

Reappraisal Buffers the Association between Stress and Negative Mood Measured Over 14 Days: Implications for Understanding Psychological Resilience

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Abstract

Reappraisal is thought to be an adaptive emotion regulation strategy, and research suggests that individuals who habitually reappraise report more positive patterns of affect overall. However, some experimental studies indicate that a greater tendency to reappraise can exacerbate stress response, and it is unclear whether reappraisal confers resilience or exacerbates response to naturally occurring stressors. In order to address this, the present study investigated whether reappraisal prospectively moderated the association between daily stressors and daily negative mood measured over 14 days. Participants ($n = 236$) completed a measure of reappraisal at baseline, before completing daily online entries of stress and positive and negative mood. Data were analysed using multilevel modelling. Results suggested that reappraisal moderated the association between stress and negative mood, such that higher levels of reappraisal were associated with lower levels of negative mood in response to stress. Moreover, higher reappraisal was also independently associated with lower levels of daily negative mood and higher levels of positive mood. These results suggest that higher reappraisal may confer resilience to stress.

Keywords: emotion regulation; reappraisal; suppression; rumination; resilience

Introduction

Recent years have seen a growing interest in resilience research. Resilience factors have been described as those which buffer the likelihood that risk will lead to adverse outcomes (Johnson, Wood, Gooding, Taylor, & Tarrier, 2011b; Johnson & Wood, 2016). Johnson and colleagues (Johnson, Gooding, Wood, & Tarrier, 2010; Johnson et al., 2014; Johnson, 2016) outline the criteria which a variable should meet in order to be considered as conferring resilience. In particular, they suggest that resilience factors should be regarded as psychological variables which exist on a separate dimension to risk, and which act to moderate the association between risk factors and outcome variables. As such, resilience factors can be viewed as those variables which have a disproportionate impact upon the occurrence of adverse outcomes, potentially 'switching on' and 'switching off' the impact of risk. Because of this, better knowledge and understanding of resilience factors could be important for the development of more accurate theoretical models of wellbeing and psychological disorder, and the improvement of clinical assessment and intervention. The current study aimed to investigate whether two highly researched emotion regulation strategies, reappraisal and suppression, conferred resilience to daily stressors upon positive and negative mood using a diary study design.

It has been suggested that emotion regulation strategies could be a key aspect of psychological resilience (Yates, Egeland, & Sroufe, 2003). Gross and colleagues (Gross, 1998b; Gross & Thompson, 2007) propose that two common strategies are reappraisal and suppression. According to Gross's taxonomy, reappraisal involves cognitively appraising events in a way that alters their emotional impact (Gross & Thompson, 2007). It is an antecedent-focused emotion regulation process which occurs immediately in response to an emotion inducing event, and thus early in the course of cognitive-emotion processes. As such, Gross and Thompson (2007) suggest that it is an adaptive strategy which does not load highly on cognitive resources. In their theory of emotion regulation strategies, Gross and colleagues (Gross, 1998a, 2002) have studied emotion reappraisal alongside expressive suppression, where individuals seek to mask the emotions they are experiencing. In contrast to reappraisal, suppression occurs once an emotion has been triggered and experienced. Suppression aims to conceal the appearance and communication of an emotion to others, and it is thought to occur late in the succession of cognitive-emotion processes (Gross & Thompson, 2007). As such, it is viewed as loading highly on cognitive resources, and being maladaptive.

Research into reappraisal has focused on two forms: instructed reappraisal and habitual or trait reappraisal. Instructed reappraisal has usually been studied in experimental settings. In these studies, participants are instructed to reappraise a stressor, such as a sad film (e.g., Butler et al., 2006) before the stressor is experienced and response is measured. Divergent from this, studies of trait reappraisal aim to measure naturally occurring individual differences in the tendency to reappraise. As such, studies of trait reappraisal may be particularly relevant for understanding resilience. This research uses the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), which was developed in order to measure this trait. Research into both forms of reappraisal has supported Gross's taxonomy, suggesting it is associated with generally positive patterns of affect. For example, in a meta-analysis of experimental studies which manipulated emotion regulation strategies, Webb, Miles and Sheeran (2012) found reappraisal was one of the most effective strategies examined.

Similarly, in a meta-analysis of studies investigating trait reappraisal, Aldao, Nolen-Hoeksema and Schweitzer (2010) found higher reappraisal was associated cross-sectionally with lower symptoms of anxiety and depression. These findings have been supported by subsequent research using experience-sampling (ESM) or diary study designs. For example, in an ESM study by Brans, Koval, Verduyn, Lin Lim and Kuppens (2013), using reappraisal as an emotion regulation strategy was associated with increases in positive affect, and in a diary study by Nezlek and Kuppens (2008), reappraisal of positive emotions was associated with increases in positive affect, self-esteem and psychological adjustment. Reappraisal of negative emotions was associated with increases in psychological adjustment.

However, it is less clear whether higher levels of trait reappraisal in particular confer resilience to subsequently experienced stressors. In order to establish this, the Bi-Dimensional Framework for resilience research suggests it is necessary to investigate whether reappraisal interacts with exposure to a stressor to attenuate changes in mood (Johnson et al., 2016). In contrast, the majority of studies into trait reappraisal have only examined direct associations between levels of reappraisal and affect. Fewer studies have examined interactions between trait reappraisal and exposure to a stressor, and some results have been counterintuitive. For example, Johnson et al. (2011) conducted two experimental studies where participants were randomly assigned to experience a laboratory-induced failure or success. The first was amongst non-clinical participants, and found higher trait reappraisal interacted with exposure to failure to amplify a range of negative emotions. The second was amongst individuals with a diagnosis of a schizophrenia-spectrum disorder, and found that higher trait reappraisal interacted with exposure to failure to predict higher levels of defeat. Similarly, Westermann, Kesting and Lincoln (2012) conducted an experimental task where participants were randomly assigned to experience social inclusion or exclusion. They found that for individuals who reported average or above average paranoia proneness at baseline, higher trait reappraisal interacted with exposure to social exclusion to amplify subsequent state paranoia. Conversely, in a cross-sectional study, Troy et al. (2010) found that higher levels of cognitive reappraisal measured using an experimental task interacted with self-reported life stress to reduce the risk of depression. Consistent with this, another cross-sectional study in children carrying a short allele in the serotonin transporter polymorphism (5-HTTLPR; a risk factor for depression), found that higher levels of reappraisal measured using the ERQ buffered the association between life stress and depression. The reasons for these conflicting findings are unclear, and may be due to differences in study design or the nature of the specific stressors studied (e.g., a laboratory induced failure versus self-reported stressful experiences). Importantly, no research has prospectively investigated trait reappraisal as a moderator of the association between subsequent naturally occurring stressors and daily mood. The present research sought to address this by investigating the association between trait reappraisal measured at baseline and response to daily stressors over the following two weeks using an electronic diary study.

The second issue concerns the association between trait reappraisal and rumination. Johnson et al. (2011) suggest that the concept of trait reappraisal may capture aspects of an underlying perseverative thought-focused cognitive coping style which is linked with concepts of rumination. The concept of rumination has been debated, with some researchers describing it as thought processes which are repetitive, analytical, and abstract (Nolen-

Hoeksema, Wisco, & Lyubomirsky, 2008; Smith & Alloy, 2009), and others linking it to a more generic perseverative thinking process (Brosschot, Gerin, & Thayer, 2006; Watkins, 2008). It is possible that both trait reappraisal and rumination overlap conceptually with this tendency toward repetitive, perseverative thinking. Consistent with the findings reported by Johnson et al. (2011) and Westermann et al. (2012) regarding trait reappraisal, rumination has also been found to increase negative emotional responses to stressors (Niven, Sprigg, Armitage, & Satchwell, 2013; Watkins, 2004; Watkins, Moberly, & Moulds, 2008), and there is some evidence that they are directly associated (Aldao & Nolen-Hoeksema, 2010; Pe et al., 2013). However, this has not always replicated (Arditte & Joormann, 2011; Gross & John, 2003), and the extent to which reappraisal and rumination are empirically associated is unclear. There is a need to study reappraisal alongside rumination, to investigate whether i) they are linked cross-sectionally, ii) higher levels of each are associated with a similar response to stress, and iii) any moderating effect of reappraisal becomes insignificant once rumination is controlled for. If these results were found, they may indicate that reappraisal can be regarded as a closely overlapping concept with rumination, and that low tendencies towards ruminating may be the more important aspect to study in relation to resilience than reappraisal. The present study aimed to address this by measuring reappraisal alongside rumination at baseline. In particular, two aspects of rumination were measured, 'reflection' and 'brooding'. Both of these concepts relate to the ways in which an individual responds to negative mood. Brooding is thought to reflect a type of negative pondering, where an individual thinks about negative mood in a self-critical, self-blaming way. Reflection is thought to reflect a more neutrally-valenced, self-focused pondering in response to negative mood (Treyner, Gonzalez, & Nolen-Hoeksema, 2003). These two types of rumination were investigated as they have been found to be both conceptually and statistically overlapping but distinct (Treyner et al., 2003), and to have varying associations with outcomes such as recovery from depression (Arditte & Joormann, 2011).

In contrast to research into reappraisal, research investigating both instructed and trait suppression has suggested that it has either a negative or neutral impact upon mood. For example, in a study where participants watched a disgust-eliciting film under instruction to either reappraise or suppress emotion, those who were suppressing emotion showed greater levels of physiological arousal (Gross, 1998a). In research into trait suppression, studies have found that high trait suppressors demonstrate higher physiological response to stressors than low trait suppressors (Lam et al., 2009), but do not report significantly higher levels of negative emotions in response to stress (Johnson et al., 2011a).

In summary, the main aim of the present study was to investigate whether emotion regulation strategy measured at baseline (reappraisal or suppression) moderated the subsequent association between stressors and positive and negative emotions experienced each day over the following 14 days. Consistent with the findings of Johnson et al. (2011), it was predicted that higher levels of trait reappraisal would be associated with a stronger association between stressors and negative emotions. The second aim was to investigate the extent to which reappraisal and rumination were associated. As this is the first study to systematically investigate this, no predictions were made. These aims were investigated using a daily diary study design. After completing baseline measures of emotion regulation strategies and rumination, participants subsequently logged on to an internet diary once a day

for two weeks to report i) the stressors they had experienced that day, and ii) their levels of positive and negative mood. As the diary was online, participant entries were time and date stamped, reducing backfilling and increasing protocol adherence.

Methods

Participants and Procedure

Participants were 236 undergraduate students (201 = female, data missing for one participant; $M_{age}=19.33$, $S.D. = 1.77$) from a university in central England, who responded to an advertisement for a diary study. They took part in the study in exchange for course credits. Participants logged on to a secure website where they read the participant information sheet and completed an electronic consent form. After reading instructions on how to take part in the study, participants completed online measures of trait reappraisal, suppression and rumination at baseline. They then received daily email reminders to log back in to the secure website once a day, each day for 14 days to complete measures of daily stressors and negative and positive emotion.

Baseline measures

Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). Reappraisal and suppression were measured using the two subscales of the Emotion Regulation Questionnaire. The reappraisal subscale contains six items assessing how often individuals use thought-change strategies to regulate positive and negative emotions. It includes items such as “I control my emotions by changing the way I think about the situation I’m in” and “When I want to feel more positive emotion (such as joy or amusement), I change what I’m thinking about”. The suppression subscale contains four items measuring the extent to which participants use suppression strategies to regulate emotions. Items include “When I am feeling positive emotions, I am careful not to express them” and “When I am feeling negative emotions, I make sure not to express them”. Responses are scored on a seven-point scale from ‘strongly disagree’ to ‘strongly agree’, with possible mean scores ranging from 1 to 7 on both subscales. Previous research has found that the scales appear to be measuring consistent traits, as test-retest reliability for both scales was found to be $\alpha = .69$ over three months (Gross & John, 2003). In the present study, internal consistency for the reappraisal subscale was $\alpha = .83$ and for the suppression subscale was $\alpha = .78$.

Ruminative Responses Scale (RRQ; Treynor et al., 2003). The 10-item Ruminative Responses Scale aims to measure two aspects of rumination: reflection and brooding. It is a reduced version of the longer Ruminative Responses Questionnaire (Nolen-Hoeksema & Morrow, 1991), with items confounded with depression removed. Participants are instructed to consider what they do when they feel depressed, and then to endorse actions listed on the questionnaire on a four point scale from ‘almost never’ to ‘almost always’. The reflection subscale contains five items (including “Go someplace alone to think about your feelings” and “Write down what you are thinking and analyze it” and the brooding subscale contains five items including “Think about a recent situation, wishing it had gone better” and “Think ‘Why do I always react this way?’”. Possible scores range from 5 to 20 on each subscale. Reflection and brooding scores have been found to converge with scores on scales of rumination in relation to positive affect (Johnson, McKenzie, & McMurrich, 2008) and are

significantly associated with the related concept of worry (Muris, Roelofs, Rassin, Franken, & Mayer, 2005). The full scale has been found to have a test-retest reliability of $r = .68$ over a year (McLaughlin & Nolen-Hoeksema, 2011). In the current study, the brooding subscale had the internal reliability for the brooding subscale was $\alpha = .75$ and the reflection subscale was $\alpha = .78$.

Daily measures

The Survey of Recent Life Experiences (SRLE; Kohn & Macdonald, 1992). The SRLE was used to measure daily stressors. It contains 51 items measuring stressors in areas such as finances, work and relationships. Items include ‘conflicts with friend(s)’ and ‘cash-flow difficulties’. Participants were asked to rate the extent to which each item had occurred for them that day on a four-point scale from one (not at all part of my life) to four (very much part of my life), with possible total scores ranging from 51 to 204. By excluding the participant’s perception of the desirability, severity or impact of events the measure is designed to be ‘decontaminated’ by general distress. It has been found to be a useful measure in general population samples (De Jong, Timmerman, & Emmelkamp, 1996; Kohn & Macdonald, 1992).

Measures of positive and negative mood. Participants were asked to rate different aspects of their mood each day on items from one (not at all) to 10 (extremely). Consistent with other studies which have sought to repeatedly sample mood (Myin-Germeys & Delespaul, 2000; van Winkel et al., 2008), the positive mood scale was created from the mean score of the six positive mood items (‘happy’, ‘successful’, ‘satisfied’, ‘excited’, ‘desirable’ and ‘calm’) and the negative mood scale was created from the mean score of six negative mood items (‘sad’, ‘anxious’, ‘defeated’, ‘lonely’, ‘guilty’ and ‘hopeless’). Each scale had a possible total score from one to 10. This form of mood measurement was chosen as similar measurement approaches have been found to both converge with longer scales of mood such as the Beck Depression Inventory (Beck, Steer, & Brown, 1996; Folstein & Luria, 1973), and to capture mood fluctuations that occur both in response to experimental tasks (Johnson, Tarrier, & Gooding, 2008) and also natural mood fluctuations experienced in response to daily stressors (van Winkel et al., 2008). Given the multi-level design of this study we estimated the internal reliability for the 6 PA and 6 NA items using the multi-level confirmatory factor analytic (MCFA) procedures and equations as specified in Geldhof, Preacher and Zyphur (2014). Specifically we calculated multilevel composite reliability (ω) and maximal reliability (H) as the most accurate measures of reliability within a multi-level framework. For NA the within factor ω was .86 and within factor H was .81 and the between factor ω was .87 and between factor H was .97. For PA the within factor ω was .86 and within factor H was .87 and the between factor ω was .87 and between factor H was .96. Thus both NA and PA are reliable for both within and between subject analyses.

Data analysis

Initially, zero-order Pearson correlational analyses were conducted to investigate cross-sectional associations between emotion regulation strategies (reappraisal and suppression) and subscales of rumination (reflection and brooding). Following this, diary completion compliance was assessed.

A multilevel model was built for each outcome: positive daily mood and negative daily mood. The primary objective was to assess whether emotion regulation strategies (reappraisal and suppression) modified the association between daily stressors and daily mood. A second objective was to further include rumination (subscales of reflection and brooding) in this model to test i) whether rumination subscales modified the association between daily stressors and mood in addition to reappraisal, and ii) whether emotion regulation strategies continued to modify stress once rumination subscales were also included as predictors. For reasons of completeness, the main and cross-level effects of the rumination scales on the stressor – mood relationships *without* inclusion of the emotional regulation strategies were also modelled.

The data were analyzed utilizing multi-level modelling and contained a two-level hierarchical structure, level 1 being the within-person variation (i.e. daily stressors, positive and negative mood) and level 2 being the between-person variability (i.e. reappraisal, suppression, rumination). We centred the level 1 predictors using within person centring. That is for the 14 days of the diary each person's daily stress is given as a deviation from that person's mean stress over the 14 days (West, Ryu, Kwok & Cham, 2011; Nezlek, 2001). We centre in this way because theoretically how an individual's stress varies on a daily basis from their average stress, will influence their mood (Lazarus, 1993; West et al., 2011).

The level 1 predictor variables were group mean centred with the stressors on mood slope modelled as a random effect. The level 2 variables were grand mean centred (Enders & Tofghi, 2007; Nezlek, 2001, O'Connor, Armitage & Ferguson, 2015). The data were analysed in four blocks. First, initial models were performed to investigate the main effects of reappraisal and suppression on positive and negative mood and to test the association between daily stressors and mood scores. Age and gender were included in all models to control for possible confounding. In the second block, in order to test the moderating effects of the emotional regulation strategies, we modelled the day-to-day within-person effects of daily stressors on positive and negative mood (separately) together with the cross-level influence of appraisal and suppression simultaneously (see Appendix for the equation used for these models). Statistically significant cross-level effects were decomposed using simple slopes as recommended by Preacher, Curran and Bauer (2006). In the third set of analyses, the second block of analyses were repeated including the main and cross-level interaction effects of the rumination scales, brooding and reflection. In the fourth set of analyses, the first two blocks were repeated, replacing the emotion regulation variables with the rumination variables. Finally, in exploratory lagged analyses, we investigated whether daily stressors experienced on the preceding day were associated with mood on the following day, and whether these relationships were moderated by the emotional regulation variables. The data were analysed using HLM7 (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011).

Results

Diary compliance

Participants completed between 2 and 14 diary entries ($m = 11.91$, $SD = 2.85$). In total, 85 % diary entries were completed, comparable with previous similar research (Galla & Wood, 2015). One entry was missing the measurement of the daily stressor measure. As this comprised <1% of the data, this entry was deleted.

Descriptive statistics and initial models

Table 1 shows descriptive statistics for the main level 1 (within participant) and level 2 (between participant) study variables. Scrutiny of Table 1 shows that participants reported experiencing a moderate number of daily stressors and lower levels of daily negative mood compared with daily positive mood. Initial level 1 models (data not shown) demonstrated that daily stressors were positively associated with negative mood, $\beta = 0.061, p < 0.001$, and inversely associated with positive mood, $\beta = -0.037, p < 0.001$. Trait reappraisal reported at baseline was significantly directly associated with lower levels of daily negative mood, $\beta = -0.046, p < 0.01$, and greater levels of daily positive mood, $\beta = 0.068, p < 0.001$. In contrast, trait suppression reported at baseline was directly associated with greater levels of daily negative mood, $\beta = 0.040, p < 0.05$, and lower levels of daily positive mood, $\beta = -0.039, p < 0.05$.

[insert Table 1]

Cross-sectional associations between emotion regulation strategies and rumination

Zero-order Pearson correlations were determined and indicated a minimal association between reappraisal and suppression, $r = .14, p < 0.05$, but no association for reappraisal with reflection, $r = .10, ns$, or brooding, $r = -.03, ns$. Suppression was significantly but minimally correlated with brooding, $r = .15, p < 0.05$ and marginally with reflection, $r = .12, p = 0.058$, and reflection was significantly associated with brooding, $r = .58, p < 0.001$.

Effects of reappraisal and suppression on the daily stressors – negative mood relationship

The findings for each model are presented in Table 2. The results showed that the influence of daily stressors on negative mood (β_{10}) remained statistically significant when the cross-level effects of the emotional regulation strategies entered the model (upper panel). Furthermore, a cross-level interaction was observed for trait reappraisal (β_{11}), such that reappraisal was found to moderate the daily stressors – negative mood relationship, $\beta = -0.01, p < 0.05$. In contrast, the cross-level interaction for suppression (β_{12}) was non-significant indicating that suppression did not moderate the daily stressors – negative emotion relationship, $\beta = 0.00, ns$.

[insert Figure 1 and Table 2]

As outlined above, the cross-level interaction was decomposed using simple slope procedures developed by Preacher, Curran and Bauer (2006). As shown in Figure 1, the analyses revealed that higher levels of reappraisal were associated with lower levels of negative mood in response to stress at high, $\beta = 0.05, p < .001$, mean, $\beta = 0.06, p < .001$, and low levels of trait reappraisal, $\beta = 0.07, p < .001$.

Effects of reappraisal and suppression on the daily stressors – positive mood relationship

The results showed that the influence of daily stressors on positive mood (β_{10}) remained statistically significant when the cross-level effects of the emotional regulation strategies entered the model (see Table 2, lower panel). However, the cross-level interaction for reappraisal (β_{11}) was not significant indicating that reappraisal did not moderate the daily stressors – positive mood relationship, $\beta = 0.00, ns$. Similarly, the cross-level interaction for

suppression (β_{12}) was also non-significant indicating that suppression did not moderate the daily stressors – positive relationship, $\beta = -0.001$, *ns*.

Emotion regulation strategies and rumination

In the third set of analyses, the second block of analyses were repeated controlling for the main and cross-level effects of the rumination scales, brooding and reflection. As shown in Table 2, brooding was significantly positively associated with negative mood (β_{04}) and inversely associated positive mood (β_{04}), but did not moderate the association between stress and either positive or negative mood (although, the effect was marginal in the latter case). Reflection was not associated with negative (β_{04}) or positive mood (β_{04}), and did not moderate the association between stress and either positive or negative mood. More importantly, the main effects of trait reappraisal on negative mood (β_{05}) and the moderating effects of reappraisal on the daily stress - negative mood relationship (β_{13}) remained unchanged after brooding and reflection were included in the model.

Effects of brooding and reflection on mood and the daily stressors – mood relationships

In the final set of analyses, the first two blocks of analyses were repeated, replacing the emotion regulation variables with the rumination variables. The results showed that higher levels of brooding were associated with higher negative affect, $\beta = 0.181$, $p < 0.001$, and lower levels of positive affect, $\beta = -0.118$, $p < 0.001$. Reflection was not associated with daily mood. Brooding was also found to moderate the daily stressor – negative affect relationship, $\beta = 0.003$, $p < 0.05$, such that higher levels of brooding were associated with stronger stressor – negative affect relations. No other cross-level moderating effects were observed.

Time-lagged models

In exploratory time-lagged analyses, we investigated whether daily stressors experienced on the preceding day were associated with mood on the following day and whether the emotion regulation variables were able to moderate these relationships. The time-lagged results showed that stressors experienced yesterday were positively associated with tomorrow's negative mood, $\beta = 0.015$, $p < 0.001$, and negatively with positive mood, $\beta = -0.007$, $p < 0.001$, but that reappraisal and suppression did not influence these relationships (negative mood: $\beta = -0.00$, *ns*, $\beta = 0.00$, *ns*, respectively; positive mood: $\beta = 0.001$, *ns*, $\beta = -0.001$, *ns*, respectively).

Discussion

The main finding of the study was that trait reappraisal moderated the association between daily stressors and negative mood. Contrary to the main prediction, the pattern of this interaction indicated that higher levels of reappraisal were associated with a weaker association between daily stressors and negative mood, suggesting that higher reappraisal may buffer the impact of stress. Higher trait reappraisal was also directly associated with lower daily negative mood and higher daily positive mood, and higher trait suppression was directly associated with greater daily negative mood and lower daily positive mood. As expected, trait suppression did not moderate the association between daily stressors and either positive or negative mood. These findings remained unchanged when rumination variables were controlled for. Cross-sectional analyses indicated that although suppression was significantly associated with both reflection and brooding, reappraisal was not associated

with either. When emotion regulation strategies were accounted for, the rumination subscale of brooding was directly associated with higher daily negative mood and lower daily positive mood, but reflection was not, and neither subscale moderated the impact of daily stress. These results extend the literature in three main ways.

First, the present results suggest that higher levels of trait reappraisal are not only associated with generally higher positive and lower negative mood, but that they may buffer individuals from negative mood in the face of stressors. This is the first study to investigate trait reappraisal as a moderator of naturally occurring stressors using a prospective design, and provides further support for emotion regulation theory which describes reappraisal as an adaptive regulation strategy (Gross, 1998b). These results are consistent with findings from naturalistic cross-sectional research and studies using experience sampling or diary methods which suggest that higher trait reappraisal is associated with positive mood and coping style (Brans et al., 2013; Nezlek & Kuppens, 2008; Johnson et al., 2010; Moore et al., 2008). They are also consistent with cross-sectional studies which have found that a greater tendency to reappraise attenuates the risk of depression in response to stress (Troy et al., 2010; Ford et al., 2014). However, they contrast with findings from experimental studies which suggest that higher levels of trait reappraisal exacerbate the association between exposure to laboratory stressors such as failure and social exclusion and negative outcomes such as lower mood (Johnson et al., 2011a) and paranoia (Westermann et al., 2012). One possibility for these divergent findings is that whether high trait reappraisal is beneficial depends upon the nature of the stressor, with experimental stressors differing from naturally occurring stressors. A second possibility is that although individuals higher in trait reappraisal experience greater negative mood in the immediate aftermath of a stressor, over time they are better able to adapt or problem-solve difficulties, leading to more general positive patterns of affect. This is consistent with the notion that reappraisal either reflects, or is associated with, perseverative cognitive processes. Brosschott et al. (2006) suggest that the tendency to think in a perseverative manner can draw attention to potential problems and prompt individuals to act, but can also lead to prolonged physiological activation in response to threats. As such, it could be hypothesised that it may draw benefits in relation to addressing problems, but may also confer vulnerability to negative emotion immediately following stressful events. However, further research would be necessary to investigate this.

These findings are pertinent to understanding psychological resilience. The Bi-dimensional framework for resilience research (Johnson et al., 2011b) proposes that psychological resilience factors are variables which attenuate, or buffer, the association between risk variables and adverse outcomes. According to this framework, by demonstrating that trait reappraisal moderates the association between daily stressors and negative mood, the current results also demonstrate that trait reappraisal can be understood as a resilience factor. Previous cross-sectional studies have indicated that higher trait reappraisal may buffer the impact of life stress on depression (Troy et al., 2010; Ford et al., 2014) but research in experimental settings has suggested that it can in fact exacerbate stress, conferring vulnerability. The present study provides ecologically valid, longitudinal evidence supporting the view that in naturally occurring settings, higher trait reappraisal may confer resilience.

Second, results from the present study indicate that the association between trait reappraisal and positive and negative mood is not explained by rumination. Neither facet of

rumination was associated with trait reappraisal cross-sectionally, and the significant associations between trait reappraisal and daily mood in the multilevel models were all maintained when reflection and brooding were included as control variables. Previous research in this area has been equivocal, with some studies indicating that rumination is cross-sectionally positively associated with reappraisal (Aldao & Nolen-Hoeksema, 2010; Pe et al., 2013). However, the present results support research which has failed to find any cross-sectional association between rumination and reappraisal (Arditte & Joormann, 2011; Gross & John, 2003). These findings are contrary to the hypothesis proposed by Johnson et al. (2011a), which suggests that the amplifying impact of trait reappraisal may be explained by a repetitive thinking process shared by both rumination and reappraisal. However, the rumination measure used in the study was focused specifically on how individuals respond to negative mood. Brosschott et al. (2006) suggest that measures of perseverative thinking in relation to stress or negative mood may not accurately capture the more general tendency towards perseverative cognition, and further research using a more general measure of repetitive thinking style may be necessary to further investigate this issue.

Third, the present results suggest that suppression was associated with higher levels of negative mood and lower levels of positive mood, but did not moderate the association between stress and mood. This is consistent with previous research (Johnson et al., 2011a), and suggests that whilst suppression may directly increase risk of negative mood, it does not exacerbate the impact of stress. Interestingly, the present findings also suggest that trait suppression may have overlaps with rumination. It was minimally but significantly associated with brooding and marginally associated with reflection, and in the multilevel models, its association with daily negative mood ceased to be significant once the rumination variables were included. Instead, the rumination facet of brooding was found to be a significant direct associate of positive and negative mood, suggesting that the variance explained by suppression could be accounted for by rumination. Theoretically, both rumination and suppression are regarded as cognitively-demanding, maladaptive responses to stress, and as such, this overlap may be regarded as theoretically consistent (Gross, 1998b; Nolen-Hoeksema & Morrow, 1991). Furthermore, this finding extends previous research by Arditte and Joorman (2011) who report a significant association between suppression and brooding, by suggesting that this association may account, at least in part, for the association between suppression and negative mood.

Results from the present study also indicated that brooding was directly associated with increased levels of daily negative mood and amplified the impact of daily stress on negative affect. However, when emotion regulation facets were included in the model, the interaction between brooding and stress ceased to be significant. In contrast, reflection was not a direct associate of negative mood and did not moderate the impact of stress upon mood, and these results were unchanged once emotion regulation facets were included in the model. These findings support previous studies reporting that rumination can amplify the harmful impact of stress (Niven et al., 2013; Watkins et al., 2008), and suggesting that brooding may be the more important aspect of rumination to consider in relation to low mood (Burwell & Shirk, 2007; Raes & Hermans, 2008). The observation that the interaction between brooding and stress ceased to be significant once suppression was included in the model provides further support for a conceptual overlap between these variables.

Exploratory time-lagged analyses from the study indicated that higher levels of daily stressors were associated with lower positive and higher negative mood on the following day. However, reappraisal and suppression did not moderate this association. Previous studies have found mixed results for the association between stress and mood on the following day. For example, one experience-sampling study reporting that stressful event negativity was associated with depressed mood for only the following 6-9 hours (Johnson, Husky, Grondin, Mazure, Doron & Swendsen, 2008). The significant results found in the present study may be due to the comprehensive nature of the stress measure used, which comprised 51 items covering a range of domains. Measuring a large number of potential stressors could have enabled an accurate measurement of overall stress experienced, including capturing high stress exposure which may impact mood in a more enduring way. The results also suggest that the buffering impact of reappraisal is restricted to same-day stress, highlighting a need for further research to understand the relationship between reappraisal and stress response over time.

The current study benefitted from a large sample size, a prospective diary-study design and an overall high participant response rate to the daily questionnaires. However, it suffered from two main limitations. First, it was limited by a reliance on self-report data. This may have led to a bias in responses to the daily stressors measure. To manage this, a measure of daily hassles, the Survey of Recent Life Experiences (Kohn & Macdonald, 1992) was chosen which only enquires about the frequency of events, rather than the participant's perspective of the troubles, and as such, is designed to be less affected by participant bias. Reliance on self-report data is also an important consideration in relation to the reappraisal measure, as individuals may not be able to accurately report their non-conscious emotion regulation habits. A previous study which investigated reappraisal using both a self-report questionnaire and a behavioural challenge reported that these two measures were not associated (Troy et al., 2010). One possibility is that the behavioural challenge captures reappraisal effectiveness, whereas the self-report questionnaire captures the frequency with which individuals consciously try to employ reappraisal as a strategy. The current findings suggest that self-reported reappraisal frequency buffers the impact of stress on negative mood, but future research could extend this by measuring reappraisal ability according to Troy et al.'s (2010) behavioural measure and investigating whether this also attenuates the association between subsequently experienced stressors and affect.

The second limitation was that a daily measure of trait use of emotion regulation strategies was not included. This would have provided a more reliable indicator of habitual emotion regulation strategies and reduced participant reliance on retrospective memory. Whilst the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) has been found to demonstrate acceptable test-retest reliability ($\alpha = .69$ over three months; Gross & John, 2003) suggesting that responses may reflect consistent traits, future research should investigate this further by including daily measures of emotion regulation.

In summary, the present study is the first to demonstrate that higher levels of trait reappraisal moderate the association between subsequently naturally occurring stressors and negative mood experienced using a daily diary study design. This supports emotion regulation theory (Gross & Johns, 2003) and previous cross-sectional studies (Ford et al., 2014; Troy et al., 2010). However, it stands in contrast to previous research conducted in

experimental settings, opening the possibility that trait reappraisal may increase immediate negative emotion but enable longer term coping. The present research also suggests that trait reappraisal and rumination are not overlapping constructs in regard to stress response.

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Figure legends

Figure 1. *Higher levels of reappraisal buffer the impact of daily stressors on negative daily mood. Note that low reappraisal = 1 standard deviation below the mean and high reappraisal = 1 standard deviation above the mean*

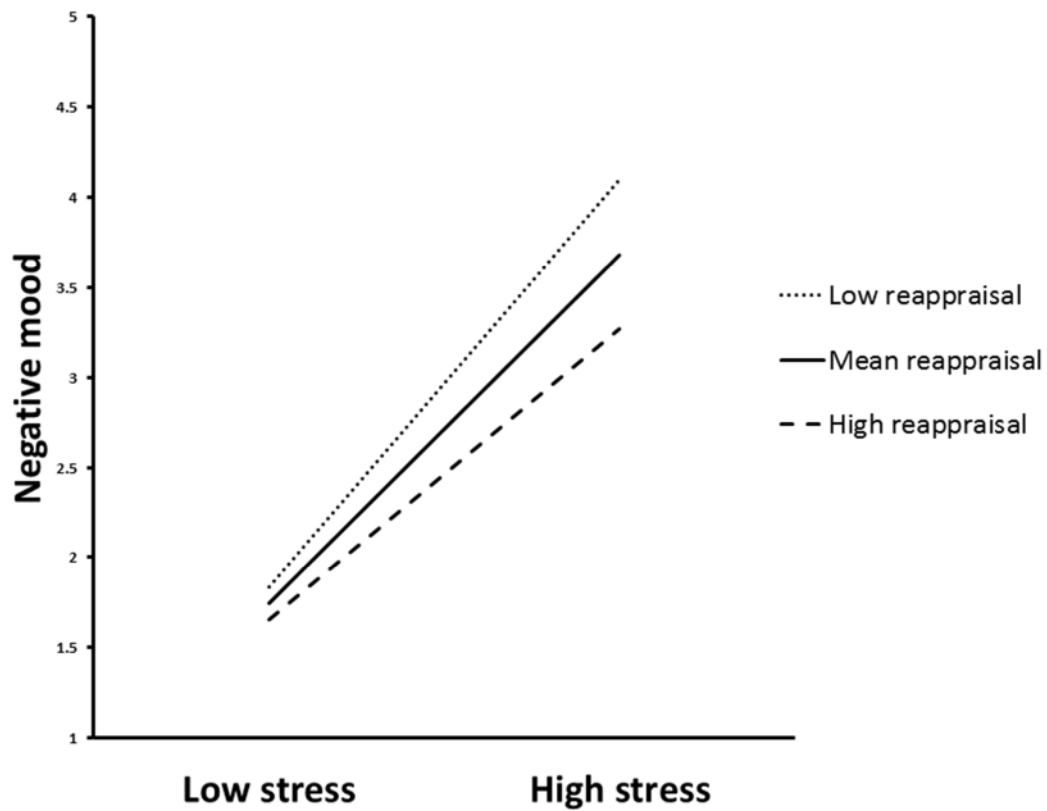


Table 1. *Descriptive statistics for the daily (Level 1) and between-person (Level 2) measures*

	Mean	SD (overall)	SD (within- individuals)
Level 1 variables			
Daily stressors	67.47	16.08	
Positive mood	4.80	1.69	1.10
Negative mood	2.66	1.65	0.98
Level 2 variables			
Age	19.33	1.77	
Male/Female	201/236		
Reappraisal	4.97	0.92	
Suppression	3.46	1.15	
Brooding	10.09	3.22	
Reflection	9.65	3.27	

Table 2. *Multilevel models investigating whether emotional regulation strategy (reappraisal and suppression) moderated the association between daily stressors and negative mood (upper panel) and daily stressors and positive mood (lower panel). These were then repeated controlling for brooding and reflection.*

	Models without rumination variables		Models controlling for rumination variables	
HLM Effect	Coefficient (SE)	P value	Coefficient (SE)	P value
<i>Intercept</i>	2.71 (0.08)	<0.001	2.68 (0.22)	<0.001
Age	-0.02 (0.03)	0.53	0.02 (0.03)	0.60
Gender	-0.16 (0.20)	0.43	0.03 (0.18)	0.88
Reflection			0.01(0.03)	0.83
Brooding			0.17 (0.03)	<0.001
Reappraisal	-0.05 (0.02)	0.003	-0.05 (0.01)	0.003
Suppression	0.04 (0.02)	0.03	0.02 (0.02)	0.31
<i>Level 1 slope</i>				
Daily stressor – negative mood	0.06 (0.00)	<0.001	0.06 (0.01)	<0.001
Reflection * daily stressor – negative mood			-0.001 (0.00)	0.97
Brooding * daily stressor – negative mood			0.00 (0.00)	0.07
Reappraisal * daily stressor – negative mood	-0.01 (0.00)	0.02	-0.01(0.00)	0.03
Suppression * daily stressor – negative mood	0.00 (0.00)	0.55	0.00 (0.00)	0.89
<i>Intercept</i>	4.79 (0.08)	<0.001	4.63 (0.26)	< 0.001
Age	-0.00 (0.03)	0.99	-0.03 (0.03)	0.33
Gender	0.30 (0.20)	0.14	0.13 (0.21)	0.53
Reflection			-0.04 (0.03)	0.23
Brooding			-0.10 (0.03)	0.002
Reappraisal	0.06 (0.01)	<0.001	0.06 (0.01)	<0.001
Suppression	-0.04 (0.02)	0.04	-0.02 (0.02)	0.24
<i>Level 1 slope</i>				
Daily stressor – positive mood	-0.04 (0.00)	<0.001	-0.04 (0.01)	<0.001
Reflection * daily stressor – positive mood			0.00 (0.00)	0.58
Brooding * daily stressor – positive mood			0.00 (0.00)	0.35
Reappraisal * daily stressor – positive mood	0.00 (0.00)	0.11	0.00 (0.00)	0.14
Suppression * daily stressor – positive mood	-0.001 (0.00)	0.60	-0.001 (0.00)	0.42

Appendix

The general form of each model in this analysis is expressed by the following equation:

$$\begin{aligned} \text{Outcome variable} = & \beta_{00} + \beta_{01}(\text{Age}) + \beta_{02}(\text{Gender}) + \beta_{03}(\text{Reappraisal}) + \\ & \beta_{04}(\text{Suppression}) \\ & \beta_{10}(\text{Daily Stressor}) + \beta_{11}(\text{Reappraisal} \times \text{Daily Stressor}) + \\ & \beta_{12}(\text{Suppression} \times \text{Daily Stressor}) + r_0 + r_1(\text{Daily Stressor}) + \varepsilon \end{aligned}$$

where β_{00} indicates the mean level of the outcome variable; β_{01} indicates the extent to which this is influenced by age, β_{02} indicates the extent to which the outcome is influenced by gender, β_{03} indicates the extent to which the outcome is influenced by reappraisal, β_{10} indicates the average size of the relationship between daily stressors and the outcome variable, β_{11} indicates the extent to which that relationship is conditional on the level of reappraisal, β_{12} indicates the extent to which that relationship (β_{10}) is conditional on the level of suppression, and ε is the error term.