicate the correct answer for the induction attention check, since a failure to answer correctly for either induction suggests that the participant did not

adequately engage with the audio exercise. In total, 25 participants ($n_{\text{mindful}} = 19$, $n_{\text{control}} = 6$) were removed for failing the induction attention check. This left 206 participants, ($n_{\text{mindful}} = 91$, $n_{\text{control}} = 115$). This differential attrition across inductions is likely due both (1) to the difficulty of the mindfulness induction itself relative to the mind-wandering control condition and (2) to the potentially more difficult induction attention question in the mindfulness condition; note above that for the mindfulness condition, the correct answer somewhat resembles incorrect answers, while this is not true for the control condition. Therefore, it is potentially the case that after exclusions the mindfulness induction condition includes only those who were able to adequately engage in the induction, a potential threat to the external validity of the study. However, I thought it was important to exclude based on this criteria as planned in order to understand the effects of a *successful* brief mindfulness induction. This left us with data from 206 participants (64% women, 34% men, 2% = non-binary or agender, $M_{\text{age}} = 19.2$, $SD_{\text{age}} = 1.39$).

Chapter 4: Results

Effects of Induction on State Mindfulness

Both as a measure of state mindfulness and as a manipulation check, I averaged across the four items ($\alpha = .79$) to determine whether participants reported greater mindfulness during the mindfulness induction than during the control induction. Results from a t -test confirmed that participants in the mindfulness condition ($M = 2.52$, $SD = 0.86$) reported slightly higher levels of state mindfulness than participants in the control condition ($M = 2.15$, $SD = 0.96$), $t(204) = 2.88$, $p = .004$, M_{diff} 95% CI [0.12, 0.63], $d = 0.41$, $r^2 = 0.04$.

Calmingness and Excitingness Ratings

The data is of a nested structure: for each subject, Perception of Affective Quality (PAQ) image ratings are nested within Rating Type (calming, exciting), within each image, within Image Arousal level (high, low). Therefore, I modeled PAQ intensity ratings using linear mixed-effects regression with restricted maximum-likelihood via the lme4 package in R (Bates et al., 2015). Unless otherwise stated, all models were fit with Induction (mindfulness, control), Image Arousal (low, high), and Rating Type (calming, exciting) as fixed effects and all higher order interactions.¹ Models were also fit with random-intercepts for subject and image and with random-slopes per subject for Image Arousal, Rating Type, and the Image Arousal x Rating Type interaction². Any additional numeric predictors included in the model as described below were mean centered. Finally, models were fit with compound symmetry, unstructured covariance structures and Type III Sums of Squares. F -values are from ANOVA tables with Satterthwaite degrees of freedom. The primary analyses of interest were the Induction x Rating Type and

¹ This model violated the assumption of homogeneity of variance; however, accounting for the heterogeneity did not change the conclusions. Therefore, the simpler model is reported.

² This complex model better fit the data according to likelihood-ratio tests than models with fewer random-effects specified, as these random-effects accounted for notable variance.

Induction x Image Arousal x Rating Type interactions. I used model-estimated marginal means for all pairwise comparison tests where relevant.

Primary Analyses

Calmingness and excitingness PAQ ratings are shown in Figure 2. Not surprisingly, there was an Image Arousal x Rating Type interaction [$F(1, 204) = 1703.55, p < .001$], such that participants found low-arousal images more calming ($M = 3.76, SE = 0.10$) than exciting [$M = 1.21, SE = 0.10, F(1, 204) = 1184, p < .001$] and high-arousal images far more exciting ($M = 3.24, SE = 0.11$) than calming [$M = 0.65, SE = 0.10, F(1, 204) = 1270, p < .001$]. However, the analyses yielded no support for any of the primary predictions that mindfulness would increase calmingness (H1a) more than excitingness (H1b). There was no significant Induction x Rating Type interaction, $F(1, 204) = 0.22, p = .64$. Additionally, there was no Induction x Image Arousal x Rating Type interaction, $F(1, 204) = 1.15, p = .29$. See Figure 2. Therefore, a brief mindfulness induction, relative to a control condition, did not influence how calming and exciting participants found the pictures, and these results did not vary by arousal level of the image. Moreover, there was no main effect of induction, further suggesting that a mindfulness induction, overall, did not influence participants' reactions to the images, relative to a control condition, $F(1, 204) = 0.12, p = .74$.

Dispositional Mindfulness

I expected that people higher in dispositional mindfulness would be more prone to experience states of mindfulness and therefore better able to be mindful in the experiment. I expected that this would, in turn, render the manipulation more effective for dispositionally mindful participants.

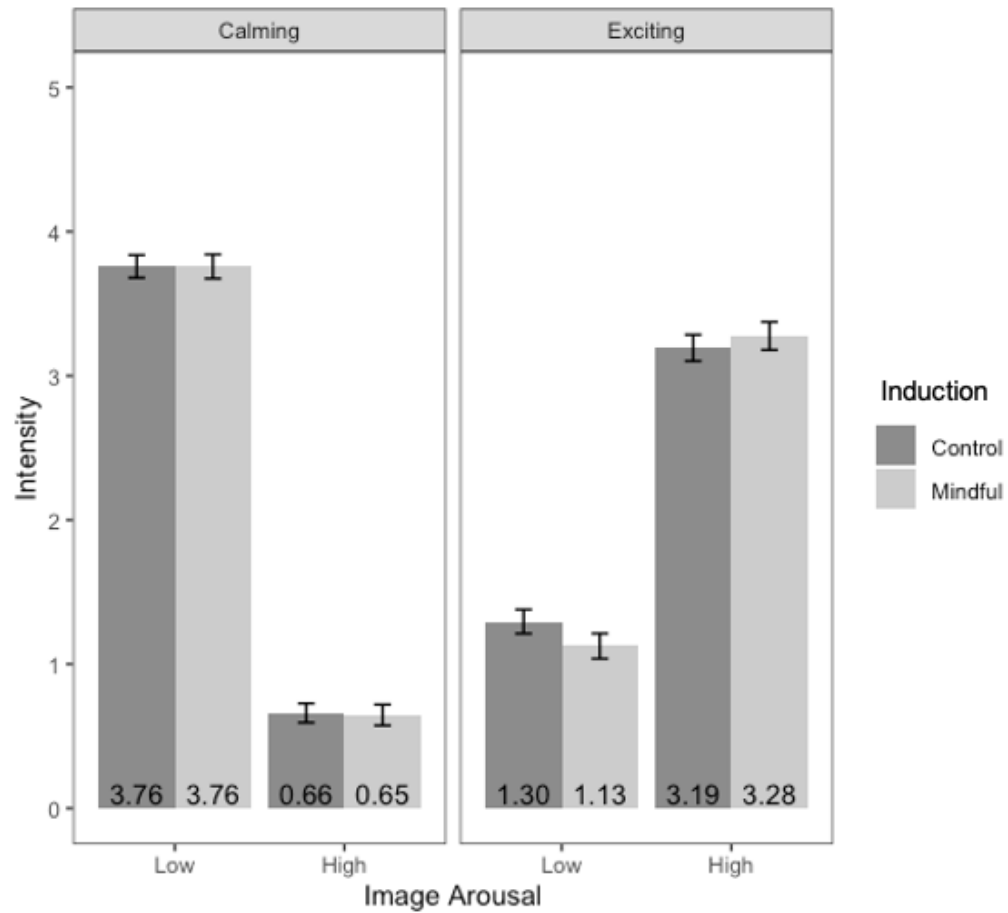


Figure 2. Mean calmingness and excitingness ratings of low- and high-arousal images among participants in the control and mindfulness conditions

Note. Bar heights represent estimated marginal means, and error bars represent 95% confidence intervals.

Therefore, I pre-registered that I would assess whether dispositional mindfulness—measured via the FFMQ-15 ($\alpha = .71$)—moderated the effect of the brief mindfulness induction on PAQ.

Effect of Dispositional Mindfulness on State Mindfulness. As a precursor to the analysis of whether dispositional mindfulness ($M = 2.10$, $SD = 0.45$) moderated the effect of the brief mindfulness induction on PAQ, I tested whether those higher in dispositional mindfulness were indeed better able to be mindful in the experiment. The ANOVA revealed that there was a main effect of FFMQ on state mindfulness, $F(1, 150) = 9.32$, $p = .003$, such that participants higher in dispositional mindfulness indicated higher levels of state mindfulness, regardless of the induction. Surprisingly, the relationship between dispositional mindfulness and state mindfulness was the same in both the mindfulness and control conditions; there was no FFMQ x Induction interaction on state mindfulness, $F(1, 150) = 0.18$, $p = .67$.

It is important to note that these particular results are likely *not* due to acquiescence response bias, wherein participants who report high ratings on both scales are simply people who report higher ratings on rating scales, in general. Indeed, this possibility is likely mitigated by the dispositional mindfulness measure including a nearly equal number of standard- and reverse-coded items. There are two other likelier possibilities at play here: (a) higher levels of dispositional mindfulness do not necessarily render the induction more effective as expected and as the results detailed below suggest, and/or (b) the state mindfulness measure was not a perfect indicator of the effectiveness of the induction. In the case of only this second possibility, I pressed on as planned to assess whether the induction influenced reactions among dispositionally mindful people.

Effect of Dispositional Mindfulness on Calmingness and Excitingness. I expected that participants who were more dispositionally mindful would find images more calming in the mindfulness than control condition, and that this increase in calmingness would be greater than any increase that may or may not occur for excitingness (H2). The relationship between dispositional mindfulness and the induction for calmingness and excitingness ratings are shown in Figure 3.

As shown in Figure 3, the analysis revealed an FFMQ x Induction x Rating Type interaction, $F(1, 150)^3 = 5.31, p = .022^4$. Follow-up tests indicated that the FFMQ x Induction interaction was not significant for calmingness ratings [$F(1, 150) = 0.07, p = .80$] but was marginally significant for excitingness ratings [$F(1, 150) = 3.19, p = .07$]. Further decomposing the FFMQ x Induction interaction for excitingness ratings⁵ revealed that for participants high in dispositional mindfulness (i.e., one standard deviation above the mean⁶), there was an effect of induction such that participants in the mindful condition found images marginally less exciting than did those in the control condition, $F(1, 150) = 3.71, p = .056$ (see the right panel of Figure 3). Among participants low in dispositional mindfulness (i.e., one standard deviation below the mean), the induction did not impact excitingness ratings, $F(1, 150) = 0.40, p = .53$. Finally, the FFMQ x Induction x Rating Type interaction was not moderated by Image Arousal, $F(1, 150) = 0.23, p = .63$.

³ Denominator degrees of freedom differ from primary analyses due to not every participant completing the separate survey for dispositional mindfulness. Moreover, denominator degrees of freedom differ per subscale in later analyses since not every participant completed every item of the dispositional mindfulness measure.

⁴ I also performed these analyses with FFMQ in place of induction; however, no conceptually interesting statistical tests were significant (all p 's > .13).

⁵ These follow-up analyses were conducted in SAS, due to the constraints of R in obtaining these values for participants one standard deviation above and below the mean in dispositional mindfulness.

⁶ Using one standard deviation above and below the mean to categorize participants as high or low in dispositional mindfulness is based on common practice; however, in this case of a novice sample, those "high" in dispositional mindfulness are still relatively low (i.e., 2.55 on a scale of 0 to 4), which may be why few effects were detected.

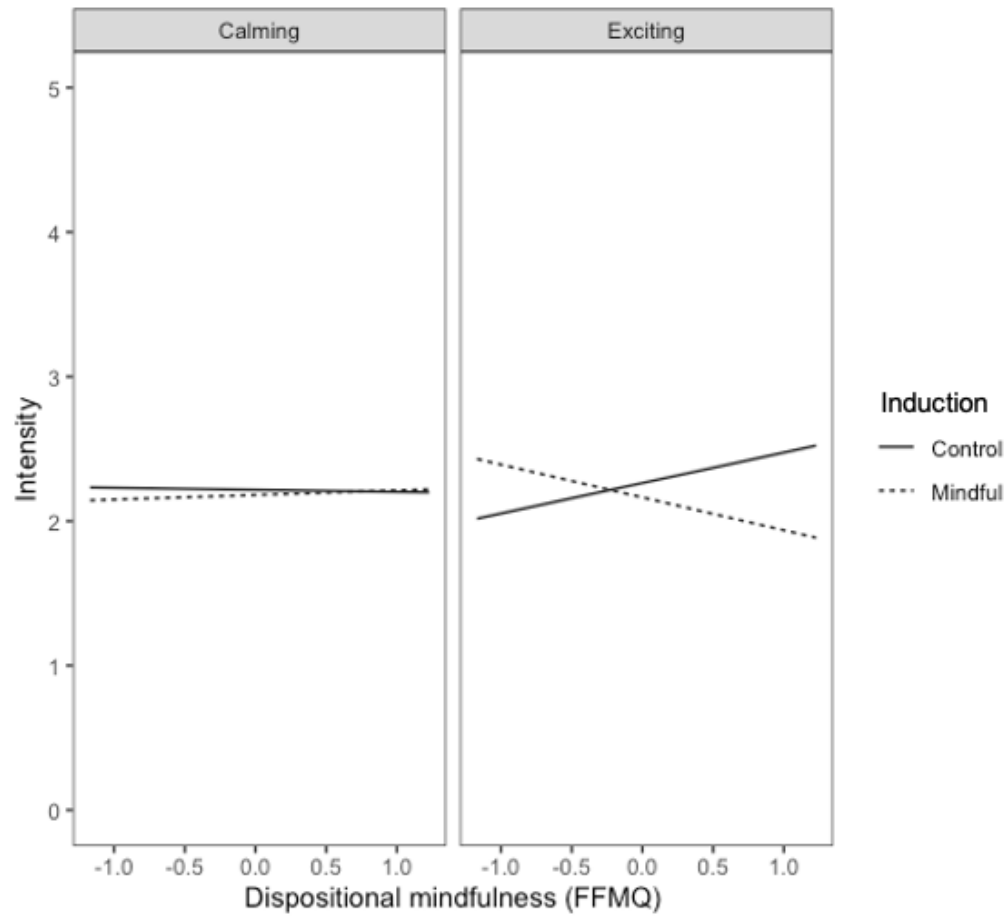


Figure 3. Dispositional mindfulness scores and calmingness and excitingness ratings among participants in the control and mindfulness conditions

Note. Lines represent estimated marginal means.

Subscale Analyses. Though the moderating effect of dispositional mindfulness was only marginally significant, perhaps it suggests that (a) one specific component of dispositional mindfulness moderates the effects of the induction and (b) the other components in the FFMQ-15 obscure its effect. Therefore, I conducted exploratory analyses to assess whether the pattern was especially strong within any of the FFMQ-15's five subscales (Awareness, Describing, Nonjudging, Nonreactivity, Observing). Table 2 shows intercorrelations among FFMQ-15's five facets. As detailed below, these exploratory analyses yielded little insight.

As shown in Figure 4, the subscale with a pattern of results that by far most closely resembled those obtained with the overall scale was the Observing subscale ($\alpha = .48$). The three items on the Observing subscale relate to participants' tendency to notice thoughts, feelings, and physical sensations. I detected an Observing x Induction x Rating Type interaction, $F(1, 1509) = 4.43, p = .037$. However, follow-up tests suggested that effects of the Observing subscale were no stronger than the putative effects of the FFMQ-15 as a whole. The Observing x Induction interaction was neither significant for calmingness ratings [$F(1, 150) = 0.01, p = .93$] nor for excitingness ratings [$F(1, 150) = 2.75, p = .10$]. Therefore, the Observing subscale did not appear to moderate the effects of the induction on how calming and exciting people found the images in any meaningful way.

The Nonjudging subscale ($\alpha = .72$) was the only other subscale of the FFMQ-15 that may have been meaningfully contributing to the moderating effect of dispositional mindfulness on the induction as described above. The three items on the Nonjudging subscale relate to participants' tendency to not evaluate thoughts or emotions as good or bad. The relationship between the Nonjudging subscale and the two inductions for calmingness and excitingness ratings are shown in Figure 5.

Table 2. Intercorrelations among FFMQ-15 Facets

FFMQ Subscale	1	2	3	4
1. Awareness				
2. Describing	.18*			
3. Nonjudging	.21**	.21**		
4. Nonreactivity	.14	.16	.21**	
5. Observing	-.03	.26**	.09	.13

Note. Sample sizes vary from 152 to 165, depending on the number of participants that completed the entirety of the relevant subscales.

* = $p < .05$, ** = $p < .01$, *** = $p < .001$; if no asterisk, then $p > .05$.

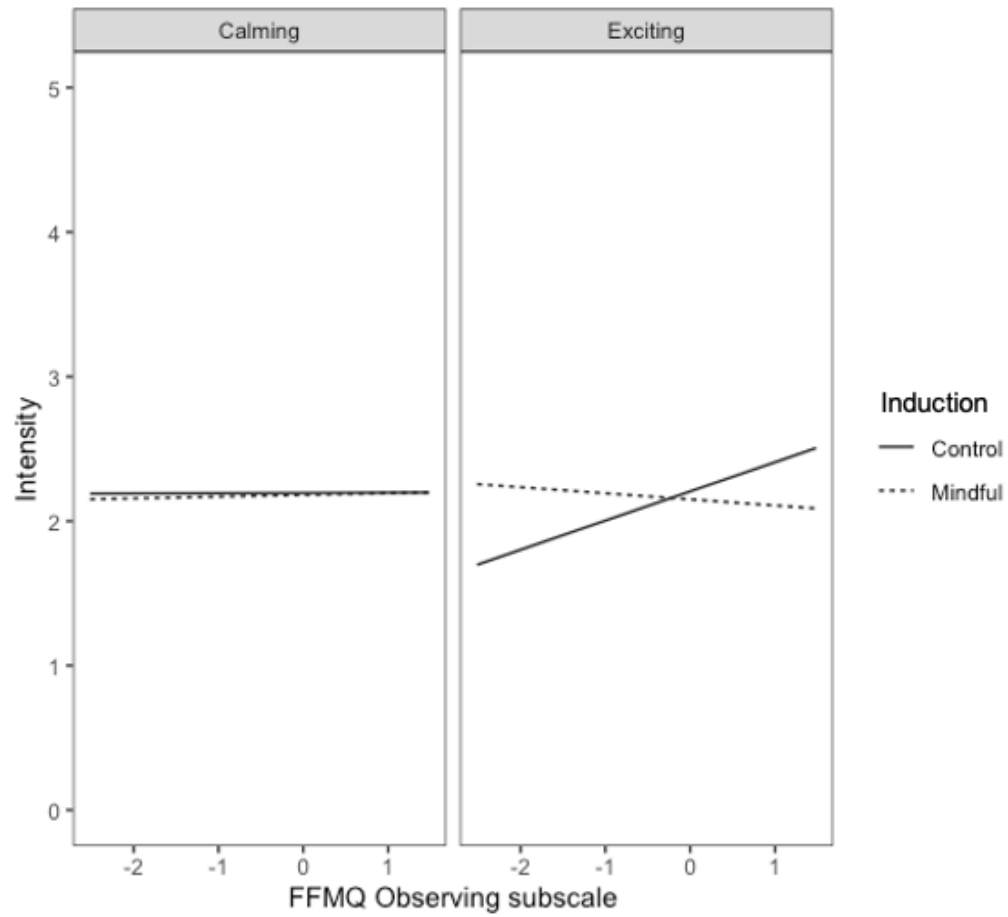


Figure 4. Observing scores and calmingness and excitingness ratings among participants in the control and mindfulness conditions

Note. Lines represent estimated marginal means.

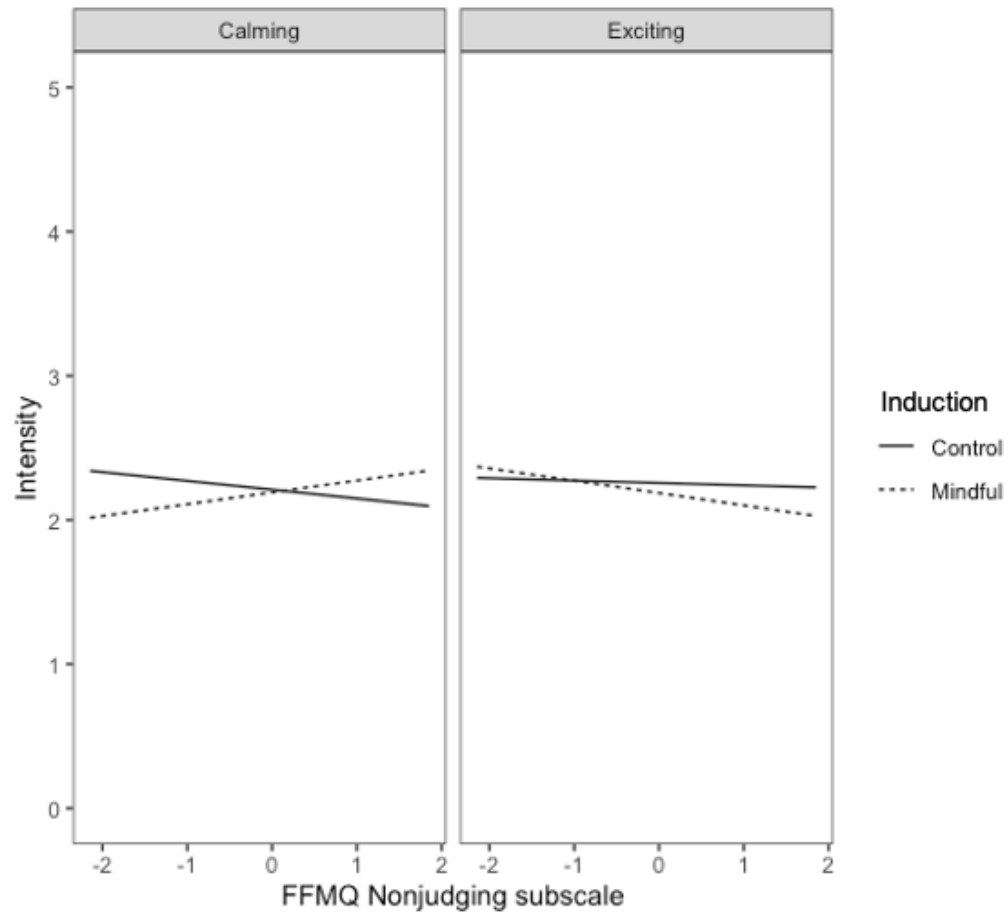


Figure 5. Nonjudging scores and calmingness and excitingness ratings among participants in the control and mindfulness conditions

Note. Lines represent estimated marginal means.

The analysis suggested a Nonjudging x Induction x Rating Type interaction, $F(1, 164) = 3.95, p = .049$, as was evident for the overall FFMQ-15 scale. Indeed, the pattern of results for excitingness ratings were somewhat similar to those of the FFMQ x Induction x Rating Type interaction described above. However, follow-up tests revealed that the Nonjudging x Induction interaction was not significant for calmingness ratings [$F(1, 164) = 2.28, p = .13$] or for excitingness ratings [$F(1, 164) = 0.28, p = .60$]. Therefore, the Nonjudging subscale also did not appear to moderate the effects of the induction on how calming and exciting people found the images in any meaningful way.

Results from no other subscales of the FFMQ-15 resembled those detected for the scale overall and contributed to the moderating effect of dispositional mindfulness on the induction: Awareness [$F(1, 164) = 0.29, p = .59, \alpha = .71$], Describing [$F(1, 164) = 2.34, p = .13, \alpha = .80$], Nonreactivity [$F(1, 153) = 0.23, p = .63, \alpha = .63$]. However, it is important to note that analyses of the Describing subscale showed a slightly different pattern of results. The three items on the Describing subscale relate to the tendency and ability to express or convey one's feelings. The relationship between the Describing subscale and the two inductions for calmingness and excitingness ratings are shown in Figure 6. Unlike for the FFMQ-15 overall or for any other subscale, the analysis suggested a main effect of the Describing subscale, $F(1, 164) = 4.03, p = .046$, with no relevant interactions (all p 's $< .13$). Thus, people higher in the describing facet found images both more calming and more exciting, regardless of induction and image arousal level.

Exploratory Analyses

Because there were no overall effects of a brief mindfulness induction on ratings of calmingness and excitingness, I explored the data further.

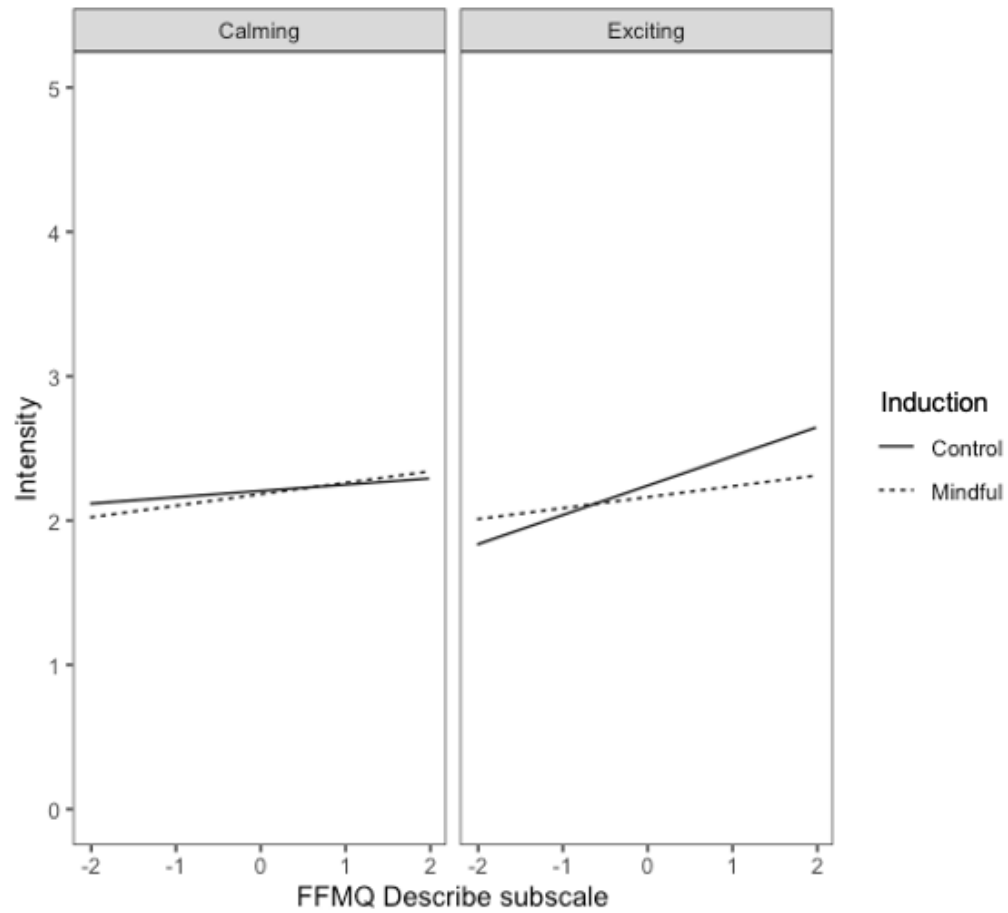


Figure 6. Describing scores and calmingness and excitingness ratings among participants in the control and mindfulness conditions

Note. Lines represent estimated marginal means.

State Mindfulness. I explored whether state mindfulness—rather than the induction—was related to participants' PAQ of the images. Based on Kabat-Zinn's (1990) conceptualization of mindfulness, it would stand to reason that participants who reached a greater level of mindfulness would find images more calming than those lower in state mindfulness. Moreover, if mindfulness is particularly likely to facilitate low-arousal positive states, then this increase in calmingness should be greater than any increase that may or may not occur for excitingness. Thus, I would expect a stronger positive relationship between state mindfulness and calmingness ratings than state mindfulness and excitingness ratings. The analysis did reveal a main effect of state mindfulness, $F(1, 204) = 6.88, p = .009$, such that people who indicated they were high in state mindfulness reported higher ratings, overall (see Figure 7). In contrast to expectations, the main effect of state mindfulness was not moderated by rating type, $F(1, 204) = 0.42, p = .52$, which indicates that people higher in state mindfulness found images both more calming and more exciting.

However, there was a marginally significant State Mindfulness x Image Arousal x Rating Type interaction, $F(1, 204) = 3.47, p = .064$ (see Figure 7). Though this effect was only marginally significant, I pursued it for exploratory purposes. A follow-up test on calmingness ratings indicated that State Mindfulness did not moderate the effect of Image Arousal, $F(1, 204) = 1.21, p = .27$. Another follow-up test on excitingness ratings indicated that the State Mindfulness x Image Arousal interaction was marginally significant, $F(1, 204) = 3.38, p = .067$. Further decomposing the State Mindfulness x Image Arousal interaction for excitingness ratings revealed that for images high in arousal, there was an effect of state mindfulness such that the more mindful a participant was, the more exciting they rated high-arousal positive images, $F(1,$

204) = 7.86, $p = .005$. For images low in arousal, state mindfulness did not impact excitingness ratings, $F(1, 204) = 0.23, p = .63$.

There are two explanations for the results that state mindfulness was associated with both increased calmingness and increased excitingness ratings. The interesting possibility is that people higher in state mindfulness had more intense affective reactions to the images, similar to results for people who were higher on the Describing subscale of the FFMQ-15. The uninteresting possibility is that this effect is driven by acquiescence response bias, especially when the response is appropriate (e.g., for excitingness of high-arousal positive images but not necessarily for calmingness of high-arousal positive images). By this latter account, participants who gave higher ratings on the state mindfulness measures and calmingness and excitingness are simply people who tend to report high ratings on rating scales. This is particularly possible due to the lack of reverse-coded items on the state mindfulness measure.

If these effects are due to the more interesting possibility of participants having achieved a greater state of mindfulness, I would expect them to be stronger in the mindfulness than control condition. This should specifically be the case because participants were indeed more mindful in the mindfulness condition, both logically and according to the measure of state mindfulness. In an attempt to address this, I looked at whether the induction impacts the relationship between state mindfulness and participants' PAQ of the images.

Participants' state mindfulness levels and PAQ for each induction are shown in Figure 8. The relationship between participants' scores on state mindfulness and their calmingness and excitingness ratings did not vary based on whether they were in the mindfulness or control conditions.

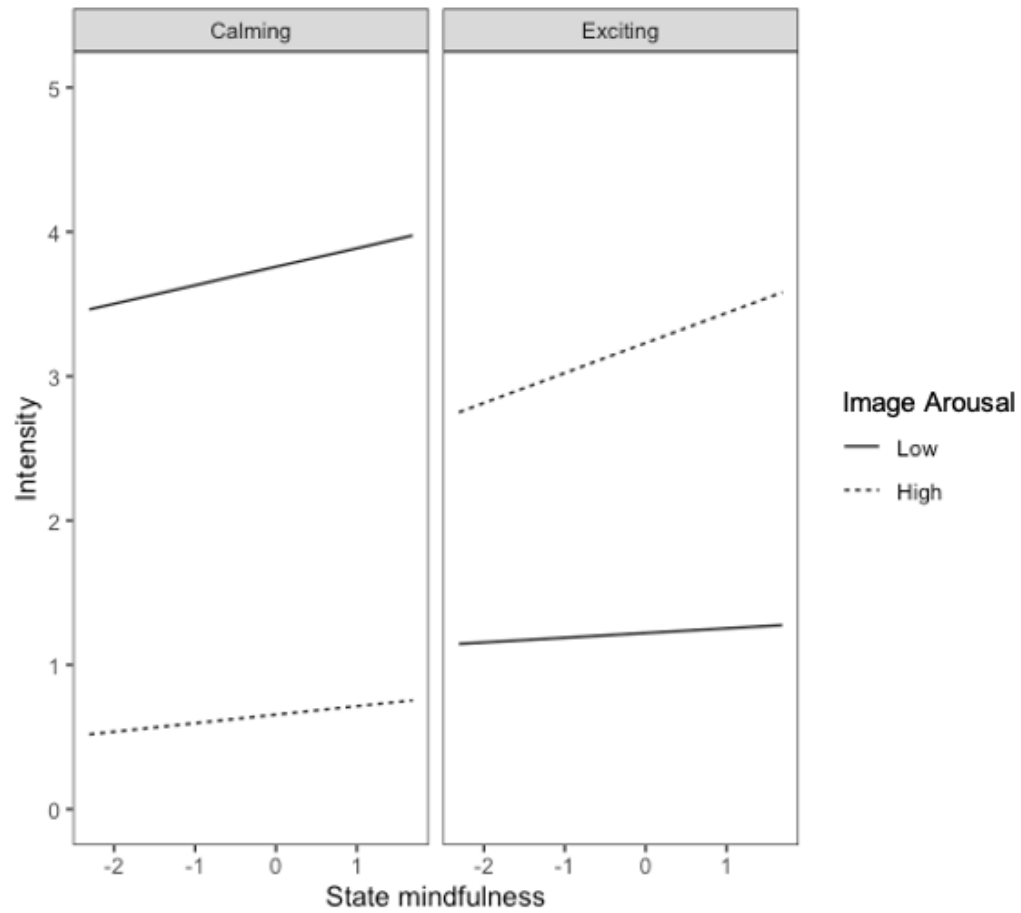


Figure 7. Participants' state mindfulness scores and calmingness and excitingness for low- and high-arousal images

Note. Lines represent estimated marginal means.

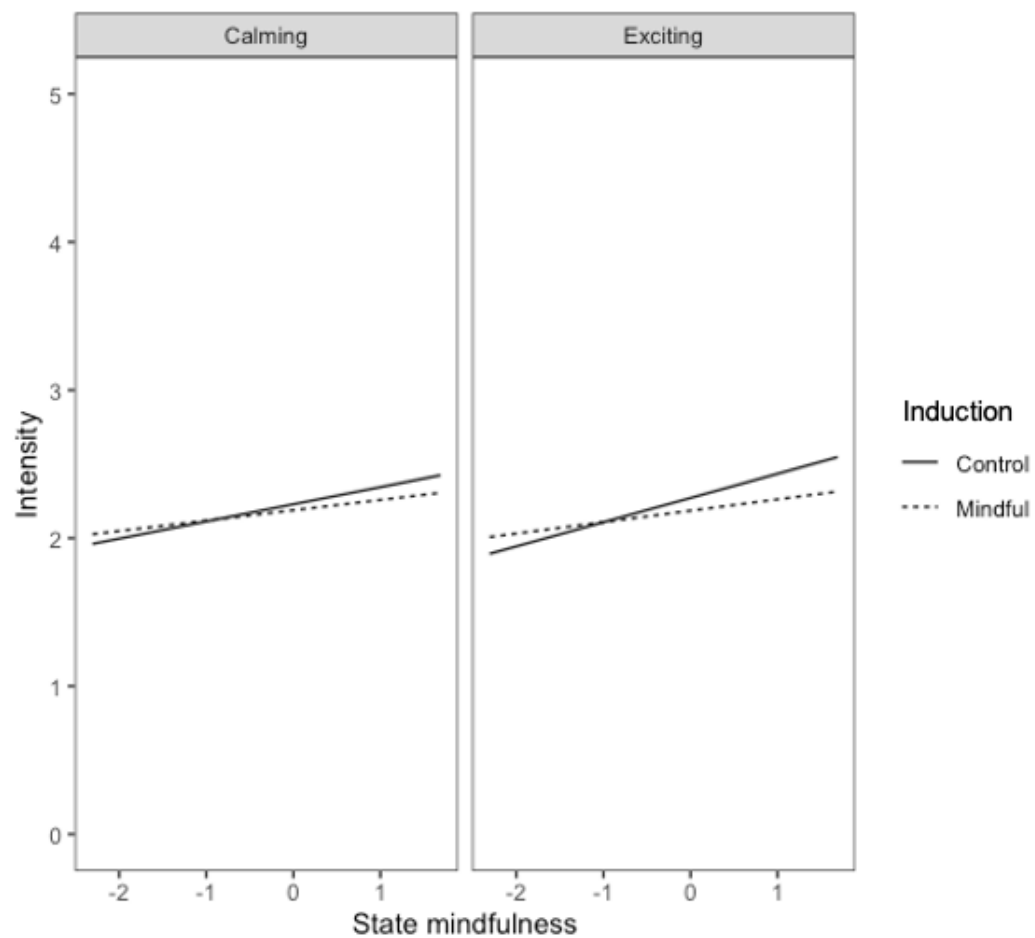


Figure 8. State mindfulness scores and calmingness and excitingness ratings among participants in the control and mindfulness conditions

Note. Lines represent estimated marginal means.

That is to say, there was no Induction x State Mindfulness interaction [$F(1, 202) = 0.61, p = .43$], nor was there an Induction x State Mindfulness x Rating Type interaction [$F(1, 202) = 0.22, p = .64$]. There was also no Induction x State Mindfulness x Image Arousal x Rating Type interaction [$F(1, 202) = 0.01, p = .92$]. However, the main effect of State mindfulness on image ratings remained, $F(1, 202) = 6.24, p = .013$. This suggests that the positive relationship between participants' state mindfulness scores and their affective reactions are most likely due to uninteresting individual differences in acquiescence.

Previous experience with mindfulness. Though I had no specific predictions, I also conducted analyses to investigate potential effects of participants' previous experience with mindfulness. The majority of participants (75%) had at least some familiarity with practicing mindfulness on a scale of 0 to 4 ($M = 1.26, SD = 1.0$); only 25% indicated no experience at all. First, I explored whether previous experience, rather than the induction, was related to participants' PAQ of the images. The analysis revealed that previous experience alone did not influence PAQ. There was no significant main effect of Previous Mindfulness Experience, $F(1, 204) = 1.89, p = .17$. There was no significant Previous Mindfulness Experience x Rating Type interaction, $F(1, 204) = 0.001, p = .98$, nor was there a Previous Mindfulness Experience x Image Arousal x Rating Type interaction, $F(1, 204) = 0.16, p = .69$.

I also assessed how previous experience with mindfulness practices may have impacted how the induction affected their ratings of calmingness and excitingness. However, previous experience practicing mindfulness did not moderate the effects of induction on ratings of calmingness and excitingness. There was no significant Previous Mindfulness Experience x Induction x Rating Type interaction, $F(1, 202) = 0.93, p = .34$, nor was there a Previous

Mindfulness Experience x Induction x Image Arousal x Rating Type interaction, $F(1, 202) = 0.003, p = .96$.

Gender. Though I had no specific predictions, I also explored gender differences. Gender did not moderate the effects of induction on ratings of calmingness and excitingness. There was no significant Induction x Gender x Rating Type interaction, $F(1, 198) = 0.81, p = .37$.

Additionally, there was no Induction x Gender x Image Arousal x Rating Type interaction, $F(1, 198) = 1.90, p = .17$.

Chapter 5: Discussion

This study examined how a brief mindfulness induction influences perceptions of calmingness relative to excitingness. Based on Kabat-Zinn's (1990) conceptualization, a likely outcome of mindfulness practice is the low-arousal positive state of peacefulness, and mindfulness practitioners warn against over-engagement with high-arousal positive emotions (Sedlmeier et al., 2012). Therefore, I expected a brief mindfulness induction would be more likely to facilitate a low-arousal positive affective reaction (i.e., calmingness) than a high-arousal positive affective reaction (i.e., excitingness). After a brief mindfulness or control induction, participants indicated how calming and exciting they perceived low- and high-arousal pleasant images. The data did not support the primary hypotheses; the mindfulness induction did not affect how calming and exciting people found the pictures. Additional analyses of individual differences yielded some, but not many, potentially interesting results.

The Mindfulness Induction Did Not Make Images More Calming or Exciting

Previous research has not yet made clear why mindfulness exerts asymmetric effects on negative and positive emotions—generally reducing negative emotions and tending to increase positive emotions. Additionally, evidence has been somewhat mixed regarding positive emotions, and previous research has also not made clear under what conditions mindfulness facilitates, reduces, or does not impact positive affective responding (see Jiménez et al., 2020 and Jordan & Larsen, 2020 for reviews). In attempting to reconcile these varying effects, I wondered whether mindfulness may be more likely to increase certain types of positive affective responding than others. The mental composure and non-reactivity that mindfulness practice fosters align with the low-arousal positive state of peacefulness (Kabat-Zinn, 1990), and mindfulness is not meant to facilitate high-arousal positive affect; mindfulness practitioners even

warn against over-engagement with high-arousal positive emotions (Sedlmeier et al., 2012). Therefore, I posited that one overarching possibility is that mindfulness may be more likely to increase low- than high-arousal positive emotional responding. I also wondered whether mindfulness may more reliably exert influence on *earlier* aspects of affective processes such as how evocative stimuli are *perceived*, rather than on downstream processes that are more often measured like emotional experience (Hölzel et al., 2011).

This study is the first to test whether a brief mindfulness *induction* would be more likely to facilitate a low-arousal than high-arousal affective reaction. Moreover, it is the first to test whether any conceptualization of mindfulness is more likely to elicit low- than high-arousal perceptions of affective quality (PAQ) of low- and high-arousal stimuli, respectively. However, I did not find evidence that a brief mindfulness induction impacted people's perceptions of calmingness and excitingness of low- and high-arousal pleasant images. Therefore, the present study did not provide evidence that a brief mindfulness induction alone influences perceptions of affective quality, nor did it provide evidence that a mindfulness induction is more likely to facilitate low- than high-arousal positive responding.

To some degree, these particular null results are not surprising, as they are in line with the few studies that have explored effects of mindfulness on PAQ. Indeed, previous studies have found null effects when assessing the relationship between PAQ of pleasant pictures and previous mindfulness experience (Lee et al., 2012), brief inductions of mindfulness (Valim et al., 2019) and mindfulness interventions (Leung et al., 2018). However, I had speculated that there may be a couple of reasons for these prior null effects. First, if there were any potential effects of mindfulness on low- versus high-arousal positive responding, they may have been masked by combining responses to stimuli of varying arousal levels (Valim et al., 2019). Second, perhaps

we have not yet seen any potential effects of mindfulness on *low*-arousal PAQ because previous research has only specifically elicited high-arousal PAQ when discerning effects of mindfulness on PAQ of a particular level arousal level (Lee et al., 2012; Leung et al., 2018). However, the current study of mindfulness on the effects of PAQ addressed these possibilities and study limitations with the inclusion of *both* low- and high-arousal positive stimuli and measures, yet still found null effects of mindfulness. Therefore, I can draw a couple of potential conclusions. First, it may be the case that mindfulness does not at all influence perceptions of affective quality (PAQ). And second, it may also be the case that a brief mindfulness induction is not more likely to facilitate low-arousal than high-arousal positive affective responding, overall, whether it be PAQ or emotional experience.

PAQ Versus Emotional Experience

However, it is possible that these particular null effects and the null effects found in similar studies above that assess PAQ may be specific to the (lack of) impact of mindfulness on PAQ, in general, rather than on how mindfulness may or may not be more likely to facilitate low-arousal than high-arousal positive affective responding. Again, I had speculated at the outset of this study that one possibility for overall murkiness in how mindfulness influences positive emotional responding may be that mindfulness more reliably exerts influence on *early* aspects of affective processes, such as how evocative stimuli are *perceived* (Hölzel et al., 2011). Therefore, this study addressed only a small snapshot of the influence of mindfulness on early affective responding—how mindfulness affects perceptions of affective quality, or stimuli’s potential to influence how we feel.

This helps to inform our theoretical understanding of mindfulness and the processes through which it does and does not work. As Teper et al. (2013) note and prior reviews have

made apparent (e.g., Jordan & Larsen, 2020; Khoury et al., 2015; Leyland et al., 2019; Schumer et al., 2018; Tomlinson et al., 2018) there is an obvious link between mindfulness and emotional responding; however, that link and the processes through which mindfulness impacts emotion is yet to be fully understood. These null results and others suggest that perceptions of affective quality are not necessarily a component of affective responding that mindfulness impacts. This aligns with Teper et al.'s (2013) suggestion that mindfulness may not influence initial, immediate affective reactions but instead could primarily exert its influence on later, more downstream aspects of the affective process. Indeed, other studies have found evidence that mindfulness does influence later aspects of the affective process—that is to say, later than PAQ—such as positive emotional *experience* (see Jiménez et al., 2020 and Jordan & Larsen, 2020 for reviews).

Moreover, since mindfulness more reliably influences these later aspects of affective processes like emotional experience, this would, in turn, mean that these downstream processes are specifically where future research is most likely to detect any potential difference in effects of mindfulness on low- versus high-arousal affective responding. In fact, other researchers have specifically noted the likelihood that mindfulness would be more likely to elicit low-arousal than high-arousal affective states (Jones et al., 2018; Koopmann-Holm et al., 2013; Rowland et al., 2018). And this possibility has been partially corroborated by previous correlational research (McManus et al., 2019), daily-life studies (Du et al., 2019; Jones et al., 2018; Lindsay et al., 2018; Matos et al., 2017; Rowland et al., 2018), and laboratory studies (Brunyé et al., 2013; Molet et al., 2013) that have found some evidence of mindfulness facilitating *low*-arousal positive emotional experience. Additionally, mindfulness has generally not exerted effects on high-arousal positive emotions (Cosme & Wiens, 2015; Eddy et al., 2015; Edwards et al., 2018;

Jones et al., 2018; Koopmann-Holm et al., 2013; Matos et al., 2017; Rosenberg et al., 2015; Sze et al., 2010; Valim et al., 2019) or in some cases, has not been as strongly associated with mindfulness as is low-arousal positive emotional experience (Lindsay et al., 2018; McManus et al., 2019). In yet another study, a mindfulness induction even *reduced* high-arousal experience to positive stimuli, relative to those who underwent a control condition (Beblo et al., 2018). Therefore, this study's null effects of mindfulness on low- and high-arousal PAQ and similar null effects found by others are all potentially specific to the influence—rather, the *lack* of influence—of mindfulness on PAQ, overall.

Affective Processes in the Laboratory Versus Daily Life

Mindfulness may also more reliably influence the types of situations that people find themselves in, rather than specific responses to any given situation. This study extended prior research by actually eliciting both the low- and high-arousal perceptions of affective quality in question—a potentially strong and controlled test of the prediction that mindfulness is more likely to facilitate low- than high-arousal positive affective reactions. However, most of the previous mindfulness studies mentioned above that found effects of mindfulness on low- and/or high-arousal positive emotions measured these emotions as they occurred in participants' *daily life*, either by asking people to summarize their daily emotional experiences over time (e.g., Lindsay et al., 2018; Matos et al., 2017; McManus et al., 2019) or by ecological momentary assessment (Rowland et al., 2018). Since I did not detect direct effects of the mindfulness induction when low- and high-arousal positive PAQ was experimentally induced, it is possible that mindful people generally react to any given affective situation similarly (e.g., to the calmingness of a low-arousal positive image), yet simply find themselves in different affective situations in their daily lives than do less mindful people. For example, as could be the case

regarding McManus et al. (2019), perhaps dispositionally mindful people tend to seek out more calming situations, such as a walk in nature, than more exciting situations, such as a sporting event.

Additionally, in understanding how and whether mindfulness influences responses to low- versus high-arousal situations, it would be helpful to know whether states of mindfulness themselves elicit specific feelings. These feelings would, in turn, reasonably influence how and whether mindfulness exerts effects on responding to emotional situations. Generally, studies that induce states of mindfulness do not measure the influence of the mindfulness induction alone on emotional experience. There are some exceptions to this (Brunyé et al., 2013; Edwards et al., 2018; Molet et al., 2013; Reynolds et al., 2015; Valim et al., 2019). However, no study has been conducted to compare the influence of a mindfulness induction alone on *both* low- and high-arousal positive emotional responding. Future research may attempt to better understand whether a brief mindfulness induction alone is more likely to increase low- than high-arousal positive emotional experience.

Potential Methodological Explanations

Still, it is possible that mindfulness does influence PAQ and may even elicit more intense low- than high-arousal PAQ, yet I simply did not see these effects. If this is the case, these null results and inconclusive findings relative to those of related studies on emotional experience may be at least partially explained by methodological limitations and differences.

Difficulty of Brief, One-Time Mindful Inductions. Many of the previous studies noted above that have found effects of mindfulness on low- and/or high-arousal positive emotional experience utilize mindfulness *interventions* that involve teaching participants mindfulness over the course of several weeks (e.g., Jones et al., 2018; Lindsay et al., 2018; Matos et al., 2017).

Again, I extended prior research by assessing effects of a brief mindfulness *induction* on low- versus high-arousal affective responding. Thus, another explanation for overall null results is that a brief mindfulness induction, in general—and more specifically, a brief mindfulness induction administered in an online study—may not be strong enough to elicit any subtle differences (if these differences do exist) in low- versus- high-arousal positive PAQ in a novice sample.

Practicing mindfulness is difficult, especially for novices (Brewer et al., 2013), and this study involved a novice sample. Participants tended to report that they had only practiced mindfulness just a few times; average experience was only 1.26 ($SD = 1.0$) on a scale of 0 to 4.

Still, if mindfulness influences PAQ, I expected that at minimum, I would detect differences between participants in the mindfulness and control conditions on *low*-arousal PAQ, since others have found that a mindfulness induction elicits more low-arousal positive emotional experience (Brunyé et al., 2013; Molet et al., 2013). I expected this effect of mindfulness on low-arousal PAQ even if it did not necessarily differ from the effect of mindfulness on *high*-arousal PAQ. Therefore, it may be the case that *this* brief mindfulness induction, specifically, was simply not strong enough to elicit any expected effects of mindfulness on PAQ, if these effects exist. While the state mindfulness measure suggested that the mindfulness manipulation was technically successful, participants reported a relatively minimal difference in state mindfulness across the two inductions ($d = 0.41$).

To mitigate the difficulties of inducing a brief state of mindfulness in a novice sample, future research involving brief mindfulness inductions may focus on participants with more previous experience practicing mindfulness who may be better able to participate in a brief mindfulness induction. This is feasible, since mindfulness practices have become increasingly

widespread with the proliferation of sophisticated (and often, free) apps. Indeed, the large majority of participants indicated at least a little experience practicing mindfulness.

Non-ideal Emotion Induction. As mentioned above, most mindfulness studies that induce positive emotional experience do not differentiate between low- or high- (or moderately, for that matter) arousing images; researchers typically simply note the average arousal level for the stimuli as a whole, rather than for any given stimulus or stimulus group (e.g., Arch & Craske, 2006; Kiken & Shook, 2014; Ortner et al., 2007; Parsons et al., 2019; Reva et al., 2014; Taylor et al., 2011; Watford & Stafford, 2015). The same is true for studies that explore effects of mindfulness on PAQ (Valim et al., 2019), or they only use pleasant images that are very high in arousal (Lee et al., 2012; Leung et al., 2018). Therefore, this study extended prior research by utilizing low- and high-arousal pleasant images to actually elicit, measure, and compare the relevant perceptions of affective quality. However, I did not find any overall effects of the mindfulness induction on calmingness and excitingness of low- and high-arousal pleasant images.

Ceiling and Floor Effects. Across conditions, people found low-arousal images to be very calming and not very exciting. Additionally, people found high-arousal images to be very exciting and not very calming. Therefore, another possibility for the null results as suggested by D. Batson (personal communication, April 16, 2021) is that any potentially existing effects of mindfulness on PAQ may have been masked by *ceiling effects* and *floor effects*. By this account, for instance, participants perceived high-arousal pleasant images to be so exciting that there is little room at the top of the scale for potential variability due to mindfulness (i.e., ceiling effects). The same would be true for calmingness of low-arousal pleasant images. Relatedly, participants perceived high-arousal pleasant images to lack calmingness to the degree that there is little room

at the bottom of the scale for potential variability due to mindfulness (i.e., floor effects). The same would be true for calmingness of high-arousal pleasant images. Moreover, PAQ may be particularly susceptible to these ceiling and floor effects, as some prior research has shown that perception ratings tend to be higher than feelings ratings. Indeed, Hunter et al. (2010) found that while perception ratings of music were highly correlated with the feelings the music elicited, perception ratings tended to be higher than ratings of feelings.

As also suggested by D. Batson (personal communication, April 16, 2021), perhaps the most reasonable way to address these ceiling and floor effects is by including moderately arousing stimuli. Indeed, any potential effects of a brief mindfulness induction on PAQ may have been more apparent for perceptions of these stimuli; participants might find some moderately arousing images to be moderately calming and others moderately exciting. If so, there would be room left between the floor and ceiling to detect any potentially subtle effects of mindfulness, if they exist. Therefore, future studies including moderately arousing images may help discern whether mindfulness influences PAQ at all and whether mindfulness influences is more likely to facilitate low- than high-arousal positive emotional responding.

Range Effects. Including moderately arousing stimuli would also mitigate the masking of any potential effects that may have resulted from participants comparing low- and high-arousal stimuli. People judge stimuli in comparison to other stimuli in the stimulus set (Parducci, 1968). For example, participants harshly judge an immoral act such as poisoning a neighbor's barking dog when it is among a list of milder acts of wrongdoing (e.g., checking into a hotel with an alias; Parducci, 1968). On the other hand, such an immoral act is judged *less* harshly, overall, when it is among a list of more evil acts, such as murdering a person for no reason (Parducci, 1968). Parducci (1968) terms such relativism of judgments *range effects*.

The image task involved participants viewing low- and high-arousal pleasant images in random order, likely creating a situation in which participants are making direct comparisons of low- versus high-arousal images. If this were the case, it could mean that participants may have reserved the lower end of the calmingness scale for high-arousal photos, leaving only the upper end of the calmingness scale for low-arousal photos. Similarly, participants may have reserved the upper end of the excitingness scale for high-arousal photos, leaving only the lower end of the excitingness scale for low-arousal photos. This could, in turn, reduce the variability potentially created by the mindfulness versus control induction, effectively masking any effects of mindfulness that may potentially exist.

Again, using only moderately arousing stimuli would likely mitigate these range effects. However, if a future mindfulness study found it useful to incorporate stimuli of varying arousal levels, range effects could also be mitigated by showing participants *only* low-, moderately, or high-arousal images, eliminating the chances for comparison altogether.

Content of Stimuli. Although the stimuli were clearly impactful—participants found the images to be very calming and very exciting, respectively—it is possible that the stimuli did not elicit the processes for which we are most likely to see the effects of mindfulness. An important aspect of mindfulness relates to not over-identifying with experiences and emotions; it is important to hold them at a distance and allow space between the mindfulness practitioner and the thought or feeling (Kabat-Zinn, 1990). It may be the case that my stimuli, which were images of landscapes and strangers, may have not engaged the processes or elicited the PAQ that mindfulness would be most likely to impact. That is to say, perhaps any participant, whether they were mindful or not, would have evaluated these images in the same way. On the other hand, stimuli that would elicit more self-relevant affective reactions (e.g., autobiographical recall) may

have allowed for greater utilization of mindfulness—allowing the participant to hold these affective evaluations at somewhat of a distance—and potentially allowed us to see these effects in the data in some expected way.

Lack of Engagement. The finding that a brief mindfulness induction does not influence calmingness and excitingness may have been due to an overall lack of engagement in this online study. Ideally, I would have conducted this study in a moderated laboratory setting. However, because of the COVID-19 pandemic, I instead conducted this study via an unmoderated Qualtrics session; therefore, it was difficult to ensure that participants were engaged with the study and whether they actually participated in the experimental mindfulness manipulation. Still, I attempted to account for these challenges in a number of ways: I reiterated to participants the importance of their data; asked them to confirm that they would complete the study in a quiet place without distractions; suggested the use of headphones; told them ahead of time that they would be asked questions about the content of the audio task; used Qualtrics to disallow participants from continuing on past the induction before the allotted time had passed; and finally, excluded participants with potentially meaningless data (see above in Data Exclusion) and participants who answered the attention check incorrectly⁷. However, a lack of engagement is likely not the only explanation; at least one other study involving this same brief mindfulness induction was conducted online and reported emotional differences as a result of the mindfulness manipulation (Hafenbrack et al., 2014). Still, online mindfulness inductions are far from the norm, and a future study could simply and effectively mitigate these engagement difficulties by conducting the research in a laboratory.

⁷ By excluding participants who answered the induction attention check incorrectly, the external validity of the study was potentially compromised. This is because the final sample contained only those participants who were able to adequately engage with the mindfulness and mind-wandering inductions, which plausibly does not resemble the general population or even the general undergraduate student population.

Roles of Dispositional Mindfulness

As detailed above, a key likelihood of mindfulness practice is facilitation of the low-arousal state of peacefulness (Kabat-Zinn, 1990), aligning with the mental composure and nonreactivity that mindfulness practices foster. On the other hand, mindfulness is *not* intended to foster high-arousal positive affect; Buddhist and Hindu teachings from which Western mindfulness practices originate even warn against over-engagement with high-arousal positive emotions (Sedlmeier et al., 2012). Therefore, I expected that a mindfulness induction would be more likely to increase low- than high-arousal PAQ, relative to a control condition. Importantly, I also expected these effects would be stronger among people higher in dispositional mindfulness.

Although I did not see overall effects of the brief mindfulness induction on calmingness and excitingness, I assessed the pre-registered prediction that dispositional mindfulness (as measured by the FFMQ-15) may moderate the effect of the brief mindfulness induction on calmingness and excitingness. In contrast to expectations, dispositionally mindful people did not report increased calmingness in the mindful condition relative to the control condition; dispositionally mindful people in the mindfulness condition found the pictures no more calming than did dispositionally mindful people in the control condition.

However, slightly more in line with expectations, dispositionally mindful participants found images marginally *less exciting* after a mindfulness induction than after a control induction. Admittedly, this finding is somewhat surprising when compared to previous research, considering prior studies of mindfulness and PAQ have not found evidence that mindfulness impacts high-arousal responding at all (Lee et al., 2012; Leung et al., 2018; Valim et al., 2019). Still, this finding that dispositionally mindful people find images less exciting after a

mindfulness than control condition provides some evidence for theoretical indications that mindfulness is not meant to facilitate high-arousal positive emotions. It also closely aligns with at least one case in which mindfully watching a joyful film *reduced* self-reported experience of arousal relative to a control condition (Beblo et al., 2018). However, importantly, this study extends Beblo et al. (2018) and others discussed above by also determining how this elicited high-arousal responding compares to elicited low-arousal responding after a brief mindfulness induction.

It is also worth noting that this finding somewhat corroborates the possibility discussed earlier that these particular stimuli may have masked any potential subtle effects of the mindfulness induction. If floor and ceiling effects were at play, then only the strongest of any potentially existing effects of mindfulness could have been detected. I presumed effects of mindfulness would be strongest among dispositionally mindful participants, and that is what was found: among the most dispositionally mindful of participants, the induction elicited some of the expected effects, as discussed above. That is to say, it may be the case that I could only ever have detected subtle effects among the most dispositionally mindful of participants—where effects would be presumed to be the strongest—with these particular stimuli and the resulting ceiling/floor effects.

Finally, I had expected that dispositionally mindful participants would show stronger effects as described above because they would be better able to be mindful in the experiment. It is important to note, however, that surprisingly, dispositionally mindful people in the mindfulness condition did not report higher levels of state mindfulness than did dispositionally mindful people in the control condition. Therefore, it is possible that higher levels of dispositional mindfulness did *not* render the induction more effective, as suggested by the above

results, and that these effects are due to some other unknown process or possibility—including Type I error. However, it is also plausible that the state mindfulness measure was simply not a perfect indicator of the effectiveness of the induction and that dispositional mindfulness *did* strengthen the effect of the induction. As detailed above, results somewhat corroborated the second possibility.

Findings for the Describing Subscale Show a Different Pattern. Again, people who were high in dispositional mindfulness, overall, reported finding images marginally less exciting after a mindfulness induction than after a control induction. No subscale, in particular, seemed to meaningfully drive this effect. However, one subscale showed a notably different pattern; participants high on the Describing subscale of the FFMQ-15 found images both *more* calming and *more* exciting, irrespective of the induction they underwent. This is surprising, for a couple of reasons. First, I had not predicted that any conceptualization of mindfulness would be related to equally strong increases in calmingness and excitingness. Second, prior studies of mindfulness and PAQ have not found evidence that mindfulness impacts high-arousal responding (Lee et al., 2012; Leung et al., 2018; Valim et al., 2019).

These findings do align to a degree with some previous research that found dispositionally mindful people (McManus et al., 2019) and participants who underwent a mindfulness intervention (Lindsay et al., 2018) reported more daily-life experiences of both low- and high-arousal positive emotional experience. Importantly however, Lindsay et al. (2018) did not indicate whether low- and high-arousal positive emotional experience differed. And *unlike* the findings in this study, McManus et al. (2019) found that while dispositional mindfulness facilitated both low- and high-arousal positive responding, dispositionally mindful people tended to report *more* low- than high-arousal positive responding.

Still, these results beg the question of why the describing facet in particular would equally facilitate calmingness and excitingness, while no other subscale shows a pattern of intensifying PAQ. The three items on the Describing subscale relate to the tendency and ability to express or convey one's feelings. The image task required participants to perceive the emotional aspects of images, and being high on this facet may have simply facilitated emotional perceptions, in general. Admittedly, I would have expected these participants to be a bit more discerning by rating low-arousal images as more calming, specifically. Moreover, I would have expected them to rate high-arousal images, in particular, as more exciting. Nonetheless, it may be the case that this describing facet facilitates the perception of both calming and exciting aspects of an image, while the other facets do not. Finally, it is important to note that these results are likely not driven simply by acquiescence bias, considering the FFMQ-15 and most of its subscales (including Describing) contains reverse-coded items.

State Mindfulness May Elicit More Intense Affective Reactions

Again, I predicted that mindfulness would be more likely to facilitate low- than high-arousal PAQ, and I had not predicted that any conceptualization of mindfulness would be related to equally strong increases in calmingness and excitingness. However, there was some evidence that people who were higher in state mindfulness found the pictures both more calming and more exciting. And similar to the findings for the Describing dispositional mindfulness subscale, this effect was equally strong in the mindfulness and control conditions. I explore two possible explanations for these results. One obvious possibility is that people higher in state mindfulness had more intense affective reactions to the images. The uninteresting possibility is that this effect is driven by acquiescence response bias, such that some people tend to report high ratings on scales.

Potential for More Intense Affective Reactions. This first possibility—that state mindfulness equally facilitates both calmingness and excitingness—contradicts my predictions but aligns closely with at least one previous related study showing that people who reported higher levels of state mindfulness in any given moment also reported more intense low- *and* high-arousal positive emotional states in daily life (Rowland et al., 2018). Importantly, it also aligns with the unexpected findings above that people dispositionally high on the describing facet found images both more calming and more exciting. Therefore, perhaps people who reached high levels of state mindfulness in this study simply perceived the stimuli to be more emotional, in general.

Additionally, it might also be the case that in a novice sample of participants, in particular, state mindfulness can simply accentuate the positive—be it low- or high-arousal positive affective responding. Experienced practitioners conceptualize mindfulness in such a way that the likely outcome is calmness and peacefulness (Kabat-Zinn's, 1990). Moreover, Buddhist and Hindu teachings from which Western mindfulness practices originate even warn against over-engagement with high-arousal positive emotions (Sedlmeier et al., 2012). Still, this study was conducted within a novice sample of participants—few of which had extensive experience practicing mindfulness—and in a Western setting where high-arousal positive emotions are particularly valued (Tsai et al., 2006). Therefore, state mindfulness in a sample of novice participants may manifest in such a way that it simply accentuates any positive responding by tuning in participants to the present (positive) moment and therefore is associated with increased low- *and* high-arousal positive PAQ—simply because both low- and high-arousal positive affective responding is indeed pleasant and desirable. Replication among participants with more experience practicing mindfulness may help clarify this possibility.

Moreover, it is worth noting that just because state mindfulness may facilitate both low- and high-arousal positive affective perceptions, it does not necessitate that mindfulness therefore facilitates these positive emotional *experiences*. Though PAQ and emotional experience tend to be correlated, they are distinct aspects of the affective process and can operate at distinct intensities (Hunter et al., 2010). It may be the case that state mindfulness can intensify evaluations of a stimulus to one degree while it influences emotional experience to another. This would allow for results regarding state mindfulness increasing high-arousal positive PAQ to potentially not contradict with mindfulness principles. Indeed, mindfulness principles that convey the practice is not meant to facilitate high-arousal positive emotions may speak more to emotional experience than evaluations of an event or stimulus.

Evidence for Acquiescence. It is admittedly difficult to determine whether the finding that state mindfulness was associated with more intense calmingness and excitingness reactions is driven by meaningful differences in state mindfulness or whether it is driven by response bias. Still, it is important to reiterate that the results showing state mindfulness equally increased low- and high-arousal positive PAQ run counter to theoretically based predictions; therefore, I must evaluate them with utmost skepticism.

Effects Do Not Differ By Induction. First, if these effects are due to the interesting possibility of participants having achieved a greater state of mindfulness and therefore are having more intense positive reactions, I would expect them to be stronger in the mindfulness than control condition. This should specifically be the case because participants were indeed more mindful in the mindfulness condition (both logically and according to the measure of state mindfulness). However, the effect of state mindfulness on participants' perception of the images did not differ based on whether they were in the mindfulness or control condition. This is

concerning; still, it is possible that the induction simply had such little influence, overall, that its impact cannot be seen here.

Effects Do Not Align with Other Predicted Findings. In another attempt to discern whether the effect of state mindfulness on image ratings is meaningful, I stacked it against other theoretically based predictions and findings in the study. In doing so, I determined that state mindfulness findings did not necessarily align. As discussed previously, I had expected that *dispositionally* mindful participants would be particularly likely to show predicted patterns, and this is partially what was found: overall, dispositionally mindful participants perceived images as *less* exciting in the mindful than control condition. Effects of *state* mindfulness are in the opposite direction: participants who report higher levels of state mindfulness perceive images to be *more* exciting (and more calming). It may be the case that trait mindfulness influences PAQ differently than does state mindfulness; perhaps being dispositionally mindful can reduce high-arousal positive PAQ regardless of state mindfulness levels, while state mindfulness, in general, perhaps can facilitate positive PAQ. Still, this is somewhat of a theoretical stretch; high levels of trait mindfulness should mean that someone often experiences state mindfulness. Additionally, the lack of alignment with other predicted findings is also concerning. Ultimately, this likely suggests that participants who indicated high ratings on the state mindfulness measures and image ratings are likely more strongly agreeing with survey statements, in general. Replication and utilization of a state mindfulness measure with reverse-coded items could help further discern this possibility.

Conclusion

In conclusion, the present study did not provide evidence that a brief mindfulness induction alone influences perceptions of affective quality, nor did it provide evidence that a

mindfulness induction is more likely to facilitate low- than high-arousal positive responding. Methodological limitations such as the difficulty of practicing a brief mindfulness induction for novices, a flawed emotion induction, and a lack of participant engagement likely contributed to the null findings. Future research can address these limitations primarily by including moderately arousing pleasant images and conducting the study in a laboratory. Despite null findings regarding the mindfulness induction overall, I did find evidence that various individual differences played a role, partially supporting and partially refuting predictions. Dispositionally mindful participants, overall, found images less exciting after a mindfulness than a control condition. I take this as some evidence that dispositional mindfulness may strengthen the effectiveness of a brief mindfulness induction to influence emotional responding in ways that align with theories of mindfulness—by reducing high-arousal positive responding. Unexpectedly, I also found that participants higher in state mindfulness reported more calmingness and more excitingness; they especially reported higher excitingness for high-arousal positive images. It may be the case that those who were more mindful in the moment experienced more intense affective reactions, overall. Perhaps state mindfulness simply accentuates the positive in a novice sample; however, it is also likely that these unexpected effects may be due to acquiescence response bias. Future research may address these possibilities by exploring the effect of mindfulness on low- and high-arousal positive responding among a more experienced sample and by utilizing a measure of state mindfulness with reverse-coded items.

References

- Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy*, 44(12), 1849–1858.
<https://doi.org/10.1016/j.brat.2005.12.007>
- Baer, R. A. (2010). *Assessing Mindfulness & Acceptance Processes in Clients: Illuminating the Theory & Practice of Change*. New Harbinger Publications.
- Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment*, 15(3), 329–342.
<https://doi.org/10.1177/1073191107313003>
- Balconi, M., Fronda, G., & Crivelli, D. (2019). Effects of technology-mediated mindfulness practice on stress: Psychophysiological and self-report measures. *Stress*, 22(2), 200–209.
<https://doi.org/10.1080/10253890.2018.1531845>
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1–48.
<https://doi.org/10.18637/jss.v067.i01>
- Beblo, T., Pelster, S., Schilling, C., Kleinke, K., Iffland, B., Driessen, M., & Fernando, S. (2018). Breath versus emotions: The impact of different foci of attention during mindfulness meditation on the experience of negative and positive emotions. *Behavior Therapy*, 49(5), 702–714. <https://doi.org/10.1016/j.beth.2017.12.006>
- Brewer, J. A., Davis, J. H., & Goldstein, J. (2013). Why is it so hard to pay attention, or is it? Mindfulness, the factors of awakening and reward-based learning. *Mindfulness*, 4(1), 75–80. <https://doi.org/10.1007/s12671-012-0164-8>
- Broderick, P. C. (2005). Mindfulness and coping with dysphoric mood: Contrasts with

- rumination and distraction. *Cognitive Therapy and Research*, 29(5), 501–510.
<https://doi.org/10.1007/s10608-005-3888-0>
- Brown, K. W., Goodman, R. J., & Inzlicht, M. (2013). Dispositional mindfulness and the attenuation of neural responses to emotional stimuli. *Social Cognitive and Affective Neuroscience*, 8(1), 93–99. <https://doi.org/10.1093/scan/nss004>
- Brown, K. W., Weinstein, N., & Creswell, J. D. (2012). Trait mindfulness modulates neuroendocrine and affective responses to social evaluative threat. *Psychoneuroendocrinology*, 37(12), 2037–2041.
<https://doi.org/10.1016/j.psyneuen.2012.04.003>
- Brunyé, T. T., Mahoney, C. R., Giles, G. E., Rapp, D. N., Taylor, H. A., & Kanarek, R. B. (2013). Learning to relax: Evaluating four brief interventions for overcoming the negative emotions accompanying math anxiety. *Learning and Individual Differences*, 27, 1–7.
<https://doi.org/10.1016/j.lindif.2013.06.008>
- Chan, E. Y. (2019). Mindfulness and willingness to try insects as food: The role of disgust. *Food Quality and Preference*, 71, 375–383. <https://doi.org/10.1016/j.foodqual.2018.08.014>
- Chiesa, A. (2013). The difficulty of defining mindfulness: Current thought and critical issues. *Mindfulness*, 4(3), 255–268. <https://doi.org/10.1007/s12671-012-0123-4>
- Cosme, D., & Wiens, S. (2015). Self-reported trait mindfulness and affective reactivity: A motivational approach using multiple psychophysiological measures. *PLoS ONE*, 10(3), 1–23. <https://doi.org/10.1371/journal.pone.0119466>
- Creswell, J. D. (2017). Mindfulness interventions. *Annual Review of Psychology*, 68(1), 491–516. <https://doi.org/10.1146/annurev-psych-042716-051139>
- Creswell, J. D., Pacilio, L. E., Lindsay, E. K., & Brown, K. W. (2014). Brief mindfulness

- meditation training alters psychological and neuroendocrine responses to social evaluative stress. *Psychoneuroendocrinology*, 44, 1–12.
<https://doi.org/10.1016/j.psyneuen.2014.02.007>
- Crosby, B. (1944). *Ac-Cent-Tchu-Ate the Positive*. Decca Records.
- Davidson, R. J. (2010). Empirical explorations of mindfulness: Conceptual and methodological conundrums. *Emotion*, 10(1), 8–11. <https://doi.org/10.1037/a0018480>
- Du, J., An, Y., Ding, X., Zhang, Q., & Xu, W. (2019). State mindfulness and positive emotions in daily life: An upward spiral process. *Personality and Individual Differences*, 141, 57–61. <https://doi.org/10.1016/j.paid.2018.11.037>
- Eddy, M. D., Brunyé, T. T., Tower-Richardi, S., Mahoney, C. R., & Taylor, H. A. (2015). The effect of a brief mindfulness induction on processing of emotional images: An ERP study. *Frontiers in Psychology*, 6. <https://doi.org/10.3389/fpsyg.2015.01391>
- Edwards, M. K., Rhodes, R. E., Mann, J. R., & Loprinzi, P. D. (2018). Effects of acute aerobic exercise or meditation on emotional regulation. *Physiology & Behavior*, 186, 16–24.
<https://doi.org/10.1016/j.physbeh.2017.12.037>
- Egan, R. P., Hill, K. E., & Foti, D. (2018). Differential effects of state and trait mindfulness on the late positive potential. *Emotion*, 18(8), 1128–1141.
<https://doi.org/10.1037/emo0000383>
- Greenberg, J., & Meiran, N. (2014). Is mindfulness meditation associated with “feeling less?” *Mindfulness*, 5(5), 471–476. <https://doi.org/10.1007/s12671-013-0201-2>
- Grossman, P. (2011). Defining mindfulness by how poorly I think I pay attention during everyday awareness and other intractable problems for psychology’s (re)invention of mindfulness: Comment on Brown et al. (2011). *Psychological Assessment*, 23(4), 1034–

1040. <https://doi.org/10.1037/a0022713>

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*, 57(1), 35–43. [https://doi.org/10.1016/S0022-3999\(03\)00573-7](https://doi.org/10.1016/S0022-3999(03)00573-7)

Grossman, P., & Van Dam, N. T. (2011). Mindfulness, by any other name...: Trials and tribulations of *sati* in western psychology and science. *Contemporary Buddhism*, 12(1), 219–239. <https://doi.org/10.1080/14639947.2011.564841>

Gu, J., Strauss, C., Crane, C., Barnhofer, T., Karl, A., Cavanagh, K., & Kuyken, W. (2016). Examining the factor structure of the 39-item and 15-item versions of the Five Facet Mindfulness Questionnaire before and after mindfulness-based cognitive therapy for people with recurrent depression. *Psychological Assessment*, 28(7), 791–802.

<http://dx.doi.org.proxy.lib.utk.edu/90/10.1037/pas0000263>

Hafenbrack, A., Kinias, Z., & Barsade, S. (2014). Debiasing the mind through meditation: Mindfulness and the sunk cost bias. *Academy of Management Proceedings*, 25(2), 369–376. <https://doi.org/10.5465/ambpp.2013.11582abstract>

Hertz, R. M., Laurent, H. K., & Laurent, S. M. (2015). Attachment mediates effects of trait mindfulness on stress responses to conflict. *Mindfulness*, 6(3), 483–489.

<https://doi.org/10.1007/s12671-014-0281-7>

Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science*, 6(6), 537–559.

<https://doi.org/10.1177/1745691611419671>

Huffziger, S., & Kuehner, C. (2009). Rumination, distraction, and mindful self-focus in

depressed patients. *Behaviour Research and Therapy*, 47(3), 224–230.

<https://doi.org/10.1016/j.brat.2008.12.005>

Hunter, P. G., Schellenberg, E. G., & Schimmack, U. (2010). Feelings and perceptions of happiness and sadness induced by music: Similarities, differences, and mixed emotions. *Psychology of Aesthetics, Creativity, and the Arts*, 4(1), 47–56.

<https://doi.org/10.1037/a0016873>

Iwamoto, S. K., Alexander, M., Torres, M., Irwin, M. R., Christakis, N. A., & Nishi, A. (2020). Mindfulness Meditation Activates Altruism. *Scientific Reports*, 10, 1–7.

<https://doi.org/10.1038/s41598-020-62652-1>

Jiménez, Ó., Ramos, N. S., González-Moraleda, Á., & Resurrección, D. M. (2020). Brief mindfulness-based interventions in a laboratory context: A systematic review of randomized controlled trials. *Mindfulness*, 11(5), 849–861.

<https://doi.org/10.1007/s12671-020-01320-x>

Jones, D. R., Graham-Engeland, J. E., Smyth, J. M., & Lehman, B. J. (2018). Clarifying the associations between mindfulness meditation and emotion: Daily high- and low-arousal emotions and emotional variability. *Applied Psychology: Health and Well-Being*, 10(3), 504–523. <https://doi.org/10.1111/aphw.12135>

Jordan, D. K., & Larsen, J. T. (2020). *Eliminate the negative, accentuate the positive? A systematic review of the effects of mindfulness on state emotional expression and experience* [Manuscript in preparation].

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

Kemeny, M. E., Foltz, C., Cavanagh, J. F., Cullen, M., Giese-Davis, J., Jennings, P., Rosenberg,

- E. L., Gillath, O., Shaver, P. R., Wallace, B. A., & Ekman, P. (2012). Contemplative/emotion training reduces negative emotional behavior and promotes prosocial responses. *Emotion*, 12(2), 338–350. <https://doi.org/10.1037/a0026118>
- Khoury, B., Sharma, M., Rush, S. E., & Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *Journal of Psychosomatic Research*, 78(6), 519–528. <https://doi.org/10.1016/j.jpsychores.2015.03.009>
- Kiken, L. G., & Shook, N. J. (2014). Does mindfulness attenuate thoughts emphasizing negativity, but not positivity? *Journal of Research in Personality*, 53, 22–30. <https://doi.org/10.1016/j.jrp.2014.08.002>
- Koopmann-Holm, B., Sze, J., Ochs, C., & Tsai, J. L. (2013). Buddhist-inspired meditation increases the value of calm. *Emotion*, 13(3), 497–505. <http://dx.doi.org/10.1037/a0031070>
- Lalot, F., Delplanque, S., & Sander, D. (2014). Mindful regulation of positive emotions: A comparison with reappraisal and expressive suppression. *Frontiers in Psychology*, 5, 1–9. <https://doi.org/10.3389/fpsyg.2014.00243>
- Lee, T. M. C., Leung, M.-K., Hou, W.-K., Tang, J. C. Y., Yin, J., So, K.-F., Lee, C.-F., & Chan, C. C. H. (2012). Distinct neural activity associated with focused-attention meditation and loving-kindness meditation. *PLoS ONE*, 7(8), 1–11. <https://doi.org/10.1371/journal.pone.0040054>
- Leung, M.-K., Lau, W. K. W., Chan, C. C. H., Wong, S. S. Y., Fung, A. L. C., & Lee, T. M. C. (2018). Meditation-induced neuroplastic changes in amygdala activity during negative affective processing. *Social Neuroscience*, 13(3), 277–288. <https://doi.org/10.1080/17470919.2017.1311939>

- Leyland, A., Rowse, G., & Emerson, L.-M. (2019). Experimental effects of mindfulness inductions on self-regulation: Systematic review and meta-analysis. *Emotion*, 19(1), 108–122. <http://dx.doi.org.proxy.lib.utk.edu/90/10.1037/emo0000425>
- Lindsay, E. K., Chin, B., Greco, C. M., Young, S., Brown, K. W., Wright, A. G. C., Smyth, J. M., Burkett, D., & Creswell, J. D. (2018). How mindfulness training promotes positive emotions: Dismantling acceptance skills training in two randomized controlled trials. *Journal of Personality and Social Psychology*, 115(6), 944–973. <https://doi.org/10.1037/pspa0000134>
- Long, E. C., & Christian, M. S. (2015). Mindfulness buffers retaliatory responses to injustice: A regulatory approach. *Journal of Applied Psychology*, 100(5), 1409–1422. <https://doi.org/10.1037/apl0000019>
- Mason, M. F., Norton, M. I., Van Horn, J. D., Wegner, D. M., Grafton, S. T., & Macrae, C. N. (2007). Wandering minds: The default network and stimulus-independent thought. *Science*, 315(5810), 393–395. <https://doi.org/10.1126/science.1131295>
- Matos, M., Duarte, C., Duarte, J., Pinto-Gouveia, J., Petrocchi, N., Basran, J., & Gilbert, P. (2017). Psychological and physiological effects of compassionate mind training: A pilot randomised controlled study. *Mindfulness*, 8(6), 1699–1712. <https://doi.org/10.1007/s12671-017-0745-7>
- McManus, M. D., Siegel, J. T., & Nakamura, J. (2019). The predictive power of low-arousal positive affect. *Motivation and Emotion*, 43(1), 130–144. <https://doi.org/10.1007/s11031-018-9719-x>
- Molet, M., Macquet, B., Lefebvre, O., & Williams, K. D. (2013). A focused attention intervention for coping with ostracism. *Consciousness and Cognition*, 22(4), 1262–1270.

- <https://doi.org/10.1016/j.concog.2013.08.010>
- Nielsen, L., & Kaszniak, A. W. (2006). Awareness of subtle emotional feelings: A comparison of long-term meditators and nonmeditators. *Emotion*, 6(3), 392–405.
<https://doi.org/10.1037/1528-3542.6.3.392>
- Ortner, C. N. M., Kilner, S. J., & Zelazo, P. D. (2007). Mindfulness meditation and reduced emotional interference on a cognitive task. *Motivation and Emotion*, 31(4), 271–283.
<https://doi.org/10.1007/s11031-007-9076-7>
- Parducci, A. (1968). The relativism of absolute judgments. *Scientific American*, 219(6), 84–90.
<https://doi.org/10.1038/scientificamerican1268-84>
- Parsons, E. M., Dreyer-Oren, S. E., Magee, J. C., & Clerkin, E. M. (2019). Evaluating the indirect effects of trait mindfulness facets on state tripartite components through state rumination and state experiential avoidance. *The Journal of Nervous and Mental Disease*, 207(6), 440–450. <https://doi.org/10.1097/NMD.0000000000000993>
- Ramos Díaz, N. S., Jiménez, O., & Lopes, P. N. (2014). The role of mindfulness in coping with recollections of acute stressors: A laboratory study. *Psicothema*, 26(4), 505–510.
<https://doi.org/10.7334/psicothema2014.71>
- Remington, N. A., Fabrigar, L. R., & Visser, P. S. (2000). Reexamining the circumplex model of affect. *Journal of Personality and Social Psychology*, 79(2), 286–300.
<https://doi.org/10.1037/0022-3514.79.2.286>
- Remmers, C., Topolinski, S., & Koole, S. L. (2016). Why being mindful may have more benefits than you realize: Mindfulness improves both explicit and implicit mood regulation. *Mindfulness*, 7(4), 829–837. <https://doi.org/10.1007/s12671-016-0520-1>
- Reva, N. V., Pavlov, S. V., Loktev, K. V., Korenyok, V. V., & Aftanas, L. I. (2014). Influence of

- long-term Sahaja Yoga meditation practice on emotional processing in the brain: An ERP study. *Neuroscience*, 281, 195–201. <https://doi.org/10.1016/j.neuroscience.2014.09.053>
- Reynolds, L. M., Lin, Y. S., Zhou, E., & Consedine, N. S. (2015). Does a brief state mindfulness induction moderate disgust-driven social avoidance and decision-making? An experimental investigation. *Journal of Behavioral Medicine*, 38(1), 98–109. <https://doi.org/10.1007/s10865-014-9582-5>
- Rosenberg, E. L., Zanesco, A. P., King, B. G., Aichele, S. R., Jacobs, T. L., Bridwell, D. A., MacLean, K. A., Shaver, P. R., Ferrer, E., Sahdra, B. K., Lavy, S., Wallace, B. A., & Saron, C. D. (2015). Intensive meditation training influences emotional responses to suffering. *Emotion*, 15(6), 775–790. <http://dx.doi.org.proxy.lib.utk.edu:90/10.1037/emo0000080>
- Rowland, Z., Wenzel, M., & Kubiak, T. (2018). A mind full of happiness: How mindfulness shapes affect dynamics in daily life. *Emotion*, 20(3), 436–451. <https://doi.org/10.1037/emo0000562>
- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39(6), 1161–1178. <https://doi.org/10.1037/h0077714>
- Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, 110(1), 145–172. <https://doi.org/10.1037/0033-295X.110.1.145>
- Russell, J. A., & Barrett, L. F. (1999). Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant. *Journal of Personality and Social Psychology*, 76(5), 805–819. <https://doi.org/10.1037/0022-3514.76.5.805>
- Sauer, S., Walach, H., Schmidt, S., Hinterberger, T., Lynch, S., Büssing, A., & Kohls, N. (2013). Assessment of mindfulness: Review on state of the art. *Mindfulness*, 4(1), 3–17.

<https://doi.org/10.1007/s12671-012-0122-5>

- Schumer, M. C., Lindsay, E. K., & Creswell, J. D. (2018). Brief mindfulness training for negative affectivity: A systematic review and meta-analysis. *Journal of Consulting and Clinical Psychology, 86*(7), 569–583. <https://doi.org/10.1037/ccp0000324>
- Sedlmeier, P., Eberth, J., Schwarz, M., Zimmermann, D., Haarig, F., Jaeger, S., & Kunze, S. (2012). The psychological effects of meditation: A meta-analysis. *Psychological Bulletin, 138*(6), 1139–1171. <https://doi.org/10.1037/a0028168>
- Sze, J. A., Gyurak, A., Yuan, J. W., & Levenson, R. W. (2010). Coherence between emotional experience and physiology: Does body awareness training have an impact? *Emotion, 10*(6), 803–814. <https://doi.org/10.1037/a0020146>
- Tamir, M. (2016). Why do people regulate Their emotions? A taxonomy of motives in emotion regulation. *Personality and Social Psychology Review, 20*(3), 199–222. <https://doi.org/10.1177/1088868315586325>
- Taylor, V. A., Grant, J., Daneault, V., Scavone, G., Breton, E., Roffe-Vidal, S., Courtemanche, J., Lavarenne, A. S., & Beauregard, M. (2011). Impact of mindfulness on the neural responses to emotional pictures in experienced and beginner meditators. *NeuroImage, 57*(4), 1524–1533. <https://doi.org/10.1016/j.neuroimage.2011.06.001>
- Teper, R., Segal, Z. V., & Inzlicht, M. (2013). Inside the mindful mind: How mindfulness enhances emotion regulation through improvements in executive control. *Current Directions in Psychological Science, 22*(6), 449–454. <https://doi.org/10.1177/0963721413495869>
- Tomlinson, E. R., Yousaf, O., Vittersø, A. D., & Jones, L. (2018). Dispositional mindfulness and psychological health: A systematic review. *Mindfulness, 9*(1), 23–43.

<https://doi.org/10.1007/s12671-017-0762-6>

- Tsai, J. L., Knutson, B., & Fung, H. H. (2006). Cultural variation in affect valuation. *Journal of Personality and Social Psychology*, 90(2), 288–307. <https://doi.org/10.1037/0022-3514.90.2.288>
- Valim, C. P. R. A. T., Marques, L. M., & Boggio, P. S. (2019). A positive emotional-based meditation but not mindfulness-based meditation improves emotion regulation. *Frontiers in Psychology*, 10, 1–12. <https://doi.org/10.3389/fpsyg.2019.00647>
- Watford, T. S., & Stafford, J. (2015). The impact of mindfulness on emotion dysregulation and psychophysiological reactivity under emotional provocation. *Psychology of Consciousness: Theory, Research, and Practice*, 2(1), 90–109. <https://doi.org/10.1037/cns0000039>
- Winning, A. P., & Boag, S. (2015). Does brief mindfulness training increase empathy? The role of personality. *Personality and Individual Differences*, 86, 492–498. <https://doi.org/10.1016/j.paid.2015.07.011>
- Wu, R., Liu, L.-L., Zhu, H., Su, W.-J., Cao, Z.-Y., Zhong, S.-Y., Liu, X.-H., & Jiang, C.-L. (2019). Brief mindfulness meditation improves emotion processing. *Frontiers in Neuroscience*, 13. <https://doi.org/10.3389/fnins.2019.01074>

Appendix

Appendix A: 15-Item Five-Facet Mindfulness Questionnaire

Participants responded on a scale of *Never or very rarely true* (0) to *Very often or always true* (5)

1. When I take a shower or a bath, I stay alert to the sensations of water on my body
2. I'm good at finding words to describe my feelings.
3. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
4. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
5. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
6. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
7. I have trouble thinking of the right words to express how I feel about things.
8. I do jobs or tasks automatically without being aware of what I'm doing.
9. I think some of my emotions are bad or inappropriate and I shouldn't feel them.
10. When I have distressing thoughts or images, I am able just to notice them without reacting.
11. I pay attention to sensations, such as the wind in my hair or sun on my face.
12. Even when I'm feeling terribly upset, I can find a way to put it into words.
13. I find myself doing things without paying attention.
14. I tell myself I shouldn't be feeling the way I'm feeling.
15. When I have distressing thoughts or images, I just notice them and let them go.

Appendix B: Induction Attention Check

Mindfulness Induction

1. Which of the following did the recording NOT ask you to do?
 - a. Place your hand on your abdomen
 - b. Pay attention to the sensation of your breathing
 - c. Acknowledge the thoughts you may have
 - d. Hold your breath for 10 seconds (correct)

Control Induction

1. Which of the following did the recording NOT ask you to do?
 - a. Settle into a comfortable sitting position
 - b. Let your mind wander freely
 - c. Think about whatever you want to think about
 - d. Place your hand on your abdomen (correct)

Appendix C: State Mindfulness Measure / Manipulation Check

Participants responded on a scale of *Not at all* (0) to *Very much* (4)

1. Think back to when you were doing the audio task, to what extent were you...
 - a. Absorbed in the present moment
 - b. Focused on your breathing
 - c. Focused on the physical sensations of breathing
 - d. In touch with your body

Appendix D: Previous Mindfulness Experience Measure

1. To what extent, if any, have you previously practiced mindfulness?
 - a. None (0)
 - b. I have practiced mindfulness just a few times, so I am still quite inexperienced (1)
 - c. I have practiced mindfulness more than a few times, so I have some experience but not a lot (2)
 - d. I have practiced mindfulness quite a bit - far more than a few times - so I am quite experienced (3)
 - e. I have spent a great deal of time regularly practicing mindfulness, so I am very experienced (4)

Vita

After earning their Bachelor of Science degree in Psychology in 2008 from Freed-Hardeman University, they earned a Master of Arts degree in Experimental Psychology from Middle Tennessee State University in 2011. Following graduation, they moved to Chicago, IL and worked as a Research Analyst at Technomic, a market research firm servicing the foodservice industry. After nearly five years and two promotions to Consumer Research Manager, they moved to Knoxville, TN to pursue a doctoral degree in Social Psychology at the University of Tennessee in August 2016. Under the guidance of Dr. Jeff Larsen, in August 2021, Dean satisfied all requirements for their doctoral program, earning a PhD in Experimental Psychology with a concentration in Social Psychology. After graduation, they plan to pursue a career in User Experience Research (UXR), since having completed two UXR internships during their tenure as a doctoral student.