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Emotion regulation strategies in daily life: mindfulness, cognitive reappraisal and emotion suppression

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ABSTRACT

Most empirical studies of emotion regulation have relied on retrospective trait measures, and have not examined the link between daily regulatory strategies and every day emotional well-being. We used a daily diary methodology with multilevel modelling data analyses ($n = 187$) to examine the influence of three emotion regulation strategies (mindfulness, cognitive reappraisal and emotion suppression) on the experience of daily negative and positive affect. Our results suggested that daily mindfulness was associated with lower negative and higher positive affect whereas the converse pattern was found for daily emotion suppression; cognitive reappraisal was related to daily positive, but not negative affect. When daily mindfulness, suppression and reappraisal were included in the same models, these strategies predicted unique variance in emotional well-being. Random slope analyses revealed substantial variability in the utility of these strategies. Indeed the presumably "adaptive" cognitive reappraisal strategy seemed to confer no benefit to the regulation of negative affect in approximately half the sample. Additional analyses revealed that age moderates the effect of cognitive reappraisal on daily negative affect: Higher use of reappraisal was associated with more negative affect for adolescents (aged 17 to 19) but became associated with less negative affect with increasing age. We interpret these results in line with a contextual view of emotion regulation where no strategy is inherently "good" or "bad".

Difficulties in healthy emotion regulation are increasingly viewed as a trans-diagnostic process underlying a range of clinical problems (Ellard, Fairholme, Boisseau, Farchione, & Barlow, 2010). Research on emotion regulation has also been shown to have high clinical relevance, providing empirical and theoretical support for many modern approaches to psychological therapy (Kring & Sloan, 2009). Emotion regulation has been described as the process by which individuals modify their emotions, their response to the emotions or the situations that elicit emotions in order to respond appropriately to environmental demands (Gross, 1998). Specific strategies have generally been argued to have either "adaptive" or

"maladaptive" profiles based upon their immediate effects on affect, behaviour and cognition, as well as on their relationships to psychopathology (Gross, 1998, 2015; Gross & John, 2003).

Despite the apparent significance of emotion regulation strategies to emotional well-being, there has been limited research into the role of emotion regulation in the daily life of individuals, and the distinctive contribution of the various strategies to daily emotional well-being. Empirical studies into emotion regulation have almost entirely relied upon cross-sectional and experimental research designs (Gross & John, 2003), using a "trait" approach to measurement where people contribute data from one time point. This approach is a valid means of examining emotion regulation as a trait, however, other approaches are needed to uncover the nature of emotion regulation as it occurs in daily life (Gross & John, 2003). This is because results measured at the trait level are often independent from those measured at the "state" or "within-person" level (Brose, Voelkle, Lövdén, Lindenberger, & Schmiedek, 2015; Kashdan & Nezlek, 2012). The present study examined the relative contributions of three of the most common emotion regulation strategies in basic research and therapy (mindfulness, cognitive reappraisal and emotion suppression) on daily emotional well-being.

Each of these three emotion regulation strategies, and why they are likely to be of profound importance to everyday emotional experiences, is discussed. Cognitive reappraisal is an antecedent-focused strategy and has been defined as a form of cognitive change which involves construing a potentially emotion eliciting situation in a way that changes its emotional impact before that impact has fully occurred (Gross & John, 2003). A great deal of research has contrasted reappraisal with suppression. Emotion suppression is a response-focused strategy that involves the active inhibition of ongoing emotion-expressive behaviour (Gross & Levenson, 1993).

Previous studies have shown that reappraisal, relative to no emotion regulation and relative to response-focused emotion regulation, is related to benefits in emotional well-being. Across a range of emotion inducing contexts, reappraisal has been argued to effectively decrease negative affect, and does so without significant physiological expense, meaning there appears to be little to no negative side effects of the strategy (Gross, 2002; Mauss, Cook, Cheng, & Gross, 2007). Past studies suggest that individuals who report making frequent use of reappraisal generally experience greater positive emotions and less negative emotions, and show superior functioning in interpersonal domains across self and peer-reports (Gross & John, 2003).

A different profile has emerged from studies of emotion suppression. Researchers have found that emotion suppression is useful when people want to alter their emotion-expressive behaviour, but it fails to provide subjective relief to the experience of negative emotions, and comes with a substantial cost to cognition, physiology and relationship functioning (Gross, 2002). These findings have led to the general conceptualisation of cognitive reappraisal as being an "adaptive" strategy and emotion suppression as being a "maladaptive" regulatory strategy (Gross & John, 2003).

Mindfulness has been proposed as an alternative or complement to the more traditional response-focused strategy of cognitive reappraisal. Mindfulness has been defined as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4). This definition characterises mindfulness as being made up of (a) an awareness component where one's attention is being purposely harnessed towards

the present moment, and (b) an *accepting* stance towards this experience characterised by an attitude of curiosity and openness (Bishop, 2002). Placed within an emotion regulation framework, it has been hypothesised that mindfulness could facilitate a healthy engagement with, and expression of emotions, guarding against problems associated with both the under engagement (e.g. alexithymia) and over engagement of emotions (e.g. emotion dysregulation) (Chambers, Gullone, & Allen, 2009). Chambers et al. (2009) argue that mindfulness is a strategy antithetical to the putatively problematic strategy of emotion suppression, a view shared by proponents of more recent behavioural and cognitive therapy approaches such as Acceptance and Commitment Therapy (Hayes, Strosahl, & Wilson, 1999). While cognitive reappraisal is largely concerned with changing the negative *content* of cognitions to regulate emotions, mindfulness has been proposed to focus on a person's capacity to *relate* differently to these cognitions and emotional experiences (Chambers et al., 2009).

Are there regulation strategies that are inherently good or bad?

There has been a growing interest recently in the idea that emotion regulation strategies may not be inherently good or bad for emotional well-being. Rather, their value may depend on the person using them, and the situation in which they are used (Kashdan & Rottenberg, 2010). From this contextual perspective, strategies are not considered universally adaptive or maladaptive (Aldao, 2013).

Research is starting to support a contextual view of emotion regulation. One study aimed to investigate if contextual influences may be involved in the usefulness of emotion suppression (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004). This study involved 101 college students in New York directly after the 2001 terror attacks. Participants' ability to both enhance and suppress emotional expression in the months following the attacks was measured, and the capacity to both suppress and express within the same participant was conceptualised as a measure of expressive flexibility. The results of this study found that people who were better able to *both* enhance and suppress the expression of emotion predicted lower distress by the end of the second year of college. These results suggest that the capacity to suppress emotions may be related to benefits to emotional well-being, as long as this capacity occurs in the context of a corresponding capacity to enhance emotional expression.

A more recent study has reported similar contextual influences governing the impact of reappraisal as an emotion regulation strategy (Troy, Shallcross, & Mauss, 2013). This study hypothesised that reappraisal may be adaptive when stressors are uncontrollable (when the person has little control over the situation) but maladaptive when stressors can be controlled (when the person can change the situation). To test this theory, Troy, Shallcross, and Mauss (2013) measured cognitive-reappraisal ability, severity of recent life stressors, perceived stressor "controllability" and level of depression amongst 170 participants who had reported experiencing a stressful life event during the preceding 8 weeks. Results indicated that for subjects with high perceived stressor "uncontrollability", higher cognitive reappraisal ability was associated with lower levels of depression following a stressful life event. In contrast, for participants with stressors perceived to be more controllable, higher cognitive-reappraisal ability was associated with greater levels of depression. The authors interpreted these findings as support of a theoretical model in which particular emotion-regulation strategies are not adaptive or maladaptive per se rather, their utility is dependent upon context.

In another recent study, Aldao and Nolen-Hoeksema (2012) investigated the impact of regulatory strategy selection on indices of emotional well-being. In this study, retrospective reports of emotion eliciting situations were used to overcome some of the problems associated with a pure trait-based approach, and to start to understand some of the contextual influences governing emotion regulation. This study found that flexibility was a predictor of emotional well-being in its own right for putatively adaptive strategies (e.g. reappraisal, problem solving), but not for maladaptive strategies (e.g. emotion suppression, self-criticise). The researchers noted that although a step in the right direction, their research paradigm had some major limitations as it remained reliant upon retrospective reports, which have been shown to be subject to reporting biases, and in some studies, to have low correspondence with concurrent reports. They thus called for future studies to employ more favourable methodologies such as ecological momentary assessment and daily diary data collection to replicate their findings, and investigate if there are discrepancies between results based on state level vs. trait-level methodologies (Aldao & Nolen-Hoeksema, 2012).

Research such as this has led to a refining of the original *process* model of emotion regulation to include a more contextual view of emotion regulation (Gross, 2015). Gross (2015, p. 17) acknowledges that some strategies appear to have a more adaptive or maladaptive profile in general (e.g. cognitive reappraisal vs. emotion suppression), yet the adaptiveness of a given strategy will ultimately depend on "…the person, the situation, and the goals that person has in that situation". Gross (2015) thus argues that an important area of future investigation is to examine how the adaptive value of regulatory strategies is influenced by personality and contextual variables.

Emotion regulation as a daily process

Only recently have researchers started to investigate emotion regulation in daily life (Kashdan & Steger, 2006; Nezlek & Kuppens, 2008). Upon examining the relationship between the strategies of daily cognitive reappraisal and emotion suppression, with daily events and reactions to them in clinical and non-clinical populations, researchers found that cognitive reappraisal to have beneficial effects on affect, self-esteem and adjustment; with the converse effects for emotion suppression (Blalock, Kashdan, & Farmer, 2016; Nezlek & Kuppens, 2008). In non-clinical samples, the adverse effects of daily emotion suppression were found for both daily positive and negative affect, but the relationship between cognitive reappraisal and daily reported affect was more complex. Looking at its links with reported daily level of positive and negative affect only, daily cognitive reappraisal was only found to be significantly related to increases in positive affect, with no significant relationship with daily negative affect (Nezlek & Kuppens, 2008). This is a somewhat surprising result given the many empirical studies to date demonstrating reappraisal to be related to decreases in negative emotions, but is wholly possible given the different measurement approaches implemented. That is, relationships found at the trait level do not necessarily hold at the state, or daily level (Nezlek, 2007).

A more recent study further examined emotion regulation in daily life in two cohorts of university students who were prompted to report on their emotional experiences via a designated palmtop 10 times per day over 7 days (Brans, Koval, Verduyn, Lim, & Kuppens, 2013). This study found that (a) cognitive reappraisal was the least used strategy of the six strategies measured (the study also included rumination, suppression, distraction, social

sharing and reflection), and (b) cognitive reappraisal was not related to daily negative affect in either cohort, and was only marginally related to increased positive affect in one of the two cohorts. One of the other major findings of this study was that whilst three of the strategies were linked to increases in negative affect (rumination, suppression and sharing); no strategies were associated with decreases in daily negative affect. The results of these two daily process studies indicate that some strategies appear to be associated with poorer emotion regulation (suppression, rumination and sharing), when measured in daily life, no strategies appeared to be related to *decreases* in negative affect.

One study has explored the role of daily mindfulness on daily emotion regulation whilst constructing a state version of the Mindful Attention and Awareness Scale (MAAS) (Brown & Ryan, 2003). This study found that state mindfulness was discriminable from trait mindfulness, and that state mindfulness predicted unique variance in daily positive and negative affect above and beyond the impact of trait mindfulness.

A sampling of the existing body of work on emotion regulation in daily life suggests that how emotions are managed in the moment offer unique explanatory power in understanding the well-being and functioning of individuals. The goal of basic science is to predict what people will experience and do in their everyday life and daily diary studies offer insight into these moments for the same person, in various situations, and over time.

The present research

Past research into emotion regulation has overwhelmingly used either retrospective designs, analogue designs or has used trait measures of emotion regulation with suboptimal ecological validity. The few studies that have employed daily measures have focused on comparisons between reappraisal and suppression, and not included the potential unique value that mindfulness could contribute to understanding daily emotional well-being.

The present study had four overarching goals. First, we explored the degree of convergence between mean daily and trait measures of emotion regulation and well-being. In particular, we were interested in the crossover correlations between mean daily and trait measures of emotion regulation constructs given their divergent measurement approaches.

Second, we examined the extent that daily measures of reappraisal, suppression, and mindfulness overlapped with each other and predicted unique variance in emotional well-being. We were particularly interested in the role of mindfulness as a beneficial emotion regulation strategy with regards to daily negative affect given the paucity of data on the beneficial forms of emotion regulation on negative affect (Brans et al., 2013), and the promising results found in an earlier study validating a measure of state mindfulness (Brown & Ryan, 2003).

Third, we examined the extent that the utility of the three emotion regulation strategies varied between individuals. If the utility of a strategy depends on the interaction between an individual and their particular context, then we would expect the link between a strategy's use and healthy emotional outcomes would depend on the individual using it. In contrast, if context makes little difference, we would expect strategies like mindfulness and cognitive reappraisal to have the same benefit across subjects, and suppression to have the same negative effect across subjects. Demonstrating that the utility of emotion regulation strategies depends on the person is thus a prerequisite for a contextual approach to emotion regulation.

Finally, we were interested in the directionality of the effects of the three strategies on emotional well-being from one day to the next. A key assumption of the emotion regulation model is that strategies have an impact on levels of experienced affect. Rarely do empirical studies consider that levels of affect might impact regulation strategies.

Method

Participants

Data were collected from 187 college students (40 men, 133 women, 14 with missing data) with a mean age of 23.9 years (SD = 9.06, range 17–63) and an ethnic composition of 53.1% Caucasian, 11.7% Latino/Hispanic, 11.2% Asian, 7.1% African-American, 1.6% Middle-Eastern, 1.1% Native-American and 6.5% other. The total 187 participants provided 3852 days of data at an average of 20.59 days per person (SD = 2.06).

Procedure

Participants were recruited through an online portal for students seeking to participate in research, as well as flyers and online advertisements for a study on personality and behaviour. During the consent process, participants were informed that the purpose of the study was to better understand people's experiences of emotions in daily life. Participants completed a 1 ½ h introductory session where they provided baseline data, including demographic information and trait measures, and were trained how to correctly complete the daily online survey. Participants were then asked to complete this survey before going to sleep for the next 21 days. Participants received weekly reminder emails emphasising the importance of compliance, confidentiality and the time-and-date stamping of online entries. After completing the study, subjects received research credit as a part of their course unit, and raffle tickets into a draw to win one of ten $25 gift certificates.

Measures

Trait emotion regulation

Trait cognitive reappraisal and emotion suppression was measured using the full 10-item Emotion Regulation Questionnaire (ERQ) (Gross & John, 2003). The ERQ is designed to assess individual differences in the habitual use of cognitive reappraisal and expressive suppression as emotion regulation strategies. The 6-item trait cognitive reappraisal subscale has been shown to have adequate internal consistency (.79) and test–retest reliability (.69) in undergraduate student samples (Gross & John, 2003). The cognitive reappraisal factor measures the tendency for people to engage in construing potentially emotion-eliciting situations ways that change its emotional impact (Gross & John, 2003). The 4-item trait emotion suppression scale has been shown to have acceptable internal consistency (.73) and test–retest reliability (.69) in undergraduate student samples and measures the tendency for people to engage in active inhibiting of ongoing emotion-expressive behaviour (Gross & John, 2003).The scale uses a 7-point Likert-type scale from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*), where higher scores indicate increased use of the regulatory strategy.

Trait mindfulness was assessed using the Langer Mindfulness Scale (LMS) (Pirson, Langer, Bodner, & Zilcha-Mano, 2012). The LMS is a 21-item self-report measure of an individual's tendency to be mindful. Each item is assessed using a 7-point Likert-type scale, ranging from 1 = strongly disagree through to 7 = strongly disagree with higher LMS scores reflecting higher trait mindfulness. In a pooled sample of 952 undergraduate students and community members, Bodner and Langer (2001) report Cronbach's alpha for the LMS total mindfulness score to be .85.

Trait Positive and Negative Affect

Trait positive and negative affect were measured using the *Positive and Negative Affect Schedule* (PANAS) (Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item self-report scale that measures positive and negative mood states in relation to several time frames (e.g. previous week, month). The current study used the PANAS items anchored to the following statement; "Indicate to what extent you generally feel this way, that is, how you feel on the average". The *negative affect* scale consists of 10 adjectives describing negative emotions (e.g. scared, upset) whilst the *positive affect* scale consists of 10 adjectives which describe positive emotions (e.g. interested, proud). Participants rate the degree to which they feel each emotion on a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). The PANAS has demonstrated good internal consistency with Cronbach's alpha for both scales reported to be between .87 and .88 (Watson et al., 1988).

Daily emotion regulation

Daily emotion suppression was measured using a modified 3-item state measure adapted of the 10-item Emotion Regulation Questionnaire (Gross & John, 2003) "I keep my emotions to myself" (item 2), "When I am feeling positive emotions, I am careful not to express them" (item 4), and "When I am feeling negative emotions, I make sure not to express them" (item 9). Participants were asked to indicate how frequently they had experienced each item that day using a 7-point Likert-type scale from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*), where higher scores indicate increased use of the regulatory strategy. The ERQ is designed to assess individual differences in the habitual use of cognitive reappraisal and expressive suppression as emotion regulation strategies. The 3-item state measure of emotion suppression represents a parsing down from a 4-item state measure used in a previous study (Kashdan & Steger, 2006) which was reported to have high reliability (.97).

Daily cognitive reappraisal was measured using a modified 2-item state measure adapted from items 1 and 3 of the ERQ. This included the following items; "When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about" (item 1), and "When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about" (item 3). The cognitive reappraisal factor measures the tendency for people to engage in construing potentially emotion-eliciting situations ways that change its emotional impact (Gross & John, 2003). The two items chosen were based upon a study by Kashdan and Steger (2006) who reported high reliability (.97) for the four item state measure of cognitive reappraisal.

The 5-item state MAAS (Brown & Ryan, 2003) assesses the short-term expression of a receptive state of mind in which attention, informed by a sensitive awareness of what is occurring in the present moment, is simply observing what is taking place as it unfolds (Brown & Ryan, 2003). For the purposes of this study, a 3-item version of the state MAAS

was used so as not to overburden respondents without any corresponding benefit in terms of validity or reliability (e.g. Farmer & Kashdan, 2012). Two items drawn from the state MAAS used for the current study were (1) "I found myself preoccupied with the future or the past" and (2) "I found myself doing things without paying attention". A third item "I accepted my feelings, thoughts, and bodily sensations without judging or trying to change them" was constructed and added so as to broaden our mindfulness measure to include an "acceptance" aspect emphasised by some mindfulness researchers (e.g. Bishop, 2002). Participants were asked to indicate how frequently they had experienced each item that day using a 6-point Likert-type scale from 1 (*almost always*) to 6 (*almost never*), where high scores reflective of increases in daily mindfulness. The original state MAAS has shown excellent psychometric properties (e.g. reliability = .92; Brown & Ryan, 2003), and to be predictive of trait MAAS scores, and both lower negative, and higher positive daily affect independent of the trait MAAS (Brown & Ryan, 2003).

Daily positive and negative affect

Daily positive and negative affect was measured by responses to four positively valanced adjectives (enthusiastic, happy, satisfied and excited) and four negatively valanced adjectives (embarrassed, disappointed, anxious and sad). Participants answered using a 7-point scale with endpoints 1 = "Did not feel this way at all" and 7 = "Felt this way very strongly". The daily negative (.68) and positive affect (.73) measures have been found to have adequate reliability in a previous diary study (Machell, Goodman, & Kashdan, 2015).

Analysis

We used multilevel modelling data analysis techniques to account for the nested structure of our data with 3852 days within 187 people. A multilevel modelling approach allowed us to test for individual variation in slopes using the "lme4" (Bates, Maechler, Bolker, & Walker, 2014) and "nlme" (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2016) packages of the statistical program "R" Version 3.1.3 (R Core Development Team, 2016). A control for autoregressive error structures was applied to all multilevel models with the exception of the lagged (time contingent) models. Including this error structure did not substantively change any of the results of the multilevel models.

Results

Exploratory plots were examined across the repeated measures data, and a linear model was confirmed as adequately describing the trajectories. Where possible, all 21 time points were included in the analysis although there were incomplete data in some cases. The average intra-class correlations (ICCs) for daily reappraisal, mindfulness and suppression were .63 (95%CI = .58–.68), .49 (95%CI = .43–.54) and .57 (95%CI = .52–.62), respectively, indicating an acceptable level of variability in the daily measures of emotion regulation. The ICCs for daily negative and positive affect were 0.33 (95%CI = .28–.39), and 0.39 (95%CI = .33–.44) suggesting that 67% and 61% of the variability in negative and positive affect was within person. Means, standard deviations, reliabilities and correlations between daily and trait emotion regulation, and positive and negative affect are displayed in Table 1.

Table 1. Means, standard deviations, reliabilities and correlations between daily and trait emotion regulation and positive and negative affect.

Measure (Scale Range)	Mean (SD) α	1	2	3	4	5	6	7	8	9	10
1) Daily Negative Affect (1–7)	9.84 (4.77) .90	–	–.36***	–.01	–.52***	.21***	.33***	–.07	–.08	.02	.03
2) Daily Positive Affect (1–7)	16.38 (5.84) .92		–	.34***	.20*	–.17*	.01	–.03	.05	–.02	–.05
3) Daily Cognitive Reappraisal (1–7)	7.40 (3.43) .97			–	–.13	.32***	.16	–.02	.16	.11	.02
4) Daily Mindfulness (1–7)	14.01 (3.49) .94				–	–.30***	–.28***	.01	–.01	–.10	–.08
5) Daily Emotion Suppression (1–7)	8.13 (4.04) .96					–	.10	.09	–.02	.15	.16
6)) Trait Negative Affect (1–10)	18.92 (6.61) .85						–	–.30***	–.13	–.14	.17*
7) Trait Positive Affect (1–10)	34.35 (6.47) .85							–	.36***	.48***	–.28***
8) Trait Cognitive Reappraisal (1–7)	28.36 (6.75) .84								–	.46***	–.03
9) Trait Mindfulness (1–7)	106.91 (15.56) .87									–	–.13
10) Trait Emotion Suppression (1–7)	12.84 (5.47) .81										–

Notes: Shaded area highlights correlations between trait and mean daily variables. Daily variables are averaged by person. Dark shading highlights correlations between average daily and trait measures of similar constructs. All daily variables in this table have been averaged by person. Reliabilities for the daily measures were calculated from the ICCs. The reliabilities for the trait measures represent Cronbach's alphas.
Significance level indicated by.
*p < .05; **p < .01; ***p < .001.

Relationship between daily and trait measures

The associations between the average of a person's daily measures and their trait measures are displayed in Table 1. In general, larger correlations were observed between data collected at the same level; there was a general lack of association between measures collected at different levels (i.e. daily vs. trait). For example, mean daily negative affect was found to be significantly related to trait negative affect (.33, p = <.001), however, a person's mean level of daily positive affect was not significantly related to trait positive affect (p = >.05). No significant effects were found for cross over relations between mean daily and trait measures for any of the strategies. The results of these analyses are highlighted in the shaded area of Table 1.

Within-day effects of emotion regulation strategies

For the within-day effects, we first examined the relationships between strategies. Multilevel regression analyses revealed daily reappraisal to predict higher levels of daily suppression (β = −.11, $t(3025)$ = −2.09, $p < .05$) and lower levels of daily mindfulness (β = .23, $t(3043)$ = 4.26, $p < .001$). Daily mindfulness was found to be related to lower levels of daily emotion suppression (β = −.28, $t(3025)$ = −4.24, $p < .001$).

Next we compared a model in which the slopes for each daily strategy were random vs. a model in which these slopes were fixed. Across all three strategies, Chi-Square difference tests indicated that the random slope models were significantly better fitting (see Table 2).

Table 3 indicates that the slopes for mindfulness and emotion suppression were significant ($p < .001$) for both daily negative and positive affect, demonstrating that in general, within-person mindfulness was related to benefits to emotional well-being whilst emotion suppression was generally predictive of lower levels of emotional well-being. Similar results were found with the relationships between daily cognitive reappraisal and positive affect, with a significant positive relationship found as expected ($p < .001$). However, the slope for daily cognitive reappraisal was not significant for daily negative affect, meaning the strategy was not generally associated with lower daily negative affect.

Given the significance of the random slopes model, we examined the variability in the effect of each strategy on positive and negative affect. The right side of Table 3 (B_{Low} and B_{High}) presents the slope plus or minus one standard deviation from the mean slope. These results can be understood visually in Figures 1–3. The effects of daily mindfulness tended to vary from highly positive (e.g. strong link with emotional well-being) to only moderately positive (relatively weak link to emotional well-being). A similar, but opposite pattern was observed for emotion suppression. Thus, mindfulness was generally associated with positive outcomes and emotion suppression with negative emotional outcomes, but the strength of

Table 2. Results of χ^2 difference tests comparing random intercept and random slope models.

Negative affect	Difference	df	p-value
Mindfulness	26.99	2	<.0001
Reappraisal	75.69	2	<.0001
Suppression	30.88	2	<.0001
Positive affect			
Mindfulness	37.83	2	<.0001
Reappraisal	86.92	2	<.0001
Suppression	33.64	2	<.0001

Table 3. Random slope and random intercept model statistics for daily emotion regulation on daily negative and positive affect.

Negative affect	B	SD	df	B_{Low}	B_{High}
(Intercept)	9.814*	2.205*	3019	7.609	12.019
Mindfulness	−1.517*	.896*	3019	−2.413	−.621
(Intercept)	10.163*	2.626*	3031	7.537	12.789
Reappraisal	−.202	1.442*	3031	−1.644	1.240
(Intercept)	10.002*	2.516*	3031	7.486	12.518
Suppression	1.027*	1.036*	3031	−.009	2.063
Positive affect					
(Intercept)	16.386*	3.408*	3023	12.978	19.794
Mindfulness	1.045*	1.295*	3023	−.250	2.340
(Intercept)	16.103*	3.125*	3034	12.978	19.228
Reappraisal	1.353*	1.780*	3034	−.427	3.133
(Intercept)	16.268*	3.388*	3034	12.88	19.656
Suppression	−.795*	1.336*	3034	−2.131	.541

Note: Slope ("influence") was shown to significantly vary by individual, B_{Low} = slope 1 SD.
Below the average. B_{High} = slope 1 SD above the average.
*$p < .001$.

this effect varied significantly between people. However, as seen in Figure 3, an interesting profile emerged for the effect between daily reappraisal and negative affect such that among some people higher daily reappraisal was associated with *lower* negative affect, whereas for others it was associated with *higher* negative affect.

We also found that reappraisal was generally associated with greater positive affect, with a strong positive relationship observed for some people and a weak positive relationship for others.

We next assessed the extent that the three strategies predicted unique variance in positive and negative affect. We conducted a multilevel regression analyses that included all three emotion regulation strategies as independent variables (predictors) at Level 1 (the within-person level) with daily negative and positive affect as the dependent variables. The 2-part equation for this model is given below:

$$DailyAffect_{ij} = \beta_{0j} + \beta_{1j}DailyReappraisalij + \beta_{2j}DailyMindfulnessij + \beta_{3j}DailySuppressionij + \varepsilon ij$$

where $\beta_{0j} = \gamma_{00} + \mu_{0j}$, $\beta_{1j} = \gamma_{01} + \mu_{1j}$, $\beta_{2j} = \gamma_{02} + \mu_{2j}$, $\beta_{3j} = \gamma_{03} + \mu_{3j}$

In these analyses $DailyAffect_{ij}$ was the dependent measure for person i on occasion j, and $\beta_{1j} - \beta_{3j}$ are coefficients denoting the random slope between the regulation strategy and affect. When all three strategies were entered into a regression equation at step one predicting daily negative affect, all were found to be significant unique predictors (mindfulness $\beta = -1.39$, $t(3012) = -12.55$, $p < .001$, cognitive reappraisal $\beta = -.31$, $t(3012) = -2.48$, $p < .05$ and emotion suppression $\beta = .81$, $t(3012) = 6.87$, $p < .001$).

The three emotion regulation strategies were then entered together into a regression equation at step one predicting daily positive affect again resulting in all three strategies achieving statistical significance as unique predictors (mindfulness $\beta = .96$, $t(3016) = 6.80$, $p < .001$, cognitive reappraisal $\beta = 1.44$, $t(3016) = 8.37$, $p < .001$ and emotion suppression $\beta = -.73$, $t(3016) = -5.30$, $p < .001$).
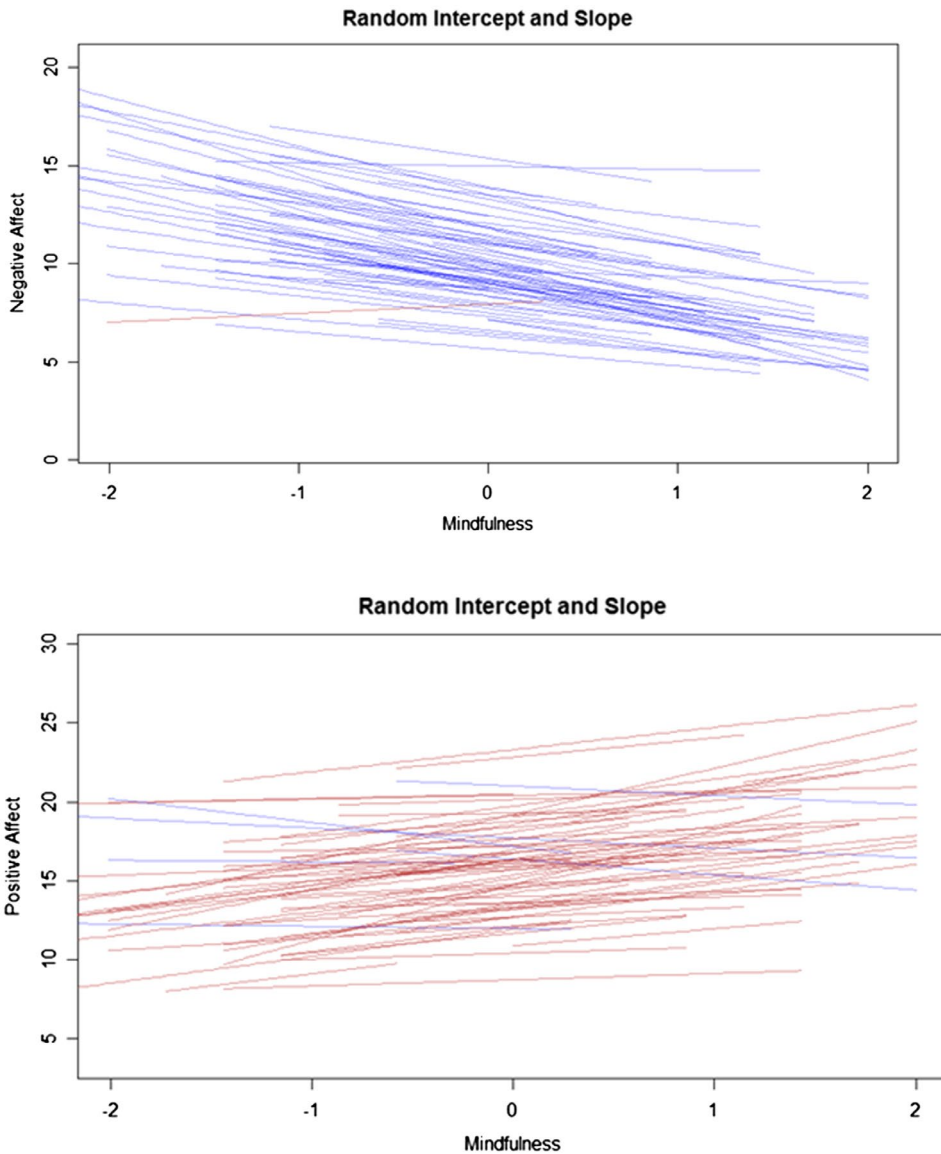
Figure 1. Random intercept and slope models for daily mindfulness on daily positive and negative affect.
Note: Red lines indicate participants for whom there is a positive relationship between regulatory strategy and daily affect, blue lines represent participants for whom there is a negative relationship between regulatory strategy and daily affect. A colour version of this figure can be found online at http://dx.doi.org/10.1080/16506073.2016.1218926.

Spill-over effects of emotion regulation strategies

The static, within-day relationships discussed so far do not address the issue of directionality. To gain further insight into the relationship between daily emotion regulation and emotional well-being, we conducted a series of analyses examining so called "spill-over effects"; the effect that carries over from one day to the next (e.g. Farmer & Kashdan, 2012). First we estimated three separate models for each of the three strategies by positive and
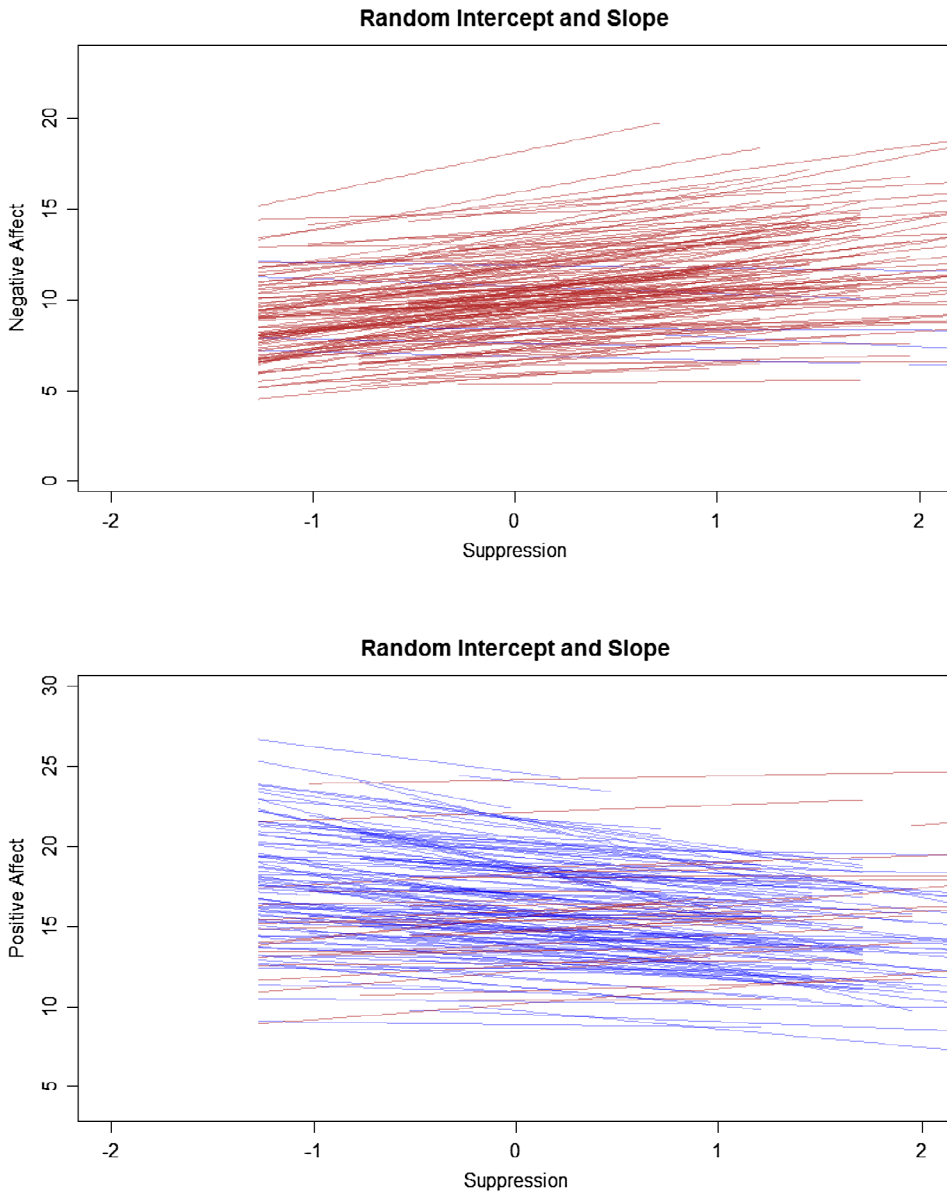
Figure 2. Random intercept and slope models for daily emotion suppression on daily positive and negative affect.

Note: Red lines indicate participants for whom there is a positive relationship between regulatory strategy and daily affect, blue lines represent participants for whom there is a negative relationship between regulatory strategy and daily affect. A colour version of this figure can be found online at http://dx.doi.org/10.1080/16506073.2016.1218926.

negative affect to examine the effect of previous day strategy use on next day affect experiences. Model 1 examined a basic spill-over effects model with previous day strategy use predicting next day positive and negative affect. Reciprocal effects were then examined by estimating the effect of lagged positive and negative affect on next day strategy use. Model 2 then estimated a random slopes model where the slope of daily affect was allowed to vary.
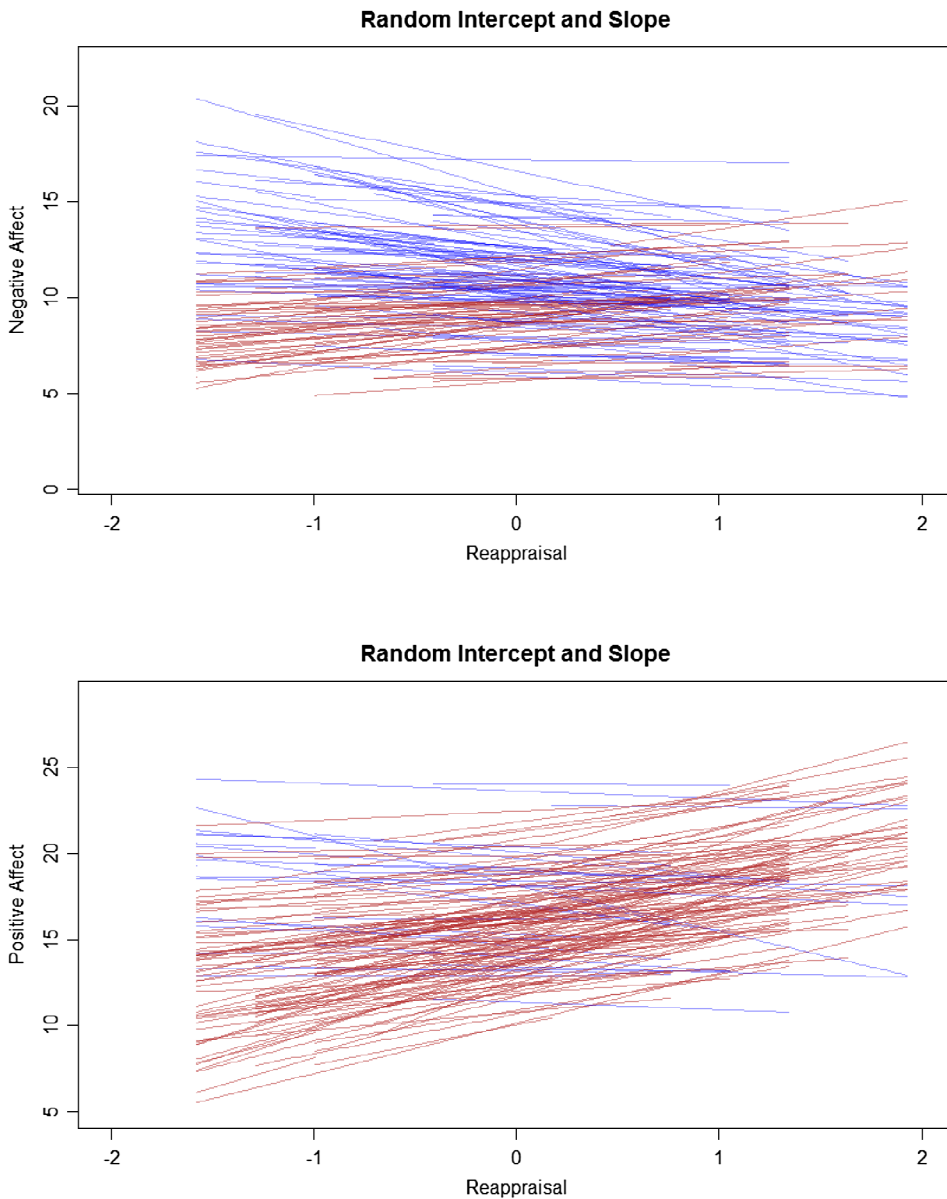
Random Intercept and Slope

Random Intercept and Slope

Figure 3. Random intercept and slope models for daily cognitive reappraisal on daily positive and negative affect.

Note: Red lines indicate participants for whom there is a positive relationship between regulatory strategy and daily affect, blue lines represent participants for whom there is a negative relationship between regulatory strategy and daily affect. A colour version of this figure can be found online at http://dx.doi.org/10.1080/16506073.2016.1218926.

Model 3 tested a random slopes model in which strategy use was also allowed to vary. In all cases, Chi-square difference tests indicated that Model 2 was the best fitting model ($p < .01$). Model 2 tested the lagged effect of emotion regulation strategy on next day affect, and then the lagged effect of daily affect on next day emotion regulation strategy.

Results indicate that cognitive reappraisal, emotion suppression and mindfulness have differential effects on next day affect experiences. Accounting for previous day's negative affect, there was no main effect for cognitive reappraisal on next day negative affect ($\beta = -.03$, $t(2926) = -1.51$, $p > .05$). Reversing this equation, controlling for cognitive reappraisal, there was also no main effect for negative affect on next day cognitive reappraisal ($\beta = -.006$, $t(2921) = -1.514$, $p > .05$). Accounting for the previous day's positive affect, there was a significant main effect for cognitive reappraisal on next day positive affect ($\beta = .09$, $t(2933) = 4.387$, $p < .05$). There was however no significant reciprocal effect for positive affect on the next day's cognitive reappraisal ($\beta = -.001$, $t(2936) = -.098$, $p > .05$).

Controlling for the previous day's negative affect, there was no main effect for emotion suppression on next the day's negative affect ($\beta = .012$, $t(2926) = .641$, $p > .05$). Reversing this equation, controlling for emotion supression, there was a main effect for negative affect on next day emotion supression ($\beta = .045$, $t(2921) = 3.08$, $p < .05$). Accounting for the previous day's positive affect, there was no main effect for emotion supression on next day positive affect ($\beta = .021$, $t(2933) = 1.11$, $p > .05$). There was also no reverse effect for positive affect on the next day's emotion suppression ($\beta = -.003$, $t(2936) = -.25$, $p > .05$).

Mindfulness had the most robust lagged relationships with daily positive and negative affect. Controlling for the previous day's negative affect, there was a main effect for mindfulness on the next day's negative affect ($\beta = -.072$, $t(2913) = -.365$, $p < .05$). Reversing this equation, controlling for mindfulness, there was also a main effect for negative affect on next day mindfulness ($\beta = -.043$, $t(2908) = -2.72$, $p < .05$), supporting a reciprocal influences model of the relationship between daily mindfulness and negative affect. Accounting for the previous day's positive affect, there was no main effect for mindfulness on next day positive affect ($\beta = .002$, $t(2921) = .12$, $p > .05$). There was however a reverse effect for positive affect on the next day's mindfulness ($\beta = .033$, $t(2914) = 2.09$, $p < .05$).

Gender, age and ethnicity as trait moderators of daily emotion regulation

Next, we explored the potential moderating effect of gender, age and ethnicity on the daily regulation of positive and negative affect. No significant interactions were found for gender or ethnicity ($p < .05$). However, a significant interaction was found for cognitive reappraisal × age for daily negative affect. As can be seen in Figure 4, among the younger adults in the sample, cognitive reappraisal was associated with *higher* levels of daily negative affect but was associated with increasingly lower levels of negative affect with age, crossing a zero line of effect at about age 20 ($\beta = -.1.24$, $t(2814) = -2.27$, $p = .023$). No other significant interactions were found for regulatory strategies × age.

Discussion

A plethora of evidence exists suggesting general "adaptive" or "maladaptive" profiles for particular emotion regulation strategies depending on their association with emotional well-being outcomes (Gross, 2002). Recent theoretical (Gross, 2015) and empirical literature (Aldao, 2013) on emotion regulation however, suggest a contextual approach to emotion regulation in which the utlimate adaptivness of a given strategy depends on the person in a given context. The primary aim of this study was to use daily diary methodology to further our understanding of the relationship between emotion regulation stategies and
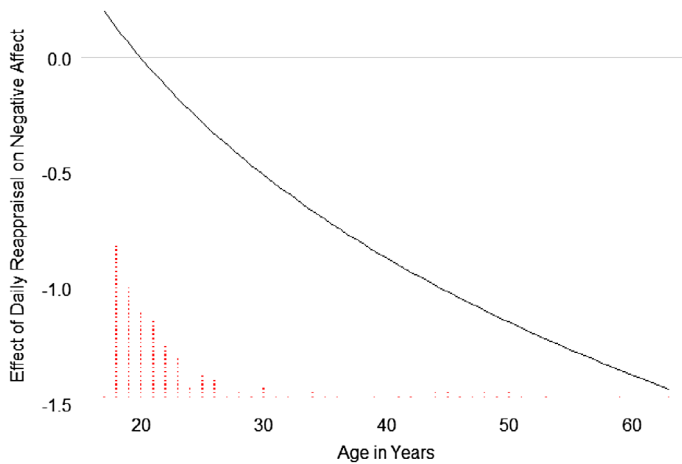
Figure 4. Age as a moderator of the relationship between daily cognitive reappraisal and negative affect. A colour version of this figure can be found online at http://dx.doi.org/10.1080/16506073.2016.1218926.

emotional well-being as it is experienced in daily life. A core assumption of this research being that results obtained from daily measures may differ from those collected from one-off trait assessments.

In general, associations between daily and trait measures were evidenced to be weak to non-existent. In particular, correlations between trait and daily measures of similar underlying constructs were weakly related overall. For example, trait and daily positive affect were found to be statistically unrelated meaning that the general degree of positive affect a person reported at the beginning of the study (trait) was not predictive of their positive affect as reported over the next 21 days. An exception was daily and trait negative affect which was found to be modestly related (.33). Trait versions of emotion regulation strategies were found to be unrelated to their daily counterparts, although there was a trend towards significance for daily trait correlations for both reapprasial and suppression. We interpret these, broadly speaking, low to non-existent daily trait correlations as evidence of the distictivness of the daily and trait measures. It should be noted however that the daily measure of mindfulness used in this study was derived from the trait MAAS and not the LMS, the trait mindfulness measure used in this study. Nonetheless these results suggest that relationships that have been found at the trait level in the emotion regulation literature from one-off trait administrations, are likley on occasion to yeild different results to measures given daily or more frequently, consistent with the assertions of Nezlek (2007).

Emotion regulation in daily life

A central finding of the present study relates to the results of the random slope models, which suggest that for almost all people, daily mindfulness is associated with higher levels of positive affect and lower levels of negative affect, supporting the idea of a general adaptive profile for mindfulness (Chambers et al., 2009). The converse pattern was found for emotion suppression supporting the idea of a general "maladaptive" profile for the strategy. However, the benefit or lack there of varied markedly within people. For example, for some people

increased mindfulness was associated with substantial decreases in negative affect. For others, there was only slight benefit of mindfulness, and slight lack of benefit in suppression in relation to emotional well-being. Cognitive reappraisal produced the most complex picture within person for negative affect. Amongst some people, it was assocated with decreased negative affect, whereas for others it was associated with increased negative affect.

The finding that daily cognitive reappraisal is not *generally* related to decreased negative affect in daily life is inconsistant with a vast literature, informed by a trait measurement approach, which has generally found the strategy to be related to decreased negative affect (Gross & John, 2003), and to therefore have a general adaptive profile. The results of the current study thus converge with those of Brans et al. (2013) who tracked emotion regulation on multiple instances within days, and similarly found no significant relationship between daily cognitive reappraisal and negative affect. Taken together, these two studies provide initial daily process evidence that on days when people experience lower levels of negative affect, they do not report engaging in higher levels of cognitive reapprasial. Investigating this matter further, the current study found that cognitive reappraisal was in fact related to decreased negative affect in approximately half of the participants, but that in the other half, it was related to *increases* in negative affect. This indicates that significant variation exists in the relationship between daily reappraisal and negative affect between people. For some people it seems, reappraisal is associated with benefits to emotional well-being, whilst for others it may have a problematic relationship to emotional well-being.

Notwithstanding these findings, the current study also found that daily cognitive reappraisal was in fact a strong predictor of daily positive affect. One possible implication of this is that whilst cognitive reappraisal may not necessarily assist with regulating intense *negative emotions* once they are activated, the strategy may help with maintaining more consistent *positive affect* experiences on a daily basis. A behavioural explanation for this could be that cognitive reappraisal may contribute to a person's level of behavioural activation, leading to increased opportunity to contact rewarding contingencies in the environment, leading to more positive affect. (e.g. Hayes et al., 1999; Jacobson, Martell, & Dimidjian, 2001). These findings support recent conceptualisations of emotion regulation which frame the effectivness of different emotion regulation stratagies as being dependant on person and context (e.g. Aldao, 2013; Gross, 2015), and highlights the need for further studies to investigate moderators and contextual factors which might explain why reappraisal is associated with benefits for some people but not others.

Similar results were found when looking at the effect of strategy use from one day to the next. Cognitive reappraisal was a signifcant predictor of next day positive affect but not negative affect. Interestingly, there was no effect of emotion suppression on next day positive or negative affect, rather negative affect appears to predict more emotion suppression on subsequent days. For mindfulness, a reciprocal influence model was supported for negative affect with mindfulness predicting lower negative affect, and lower negative affect predicting higher next day mindfulness. However, mindfulness did not predict next day positive affect, rather positive affect was found to influence next day mindfulness. These "spill-over" findings suggest a complex relationship between regulatory strategies and emotional experiences such that the directionality of the relationship may not always be linear, where strategies directly impact emotional experiences as is often assumed, rather emotions appear in some contexts at least to also impact the use of strategies. Similar studies tracking several instances of emotional experience within days would be expected to shed

further light on the issue of the directionality in the relationship between strategies and emotional experiences.

Multilevel regressions indicated links between the three daily strategies suggesting that people often use multiple and seemingly contradictory strategies on any given day. However, the correlations between these strategies was weak. For example, there was only about 7% shared variance between daily mindfulness and suppression, a surprising finding since the constructs have been proposed by some to be antithetical processes (e.g. Chambers et al., 2009). Similarly, daily reappraisal was found to predict lower levels of daily mindfulnes, contrary to some theorietical positions which posit mindfulness to be a prerequisite for reappraisal ability (e.g. Garland, Gaylord, & Fredrickson, 2011; Troy, Shallcross, Davis, & Mauss, 2013). Interestingly, reappraisal predicted higher emotion suppression in daily life suggesting that in some contexts perhaps, cognitive reappraisal may serve an emotion suppressive function, consistent with the view of cognitive reappraisal held by most mindfulness-based approaches to psychotherapy (e.g. Hayes et al., 1999).

Cognitive reappraisal improves with age

The present data suggest that an important factor moderating the effect of daily reappraisal on negative affect is a person's maturity. For the younger adults in the sample, daily reappraisal was associated more negative affect, but for those of 20 years and older, reappraisal was associated with increasing benefits to emotional well-being. Whilst we are cautious given this university sample is inherently more representitive of younger adults, the impact of age on cognitive reappraisal deserves further empirical study. In particular, these results are at odds with the popular notion in the emotion regulation literature (Urry & Gross, 2010), supported by empirical studies using one-off assessments (e.g. Opitz, Rauch, Terry, & Urry, 2012), that the effectiveness of cognitive reappraisal may actually *decline* with age. At the other end of the maturity continuum, our finding that cognitive reappraisal is associated with decreased benefits for teenagers naturally calls for similar daily diary studies of emotion regulation in younger samples. Broadly speaking, we interprete these age moderator results as being consistent with a flexibility view of emotion regulation (Kashdan & Rottenberg, 2010), and the notion that older adults may become better skilled at both applying (Sahdra, Ciarrochi, & Parker, 2016) and choosing between the regulatory strategies with age (Urry & Gross, 2010).

Implications for clinical models

The current findings have some implications for behavioural and cognitive approaches to clinical interventions that warrant discussion. Firstly, these results may be interpreted as challenging to therapy interventions such as traditional CBT which emphasise cognitive reappraisal of "negative automatic thoughts" as a core theraputic ingredient necessary in assisting with the regulation of negative emotions. In the current sample, we found that daily reappraisal showed no consistent relationship to daily negative affect. This may in part be explained by our secondary analyses which found that cognitive reappraisal was associated with *both* increases and decreases in negative affect depending on the person. If these results were to hold for clinical populations, this would indicate that for people presenting with high levels of negative affect as a core clinical problem, perhaps the vast majority of

clinical patients, reapprasial may not be a universally benifical strategy, and in some cases, may infact lead to increased negative affect. Future studies are needed, utilising intensive longditudinal designs such as we have implemented in the current study, with a range of clinical populations to test if these assertions can be generalised.

Our results also converge with a small but growing literature from CBT treatment outcome studies which similarly indicate that cognitive reappraisal may not be a universally useful regulation strategy for promoting health and emotional well-being. For example, Brozovich and colleagues (Brozovich et al., 2015) recently found in their randomised controlled trial of CBT for Social Anxiety Disorder (SAD) that decreases in rumination over the course of their CBT study, rather than increases in reappraisal, were associated with treatment outcome indicating that in this context at least, reappraisal did not appear to be a key mechanism of change. Interestingly this study also found a positive relationship between baseline rumination and reappraisal, indicating that amongst people suffering SAD, reappraisal was actually positively associated with rumination. Notwithstanding this, the current study did find that cognitive reappraisal was associated with decreased negative affect for some people *and* increased positive affect for most, indicating that much more needs to be studied in relation to the contextual influences governing cognitive reappraisal, and its relationship to emotional well-being. Future studies are needed to answer the question of in what contexts and for whom is cognitive reappraisal an effective emotion regulation strategy for negative affect? We also interpret the current results as being generally supportive of recent "contextual" approaches to therapy which (a) view mindfulness as a broadly beneficial emotion regulation strategy, and (b) which hold that appreciating flexibility and context is fundamental to understanding healthy emotion regulation (Hayes et al., 1999).

In terms of translating these findings into clinical practice, some strategies appear to be quite generally problematic (e.g. emotion suppression), whilst others appear to have a more adaptive general profile (e.g. mindfulness). However, we argue that the current results point to the importance of a more "contextual" approach to therapy involving emotion regulation problems, grounded in individualised case formulation, and an appreciation for the individual and their particular context. That is therapy endeavours involving emotion regulation may benefit from an explicit awareness that all strategies, putativly adaptive or maladaptive, may be effective for certain people and in certain contexts, and this requires careful assessment.

Limitations and future directions

Although the methods used in the current study have extended the study of emotion regulation beyond traditional trait measures and single-occasion measurement, these results should be interpreted in the light of several limitations. Firstly, our daily measures are self-report measures that participants completed at the end of the day, albeit in the context of an intense, repeated measurement design. This means that whilst some of the problems associated with self-report may have been minimised (e.g. recall bias); they have not been eliminated completely. Future research may benefit from considering additional measurement approaches which minimise bias, such as event-contingent reporting where participants report events as they occur several times throughout one day.

The current results also relate to emotional experiences in a broad way, describing relations with global negative and positive affect. Whilst a useful starting point, this design did

not uncover how daily emotion regulation functions with more specific emotions (e.g. guilt, shame, anger etc.) or dimensions of emotional experiences (e.g. high and low active affect). Future studies might consider investigating if the current results hold across a range of more nuanced dimensions of emotion. Relatedly, we have operationalised emotional well-being in the current study as involving more positive and less negative affect. We acknowledge that this definition of emotional well-being is not universally accepted, and may in fact be in direct conflict with the stance adopted in many mindfulness-based therapy models which may emphasise outcomes of quality of life or valued living (e.g. Hayes et al., 1999).

Another potential issue relates to the 2-item daily cognitive reappraisal measure which retains two items from Gross and John's (2003) original trait ERQ; "When I want to feel more positive emotion, I change what I am thinking about" and "When I want to feel less negative emotion, I change what I am thinking about". Although this 2-item combination has been used by other authors (e.g. Nezlek & Kuppens, 2008), it could be argued that these items in isolation may not accurately reflect the construct of reappraisal as intended, but could function more as a form of distraction. We note however that Brans et al. (2013) used different items in their 2-item state measure; "I have changed the way I think about what causes my feelings" and "did you see the event that caused your feelings from a different perspective?", and as noted above, reported similar findings on the lack of relationship between reappraisal and negative affect.

It should also be noted that the use of the ERQ measures of cognitive reappraisal and emotion suppression are also very specific, and may not always map meaningfully onto other definitions of the constructs as they are used in research or in the clinic. For example, the way in which the reappraisal items are structured (e.g. when I want to experience less negative emotion, I change what I am thinking) implies that reappraisal is used to avoid emotions. However, in practice this may not always be the case. For example, in CBT, reappraisal is often used in order to help patients to engage more with emotions or emotion eliciting situations (e.g. exposure), or to test out negative beliefs experientially (e.g. behavioural experiments).

A more major limitation of the current study is that contextual factors outside of "the person" were not studied. This means that whilst we were able to ascertain that the utility of emotion regulation strategies differed by person, and that age moderates the effect of one strategy, we were unable to yet uncover more specific contextual influences governing daily emotion regulation. Future studies investigating the contextual nuances of daily emotion regulation are clearly needed. For example, whilst emotion suppression was generally associated with poor emotional well-being for most people, there were still some individuals for whom emotion suppression appeared to be related to greater emotional well-being over the course of the study. This is consistent with a contextual view of emotion regulation, and emerging research which indicates that even putatively "maladaptive" strategies such as emotion suppression may be associated with benefits in some contexts (Mitmansgruber, Beck, & Schüßler, 2008).

Finally, the use of a sample of university students in this study also limits the generalisability of the results. In particular, given some of the central findings of this study relate to the regulation of negative affect, it is important to note that mean levels of negative affect in this sample appear quite low. This has implications for generalising to clinical samples, which by their very nature are more likely to be more distressed. Extending the current findings to clinical samples, and samples that experience higher levels of negative affect are

thus clearly needed. Relatedly, no data were collected regarding participant's psychological history, or their past or current experience of psychotherapy or related practices (e.g. meditation). These variables may be important moderators of daily emotion regulation, and so warrant attention in future daily process studies.

The current data add to a growing literature in support of a contextual view of emotion regulation, and the need for more ecologically valid methods to uncover the nature of emotional well-being. Empirical examinations and intervention programs may benefit from a contextual view of emotion-regulation difficulties, where strategies are closely matched to the person and their particular context. Such a view shows promise in furthering our understanding of the nuances of emotion regulation, and what are the best contributors to a particular person's daily emotional well-being.

Disclosure statement

No potential conflict of interest was reported by the authors.

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