



Daily stress and the benefits of mindfulness: Examining the daily and longitudinal relations between present-moment awareness and stress responses



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ABSTRACT

Theories of mindfulness claim that a state of present-moment awareness enhances self-regulation in the presence of negative emotion. However, very little research has tested this claim in relation to daily stressors. This paper examined whether present-moment awareness during daily stressful events predicted enhanced responding to (a) the same day's event, (b) a stressful event on the subsequent day and (c) stressful events on average, among a sample of adults ($N = 143$) over 20 days. We found support for these predictions, controlling for negative affect and stress-related appraisals. These novel findings extend the personality literature by showing that present-moment awareness facilitates adaptive stress-responses, independent of an individual's affective state and the severity of threat experienced.

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1. Introduction

Daily stressors and hassles such as being stuck in traffic, losing keys or arguing with family may seem relatively benign. But there's evidence that these relatively minor stressors have a more negative impact on well-being than bigger life events because of their regularity and cumulative effects (Almeida, 2005; Chamberlin & Zika, 1990; Serido, Almeida, & Wethington, 2004). Oftentimes, people respond to these stressors by seeking to suppress thinking (Gross & John, 2003), by denying them (Brown & Locker, 2009), or by distracting themselves (Wilson et al., 2014). While these avoidant strategies often serve short term adaptive functions (van 't Riet & Ruiters, 2013), when used repeatedly they undermine well-being and behavioural effectiveness (Hayes, Luoma, Bond, Masuda, & Lillis, 2006).

Several individual-difference (e.g., personality, social support, health and socioeconomic) and intra-individual (e.g., mood, self-efficacy and physical symptoms) variables have been found to predict reactivity to daily stressors (Affleck, Tennen, Urrows, & Higgins, 1994; Almeida, 2005; Chamberlin & Zika, 1990; Tennen,

Affleck, Armeli, & Carney, 2000). However, very little research has examined the role of a state of present-moment awareness (as opposed to somatic or affective states) in predicting responses to daily stress. Being psychologically present connects an individual to the opportunities available in any situation, and is therefore likely to broaden the range of possible responses to stress, meaning that such responses are more adaptive (Brown & Ryan, 2003; Hayes et al., 2006; Shapiro, Carlson, Astin, & Freedman, 2006).

Present-moment awareness has been defined as the "continuous monitoring of experience with a focus on current experience rather than preoccupation with past or future events" (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008, p. 205). Research into the effects of maintaining a state of present-moment awareness has increased rapidly in recent decades, as a part of the growing research (e.g., Brown, Ryan, & Creswell, 2007) and practical (e.g. Reb & Atkins, 2015) interest in mindfulness. Dozens of studies have reported that present-moment awareness as a general disposition is associated with a host of psychological benefits, such as reduced anxiety and depressive symptoms, lowered perceived stress, increased mood and improved well-being (Brown et al., 2007; Weinstein, Brown, & Ryan, 2009). However, much less research has explored how changes in state attention and awareness predict enhanced

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responses to stress (Keng, Smoski, & Robins, 2011; Tanay & Bernstein, 2013).

We are only aware of one study directly examining the relations among state present-moment awareness and coping with stress (Weinstein et al., 2009, Study 3). Participants in that study were prompted to report their momentary level of present-moment awareness three times per day, and these assessments predicted less avoidance coping measured at the end of each day over a seven-day period. Several other studies have examined whether state present-moment awareness positively influences other stress-related variables. For example, state mindfulness (measured with versions of the state Mindful Attention and Awareness Scale (MAAS); Brown & Ryan, 2003) has been found to predict greater post-conflict commitment, respect and support of a romantic partner (Barnes, Brown, Krusemark, Campbell, & Rogge, 2007) and improved insight problem solving (Ostafin & Kassman, 2012). More recently, Hülshager, Alberts, Feinholdt, and Lang (2012; Study 2), found that state mindfulness (measured using the state MAAS) predicted less emotional exhaustion, measured daily over 10 working days, among a sample of professionals. Taken together, this research suggests that present-moment awareness should enhance the effectiveness of individuals' responses to daily stressors as they occur.

The present study examined the effects of present-moment awareness on three stress-response variables: values-consistent responding, coping self-efficacy and avoidance coping (following Weinstein et al., 2009). By examining three stress-response variables, we were able to corroborate findings across outcome variables and therefore draw more robust conclusions than would be possible by measuring a single outcome alone (Weinstein & Ryan, 2011). The relations between present-moment awareness and each of values-consistent responding, coping self-efficacy and avoidance coping are reviewed next.

1.1. Present-moment awareness and values-consistent responding to stress

Values-consistent behaviour is freely-chosen behaviour that is consistent with how an individual wishes to respond within the broader context of their life and long-term goals, rather than being unduly influenced by the short-term contingencies of the immediate environment (Smout, Davies, Burns, & Christie, 2014). Values-consistent action predicts less psychological distress and enhanced well-being (Ciarrochi, Fisher, & Lane, 2011; Ferssizidis et al., 2010; Smout et al., 2014) and in the context of stressful experiences predicts greater pain tolerance (Páez-Blarrina et al., 2008) and less defensiveness (Crocker, Niiya, & Mischkowski, 2008).

When an individual is psychologically present, they are more aware of their options as well as their values, and are therefore more likely to respond in autonomously-motivated and values-consistent ways (Hayes et al., 2006; Weinstein & Ryan, 2011). Several studies have demonstrated this. For example, Brown & Ryan (2003; Study 4) found that state present-moment attention and awareness, measured three times per day over 14 consecutive days, predicted greater momentary autonomy, controlling for covariates such as gender and time of day. Autonomy is defined as behaviour that is self-endorsed and volitional (Ryan & Deci, 2000) so it is indicative of values-consistent behaviour. Another study found that trait mindfulness (measured using the trait MAAS; Brown & Ryan, 2003) predicted more autonomously motivated behaviour (Levesque & Brown, 2007). More recently, present-moment awareness has been found to be positively associated with values-consistent behaviour (Smout et al., 2014; Trompeter et al., 2013).

In the context of every-day stressful events, we therefore expected that present-moment awareness would predict more

values-consistent responses to such events. Consistent with previous research (e.g., Arch & Craske, 2006; Britton, Shahar, Szepeswol, & Jacobs, 2012; Hülshager et al., 2012; Reber et al., 2012), we expected that present-centred individuals would be less reactive to negative emotion, and that this in-turn would enable more values-consistent responses to stressful experiences.

1.2. Present-moment awareness and coping self-efficacy

In addition, we expected that present-moment awareness would predict greater perceived self-efficacy in coping with daily stressful events. Coping self-efficacy describes the perceived competence the individual has for dealing with a stressor (Schwarzer & Renner, 2000) and has been consistently found to predict greater resilience and less trauma following stressful events (Benight & Bandura, 2004; Luszczynska, Benight, & Cieslak, 2009). Conversely, low self-efficacy in relation to challenging experiences is associated with depression, anxiety and a loss of well-being (Karademas, 2006). Coping self-efficacy is therefore an important measure of an individuals' ability to effectively respond to stressful events (Benight & Bandura, 2004).

In the context of daily stressors, we expected that higher levels of present-moment awareness would be associated with enhanced coping self-efficacy, as increased present-moment awareness widens the range of response options available to the person (Hayes et al., 2006; Shapiro et al., 2006), meaning that an individual's perception of their ability to influence such situations should increase. Several studies provide support for this prediction. For example, a study of post-graduate counselling students found that present-moment attention (specifically, the ability to sustain and switch attention) predicted greater counselling self-efficacy (Greason & Cashwell, 2009). More recent studies of mothers and prospective mothers found that mindfulness-based interventions resulted in significantly greater maternal self-efficacy, relative to controls (Byrne, Hauck, Fisher, Bayes, & Schutze, 2014; Perez-Blasco, Viguer, & Rodrigo, 2013).

1.3. Present-moment awareness and avoidance coping

Finally, we expected that present-moment awareness would predict less avoidance coping with daily stressful events. Avoidance coping has been associated with greater psychological distress and reduced well-being across the life-cycle and across a range of stressors (for reviews, see Duangdao & Roesch, 2008; Nicholls & Polman, 2007; Roesch et al., 2005). As discussed, Weinstein et al. (2009; Study 3) found that state present-moment awareness predicted less avoidance (but not more approach) coping with daily stressful events, over a seven-day period. Other studies have sought to manipulate present-moment awareness via mindfulness interventions, and have found reductions in avoidance behaviours (Bergomi, Ströhle, Michalak, Funke, & Berking, 2013), and greater willingness to be exposed to unpleasant stimuli (Arch & Craske, 2006). These findings suggest that being in a state of present-moment awareness should be associated with less avoidance coping with daily stressors.

1.4. Controlling for the effects of threat appraisals and negative affect

Being psychologically present is claimed to facilitate more adaptive and less defensive responses to stressful situations, independent of how much negative emotion such situations elicit (Brown & Ryan, 2003; Hayes et al., 2006; Weinstein & Ryan, 2011). To test this claim, the present study controlled for the effects of two affect-related variables, threat appraisal and daily negative affect, on stress responses. Perceptions of threat have been consistently shown to predict more avoidant and defensive

responding to stressful events (Park, Armeli, & Tennen, 2004; Sherman & Cohen, 2006; Stowell, Kiecolt-Glaser, & Glaser, 2001). When an individual's self-concept is threatened, defensive and avoidant responses are a way of protecting self-esteem (Sherman & Cohen, 2006). In addition, negative affect has been associated with less flexible and adaptive responses to stressful events (Fresco, Williams, & Nugent, 2006) including daily stressors (Affleck et al., 1994; Park et al., 2004). In the present study, we therefore expected that present-moment awareness would facilitate more effective responses to daily stressors, independent of an individual's level of perceived threat associated with the stressor, and the degree of general negative affect the person experiences on a given day.

The model we tested in the present study is displayed in Fig. 1. Each of these variables was measured at the end of each day over a 20 day period, using retrospective recall of daily events.

We tested the above model in three ways: (a) as between-subjects effects, exploring whether higher average present-moment awareness during daily stressful events was associated with enhanced responses to daily stressors on average; (b) as within-subjects effects, testing whether within-subject increases in present-moment awareness were associated with enhanced responses to daily stressful events; and (c) as lagged effects, examining whether present-moment awareness on one day predicted more adaptive responses to a stressful event on a subsequent day. Regarding between-subjects effects, our first hypothesis was that differences in present-moment awareness during daily stressful events will predict more values-consistent responding, less avoidance coping and greater coping self-efficacy in relation to such events, independent of individual differences in daily negative affect and event-related stress appraisals.

Within-subjects analyses enabled the examination of within-day, *intra-individual* associations between present-moment awareness in relation to daily stressful events and the three dependent variables (see Bolger & Laurenceau, 2013). This approach treats each individual as his or her own control, by assessing whether being above one's own average level of present-moment awareness on any given day is associated with enhanced coping responses, with each day's association for each individual then averaged across days and individuals (Bolger & Laurenceau, 2013). Our second hypothesis, in relation to these within-subjects relationships, was that within-subjects variation in

present-moment awareness during a daily stressful event will predict more values-consistent responding, less avoidance coping and greater coping self-efficacy in relation to that event, independent of within-subjects variation in daily negative affect and event-related stress appraisals.

Regressing predictors lagged by a meaningful time-period (e.g., one day) upon relevant outcome variables enables one to draw stronger inferences about the temporal relations between variables than the cross-sectional analyses described above (Kleiber & Zeileis, 2008). This approach has been used in the study of daily stress previously (e.g., Affleck et al., 1994; Caspi, Bolger, & Eckenrode, 1987; DeLongis & Holtzman, 2005), but not to our knowledge in relation to present-moment-awareness and stress-responses. In the present study, we tested whether the effects of present-moment awareness during a stressful event 'spilled over' to influence responses to a separate stressful event the following day. Consistent with the conservation of resources model of stress (Hobfoll, 1989), we expected that greater present-moment awareness in relation to a stressor on one day would conserve coping resources (via less rumination and avoidance), meaning that the individual is better placed to respond to a subsequent but proximal stressor more effectively. Consistent with previous research on daily stress responses, we expected this effect to be relatively short-lived, predicting changes in stress-responses on the subsequent day but not further (Affleck et al., 1994; Bolger, DeLongis, Kessler, & Schilling, 1989; Tennen et al., 2000). Our third and final hypothesis was therefore that an individual's levels of present-moment awareness during a stressful event *yesterday* will predict more values-consistent responding, less avoidance coping and greater response self-efficacy in relation to a stressful event *today*, independent of negative affect and event-related stress appraisals *yesterday*.

2. Method

2.1. Participants

Participants were 143 undergraduate and post-graduate students, and university staff (76.3% female; mean age 33.7). Around 74% identified as Caucasian, 14% as East or South Asian and 11% as 'other'. Ninety-five per cent of participants held an undergraduate diploma or degree and 37% held a master's or PhD degree.

2.2. Procedure

Participants for the present study were recruited as a part of a larger, multi-purpose study that included a randomised controlled mindfulness intervention. Students and staff at three Australian universities were recruited via online advertising for a mindfulness course for which they paid AUD 100 and were randomly allocated to one of three conditions (mindfulness ($n = 59$), mindfulness-plus-values ($n = 60$), and a waitlist control condition ($n = 80$)) for the separate randomised controlled study. This research was approved by the ethics committee of first authors' institution.

Consenting individuals in the mindfulness and mindfulness-plus-values conditions received an AUD 100 refund for the course upon completion of 20 daily surveys described below. Individuals in the waitlist condition ($n = 80$) were not provided with a financial incentive to complete the daily surveys. A total of 22 participants from the waitlist condition completed the daily surveys (27% of the waitlist condition), while all participants in the treatment conditions completed at least one daily survey, so were all included in this study. Those in the treatment conditions completed the daily surveys approximately four months prior to those in the waitlist condition.

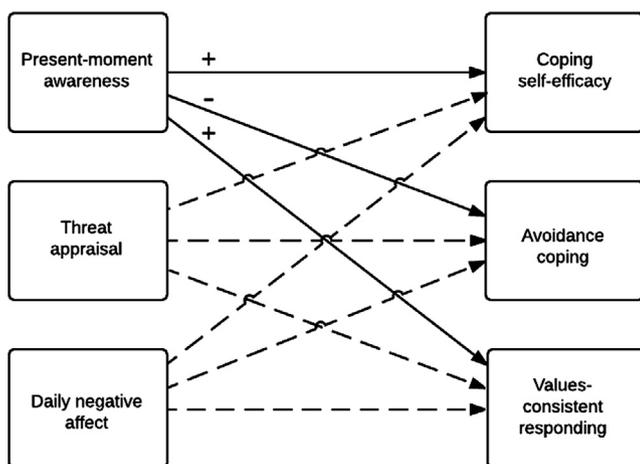


Fig. 1. Flow chart showing the relationships tested in this study. *Note.* The solid lines with arrows represent the relationships tested for in this study, while the dashed lines with arrows represent the relationships we controlled for in this study. The '+' sign indicates that a positive relationship was predicted; the '-' sign indicates a negative relationship was predicted.

Participants completed the 20 daily surveys in four separate weekly-blocks: five daily surveys over the five working days in the week preceding their first mindfulness training session; five daily surveys over the five working days in the week immediately following their second training session (four weeks after the first set of daily surveys); five surveys over the five working days in the week following their third and final mindfulness training session (four weeks after the second set of daily surveys); and a final set of five surveys over five working days, four weeks after their final mindfulness training session. Participants received each daily survey at 4 pm and were given until 10 am the following morning to complete it. Piloting ($n = 15$) indicated that each daily survey took approximately 2 min to complete. Each daily survey included eleven items, six of which were for the present study and are described below. Consenting participants also completed a 10–15 min baseline survey (linked to the AUD 100 refund for all participants), the responses to which were used to validate the single-item measures in the present study and are described below.

2.3. Measures

As this was a daily-diary study, single-item measures were used so as to minimise the non-response rate across the 20 daily surveys. Although common in daily-diary and experience sampling research (Fuchs & Diamantopoulos, 2009), the use of single-item measures is a potential limitation (Cohen, Cohen, West, & Aiken, 2003). To address this, several steps were taken. First, wherever possible, we used single-item measures that had been validated in previous research (i.e., the measures of threat-appraisal and coping self-efficacy). Second, where such measures did not exist, we adapted single-item measures from multi-item scales that have displayed acceptable validity and reliability (i.e., the negative affect (Diener et al., 2009), valued-action (Smout et al., 2014) and avoidance coping (Carver, 1997) measures). Third, the constructs measured in this study were relatively concrete, conceptually simple and unidimensional in nature, making them well-suited to single-item measurement (Fuchs & Diamantopoulos, 2009). Finally, we validated the single-item measures against multi-item versions of each construct, and assessed the internal as well as the test-retest reliability of each single-item measure (see *Supplemental Material*).

For each daily survey, participants were asked to reflect on their most stressful or challenging situation of the past day, consistent with previous studies of daily stress to have done this (e.g., Park et al., 2004; Todd, Tennen, Carney, Armeli, & Affleck, 2004; Weinstein et al., 2009), and respond to the following items:

2.3.1. Present-moment awareness

A single-item measure of was adapted from the 'Act with awareness' subscale of the Five Facets of Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), which focuses on awareness of actions, thoughts and feelings and has 8 items. The single item created for the present study was: "Reflecting on this situation, how aware were you of your actions, thoughts and feelings at the time?"

2.3.2. Threat appraisal

A single item measure of threat appraisal was taken from Hodgins et al. (2010) and Tomaka, Blascovich, Kesley, and Leitten (1993), on a 1 (*not at all*) to 5 (*extremely*) Likert scale: "How threatening was this experience for you?"

2.3.3. Negative affect

This was measured using a single item adapted from the Scale or Positive and Negative Emotions (Diener et al., 2009), which asks individuals to rate the frequency of a range of positive and negative

emotions. The item was: "How often did you experience negative emotions today? (e.g. Unpleasant, sad, angry, upset, bored, disappointed, nervous)" on a 1 (*very rarely or never*) to 5 (*very often*) Likert scale.

2.3.4. Perceived self-efficacy

A single item measure of perceived self-efficacy was taken from Chwalisz, Altmaier, and Russell (1992): "How confident did you feel about your ability to deal with this situation?" Subjects rated themselves on a 1 (*not at all*) to 5 (*extremely*) Likert scale.

2.3.5. Avoidance coping

Avoidance coping was measured using the item: "To what degree did you turn to other activities to take your mind off this situation?" on a 1 (*not at all*) to 5 (*completely*) Likert scale. The item was adapted from the behavioural disengagement subscale of the Brief COPE Inventory (Carver, 1997).

2.3.6. Values-consistent responding

This item was adapted from the Values-Progress subscale of the Valuing Questionnaire (Smout et al., 2014): "Did you respond to the situation in a way that you would generally like to respond?" on a 1 (*not at all*) to 5 (*completely*) Likert scale.

3. Statistical analyses

As discussed, relatively minor nuisances and hassles can have a larger effect on well-being than more major life-stressors, due to their cumulative effects across time (Almeida, 2005; Chamberlin & Zika, 1990; Serido et al., 2004). We therefore included all reports of individuals' most stressful daily events in our analyses, even those that were appraised as relatively unthreatening, consistent with similar approaches elsewhere (Park et al., 2004; Todd et al., 2004; Weinstein et al., 2009).

Two sets of analyses were conducted in this paper: (a) between- and within-subjects analyses (conducted simultaneously); and (b) lagged analyses. In multi-level modelling, level 1 variables include both within- and between-subjects variance and this needs to be appropriately accounted for, otherwise effects at one level confound effects at the other (Bolger & Laurenceau, 2013; Preacher, Zhang, & Zyphur, 2015). Multi-level power calculations, based on the effects obtained by Weinstein et al. (2009, Study 3) on avoidance coping ($\beta = -0.42$), indicated a sample size of $N = 108$ was required to achieve power of 0.90 for the within-subjects analyses. Brief descriptions of the approach taken for the between- and within-subjects analyses, as well as the lagged analyses, are provided next, following methods outlined in Preacher, Zhang, Zyphur, and across levels of analysis. *Psychological Methods* (in press) and Bolger and Laurenceau (2013).

3.1. Between- and within-subjects analyses

The between- and within-subjects analysis used in the present study is illustrated in Eq. (1). Here, between-subjects variation in present-moment awareness, $\gamma_{10}(X_j)$, and within-subjects deviations from each subjects' mean awareness score, $\gamma_{10}(X_{ij} - X_j)$, were regressed on the three dependent variables in this study (i.e., values-consistent action, avoidance coping and coping self-efficacy), denoted as Y_{ij} . We controlled for 'day', $\gamma_{20}D_{ij}$ (1–20 days across the study period, median-centred), and 'week', $\gamma_{30}W_{ij}$ (four, one-week blocks across the study period, also median-centred), as well as experimental condition, $\gamma_{04}C_j$, and financial incentive, $\gamma_{05}F_j$. Lastly, we controlled for threat appraisal and negative affect, with between-subjects variation in these covariates denoted, respectively, as $\gamma_{02}(TA_j)$ and $\gamma_{03}(NA_j)$, and within-subjects

deviations from these individual-means denoted as $\gamma_{40}(TA_{ij} - TA_{.j})$ and $\gamma_{50}(NA_{ij} - NA_{.j})$. These were the fixed effects terms. The remaining five terms were random effects, where u_{0j} was a random intercept term for each individual, $u_{1j}(X_{ij})$ was a term for the random slope of present-moment awareness for each subject, $u_{2j}(TA_{ij})$ was a term for the random slope of threat appraisal for each subject, $u_{3j}(NA_{ij})$ was a term for the random slope of negative affect for each subject, and ε_{ij} is a random residual component, specific to each subject.

$$Y_{ij} = \gamma_{00} + \gamma_{01}(X_{.j}) + \gamma_{10}(X_{ij} - X_{.j}) + \gamma_{20}D_{ij} + \gamma_{30}W_{ij} + \gamma_{40}(TA_{ij} - TA_{.j}) + \gamma_{50}(NA_{ij} - NA_{.j}) + \gamma_{02}(TA_{.j}) + \gamma_{03}(NA_{.j}) + \gamma_{04}C_{.j} + \gamma_{05}F_{.j} + u_{0j} + u_{1j}(X_{ij}) + u_{2j}(TA_{ij}) + u_{3j}(NA_{ij}) + \varepsilon_{ij} \quad (1)$$

3.2. Lagged analyses

In order to assess lagged effects of present-moment awareness on the three dependent variables across time, we lagged present-moment awareness by a single-day (Kleiber & Zeileis, 2008; $\gamma_{10}(X_{(i-1)j})$ in Eq. (2)). In addition, we controlled for the autoregressive effects of the previous day's levels of each dependent variable upon levels of the same variable today ($\gamma_{20}(Y_{(i-1)j})$ in Eq. (2)). We also controlled for experimental condition ($\gamma_{01}C_{.j}$), whether or not participants received a financial incentive ($\gamma_{02}F_{.j}$), both level 2 variables, and lagged threat appraisal $\gamma_{30}(TA_{(i-1)j})$ and negative affect ($\gamma_{40}NA_{(i-1)j}$), both level 1 variables. Lastly, to control for the fact that days were clustered within weekly blocks, we included 'week' as a fixed effect control variable, $\gamma_{50}W_{ij}$. These were the fixed effects terms. The random effects terms were: u_{0j} , a random intercept term; three random slope terms for lagged present-moment awareness, $u_{1j}(X_{(i-1)j})$, threat appraisal, $u_{2j}(TA_{(i-1)j})$, and negative affect, $u_{3j}(NA_{(i-1)j})$, and ε_{ij} , a random residual term.

$$Y_{ij} = \gamma_{00} + \gamma_{10}(X_{(i-1)j}) + \gamma_{20}(Y_{(i-1)j}) + \gamma_{30}(TA_{(i-1)j}) + \gamma_{40}(NA_{(i-1)j}) + \gamma_{50}W_{ij} + \gamma_{01}C_{.j} + \gamma_{02}F_{.j} + u_{0j} + u_{1j}(X_{(i-1)j}) + u_{2j}(TA_{(i-1)j}) + u_{3j}(NA_{(i-1)j}) + \varepsilon_{ij} \quad (2)$$

The above analyses were conducted using the 'lmeTest' (Kuznetsova, Brockhoff, & Christensen, 2015), 'lme4' (Bates, Mächler, Bolker, & Walker, 2015) and the 'Hmisc' packages (Harrell, Dupont, et al., 2015) in R 3.2.3 (R Core Team, 2015). For these analyses, *p*-values were calculated using the 'lmerTest' package (Kuznetsova et al., 2015) and all continuous variables (i.e., predictors and outcomes) were standardized. Missing data were minimal in this study, ranging from 0.59% for threat appraisal to 0.97% for coping self-efficacy.

4. Results

We first tested whether there were differences in the dependent variables between those who volunteered to participate in the study and those who received a financial incentive to do so. We found significant differences between the two groups on coping self-efficacy ($M_{\text{paid}} = 3.22$; $M_{\text{unpaid}} = 3.04$; $t = 2.75$, $p\text{-value} = 0.006$), though not on any of the other study variables. We therefore included 'financial incentive' as a covariate in subsequent analyses.

In addition, we did not find significant effects of either intervention on values-consistent action, coping self-efficacy or avoidance coping over time, either as main effects or as interactions with present-moment awareness. We therefore did not further analyse experimental effects in this study, though we included 'experimental condition' as a covariate in all inter- and intra-individual-difference analyses.

Consistent with our first hypothesis, higher average present-moment awareness between individuals was associated with significantly higher values-consistent responding and self-efficacy in relation to daily stressful events, on average (see Table 1). That is, across stressful events, having higher levels of present moment awareness means individuals are more likely to feel they can successfully influence such events, and their responses are more likely to be consistent with their personally-held values. However, we did not find that higher average present-moment awareness predicted less avoidance coping on average.

Regarding within-subjects effects (our second hypothesis), an individual being above his or her own average level of present-moment awareness in relation to a daily stressful event was associated with more values-consistent responding to this event and greater coping self-efficacy (see Table 1). These effects occurred after controlling for between- and within-subjects variation in both threat appraisal and daily negative affect, as well as other control variables. Notably, within-subjects variation in present-moment awareness was not a statistically-significant predictor of less avoidance coping, though this effect was close to the $p = 0.05$ level.

Lastly, to test the possibility that there were maturation effects that occurred between weekly blocks that may have masked or amplified within-subjects effects in the above results (for example, due to the interventions), we calculated between-week average scores on the predictor variables (present-moment awareness, threat appraisal and daily negative affect), and their within-person, within-week deviations. The pattern of results from this sensitivity analysis were consistent with the above findings and are reported in Supplemental Material.

The above pattern of results was replicated when we tested the lagged effects of present-moment awareness upon the three

Table 1
Between- and within-subjects effects of present-moment awareness predicting values-consistent action, coping self-efficacy and avoidance coping.

	Values-consistent action				Coping self-efficacy				Avoidance coping			
	β	SE	t-value	p-value	β	SE	t-value	p-value	β	SE	t-value	p-value
Intercept	3.36***	0.19	17.37	<0.001	-0.31	0.18	-1.67	0.095	-0.11	0.21	-0.55	0.584
Condition	-0.02	0.06	-0.29	0.772	0.00	0.07	0.02	0.988	0.01	0.08	0.17	0.867
Incentive	-0.08	0.09	-0.87	0.387	-0.09	0.10	-0.94	0.350	-0.01	0.11	-0.10	0.924
Week	0.00	0.06	-0.03	0.978	0.16***	0.06	2.87	<0.001	0.05	0.06	0.76	0.448
Day	0.01	0.01	0.60	0.550	-0.03*	0.01	-2.46	0.014	-0.01	0.01	-1.12	0.264
Threat appraisal (between)	0.03	0.04	0.72	0.475	0.00	0.04	-0.05	0.960	0.04	0.04	0.84	0.400
Threat appraisal (within)	-0.15***	0.03	-5.87	<0.001	-0.30***	0.02	-13.50	<0.001	0.08***	0.02	3.08	<0.001
Negative affect (between)	-0.22***	0.03	-6.31	<0.001	-0.24***	0.04	-6.06	<0.001	0.20***	0.04	4.45	<0.001
Negative affect (within)	-0.26***	0.02	-11.46	<0.001	-0.20***	0.02	-8.65	<0.001	0.15***	0.02	6.34	<0.001
Awareness (between)	0.16***	0.03	4.72	<0.001	0.09*	0.04	2.57	0.011	0.00	0.04	0.10	0.921
Awareness (within)	0.16***	0.03	6.27	<0.001	0.09***	0.02	4.34	<0.001	-0.04	0.02	-1.85	0.067

Note. * $p < 0.05$, *** $p < 0.001$. There were $N = 143$ individuals (level 1) and $N = 2332$ observations (level 2) in the above models.

Table 2

Lagged present-moment awareness predicting outcome variables, controlling for lagged threat appraisal and negative affect.

	Values-consistent action				Self-efficacy				Avoidance coping			
	β	SE	<i>t</i> -value	<i>p</i> -value	β	SE	<i>t</i> -value	<i>p</i> -value	β	SE	<i>t</i> -value	<i>p</i> -value
Intercept	-0.05	0.14	-0.34	0.735	<0.00	0.14	0.01	0.994	-0.03	0.15	-0.21	0.834
Dependent variable (lagged)	0.05*	0.02	2.10	0.036	0.10***	0.02	4.15	<0.001	0.05*	0.02	2.33	0.020
Condition	-0.02	0.08	-0.29	0.771	-0.01	0.08	-0.09	0.926	0.04	0.09	0.40	0.692
Incentive	-0.08	0.11	-0.77	0.446	-0.13	0.11	-1.21	0.229	0.09	0.12	0.70	0.488
Week	0.06**	0.02	3.19	0.001	0.05**	0.02	2.98	0.003	-0.03	0.02	-1.52	0.129
Threat appraisal (lagged)	0.03	0.03	1.31	0.189	0.05	0.03	1.87	0.062	-0.02	0.02	-0.95	0.341
Negative affect (lagged)	-0.02	0.03	-0.67	0.501	-0.03	0.03	-1.13	0.258	0.03	0.02	1.13	0.258
Awareness (lagged)	0.06*	0.02	2.43	0.015	0.08**	0.02	3.40	0.001	-0.04	0.02	-1.95	0.052

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. There were $N = 143$ individuals (level 1) and $N = 2199$ observations (level 2) in the above models.

dependent variables. Consistent with our third hypothesis, we found significant effects of present-moment awareness on both values-consistent responding and coping self-efficacy, controlling for the autoregressive effects of each dependent variable and the lagged effects of threat appraisal and negative affect (see Table 2). Notably, the effect sizes for present-moment awareness predicting coping self-efficacy were similar to the within-day analyses above (0.09 versus 0.08), while it decreased somewhat for values-consistent action (0.16 versus 0.06). However, present-moment awareness did not predict reduced avoidance coping across a one-day lag (although this effect was very close to $p = 0.05$).

Also of note, neither threat appraisal nor negative affect predicted either of the three outcomes across a one-day lag. Random effects from both the within-day and lagged analyses are reported in the Supplemental Material. Due to issues of misspecification in the lagged models, we took the more conservative approach of running random intercept-only (rather than random slope and intercept) models for the lagged analyses.

5. Discussion

Theories of mindfulness claim that in the presence of an aversive experience such as stress, being psychologically present broadens one's options for responding and facilitates more adaptive responses to such experiences, independent of how much negative emotion the person experiences (Brown et al., 2007; Hayes et al., 2006; Shapiro et al., 2006). However very few studies have tested this proposition in the context of daily stressful experiences. There is evidence that daily stressors, even relatively minor hassles, have a bigger impact on well-being than acute stressors (Almeida, 2005; Serido et al., 2004), underscoring the practical value of this line of inquiry.

We expected that present-moment awareness during a daily stressful event would be associated with more values-consistent responding, greater coping self-efficacy and less avoidance coping at three levels of analysis: on average, across days; within-subjects, within the same day; and lagged across a one-day period. We expected each of these effects to be independent of how threatening the individual appraised the event as being and how much daily negative affect they experienced.

We found partial support for all three hypotheses. Regarding our first hypothesis, we found that higher average present-moment awareness during daily stressful experiences was associated with more values-consistent responding and greater self-efficacy in relation to such experiences. Regarding our second hypothesis, we found the same pattern of results: for any given individual, being above their own average level of present-moment awareness on any one day was associated with more values-consistent responding and greater self-efficacy in relation to a stressful event on that day. These findings suggest that daily stress responses are influenced by both general levels of

present-moment awareness and also by event-specific levels of present-moment awareness on any given day. Moreover, at both the between- and within-subjects levels, the above effects were independent of threat appraisal and daily negative affect. This suggests that higher present-moment awareness predicts enhanced responses to stress independent of an individuals' affective state, consistent with the theoretical predictions outlined above (Brown et al., 2007; Hayes et al., 2006; Shapiro et al., 2006).

To draw stronger inferences regarding the direction of these effects, we conducted lagged analyses, which revealed a pattern of results that was consistent with those discussed above: Present-moment awareness in relation to a stressor on one day predicted more values-consistent and self-efficacious coping responses to a different stressor the subsequent day. These effects were again independent of lagged threat appraisals and daily negative affect. We expect that these effects occurred because greater present-moment awareness regarding a stressor on one day conserves valuable coping resources which can then be used in responding to similar, subsequent stressful events, consistent with the conservation of resources model (Hobfoll, 1989). Of particular note, the effect of present-moment awareness on coping self-efficacy was similar in size within-days as it was across days. This may be because coping self-efficacy is a coping resource that is readily conserved (see Hobfoll, 1989 for discussion of self-efficacy as a stress-response resource) meaning that it is influenced both within- and across days to a similar degree.

Notably, we did not find within-day or lagged effects of present-moment awareness on avoidance coping in this study (although the lagged effects were very close to the $p = 0.05$ significance level and in the expected direction). Mindfulness research suggests that reductions in avoidance behaviours, especially in the context of stress, may be most effectively targeted by acceptance manipulations, and that manipulations of present-moment awareness are less efficacious in this regard (Donald & Atkins, 2016; Levin, Hildebrandt, Lillis, & Hayes, 2012). The findings of the present study are consistent with this. We expect that this is because acceptance directly targets the tendency toward avoidance of present-moment experience, which in-turn is linked to avoidant coping behaviours, whereas enhancing present-moment awareness less directly inhibits the avoidance of difficult or unwanted internal states (Cardaciotto et al., 2008; Hayes et al., 2006).

The relative effects of present-moment awareness and the affective predictors (threat appraisal negative affect) were also noteworthy in this study. Threat appraisal and daily negative affect predicted the dependent variables in this study within but not across days. This suggests that their effects on stress-responses are limited to the context in which they occur. In contrast, present-moment awareness had small-but-positive effects on stress-responses across days. This in-turn suggests that remaining psychologically present when faced with a stressor may be a better 'investment' in future responses to similar stressors than seeking to dampen appraisals of stress-related threat, such as through

cognitive reappraisal, or by seeking to control or inhibit negative emotions. This finding is consistent with the predictions of third-wave behaviour therapies that the *relationship* individuals have with their stress-related thoughts and feelings (i.e., present-moment awareness) matters more than the form or frequency of such thoughts and feelings (i.e., appraisals and affect; Hayes et al., 2006). It is also consistent with self-determination theory, which suggests that awareness conduces to higher quality self-regulation and coping (Ryan, Deci, & Vansteenkiste, 2016; Schultz & Ryan, 2015).

This study has a number of limitations. First, it used single-item measures of constructs. While studies have found that single-item measures, such as those used in this study, can perform as well as multiple-item scales on a range of constructs (Gardner, Cummins, Dunham, & Pierce, 1998), there are limitations to their use, including in relation to reliability, convergent validity and discriminant validity (Fuchs & Diamantopoulos, 2009). Information regarding the validation of the present study's measures is in the *Supplemental Material*.

Second, although this study demonstrated longitudinal effects of present-moment awareness upon stress responses, and controlled for the autoregressive effects of the dependent variables in each model, future research could test the effects of manipulations of present-moment awareness upon such responses, to allow stronger inferences of causality.

Notwithstanding these limitations, the present study makes a novel contribution to our understanding of the personality factors that enhance individual responses to stressful events as they occur in daily life. Our findings suggest that simply being psychologically present in the face of daily stressful events enhances a person's response to such events, but also buffers the individual from the harmful effects of similar stressors on subsequent days, above and beyond the effects of emotional states such as the person's threat-related appraisals and levels of negative affect. Given the adverse impacts of daily stress on individual well-being (Chamberlin & Zika, 1990; Tennen et al., 2000), these findings make an important contribution to this literature.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.jrp.2016.09.002>.

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