# Adult attachment and mindfulness: examining directionality, causality, and theoretical implications

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## Abstract

We present two studies that together provide preliminary evidence to challenge the view that the relationship between adult attachment and mindfulness is bi-directional (Study 1: repeated measures design and Study 2: a repeated measures study examining the efficacy of attachment security priming and a mindfulness induction). Adult attachment anxiety emerged as a significant predictor of some facets of mindfulness, over time, but the reverse was not true. Priming attachment security increased state mindfulness of mind to a greater degree than a mindfulness induction or control. These findings challenge previous research suggesting that the relationship between adult attachment and mindfulness is bi-directional, suggesting that attachment orientation plays a causal role in the development of mindfulness.



**Keywords:**

*Adult attachment, disorganized attachment, mindfulness, mindfulness induction, priming*

Adult Attachment and Mindfulness: Examining Directionality, Causality, and Theoretical Implications

## 1. Introduction

Originating in Buddhist meditation, mindfulness can be understood as a state of consciousness in which individuals have an enhanced attention to their present moment experience, coupled with an attitude of non-judgment and acceptance toward that given experience (Brown & Ryan, 2003). The benefits of mindfulness practice and mindfulness-based interventions are well-documented (see Gu et al., 2015). The capacity to be mindful is also understood as an enduring and multi-faceted trait-like individual difference (Brown & Ryan, 2003), which is associated with improved psychological well-being and positive mood, and reduced symptoms of anxiety, stress, and depression (Weinstein et al., 2009). The most widely cited and validated measure of trait mindfulness is the Five-Facet Mindfulness Questionnaire (Baer et al., 2006), which conceptualizes trait mindfulness as five distinct facets. These include three facets related to the awareness of the present moment: observation of internal and external stimuli; the ability to describe one's experiences, and acting with awareness, attending fully to one's activity. The remaining two facets relate to the attitudinal aspect of mindfulness: non-judgment of one's experiences), and non-reactivity of thoughts and feelings (Baer et al., 2004, 2006, 2008). Mindfulness-based training involves the cultivation of mindful awareness through formal and informal meditation practice. Meditation practices induce a state like, context dependent form of mindful awareness (Bishop et al., 2004), which is generally experienced as an awareness of present moment bodily sensations and mental events (Tanay & Bernstein, 2013). Over time, repeated exposure to these states cultivates the relevant traits, as evidenced in observed increases in trait mindfulness following mindfulness training interventions (Shapiro et al., 2008). Research on mindfulness is dominated by the study of its associations with well-being and mental health, at both an intervention and personality level (Gu et al., 2015). However, less is known about how individual differences in dispositional mindfulness, that is, one's capacity to be mindful, may develop independent of contemplative practice. Attachment orientation may offer insight here.

Attachment orientation is a trait-like pattern of affect regulation strategies, that develop according to the care we receive from our closest relationship partners (Bowlby, 1969). Attachment security develops when one's history of received care is characterized by sensitive, loving, and supportive relationships (Bowlby, 1973). Attachment orientation is conceptualized along two dimensions of attachment insecurity: anxiety about abandonment and avoidance of intimacy (Bartholomew & Horowitz, 1991; Brennan et al., 1998). Attachment anxiety develops in response to inconsistent care. Hyperactivation of the attachment system is reflected in a

hypersensitivity to rejection, and excessive rumination on relationship threats and one's own shortcomings, as well as increased efforts to seek proximity and protection (Mikulincer & Florian, 1998). Attachment avoidance is born from rejecting or nonresponsive caregiving. Deactivation of the attachment system is reflected in a denial of attachment needs, and the suppression of vulnerability, as well as avoidance of proximity seeking (Mikulincer & Shaver, 2003). Low attachment anxiety and low avoidance reflect attachment security (Brennan et al., 1998), which is characterized by optimal affect regulation, the ability to trust and rely on others for support when needed and an agentic sense of self (Mikulincer & Shaver, 2003). Recent literature has also conceptualized attachment disorganization in adulthood, which coexists alongside the dimensions of attachment anxiety and avoidance, and emphasizes a fear of attachment figures (Hesse & Main, 2000; Main & Solomon, 1990; Paetzold et al., 2015). The "fear" associated with attachment refers to either a fear of abandonment (attachment anxiety) or a fear of intimacy (attachment avoidance; Paetzold et al., 2015). Within the context of organized adult attachment, fear in individuals exhibiting greater attachment anxiety encourages approaching and proximity seeking behaviours and in individuals exhibiting greater attachment avoidance encourages distancing behaviours to protect against rejection and abandonment (Paetzold et al., 2015). However, individuals exhibiting disorganized patterns of attachment exhibit confused, contradictory, and chaotic behavior as they are attempting to seek comfort from the direct source of their fear (Paetzold et al., 2015). As well as chronically available and applied dispositional (or trait) attachment style, individuals also possess relationship-specific attachment styles that can be the same or different from their dispositional style. When faced with significant life events that challenge trait attachment styles in an enduring way, they are malleable to change (Bowlby, 1988); however, a level of stability is expected over a short-period of time. Several longitudinal studies have reported stability in attachment orientation over periods of weeks to months (see Hammond & Fletcher, 1991; Scharfe & Bartholomew, 1994), and across childhood from infancy to 18 years old (Waters et al., 2000). Nonetheless, the stability of individual differences in attachment orientation remains controversial (see Pinquart et al., 2013).

There are several reasons why adult attachment security and dispositional mindfulness may be linked. Ostensibly, both contribute to a range of positive outcomes, including mental and physical health, adaptive coping, and self-regulation (Ryan et al., 2007; Shaver et al., 2007). More specifically, Ryan et al. (2007) theorised that attachment security and mindfulness had a bi-directional relationship. Attachment security was proposed to foster greater attentiveness to relational patterns and therefore increase one's mindfulness capabilities. Mindfulness, on the other hand, was posited to increase one's capacity for secure relationships by

cultivating compassion for others (Cordon & Finney, 2008), and cultivating an open, receptive attention to relationship partners (Shaver et al., 2007). These propositions were partly confirmed by a recent meta-analysis which found that attachment security was positively related to mindfulness (Stevenson et al., 2017). For the included 33 studies, the overall effect sizes reported were moderate (anxiety, $r_+ = -.36$; avoidance, $r_+ = -.28$), with both dimensions of attachment insecurity associated with lower levels of mindfulness (Stevenson et al., 2017). The majority of studies reviewed in this meta-analysis failed to examine the relationship between constructs over time or the influence of experimental manipulations on either construct. As such, uncertainty remains regarding the stability and direction of this association, as the field to date has been limited to primarily cross-sectional designs, making it difficult to draw inferences about causality.

Experimental research investigating the causal relationship between mindfulness and attachment is scant, and has produced mixed findings. In an attempt to address the inherent issues with cross-sectional designs, in two separate studies Pepping, Davis, and O'Donovan (2015) found that inducing attachment security in the lab had no effect on self-reported state mindfulness, and similarly inducing mindfulness (through mindfulness practice) had no effect on self-reported state attachment. However, individual trait differences in mindfulness and attachment were not controlled for, and are likely to impact the results (e.g., Shapiro et al., 2011). In addition, although manipulation checks were included for each of the conditions, the efficacy of the inductions were not directly compared to one another (i.e. mindfulness vs attachment security) and only a general measure of state mindfulness was used (providing a total score). A further related study reported by Melen, Pepping, and O'Donovan (2016) employed a between-subjects design to investigate the effects of inducing attachment insecurity (anxiety and avoidance) on state mindfulness and whether this was mediated by emotion regulation. In this study, Melen and colleagues compared the efficacy of three experimental conditions on state mindfulness: attachment anxiety, attachment avoidance, and a control (writing exercise about brushing their teeth). They reported that priming attachment anxiety decreased self-reported state mindfulness, an effect mediated by emotion regulation capabilities. Melen and colleagues reported that priming attachment anxiety led to a decrease in state mindfulness via decreased state emotion regulation, although no effects were found when priming attachment avoidance. These findings indicate how attachment insecurity might hamper mindful awareness (Melen et al., 2016). Specifically, priming specific attachment orientations is associated with decreased overall state mindfulness. But it is still unknown whether priming attachment security, as opposed to anxiety or avoidance, would be associated with an increase in state mindfulness or the effects of priming on different aspects of mindfulness as opposed to a general measure of state mindfulness.

Previous research has begun to examine the relationship between adult attachment and mindfulness; however, there has not yet been an examination of the effects of experimentally inducing one construct on the other. Thus, the question regarding the causal link between attachment security and mindfulness remains unanswered. This question can begin to be addressed by comparing the effects of a mindfulness induction and priming an attachment orientation closely resembling the positive practice of mindfulness, which is attachment security. As such, direct inferences can be made regarding the relationship between adult attachment and mindfulness and the effects of inducing them experimentally. Considering the individual development and implementation of both attachment orientation and mindfulness, it is important to examine this more closely and further delineate the relationship between the two constructs. Theoretically, determining this causal direction may inform our theoretical understanding of how mindfulness develops as well as provide a more nuanced understanding of how attachment develops.

### 1.1. Overview

In the present studies we aimed to investigate the direction of the relationships between attachment orientation and mindfulness. In Study 1, we assessed the short-term stability and directionality of the relationship between trait adult attachment orientation and trait mindfulness over a period of 15 weeks. Assessing the stability of adult attachment and mindfulness over time will not only contribute to the on-going debate regarding the stability of attachment in adulthood (see Pinquart et al., 2013) but will also provide much needed data assessing the stability of dispositional mindfulness. We expected to see stable, negative associations between attachment insecurity (anxiety and avoidance), and the five facets of mindfulness. Consistent with theory (Ryan et al., 2007) we predicted a bi-directional relationship between the two constructs over time. In Study 2, we tested the causal direction of this relationship in an experimental design, which compared the effects of inducing attachment security, mindfulness, and a neutral control task, on state attachment and state mindfulness. As this is the first study of its kind, we do not have a prediction for the results. However, investigating whether manipulating one construct resulted in equivalent change in the other would be taken as evidence to infer a causal relationship. It should be noted that we report all measures, manipulations, and exclusions in these studies.

*Study 1.*

## 2. Method

This study was not preregistered. Data files have been uploaded to a repository (https://osf.io/wjd6f/).

### 2.1. Participants and Procedure

Undergraduate students were recruited for course credit or prize draw entry, using Sona Systems subject pool software, and a university-wide email distribution list, respectively. While only undergraduate students were permitted to take part in the study, the lower age limit was 18 years old while no upper age limit was imposed. Participants accessed the web-based survey via Qualtrics (T1) which was live for a period of 3 weeks and provided consent electronically. The order of the measures was the same at both time points and was not randomized. Participants were invited to complete the same questionnaire after an interval of 15 weeks (T2). Attentional and instructional check items were not included in the questionnaire at either time-point, due to previously highlighted limitations that such attentional checks can lead to demographic bias without improving the quality of data (Vannette, 2016; 2017). Notwithstanding this exclusion, the internal reliabilities reported suggest that participants were attentive and responding consistently.

Only complete cases were used in the analysis due to the ethical right to withdraw from the survey at any time. In total, 219 completed the measures at time point 1 (T1) (75.8% British, 68.5% female, $M_{age}$ = 19.42, SD = 2.87, range = 18- 47). Eighty-four of these participants successfully completed the same measures at time point 2 (T2) (77.4% British, 66.7% female, $M_{age}$ = 19.89, SD = 3.92, range 18- 47).

Sample size was determined a-priori and calculated using G*Power (Faul et al., 2014) which determined the minimum required sample size for bivariate correlations was 192 to capture Pearson's *r* effect size = 0.20 ($\alpha = 0.05$) with more than 80% power. The required sample size at T2 to conduct *t*-tests and multiple regression analyses ($N > 67$) was determined using the same programme (Cohen's *d* effect size 0.35, power 0.80, $\alpha = 0.05$; *f* effect size 0.20, power 0.80, $\alpha = 0.05$). Based on a priori power analysis, the sample size at both timepoints were sufficient to detect moderate effects (Cohen, 1988) in the subsequent analysis. Previous experience utilizing similar research methods informed the decision to make the survey accessible for 3 weeks at both time-points to achieve the desired sample size at T2, after attrition. As such, this resulted in a slightly larger required sample size than was previously determined.

A series of independent t-tests were conducted to determine whether those participants who completed the study differed from those who did not. No significant differences were reported for either attachment dimensions (anxiety, $t(218) = 0.00$, $p = .99$; avoidance, $t(218) = -.72$, $p = .47$) or any of the 5 facets of mindfulness (act with awareness, $t(218) = 0.07$, $p = .94$; observe, $t(218) = -1.60$, $p = .11$; describe, $t(218) = 0.98$, $p = .33$; non-judging, $t(218) = -0.81$, $p = .39$; non-reacting, $t(218) = -1.21$, $p = .25$).

### 2.2. Measures

**2.2.1. Adult Attachment Orientation.** The Revised Experiences in Close Relationships questionnaire (ECR-R; Fraley et al., 2000) was used to assess adult attachment orientation. The ECR-R is a 36-item self-report measure of two dimensions of adult attachment: anxiety (18 items) and avoidance (18 items). Participants were asked to rate the extent to which each item was descriptive of their feelings in close relationships using a seven-point Likert scale ranging from *Strongly disagree* (1) to *Strongly agree* (7). An item from the anxiety subscale is "I worry a lot about my relationships" while an example from the avoidance subscale is "I don't feel comfortable opening up to others". Various studies have demonstrated internal consistency and test-retest reliability, as well as the construct and predictive validity of both the anxiety and avoidance subscales produced by the ECR-R ($\alpha$ = .93; Sibley et al., 2005). The Cronbach's $\alpha$ for the present sample were .91 (anxiety) and .87 (avoidance).

**2.2.2 Mindfulness.** The Five Facet Mindfulness Questionnaire Short Form (FFMQ-SF; Bohlmeijer et al., 2011) is a 24-item self-report measure of five subscales of dispositional mindfulness: acting with awareness (5 items), describing (5 items), observing (4 items), non-judging (5 items), and non-reacting (5 items). Participants were asked to rate the extent to which each item was true for them using a five point Likert scale ranging from *Never or very rarely true* (1) to *Very often or always true* (5). Items from each of the subscales include "I find it difficult to stay focused on what's happening in the present moment" (acting with awareness, all items for this subscale are reversed for scoring), "I'm good at finding the words to describe my feelings" (describing), "I pay attention to physical experiences" (observing), "I tell myself I shouldn't be thinking the way I'm thinking" (non-judging, all items for this subscale are reversed for scoring), and "I watch my feelings without getting carried away by them" (non-reacting). Research has demonstrated the internal consistency of the FFMQ-SF, reporting Cronbach's $\alpha$ for each subscale ranging from .71 to .87 (Bohlmeijer et al., 2011). In the present sample, the Cronbach's $\alpha$ for each subscale of the FFMQ-SF are as follows: act with awareness (.78), observe (.72), describe (.81), non-judging (.75), and non-reacting (.79).

Participant age and gender were also measured.

**2.3. Data Analysis**

Data were analyzed using bi-variate correlations to assess the relationship between variables at each time-point, as well as between the time-points (including partial correlations to control for the collinearity between the two attachment dimensions). To test the stability of constructs over time, test-retest analyses were conducted using Pearson's correlation. In order to test the predictive value of one construct on the other (attachment orientation, mindfulness) and the theory of bi-directionality, a series of hierarchical regression

analyses were conducted. For each regression equation, the T1 score on the outcome variable was controlled for by entering it on Step 1, followed by the appropriate predictor variable(s) at Step 2.

## 3. Results

Sensitivity power analysis (with $\alpha$ = .05 and power .80) yielded effect sizes of Cohen's $r$ = 0.31 and $f$ = 0.16, indicating that the minimal detectable effects were a medium ($r$) and small ($f$) effect sizes (Faul et al., 2007). All descriptive statistics and correlation matrices for both the ECR-R and FFMQ-SF, at T1 and T2 respectively, are presented in Table 1.

[Table 1]

Descriptive statistics and bivariate correlations for the two adult attachment dimensions (anxiety and avoidance), the five mindfulness facets, and total dispositional mindfulness scores are presented in Tables 2 and 3.

### 3.1. Stability of Adult Attachment Orientation and Dispositional Mindfulness

We examined whether dispositional attachment orientation (ECR-R) and dispositional mindfulness (FFMQ-SF) remained stable over the 15-week period. Statistical analyses were performed using Pearson's correlations for test-retest reliability of the ECR-R and FFMQ-SF subscales (see Table 1). The test-retest reliability of ECR-R anxiety and avoidance and FFMQ-SF act with awareness and observe was high ($r$'s = .72 - .84 ., $p$'s < .05) and low for FFMQ-SF describe, non-judging, and non-reacting ($r$'s = .58 - .66, $p$'s < .05). Paired samples $t$-tests were used to determine whether participant scores significantly differed between T1 and T2 (see Table 2). Both dimensions of attachment insecurity and all five facets of mindfulness remained stable over time (i.e. there were no significant differences between T1 and T2 data, all $p$'s > .05).

[Table 2]

### 3.2. Associations Between Variables

*3.2.1. Within Time.*

At T1, attachment anxiety was significantly negatively correlated with total mindfulness, as well as with the individual mindfulness facets of act with awareness, describe, non-judging, and non-reacting (see Table

1). Similarly, attachment avoidance was significantly negatively correlated with total mindfulness, and the individual mindfulness facets of act with awareness, describe, and non-judging.

At T2, the same associations, in direction and significance, were observed.

*3.2.2. Across Time.*

The associations between variables were then examined across time points (T1-T2). As presented in Table 2, attachment anxiety (T1) was significantly negatively correlated with total mindfulness, act with awareness, non-judging, and non-reacting at T2. Again, similar associations were reported between attachment avoidance (T1) and total mindfulness, act with awareness, and describe at T2.

[Table 3]

[Table 4]

**3.2. Predictive Value of Variables**

Hierarchical regression analyses were conducted to determine whether participant adult attachment orientation (ECR-R) and dispositional mindfulness (FFMQ-SF) were significant predictors of each other between T1 and T2 (see Table 5). Hierarchical regression analyses were conducted to determine whether participant adult attachment orientation (ECR-R) and dispositional mindfulness (FFMQ-SF) were significant predictors of each other between T1 and T2 (see Table 5). In each model, T1 DV scores were controlled, as this would provide a stringent test of the unique role of the IV (T1) on the DV (T2) over time.

All regression models for predicting T2 facets of mindfulness (act with awareness, observe, describe, non-judging, and non-reacting*)* were significant. However, only two of these models found significant contributions from adult attachment dimensions which are detailed in Table 4. T1 attachment anxiety was a significant predictor of T2 act with awareness ($\beta$ = - 0.29, $t(83) = -3.75$, $p < .001$) and non-judging ($\beta$ = - 0.21, $t(83) = -0.22$, $p = .049$). Only the regression model for act with awareness reported a significant $\Delta R^2$ value (see Table 4), thus meaning adult attachment anxiety explained an additional 7% of unique variance in act with awareness at T2. Overall, the results of the regression analyses reveal a statistically significant relationship between attachment anxiety and the act with awareness and non-judging facets of mindfulness, over time. More specifically, higher attachment anxiety (T1) is indicative of a decreased ability to act with awareness and refrain from evaluating experiences (T2).

To examine the possible bi-directionality of this relationship, we conducted the equivalent analyses in the opposite direction, to assess whether T1 facets of dispositional mindfulness were significant predictors of adult attachment orientation at T2. As such, hierarchical regression analyses were conducted to determine the predictive value of mindfulness on adult attachment. Both dimensions of adult attachment (anxiety and avoidance) were regressed onto each of the five facets of mindfulness as was the reverse. The results of which indicate that attachment anxiety (T1) is a significant predictor of mindfulness over time but the reverse is not true. Table 4 presents these models in which adult attachment (T1) emerged as a significant predictor of mindfulness (T2) as well as the corresponding regression models assessing the predictive value of act with awareness (T1) and non-judging (T1) on attachment (T2). While both of the models were statistically significant, none of the mindfulness facets significantly and uniquely contributed to the prediction of either attachment dimension.

[Table 5]

**4. *Study 2.***

Having found evidence of a predictive relationship between attachment orientation and mindfulness over time in Study 1, we sought to establish causality by manipulating each construct in the lab, and looking for evidence of effects on the other construct. Further to this, Study 2 aims to address the limitations of previous experimental studies of attachment and mindfulness. First, a repeated measures design was employed. By manipulating each construct in the lab and looking for change in the other, this was the first study to directly compare the efficacy of an attachment security prime and mindfulness induction exercise on state measures of attachment security and mindfulness. Here, the limitation of individual variance across conditions has been minimised.

Secondly, the present study assigned one exercise per condition. In addition, the valence of materials across the conditions is closely matched, which will allow for direct comparisons of manipulation efficacy to be made. Here, we reassess the associations between state attachment and mindfulness using a higher powered sample.

Lastly, we include baseline measures of both traits and, accordingly, examine the influence of adult attachment orientation and mindfulness of the efficacy of a mindfulness induction and priming attachment security. In addition, we extend the measurement of attachment from Study 1 to include disorganized attachment in order to provide a more complete assessment of the relationship between attachment and

mindfulness that is aligned to the current conceptualizations. As such, more nuanced inferences can be made regarding the nature and direction of the relationship between adult attachment and mindfulness.

Previous research has found priming attachment security results in higher felt security and, although the present study is measuring state attachment security, similar results are expected. Carnelley and Rowe (2007) found that repeatedly priming attachment security significantly reduced attachment anxiety, so a similar effect here is expected on state attachment anxiety. No predictions have been made for state attachment avoidance as previous research has not identified any effect of priming attachment security on avoidance.

Considering the lack of previous evidence and the results of Study 1 suggesting the relationship between adult attachment and mindfulness is not bi-directional in nature, Study 2 was exploratory in nature. Therefore, no hypotheses were made about the effects of the experimental manipulations on state attachment and mindfulness.

## 5. Method

This study and analysis plan were preregistered and data uploaded to a repository (https://osf.io/zaw9c/).

### 5.1. Design

A 3 X 2 (condition X time) repeated measures design was used to test the efficacy of an attachment security prime, mindfulness induction, and a control condition on state measures of adult attachment orientation and mindfulness. Undergraduate students were recruited to complete an online baseline questionnaire assessing adult attachment and mindfulness and included a screening measure to assess participant eligibility.

*Inclusion Criteria.* Participants had to be currently enrolled as an undergraduate student and report having at least one secure attachment figure (see screening questionnaire below). A total of 30 (out of 153) participants (19.61%) were excluded from the present study based on this criterion determined by an adapted version of an attachment networks and relationship-specific attachment styles used by Rowe and Carnelley (2003) included in the baseline questionnaire. This criterion was included as a measure to ensure participants had access to a secure attachment representation due to the nature of the attachment priming condition. Participants were required to complete each lab session, on average, 7 days apart. A minimum of 5 and maximum of 9 days was deemed acceptable. Participants who were unable to schedule participation within these limits were excluded from the study ($N = 2$).

*Randomization Process.* All participants were randomly allocated to 1 of 6 testing orders for the sequence in which they completed the sessions as a method of counterbalancing. In each lab session, participants completed pre and post measures, the order of which was randomized.

It should be noted that while the results of Study 1 highlight the specific relationship between attachment anxiety and mindfulness, priming maladaptive attachment schemas is somewhat counterintuitive and would not adequately match the valence of a mindfulness exercise. However, research has shown increasing attachment security decreases attachment anxiety (see Carnelley & Rowe, 2007) which further informed the decision to prime attachment security in Study 2.

**5.2. Participants**

Undergraduate students were recruited for course credit or monetary compensation, using Sona Systems subject pool software and a university-wide email distribution list, respectively. While only undergraduate students were permitted to take part in the study, the lower age limit was 18 years old with no upper age limit imposed. It was not possible to run statistical power analysis based on data from previous research due to limited similar work. As such, at the time of preregistration, G*Power was used to conduct a sensitivity analysis to determine a conservative, feasible estimate for data collection. This determined that running a repeated measures, within factor ANOVA (groups= 3, $df = 2$) with $N = 60$ would determine an effect size 0.36 ($f$), statistical power of .80, and $\alpha = 0.05$. Because the covariates were identified following preliminary data analysis, they were not included in the sensitivity analysis. Further to this, although not reported in the preregistration, we conducted an additional a priori analysis using the formula presented by Morgan and Case (2013). This conservative sample size calculation determined that a sample of $N = 63$ was required to run a repeated measures ANCOVA to capture an effect size of 0.40 ($f$), for statistical power of .80, and $\alpha = 0.05$. Data were collected until the required sample size was reached, plus additional participants to account for attrition in the lab sessions. Taken together, these power calculations/guidelines suggest that the present sample of 70 was of adequate size to capture a medium effect size.

Only complete cases were used in the analysis due to the ethical right to withdraw from the survey at any time, resulting in 160 complete entries screened for eligibility. After all duplicate ($n = 7$) and non-qualifying ($n = 36$) entries were removed, a sample of 117 participants were invited to take part in the lab sessions. Out of the 72 participants who signed up for the remainder of the study, only two participants did not complete all experimental sessions (see Fig. 1). These participants were removed before analysis. The final

sample included 70 undergraduate students (80% British, 81.4% female). The age range was 18-56 years (*M* = 21.23; *SD* = 7.57).

[Figure 1]

**5.3. Measures**

*5.3.1. Baseline Measures*

*5.3.1.1. Adult Attachment.* Adult attachment was assessed using three measures, a modified version of the Attachment Networks and Relationship-specific Attachment Styles measure (see Rowe & Carnelley, 2003), the Experiences in Close Relationships-12 scale (ECR-12; Lafontaine et al., 2015), and the Adult Disorganized Attachment scale (ADA; Paetzold et al., 2015).

The Attachment Networks and Relationship-specific Attachment styles measure was used as a screening measure to determine whether participants had at least one secure attachment figure in their lives. Participants were presented with four descriptions representing different attachment prototypes (see Hazan & Shaver, 1987) and asked to rate whether there was a close significant other in their life that matched each description (yes or no) and how representative each prototype was of how they feel in that relationship using a Likert-scale from 1 (Not very representative) to 5 (Very representative). Participants who indicated having a secure attachment figure with a representative score of 3 and above were eligible to take part in the study.

The ECR-12 (Lafontaine et al., 2015) is a self-report assessment of adult attachment derived from the original 36-item ECR (Brennan et al., 1998). The scale's 12 items are divided into two 6-item subscales that represent the two underlying dimensions of adult attachment: attachment anxiety (e.g. "I worry about being abandoned") and attachment avoidance (e.g. "I feel comfortable depending on others"). Participants were asked to rate their feelings using a Likert scale ranging from 1 (*Disagree strongly*) to 7 (*Agree strongly*), with higher scores reflecting a greater endorsement of that construct. Test-retest reliability for this version of the ECR has been reported between .78 for anxiety and .74 and .83 for avoidance (Lafontaine et al., 2015). Reliability coefficients for the current study were good with Cronbach's α of .86 for attachment anxiety and .86 for attachment avoidance.

The ADA (Paetzold et al., 2015) is a 9-item self-report measure used to assess the level of adult disorganized attachment. Participants were asked to rate their agreement with each statement using a Likert-scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Sample items include "I never know who I am with romantic partners" and "Fear is a common feeling in close relationships". The ADA has been shown to

have high internal consistency (Cronbach's α = .91; Paetzold et al., 2015). The Cronbach's α for the current sample was 0.86.

*5.3.1.2. Mindfulness.* Dispositional mindfulness was assessed using the Five Facet Mindfulness Questionnaire, short form as in Study 1 (FFMQ-SF; Bohlmeijer et al., 2011). Research has demonstrated the internal consistency of the FFMQ-SF, reporting Cronbach's α for each subscale ranging from .71 to .87 (Bohlmeijer et al., 2011). The Cronbach's α for the current sample were as follows for the mindfulness subscales: act with awareness (.77), observing (.76), describing (.82), non-judging (.82), and non-reacting (.79).

*5.3.2. Pre/Post Measures*

*5.3.2.1. Adult Attachment.* State adult attachment was measured using an adapted version of the State Adult Attachment Measure (SAAM; Gillath et al., 2009). The SAAM was developed to measure individual differences of temporary fluctuations in the sense of attachment. It contains three dimensions measuring state levels of attachment anxiety, avoidance, and security. Respondents were asked to rate each item from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Originally a 21-item self-report measure, for the purpose of the present study the top 3 loading items from each dimension were included (see Millings et al., 2018). The Cronbach's α for state security, anxiety, and avoidance for the current sample were .81, .73, and .84, respectively (comparable to those reported by Millings et al., 2018).

*5.3.2.2. Mindfulness.* State mindfulness was measured using the State Mindfulness Scale (SMS; Tanay & Bernstein, 2013). It is comprised of two dimensions measuring mindful awareness of mental events ("I noticed emotions come and go") and mindful awareness of bodily sensations ("I clearly felt what was going on in my body"). Respondents were asked to rate each item on a scale from 1 (*Not at all*) to 5 (*Very much*). Again, the top 3 loading items for each dimension were used in the present study. The SMS has exhibited good psychometric properties and is an appropriate and valid measure of state mindfulness (Tanay & Bernstein, 2013). The Cronbach's α for the shortened mindfulness of mind and body dimensions for the current sample were .83 and .85, respectively.

Participant age and gender were also measured.

**5.4. Procedure**

The study was run in four sessions. In the first session, participants completed an online battery of baseline measures of adult attachment and dispositional mindfulness at their own convenience. Eligible participants (determined by undergraduate student status and identifying a minimum of one secure attachment

relationship) were invited to complete the remaining parts of the study, and three separate lab sessions were scheduled, on average, one week apart (with a minimum of 5 and maximum of 9 days between sessions) Session order (attachment security prime, mindfulness induction, and control condition) was counterbalanced, and participants were randomly assigned to one of six possible order combinations. On arrival to each session, participants completed the pre-manipulation questionnaire that assessed state attachment and state mindfulness, then completed the experimental manipulation, and finally completed the post-manipulation questionnaire that assessed state attachment and state mindfulness. The order in which participants were presented with each measure in the pre and post manipulation questionnaires was randomized. Participants completed a funneled debrief upon completion of their participation to evaluate awareness and suspicion of the study design and aims. Answers were independently rated for suspicion about i) the experimental manipulation ii) the dependent variables of interest and iii) the pre/post design of the study by two researchers with an inter-rated-reliability of 100%. No additional participants were removed from analysis on the basis of the ratings.

Attentional checks were not included following the experimental manipulations, due to the previously noted criticisms of including attentional and instructional checks. Rather, a direct manipulation check of state attachment and mindfulness was included to provide empirical verification that the manipulations had the intended effects. Therefore, it is reasonable to conclude participants were attentive if such empirical verification is reported.

**5.5. Experimental Conditions**

Audio recordings were used that guided participants through each experimental condition. All were comparable in length, approximately 10 minutes long, followed a similar temporal structure, and were recorded by one individual, for consistency (security prime, 9 min. 31s; mindfulness induction, 9 min. 23s; control, 9 min. 30s). Scripts for each of the auditory prime can be found in the Appendix.

*Attachment Security Prime.* This security prime was developed for the purpose of this study due to the absence of audio security primes. Previous research has employed supraliminal stimuli, writing tasks, and brief recall tasks to prime attachment security (see review by Mikulincer & Shaver, 2007a). The attachment security prime was a guided visualization that asked participants to visualize a close attachment figure, the relationship they share with them, and to visualize this individual in a situation of dealing with life's difficulties.

*Mindfulness Induction.* Participants were asked to follow along a brief mindfulness meditation exercise focusing on breath and thoughts. Participants were instructed to focus on the physical sensations of breathing

and an awareness of their thoughts. The recorded instructions for this exercise were adapted from the mindfulness meditation exercise used by Segal et al. (2002) in Mindfulness Based Cognitive Therapy.

*Control.* In the neutral priming/control condition participants were asked to follow a guided imagination exercise of a woodland walk (May et al., 2010). The recording asked participants to notice and visualize different aspects of nature in their imagined surroundings (including trees and animals).

## 6. Results

Sensitivity power analysis (with $\alpha$ = .05 and power .80) yielded effect sizes of Cohen's $f$ = 0.37, indicating that the minimal detectable effect was a medium sized effect (Faul et al., 2014), proportional to those reported by Pepping and colleagues (2015). For each of the measures (SAAM and SMS), no significant session order effects were reported (all p values > .05). These findings indicate that counterbalancing was successful.

Descriptive statistics and a correlation matrix for the measures of adult attachment and mindfulness at baseline are reported in Table 6.

[Table 6]

### 6.1. Manipulation Checks

To ensure that the experimental manipulations successfully manipulated their respective target variables, paired samples *t*-tests were conducted to assess the change in SAAM security following the security priming condition and SMS mind and body following the mindfulness induction.

For state attachment security, there was a significant increase in SAAM security scores from pre ($M$ = 5.15, $SD$ = 1.30), 95% CI [4.88, 5.42] to post ($M$ = 5.81, $SD$ = 1.18, 95% CI [5.56, 6.06]), $t(69) = -5.43$, $p < .001$, $d$ = 0.65, in the attachment security priming condition.

For state mindfulness, there was a significant increase in SMS of mind from pre ($M$ = 7.97, $SD$ = 3.03, 95% CI [7.27, 8.67]) to post ($M$ = 9.23, $SD$ = 3.19, 95% CI [8.50, 9.96]), $t(69) = -3.07$, $p$ = .003, $d$ = 0.21, and SMS of body from pre ($M$ = 7.56, $SD$ = 2.84, 95% CI [6.92, 8.21]) to post ($M$ = 11.47, $SD$ =2.56, 95% CI [10.86, 12.07]), $t(69) = -10.43$, $p < .001$, $d$ = 1.25, in the mindfulness induction condition.

### 6.2. Efficacy of Experimental Manipulations

In order to control for any effects of dispositional attachment orientation, attachment anxiety, avoidance and disorganization were included as covariates in our analysis of changes in state measure from pre-

to post- manipulation, between conditions. Co-variates were determined from preliminary bivariate correlations between baseline measures and change scores of state measure in each condition. A series of 3 (condition; security prime, mindfulness induction, control) x 2 (time; pre, post) analysis of covariance with the outlined covariates were conducted (covariate scores were mean centered prior to analysis).

*SAAM Security*. For state attachment security, there was no significant main effect of condition ($F(2, 132) = 2.01$, $p = .138$, $\eta_p^2 = 0.03$), but there was a significant main effect of time ($F(1, 66) = 37.92$, $p < .001$, $\eta_p^2 = 0.37$), significant interaction between time and dispositional attachment avoidance (ECR-12) ($F(1, 66) = 7.45$, $p = .008$, $\eta_p^2 = 0.10$), and a significant interaction between condition and time ($F(2, 132) = 7.96$, $p = .001$, $\eta_p^2 = 0.11$). Post-hoc analysis (with a Bonferroni adjustment) revealed SAAM Security increased significantly following the security prime condition when compared to the mindfulness ($M = 0.45$, 95% CI [.22, .68], $p < .001$) and control ($M = 0.40$, 95% CI [0.11, 0.68], $p = .007$) conditions.

The significant interaction between time and dispositional attachment avoidance (ECR-12) was explored further using Pearson's correlations. This revealed a significant positive correlation between dispositional attachment avoidance (ECR-12) and combined mean change scores ($r(68) = .27$, $p = .023$), such that those higher in avoidance showed more change in state security from pre- to post-manipulation, regardless of condition.

*SAAM Anxiety.* For state attachment anxiety, there was no significant main effect of condition ($F(2, 132) = 0.49$, $p = .613$, $\eta_p^2 = 0.01$), but there was a significant main effect of time ($F(1, 66) = 4.47$, $p = .038$, $\eta_p^2 = 0.06$), significant interaction between condition and time ($F(2, 132) = 4.14$, $p = .018$, $\eta_p^2 = 0.06$), and a significant interaction between condition, time, and ECR-12 avoidance ($F(2, 132) = 3.30$, $p = .040$, $\eta_p^2 = 0.05$). Contrary to predictions, post-hoc analysis (with a Bonferroni adjustment) revealed SAAM Anxiety increased significantly following the attachment security prime condition when compared to the mindfulness induction ($M = 0.34$, 95% CI [0.08, -.60], $p = .011$) and control ($M = 0.26$, 95% CI [0.00, 0.52], $p = .048$) conditions.

The significant interaction between condition, time, and dispositional attachment avoidance (ECR-12) was explored by conducting separate Pearson's correlations. However, no significant associations were reported between mean change scores and dispositional avoidance in any condition. A series of linear regressions were conducted to examine the influence of dispositional attachment avoidance on the mean change scores for SAAM Anxiety following each experimental condition. Trait avoidance did not emerge as a significant predictor of SAAM change scores following the attachment security prime, mindfulness induction, or control condition.

*SAAM Avoidance.* For state attachment avoidance, there was no significant main effect of condition ($F(2, 132) = .240$, $p = .787$, $\eta_p^2 = 0.01$), but there was a significant effect of time ($F(1, 66) = 24.26$, $p < .001$, $\eta_p^2 = 0.27$). For each of the conditions, there was a significant decrease from pre- to post- test on the SAAM Avoidance subscale (see Table 7).

*SMS Mind.* For state mindfulness of mind, there was a significant main effect of condition ($F(2, 132) = 33.22$, $p < .001$, $\eta_p^2 = 0.34$), significant main effect of time ($F(1, 66) = 81.03$, $p < .001$, $\eta_p^2 = 0.55$), and a significant interaction between condition and time ($F(2, 132) = 41.26$, $p < .001$, $\eta_p^2 = 0.39$). For each condition, there was a significant increase in SMS mind from pre to post-test (see Table 6). Post-hoc analysis (with a Bonferroni adjustment) revealed SMS Mind increased significantly following the security prime condition when compared to the mindfulness ($M = 4.55$, 95% CI [3.62, 5.48], $p < .001$) and control ($M = 5.15$, 95% CI [4.10, 6.20], $p < .001$) conditions. That is to say that the attachment security prime was most effective in increasing state mindfulness of mind, while the mindfulness induction and control condition produced comparable results.

*SMS Body.* For state mindfulness of body, there was a significant main effect of condition ($F(2, 132) = 21.14$, $p < .001$, $\eta_p^2 = 0.24$), significant main effect of time ($F(1, 66) = 52.52$, $p < .001$, $\eta_p^2 = 0.44$), and a significant interaction between condition and time ($F(2, 132) = 25.33$, $p < .001$, $\eta_p^2 = 0.28$). For each condition, there was a significant increase in SMS body from pre to post-test (see Table 6). Post-hoc analysis (with a Bonferroni adjustment) revealed SMS Body increased significantly following the mindfulness induction condition when compared to the attachment security prime ($M = 2.52$, 95% CI [1.70, 3.35], $p < .001$) and control ($M = 2.35$, 95% CI [1.59, 3.11], $p < .001$) conditions. While SMS body significantly increased following each condition, the mindfulness induction was most effective.

[Table 7]

## 7. General Discussion

In two studies, we found evidence indicating that aspects of attachment orientation predict aspects of mindfulness, over time, and that priming attachment security leads to greater increases in state mindfulness of mind. Taken together, our novel findings challenge the proposed bi-directional relationship between attachment orientation and mindfulness previously reported in the literature (Ryan et al., 2007). suggesting that attachment orientation may play a causal role in the development of mindfulness, while the reverse may not be true. There are several key points in our findings that merit discussion, specifically: i) attachment anxiety predicted mindfulness, short-term (Study 1); ii) priming attachment security increased state mindfulness of mind

(compared to mindfulness and control) (Study 2); and iii) state attachment security improvements are moderated by attachment avoidance.

### 7.1. Attachment Anxiety Predicts Mindfulness Over Time

In Study 1, a self-report repeated measures study examining constructs 15-weeks apart, we found that attachment orientation and the mindfulness facets act with awareness and observe were stable over the 15-week time period, as well as the associations between all subscales. However, the mindfulness facets of describe, non-judging, and non-reacting, significantly increased over time. We also found preliminary evidence that, contrary to theory (Ryan et al., 2007), suggests the relationship between attachment and mindfulness was not bi-directional. Rather, our findings indicate that attachment orientation (specifically attachment anxiety) was a significant predictor of two cognitive facets of mindfulness (act with awareness and non-judging), but mindfulness facets were not a predictor of adult attachment orientation. These findings suggest that attachment anxiety, and subsequent hyperactivation of the attachment system, impedes the capacity for non-judgmental mindful awareness. A possible mechanism for this could be emotion regulation abilities, highlighted in previous research as a commonality between the two constructs (Stevenson et al., 2019). Those high in attachment anxiety tend to be at the mercy of their emotions, struggle to self-sooth (Mikulincer & Shaver, 2007), and have negative self-views (Bartholomew & Shaver, 1991). These characteristics are in opposition to the mindfulness facets of acting with awareness and non-judging, which require an engagement with present-moment actions and a non-critical view of the self and internal experiences. Thus, although mindfulness can help recovery from negative affect (Leyland et al., 2018), attachment anxiety may interfere with this process.

### 7.2. Attachment Security Priming Increases State Mindfulness

In a subsequent experimental manipulation (Study 2), we found that priming mindfulness was most effective in increasing state mindfulness of body, compared to priming attachment. Priming attachment security was significantly more effective and associated with greater state mindfulness of mind when compared to the mindfulness induction and control conditions. That the mindfulness induction was most effective at increasing mindfulness of body, but second to the attachment security prime in increasing mindfulness of mind, could be explained by examining the security prime. The security prime asks participants to think about a secure attachment relationship, and visualize feeling cared for and supported in a challenging situation. This elicits negative feelings associated with the challenging situation, but also reassurance of support from loved ones, and thus processing both negative and positive thoughts and feelings in a non-defensive manner. These are the hallmarks of mindfulness of mind, and the rehearsal of adaptive cognitive processing involved in the security

prime may account for its positive effects on mindfulness of mind. An alternative explanation may relate to the quantity of body vs. mind content in the exercise (100 words more on bodily sensations than mental ones). However, it is important to note that such focus on bodily sensation is a core feature of mindfulness practice. It is tempting to assume that this latter effect is a result of reducing the negative impact of attachment insecurity on the capacity for mindfulness. However, the security prime did not reduce state attachment anxiety to a greater extent than the other conditions, suggesting this is unlikely. The results provide nascent evidence to suggest there is a direct, immediate, and causal relationship between these constructs at the state level, which is in contrast to the theory of bi-directionality. Again, if the relationship between these constructs was indeed bi-directional, we would have expected the attachment security prime and mindfulness induction to produce comparable changes for both state measures of attachment and mindfulness. This was not the case in the present study. While the mindfulness induction resulted in changes in state attachment, the magnitude of the change in mindfulness of mind following the security prime was greater and should not be overlooked.

The finding that priming attachment security also increased state attachment anxiety, although contrary to our predictions, was not considered unexpected as a recent systematic-review (see Gillath & Karantzas, 2019) detailed the mixed findings of attachment priming studies with some studies reporting decreases in attachment anxiety while others reported increases in the same construct. Engaging in (rather than avoiding) relationships can be viewed as a common factor shared by both security and anxiety attachment orientations. It is therefore possible that activating one is sufficient to produce some change in the other. Indeed, Rowe et al. (2012) found priming anxiety to have a similar effect as priming security on pain tolerance. An additional explanation involves the items of the SAAM used to capture state anxiety, which are related to strongly needing to receive love, and a desire to share feelings. Readiness (rather than a strong need) to do these things can also be considered hallmarks of security; hence this finding may be an artifact caused by our use of these items. Future research should use the full SAAM for better specificity in capturing state anxiety versus security.

### 7.3. Attachment Orientation Improvements are Moderated by Attachment Avoidance

Trait attachment avoidance interacted with each manipulation in predicting post-prime state security. No interaction with trait attachment anxiety or disorganized attached was observed. Attachment avoidance is characterized by a dampening of affective responses, suppression of negative thoughts, and high self-reliance (Mikulincer & Shaver, 2003), competence self-esteem (Brennan & Morris, 1997), and a disconnect between bodily sensations and subjective experience (Diamond & Fugandes, 2010). It is possible, then, that those highest

in avoidance have the most to gain from visualizations designed to promote feelings of positivity associated with secure relationships (the security prime), or to focus on bodily sensations (mindfulness induction) or to relax (the control condition). These individuals may also have more mental resources available to notice external or internal stimuli compared to individuals exhibiting greater attachment anxiety or disorganization. That is to say, approaching and proximity seeking behaviours associated with attachment anxiety and disorganization are more mentally taxing than avoiding behaviours.

As state attachment security significantly increased following the mindfulness induction, it is possible that the influence of dispositional attachment avoidance on SMS Mind following the mindfulness induction is due to the simultaneous priming of attachment security. Therefore, this enhanced state security, as in the security priming condition, leads to an immediate increase of mindfulness capabilities. This is further supported by the security prime significantly increasing SMS Mind over and above the mindfulness induction. In the present sample, dispositional attachment avoidance was significantly positively correlated with the observe facet of mindfulness. That is to say, those individuals exhibiting greater attachment avoidance have a heightened ability to notice internal and external stimuli. Such an association could, in part, explain the reported effects of the security prime and mindfulness induction. Throughout the literature, the observe facet has been both negatively and positively associated with attachment avoidance. In their recent meta-analysis, Stevenson and colleagues (2017) reported a significant negative association between attachment avoidance and observe, albeit a small effect size.

**7.4. Theoretical Implications**

From the findings of the current research we suggest that dispositional attachment orientation is a primary antecedent of mindfulness, with attachment anxiety predictive of some facets, over time. The two key points that emphasize this causal relationship further are: (i) the predictive contribution of attachment anxiety to later mindfulness (Study 1); and (ii) the superior performance of priming attachment security at increasing mindfulness of the mind (Study 2). The present findings begin to uncover the direction and development of this relationship and are important because they have far-reaching implications, discussed below.

Developmentally, the organization of the attachment system and inner working models, resultant of caregiver warmth and availability, not only influence the way in which we view ourselves and others, but also the capacity in which we attend to our experiences. This emphasizes further the role of the caregiver in the development of dispositional mindfulness. As mindfulness is conceptualized as an internal cognitive awareness,

it is not a product of observational learning, but rather a result of the organization of our intrinsic attachment system. That is not to say that other regulatory systems may also play a role; a topic for future research.

The results present further implications for mindfulness practice. Despite the well-documented benefits of mindfulness and its practice for a variety of interpersonal outcomes, the current experiments reveal that priming security may be a more effective way at boosting mindfulness capabilities. Augmenting attachment security could be a beneficial precursor to mindfulness practice; research has already found that enhancing attachment security augments willingness to engage in further mindfulness after an initial taster session (Rowe et al., 2016). Experimentally inducing feelings of felt security could bolster the beneficial outcomes of mindfulness by satisfying the attachment system and, subsequently, increasing mindfulness capabilities. Specifically, priming felt security could support the adaptive state of equilibrium in the attachment system – neither hyper- nor de- activation, freeing up resources to achieve optimal psychological functioning. The efficacy of a one off attachment security prime of improving mindfulness should then be explored as to shape the best practice of promoting mindfulness capabilities and, subsequently, the benefits that come along with that.

**7.5. Caveats and limitations**

Key limitations to this research should be considered alongside the conclusions drawn. The timeframe for Study 1 was for a short-medium term of 15 weeks and involved only two time points. However, this time period is an appropriate starting-off point and can be used to inform studies wishing to examine longer-term associations between constructs with further time points to test these relationships longitudinally. In addition, future longitudinal examinations of attachment and mindfulness should include measurement of disorganized attachment. Future research should employ developmental longitudinal designs to examine how attachment security and mindfulness co-develop from childhood to adulthood at both state and trait level. Future longitudinal examinations should also include measurement of disorganized attachment to further our understanding of how this construct relates to mindfulness. In Study 2, all dependent variables improved from pre- to post- manipulation, which suggests that all conditions had a positive effect. It is likely that the control condition was a pleasant and relaxing experience, rendering it an extremely stringent control – a strength of this work. Future research could additionally use a more neutral control condition, and measure potential mechanisms, such as positive affect, to attempt to further delineate the effects of each manipulation as well as include attention checks to identify inattentive participants

The generalization of the results from the current research are also limited by the sample of participants selected. Both studies recruited participants from an undergraduate student population. Furthermore, the inclusion criteria for Study 2 required that participants were able to identify at least one secure attachment figure. Thus the applicability of these findings to the general population, and to those who may not have an identifiable secure attachment figure is not known. Given the novel nature of the research, it was deemed appropriate to first test new theory using a student population (Stroebe et al., 2018) prior to testing more representative samples. However, the use of student samples, and over reliance on opportunity sampling, appears to be a common problem in attachment research, and in social psychology more generally. Future research should seek to address this.

While careful consideration went into ensuring the rigorous experimental design of this set of studies, for the analyses conducted, the number of participants allowed for detection of medium sizes. It is possible that small effects sizes in Study 1 of the predictive value of mindfulness on attachment orientation, over time, have gone undetected. Future research is needed, employing a larger sample size, and preferably, a longer time period, to examine the parameters of the findings of the current work.

**8. Conclusion**

In sum, we have made strides toward answering the 'causality dilemma' of attachment orientation and mindfulness, suggesting that aspects of attachment orientation appear to predict, and evidence greater change in, aspects of mindfulness, but the reverse may not be true. Based on this, we theorise that attachment orientation comes first, and affects the capacity for mindfulness. Further research is needed to understand the time frames and contextual factors needed for attachment orientation to contribute to the development of an enduring capacity to be mindful as well as the effects of repeated priming of both constructs.

**Ethical Approval**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethical approval for this study was granted by the [masked for review] Research Ethics Committee (UREC).

**Informed Consent**

Informed consent was obtained from all individual participants included in the study where applicable.

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## Appendix

Auditory stimuli scripts

**Attachment security priming condition:**

I am now going to take you through a guided visualization. The purpose of this visualization is not necessarily to feel more relaxed or calm or better than you did at the start of the visualization. The purpose of this is to just simply experience the images. So take a few moments now to settle into a comfortable position. Some people struggle with getting images, and others find it easy, but please just do your best.

Nobody is perfect all the time, and nobody gets it right with us all the time, but I'd like you to think about a person who is important to you, with whom you feel comfortable and safe. Try to imagine that they have been, over a fairly long period of time, consistently available to you, sensitive to your needs, and highly reliable. This person clearly has your best interests at heart and is willing to support you in every way they can.

In the relationship you have had with this important person, you have found that it was easy to be emotionally close to the other person. In this relationship, you felt comfortable depending on this person. You have also been comfortable having them depend on you. In this relationship, you have never particularly worried about being alone. You have also never worried about this person not accepting you.

Now try to picture your important person in the scenario I'm going to describe. It doesn't matter at all if you struggle to get clear images. The goal is just to experience how it feels…

I would like you to think about a situation in which you deal with one of life's difficulties. It's a problem that you cannot solve on your own. It can be real or made-up. It's a situation or time when you felt distressed, upset, or worried.

Take a moment to visualize this problematic situation. You can't deal with it on your own. You need some help from your loved ones.

Now I would like you to imagine that your important person is there with you. They understand the problem you are facing. They listen to you. They are sensitive, and they totally understand your distress. They are totally in tune with your needs in that moment. They want to help you, and their only motivation for wanting to help and support you is that they love you and care about you.

Take this time to think about how good it feels to know that this person will come to your aid like this. You don't have to feel bad or indebted - you know that they would readily leave other activities to come and assist and support you, and there are no strings attached to their help. This is just a given in your relationship with this person. They are willing and able to share your burden, and you feel able to let them.

Think about how this person might, support and help you. Maybe it's what they say that always makes you feel better. Maybe it's the expression on their face that makes you know that things are going to be just fine. Maybe they just know what to do to help you resolve things for yourself. You know this person will always be there for you, and you know very deeply that you can rely on them. Reflect on how you feel when this person is there. Perhaps it's a sense of safety, knowing that you are not alone in this. Perhaps you feel a sense of being cared for, knowing that they are looking out for you. Relief, because you know that with their support, you can solve this situation. Knowing that your important person is there for you, you simply feel lighter.

There is no need to worry that this person will leave you alone. There is no need to worry that this person will be anything other than totally accepting of you. There is no need to worry that this person has anything other than your best interests at heart. Things just feel warm and easy in their presence, and they make you feel completely content.

Take a few minutes to enjoy this feeling of complete ease and sense of security that you get from just being with this person.

And when you're ready, open your eyes, and come back to the room.

**Mindfulness induction condition:**

I am now going to take you through a guided mindfulness meditation. The purpose of this meditation is not necessarily to feel more relaxed or calm or better than you did at the start of the meditation. The purpose of this is to just simply practice mindfulness. So taking a few moments now to settle into a comfortable position – wiggle into a position so that your back is straight, but not rigid. Place your feet squarely on the ground. If you wear glasses, you may like to take them off. And gently closing your eyes if you feel comfortable doing so. And if not, just find a spot on the floor to focus on.

Feeling all the points of contact between your body and the chair, and just settling into the stillness. Let's begin by just noticing that you can feel your feet on the ground. Notice that you can feel the bottom of your feet in your shoes.

Just settling into this... bringing attention now to the feeling of the palms of your hands. And either paying attention to what you're touching or the feeling of contact. Or perhaps the feeling of the air or the temperature of the air on your palms. And just bringing all your attention and awareness to this part of the body.

And now shifting attention to the sensation of breathing. We're not trying to change the breath in any way. It doesn't have to become deeper or slower or calmer. Just paying attention to the breath as it is in this moment.

Throughout this meditation we will be using the breath as an anchor. So every time you find that your mind wanders, you start thinking, or responding to sounds or thoughts as they arise, every time you notice this, just time and time again, bring your mind back to the breath – that is, your attention back to the breath.

And so now for the next few moments, just sitting, and bringing your attention to the feeling of the in-breath, and the feeling of the out-breath. Holding in awareness that part of the body where the breath feels most vivid or strong for you. It might be your abdomen, or your chest or nose or throat. Just bringing all your attention and awareness to that part.

Every time you find your mind has wandered, just gently bring your attention back to the breath.

You may already find that your mind has wandered. And your mind is just doing what minds do. You may be noticing thoughts about the meditation, whether you are doing it right, whether this is boring. You may have thoughts about how relaxing or calming this feels. No matter what your thoughts are, just know that they are thoughts, they're mental events that come into the mind, and just as easily, if you leave them well alone, they will also go out of your mind, and be replaced by more. You may be noticing bizarre or random thoughts. You might be planning what you will do for the rest of the day or tomorrow.

The purpose of a mindfulness meditation is not to stop your thoughts or suppress them or resist them or get rid of them. It's just to know that you're thinking and then shift your attention back to the breath. So your thoughts become like background chatter – like a radio going in the background – they are there, your mind is chattering away, and you are just not getting caught up with it.

Just noticing your breathing and what is happening in the present moment. So breathing in, and breathing out... just simply observing the breath, in this moment.... And now in this moment....

Just breathing in, and just breathing out. Being aware of everything that is happening, in each moment, as it passes.

You may be becoming aware of feelings and sensations as you're sitting for this amount of time. You may be noticing themes of discomfort, or itches as you sit. See if you can experience these just as sensations. You may notice thoughts like this really hurts, or this is unbearable, or I have to scratch. And again, just because they're thoughts doesn't mean they are real or that you have to obey them. Just be willing to experience it – be open to allowing it to be there. Holding these sensations in one part of awareness, and focusing on the breath at the same time.

And observing your minds reaction. Perhaps your mind is irritated. Perhaps your mind is telling you to scratch, or to move. And if you do decide to move, or to itch, just do so mindfully.

And then just coming back to the breath, and allowing things to be, just as they are. Just breathing in, and just breathing out. Letting thoughts and sensations just enter awareness and then leave awareness. And continue to focus on your breath.

So mindfulness is awareness of everything that is happening in the present moment. Just allowing it to be there. Being willing to have the experience you are having. And just breathing in, and just breathing out.

Being aware of whatever is happening in the present moment. If you find you're lost in thoughts, just notice where your mind went. And bring your mind back to the breath. You might find that the background chatter gets less. Or maybe it doesn't. Regardless of what's happening... just come back to the breath.

And now bring your attention and awareness to the feeling in your body on the chair. And all the points of contact between you and the surface. And now just notice that you can feel your feet on the ground. Notice that you can feel the bottom of your feet in your shoes.

Then bring your attention to the palms of your hands. Whether they are touching the chair, or your body, or whether you can just feel the temperature of the air on them...just bringing your attention to the palms of your hands. Now gently bring your attention and awareness of the room around you. And when you're ready, open your eyes, and come back to the room.

**Control condition, guided imagery:**

I am now going to take you through a guided imagination exercise. The purpose of this visualization is not necessarily to feel more relaxed or calm or better than you did at the start of the visualization. The purpose of this is to just simply experience the images. So take a few moments now to settle into a comfortable position. We're going to spend some time visualizing images and scenery. Some people struggle with getting images, and others find it easy, but please just do your best.

I'm going to guide you through an imagined woodland walk. You can close your eyes and let your imagination fill in all the details as you are guided down the path. The path may look familiar to you, or it may be somewhere you have never been.

I want you to imagine that you are walking along the edge of a field towards a small wood just ahead of you.

The sun is out, the skies are clear. The air is bright and fresh. You walk into the wood along a narrow path between the trees.

The wood is composed of many kinds of trees. Many of the trees are tall and reaching up toward the skies. Some of the trees are smaller and younger saplings. You notice the dark textured brown barks on the trees. The leaves are different shades of green.

The trees extend their leafy branches down to the earth. The branches of the trees wave towards you. Gaze at the trees and focus on how they move in the wind. Watch as their branches sway effortlessly back and forth, some making creaking sounds as they do.

Brightly colored birds call from the wood, their voices rising and fading. You notice several different bird songs sounding. You can also hear the breeze fluttering through the leaves on the trees. You take a moment to enjoy these sounds.

Thousands of shades of green moss carpet the ground beneath the trees. Sunlight plays with the leaves and casts shadows on the path. You can smell the damp earth and can see a haze of blue in the distance. You feel the twigs breaking under your feet.

The upper canopy of the trees covers you like a stained glass roof overhead. The light green leaves against the light blue and white sky create a glowing, ambient light. The movement of the leaves create a dappling in the light. The light is gentle and soothing.

Look up to see the bits of the clear blue sky through the tops of the trees. Catch glimpses of birds as they fly from one tree to the next.

In front of you a winding path leads up a gentle sloping hill through the trees. Feel the path beneath your feet as you travel through the wood. The trees become denser and the air becomes cooler. It becomes darker as the trees grow closer together.

You can see blue sky through the trees. All around you are bluebells, bobbing their heads in the breeze, creating a colourful floral carpet along the ground of the wood. The scent of the bluebells wafts around you.

Ahead of you is a large log that has fallen and settled in the middle of the wood. You sit on the log and look around you at the wood. Run your hand along the branch, feeling the contours of the rough, old bark.

The woodland creatures are going about their daily business, unaware of your presence. A robin comes close and you can see the bright red of his chest. Along the log, you see beetles and ants scurrying along. Above you, the branches of the trees make strange shapes against the sky. There are sounds of bird song and the breeze passing through the tree branches.

You can hear a stream running past somewhere nearby.

After you rest for a while, enjoying your surroundings, you decide that you are now ready to leave the wood. You see the path that led you here and start walking back the way you came. As you walk back you notice the familiarity of the trees. You see the entrance to the path up ahead. As you approach the entrance, you stop for a moment, taking in all of the sights and sounds of nature. You turn around and look down at the path beneath you, taking note of what you can see and what you can hear.

And when you feel ready, opening your eyes and once again taking in the room.