Thinking Mindfully: How Mindfulness Relates to Rumination and Reflection in Daily Life

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Abstract

Mindfulness is a state of awareness comprising an attentional focus on the present moment and a nonjudgmental stance. It is associated with affective well-being and assumed to facilitate adaptive emotion regulation. To support this claim at the within-person level, we investigated associations between two mindfulness facets (present-moment attention and nonjudgmental acceptance), two emotion-regulation strategies varying in adaptiveness (rumination and reflection), and positive and negative affect in everyday life using data from two experience-sampling (ESM) studies. Study 1 consisted of $N = 70$ students who completed 54 prompts on average. Study 2 consisted of $N = 179$ middle-aged adults who completed 69 prompts on average. Results from both studies were highly consistent: The mindfulness facet nonjudgmental acceptance was more strongly related to less concurrent rumination, whereas the mindfulness facet present-moment attention was related to more concurrent reflection. As predicted, both mindfulness facets interacted with rumination in the prediction of changes in affect. When individuals were in a more mindful state, rumination was less strongly associated with *increases* in negative affect, and was less strongly associated with *decreases* in positive affect. However, mindfulness interacted with reflection in the prediction of changes in affect in an unexpected way: At higher levels of nonjudgmental acceptance, reflection was no longer associated with changes in affect. Together, these results suggest that emotion regulation strategies can be more or less adaptive depending on the level of mindfulness. They also accord with the proposal that mindfulness inhibits maladaptive emotion regulation and its impact on affective well-being.

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Mindfulness refers to a mental state that encompasses several facets, with two core

facets being (a) paying attention to the present moment and (b) relating to experiences in a

curious and accepting way (e.g., Bergomi, Tschacher, & Kupper, 2013; Bishop et al., 2004).

Mindfulness is thought to increase positive and decrease negative affect by shifting attention

to the present moment and facilitating a nonjudgmental stance towards these experiences

(e.g., Blanke, Riediger, & Brose, 2018). Moreover, it is also thought to influence affect by

promoting adaptive emotion regulation or coping[1] (e.g., Finkelstein-Fox, Park, & Riley, 2018;

Keng & Tong, 2016; Roemer, Williston, & Rollins, 2015; Weinstein, Brown, & Ryan, 2009).

Most research on mindfulness, emotion regulation, and affect has focused on *between-person associations* using *trait* questionnaires. Yet, mindfulness is argued to be best described

as a *mode of being* or a *state* (Bishop et al., 2004), varying *within persons* over time.

Measures targeting momentary states differ in many respects from those targeting stable

person-level traits (Robinson & Clore, 2002). State measures assess experiential information

(the quality of momentary experiences), whereas answers to trait measures are also based on

semantic knowledge (i.e., thoughts about the self). Thus, associations obtained at the trait

level may not translate to the state level. Moreover, previous research that *did* investigate

mindfulness as a state usually used unidimensional instead of multidimensional measures

(e.g., Weinstein et al., 2009). Drawbacks of this unidimensional approach are evident

considering that different mindfulness facets are distinctly related to different aspects of affect

(i.e., higher positive and lower negative affect; Blanke et al., 2018; Schroevers & Bradsma,

2010), and that mindfulness interventions vary in their effects on mindfulness facets

(Hildebrandt, McCall, & Singer, 2017). Consequently, different mindfulness facets may also

have distinct relations with emotion regulation at the state level.

To address these gaps in the literature, we examined how two core state mindfulness facets, present-moment attention and nonjudgmental acceptance, are related to state measures of momentary emotion regulation at the within-person level. Emotion regulation strategies are attempts to deal with emotional experiences (e.g., Gross, 1998). However, not all of these attempts are equally well suited to reduce negative or enhance positive affect (e.g., Gross, 2015) which are common goals in emotion regulation (Riediger, Schmiedek, Wagner, & Lindenberger, 2009). In the present research, we focused on two specific emotion regulation strategies, rumination and reflection[2], which are thought to vary in their adaptiveness. We focus on these two strategies because attention deployment is a defining characteristic of mindfulness (Farb, Anderson, Irving, & Segal, 2014), and rumination and reflection are strategies that operate at the level of attention deployment (Parkinson & Totterdell, 1999). These strategies entail self-reflective mental processes during which attention is focused on one's thoughts, feelings, and experiences (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Thus, mindfulness likely affects rumination and reflection and vice versa, because all draw on attentional resources. In the following, we elaborate our hypotheses regarding associations between the mindfulness facets present-moment attention and nonjudgmental acceptance with the emotion regulation strategies rumination and reflection. We also discuss potential interactions between mindfulness facets, emotion regulation strategies, and affective well-being (here defined as experiencing higher positive and lower negative affect, e.g., Schimmack, 2008).

The Role of Present-Moment Attention and Nonjudgmental Acceptance in Rumination

Rumination is defined as uncontrollably and repetitively focusing on possible reasons and consequences of events, stress, or harm (Nolen-Hoeksema et al., 2008; Raes, Hermans, Williams, Bijttebier, & Eelen, 2008). It often has a negative self-evaluative tone to it, and is a putatively maladaptive emotion regulation strategy which has been associated with reduced well-being (e.g., Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Nolen-Hoeksema, 2000).

The two mindfulness facets present-moment attention and nonjudgmental acceptance may be related to rumination in the following ways. When individuals are in a mindful mode and actively deploy their attention to the present moment (i.e., display high present-moment attention), they can either direct attention towards outside experiences (such as characteristics of a situation) or inner experiences (such as thoughts and feelings). Thus, higher present-moment attention may help to disrupt ruminative thoughts, and to move from ruminative elaboration of the self to exploring experiences (Jain et al., 2007). Furthermore, individuals in a nonjudgmental mode (i.e., high in nonjudgmental acceptance) do not judge feelings or thoughts, making them seem less threatening or harmful; they can "let go" of negative thoughts more easily (Frewen, Evans, Maraj, Dozois, & Partridge, 2008). Not judging, but accepting momentary experiences should stop evaluations of feelings or thoughts as negative, stressful, or harmful that are inherent in rumination (Rude, Little Maestas, & Neff 2007). This hinders the individual from jumping to automatic appraisals (Frewen et al., 2008). Thus, nonjudgmental acceptance should be negatively related to rumination. In line with this rationale, randomized controlled trials revealed that ruminative thinking was indeed reduced by mindfulness interventions (Ramel, Goldin, Carmona, & McQuaid, 2004; Shapiro, Oman, Thoresen, Plante, & Flinders, 2008). Together, both mindfulness facets, present-moment attention and nonjudgmental acceptance, should be associated with less rumination. To date, empirical evidence supporting this claim is missing at the within-person level. It is unknown whether moments during which individuals are mindful, are also moments during which they ruminate less.

Additionally, mindfulness and rumination may interact in predicting affective well-being. Mindfulness interventions have been shown to reduce trait ruminative thoughts, which partly accounted for the alleviating effect of mindfulness on depressive symptoms (van Aalderen et al., 2012). Moreover, rumination can lead into a negative spiral: blaming oneself for ruminating enhances the negative self-evaluation and negative feelings even more (e.g.,

Nolen-Hoeksema, 2000). Such spirals might be weakened in the presence of mindfulness. For example, in a study with adolescents, the trait mindfulness facets nonjudgment and nonreactivity moderated the effect of daily stressors on state rumination, which in turn was associated with lower state dysphoric mood (Ciesla, Reilly, Dickson, Emanuel, & Updegraff, 2012). Together, there is initial evidence in line with the interpretation that mindfulness attenuates the negative spiral between rumination and lower affective well-being. At the within-person level, and considering the effects of mindfulness at the facet-level, this may mean that situations during which individuals manage to redirect their attention back to the present moment and take a nonjudgmental stance are also situations in which individuals are less likely to ruminate. Moreover, it seems likely that rumination, if occurring in these situations, is also less strongly associated with lower affective well-being compared to situations in which individuals are in less mindful states.

The Role of Present-Moment Attention and Nonjudgmental Acceptance in Reflection

Reflection refers to repeated introspection that is motivated by curiosity and an intellectual interest in the self. Reflection, by definition, is intentional and active, and it lacks the negative evaluation inherent in rumination (Trapnell & Campbell, 1999; Watkins, 2004). It is a putatively adaptive emotion regulation strategy that increases affective well-being (e.g., Brans et al., 2013). Both theoretical notions and empirical findings on the link between mindfulness and reflection are less consistent than in the case of rumination. Brown and Ryan (2003) state that mindfulness in general has "little or no inherent relation to reflexive thought" (p. 823), since it focusses on the quality of consciousness, not the content of an experience, as done in reflection. Lau and colleagues (2006), on the other hand, argue that mindfulness relates positively to "intentional states of self-reflectiveness" (p. 1448). Further theoretical notions speak for a positive relation specifically between the mindfulness facet present-moment attention and reflection: A broader attentional deployment, as promoted in a mindful mode, may help individuals to perceive more of what is happening around or within them and

to notice new sensations and aspects of a situation (Shapiro, Carlson, Astin, & Freedman, 2006). This newly gained "food for thought" might inspire individuals to reflect.

At the trait level, a dispositional tendency for reflection was positively correlated with a global trait mindfulness measure (Brown & Ryan, 2003), and with both the curiosity and the decentering facets of the Toronto Mindfulness Scale (including aspects of present-moment attention and nonjudgmental acceptance; Lau et al., 2006). In another study, reflection was independent of the mindfulness facet acceptance, but positively associated with present-moment awareness (measured with the Philadelphia Mindfulness Scale; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008) in healthy participants (but not in a clinical subsample of the study). In another study that conceptualized reflection as an adaptive sub-facet of rumination and as a response to depressed mood (Treynor, Gonzalez, & Nolen-Hoeksema, 2003), reflection was independent of a composite measure of trait mindfulness (Feldman et al., 2007). Considering these theoretical notions and empirical findings, present-moment attention could be associated with more reflection at the within-person level. Regarding the second facet of mindfulness, nonjudgmental acceptance, there is no strong prior foundation on which to formulate an expectation on its link with reflection. Still, we speculate that a nonjudgmental stance may foster the willingness to address emotions and enable individuals to reflect with a more open attitude.

As proposed in the context of rumination, there may also be an interaction between state mindfulness facets and reflection in the prediction of affective well-being: A mindfully attentive individual perceives salient negative cues, but is also open to perceive positive aspects as well (Kabat-Zinn, 2003). Thus, we theorize that present-moment attention enhances the quality of reflective thinking by fostering the reflection on all aspects involved in an experience. At the within-person level, this may mean that times during which individuals direct their attention more to the present moment, are also times in which reflection has a more positive influence on affective well-being. We have no strong theoretical or empirical

basis to argue that nonjudgmental acceptance interacts with reflection in the prediction of affect; however, we explore this last link as well.

The Present Studies

We investigated the within-person associations between two core mindfulness facets, present-moment attention and nonjudgmental acceptance, and how they interact with the emotion regulation strategies rumination and reflection in predicting positive and negative affect. We expected that during moments in which individuals have higher levels of present-moment attention or nonjudgmental acceptance, they also have lower levels of rumination and higher levels of reflection. Furthermore, we expected that present-moment attention and nonjudgmental acceptance interact with rumination in the prediction of changes in affective well-being in the following ways: Moments during which individuals experience higher levels of mindfulness (attention and acceptance) should be moments at which higher levels of rumination are less strongly associated with increases in negative affect and decreases in positive affect. Moreover, moments during which individuals experience higher levels of present-moment attention should be moments during which higher levels of reflections are more strongly associated with increases in affective well-being. These hypotheses were tested with data from two experience-sampling (ESM) studies using smartphones. Sample sizes for both studies were determined by the principal investigators before data collection based on previous experiences with experience-sampling (no power analyses were conducted, there was no optional stopping). All items for both studies and the raw data from Study 1 are available in the supplementary material stored via the Open Science Framework. The release of the raw data from Study 2 to the public is regulated by contract and will happen once the still ongoing longitudinal data collection for this project is finished. Both studies were approved by the ethics committee of the Humboldt-Universität zu Berlin.

Supplement: https://osf.io/nvt6a/?view_only=ca5134b5484d44e18a30457c8f9474e4

Study 1

Method

Participants. Students of different disciplines (amongst them one psychology student in the first year) were recruited via online mailing lists, online advertisements, and posters around university areas in Berlin, Germany. During recruitment, the study was described as an investigation on thoughts and feelings in everyday life, not explicitly mentioning mindfulness. The target sample was 70 students (35 female) aged between 20 and 30 years, which was achieved ($M_{age} = 25.55$, $SD_{age} = 2.74$ years). There was no dropout throughout the entire study. Of the 70 students, 68 were German native speakers; the two remaining students indicated that their German language skills were equivalent to native speakers.

Procedure. In an introductory session, participants were introduced to the ESM procedure, gave informed consent on their participation, and filled out trait questionnaires. They received Huawei Ascend G330 smartphones, which started paging the participants the following day. The smartphone technology had been developed and used in previous studies (e.g., Rauers, Blanke, & Riediger, 2013; Riediger et al., 2009). During nine days, participants were paged six times daily within a self-selected fixed time frame of twelve hours. Once paged, they were asked to fill out the ESM questionnaire on the phone. The ESM questionnaires consisted of the measures detailed below and involved further variables not included in the present study. If participants missed more than one questionnaire on one or more days, up to three additional days were added to the ESM schedule. On average, participants answered 54.41 questionnaires (range: 48 – 65; $SD = 3.25$), indicating high compliance. After the ESM phase, participants were debriefed. They returned the smartphones and received their reimbursement (65 Euros on average, depending on the number of completed ESM questionnaires).

Measures. Every ESM questionnaire was introduced by asking the participants to respond to the following questions with regard to the timespan since they were last paged or since they woke up, if it was the first questionnaire of the day. All items were rated on 7-

point-scales ranging from 0 *(does not apply at all)* to 6 *(applies strongly)*. Descriptive information is depicted in the upper half of Table 1.

Mindfulness. Mindfulness was conceptualized as a mindset or mode, including current mindful states (e.g., experiencing a taste with present-moment attention) that can prevail for short moments up to several hours (e.g., since the last measurement). The Multidimensional State Mindfulness Questionnaire (MSMQ; Blanke & Brose, 2017) was used to measure the mindfulness facets present-moment attention and nonjudgmental acceptance with three items for each facet. An example item for the present-moment attention facet is: *I focused my attention on the present moment*. An example item for the nonjudgmental acceptance facet is: *I thought some of my thoughts/feelings were slightly off* (reversely coded).

Emotion regulation strategies. Rumination and reflection were measured with two items each, one referring to feelings (adopted from Brans et al., 2013) and the other referring to thoughts more generally. The items for rumination were: *I could not stop thinking about my feelings.;* and: *I could not stop thinking about certain things*; the items for reflection were: *I thought about my feelings in a calm and relaxed fashion*.; and: *I thought about certain things in a calm and relaxed fashion.*

Affective well-being. Negative affect (NA) and positive affect (PA) were assessed with three items each: nervous, downhearted, and distressed for NA, and happy, relaxed, and content for PA. Our underlying model of affect was a dimensional model (Barrett & Russell, 1998). We selected items that were used in previous intensive longitudinal designs, that were sufficiently variable, and that represented higher and lower arousal affective experiences (Brans et al., 2013; Riediger, Wrzus, & Wagner, 2014; Röcke, Li, & Smith, 2009).

Data Analysis

All analyses accounted for the hierarchical structure of the data – ESM occasions nested in participants. As preliminary analyses, to address psychometric properties of the experience-sampling measures, we calculated intra-class-correlations (ICCs) using SAS and

within-person reliabilities using a composite reliability measure (ω) derived from multilevel confirmatory factor analyses in Mplus (Geldhof, Preacher, & Zyphur, 2014).[3] This information is included in Table 1. All hypotheses were tested with multilevel analyses that were conducted using SAS PROC MIXED. We removed linear trends from all Level-1 predictors by regressing them on the measurement-occasions counting variable, using the residuals of these analyses as predictors to prevent spurious correlations (see Rovine & Walls, 2006). All predictors were modeled as fixed and random effects, and intercept and slopes were allowed to covary. The Level-1 fixed effects were evaluated based on the *t*-statistic/*p*-values ($p < .05$) and on the pseudo-R^2 (i.e., we determined the amount of Level-1 residual variance explained by the predicting variables). Random slopes were tested for significance using z and deviance testing (Singer & Willett, 2003; full models including random effects are reported in the supplement). The autoregressive structure of the data was modeled at the level of residuals and using the spatial power error structure function in SAS, the latter accounting for the unequal spacing between occasions.

In the interaction models, including mindfulness, emotion regulation, and their interaction as Level-1 predictors of PA or NA, we also included affect at the previous prompt (*t*-1; person-mean centered) as additional predictors. Importantly, this means that we tested whether *change* in affect since the previous measurement occasion was predicted by mindfulness, emotion regulation, and their interaction. More specifically, the inclusion of affect at *t*-1 models those aspects of affect at time-point *t* that are stable since the previous measurement; it leaves the residual parts of affect at *t* free for prediction. In these analyses, we did not model the autoregressive structure of the residuals as there was now an autoregressive predictor. To avoid accumulation of type II error, we report models that include both mindfulness facets as well as the related interaction terms. Note that decomposing the model into separate analyses for both mindfulness facets yielded similar patterns of findings (see supplement for details). We probed all simple slopes of statistically

significant interaction effects (Preacher, Curran, & Bauer, 2006) and illustrated these interactions in an examplary manner. We did this to facilitate the interpretation of different effects (i.e., effects conform or do not conform to the hypotheses). All models were tested using restricted maximum likelihood (REML).

Results

Present-Moment Attention, Nonjudgmental Acceptance, and Rumination.

Associations of mindfulness facets with rumination. In line with our assumptions, timespans in which individuals reported more present-moment attention and more nonjudgmental acceptance were also timespans in which they reported less rumination (Table 2, upper half, left side; see Table S1 in the supplement for random effects and separate models for each facet). In total, mindfulness accounted for 22% of the variance in rumination. Present-moment attention accounted for 3% unique variance in rumination, nonjudgmental acceptance a larger share of 12% unique variance, the rest (7%) was shared.

The interaction of mindfulness facets and rumination in the prediction of change in affect. The results of these analyses are reported in Table 3 (upper half; see Table S2 in the supplement for random effects). Prior to the analyses, we first replicated the associations between rumination and affect. In line with previous research, rumination was associated with more concurrent NA (estimate = 0.30, SE = 0.03, $p < .01$, pseudo-R^2 = 27%) and less PA (estimate = -0.22, SE = 0.02, $p < .01$, pseudo-R^2 = 12%).

Interaction effects of mindfulness facets and rumination in the prediction of change in NA. Consistent with our hypotheses, both mindfulness facets significantly interacted with rumination in the prediction of change in NA. More precisely, increases in NA (since previous measurement) that were associated with rumination were smaller the higher both mindfulness facets were. We probed these interaction effects (Preacher et al., 2006) and exemplarily illustrated the interaction effect for nonjudgmental acceptance (Figure 1). For nonjudgmental acceptance, all three depicted simple slopes (from one SD below to one SD

above the mean of nonjudgmental acceptance) reached significance (simple intercept/slope at lower levels of nonjudgmental acceptance: 1.52/ 0.24; at medium levels: 1.36/0.20; at higher levels: 1.19/0.17; p_{slope}<.01 for all slopes. For present-moment attention, all three simple slopes reached significance as well (simple intercept/slope at lower levels of present-moment attention: 1.43/ 0.25; at medium levels: 1.36/0.20; at higher levels: 1.28/0.16; p_{slope}<.01 for all slopes). This means that even at lower levels of mindfulness, increases in NA associated with rumination were smaller the higher mindfulness facets were. This also indicates that even at higher levels of mindfulness, rumination remained a significant predictor of increases in NA.

Interaction effects of mindfulness facets and rumination in the prediction of change in PA. Present-moment attention and rumination did not significantly interact in the prediction of change in PA. However, consistent with our hypothesis, nonjudgmental acceptance did. That is, paralleling the effects in NA, decreases in PA that were associated with rumination were smaller when nonjudgmental acceptance was higher. Simple slope analyses showed that all three simple slopes (from one *SD* below to one *SD* above the mean of nonjudgmental acceptance) reached significance (simple intercept/slope at lower levels of nonjudgmental acceptance: 3.17/ -0.15, p_{slope}<.01; at medium levels: 3.28/-0.11, p_{slope} <.01; at higher levels: 3.38/-0.06; p_{slope}=.02). This means that decreases in PA (since previous measurement) that were associated with rumination were smaller when nonjudgmental acceptance was higher. Again, this also indicates that rumination significantly predicted decreases in PA, despite high levels of nonjudgmental acceptance.

Present-Moment Attention, Nonjudgmental Acceptance, and Reflection.

Associations of mindfulness facets with reflection. As shown in Table 2 (upper half, right panel), present-moment attention was associated with reflection above and beyond the effect of nonjudgmental acceptance, accounting for 4% unique variance. Nonjudgmental acceptance was nonsignificant in the combined model (see the simple models in Table S1 in

the supplement for comparison), accounting for only 1% unique variance. Both predictors together explained 7% of the variance in reflection (2% shared).

The interaction of mindfulness facets and reflection in the prediction of change in affect. The results of these analyses are reported in Table 4 (upper half; see Table S2 in the supplement for random effects). As we did in the context of rumination, we first examined the associations between reflection and affect. Reflection was associated with less NA (estimate = -0.06, $SE = 0.02$, p < .01, pseudo-R^2 = 4%) and more PA (estimate = 0.18, $SE = 0.03$, $p < .01$, pseudo-R^2 = 7%).

Interaction effects of mindfulness facets and reflection in the prediction of change in NA. Neither mindfulness facet interacted with reflection in the hypothesized fashion. Instead, in the combined model, reflection and nonjudgmental acceptance interacted in such a way that at higher levels of nonjudgmental acceptance, the decrease in NA associated with reflection was lower than at lower levels of nonjudgmental acceptance (see simple models in Table S2 in the supplement as a comparison). The interaction effect for nonjudgmental acceptance is depicted in Figure 2. Only the slope at lower levels (one *SD* below the mean) of nonjudgmental acceptance was significant (simple intercept/ slope: 1.62/-0.06, p_{slope}=.02) indicating that reflection contributed to declines in NA at lower levels of nonjudgmental acceptance, but not at average (1.38/-0.03, p_{slope}=.14) or at higher levels (1.14/0.01, p_{slope}=.78). At the same time, higher nonjudgmental acceptance was associated with more decline in NA regardless of reflection.

Interaction effects of mindfulness facets and reflection in the prediction of change in PA. Neither mindfulness facet interacted with reflection in the prediction of change in PA (see Table S2 in the supplement for simple models).

Discussion

Our results showed that facets of mindfulness were differentially associated with rumination and reflection at the within-person level. Specifically, nonjudgmental acceptance

was more strongly related to less rumination, whereas present-moment attention was more strongly related to more reflection. The results also support the interaction effects of mindfulness with emotion regulation that we expected to find in this study. Both mindfulness facets interacted with rumination in predicting changes in affective well-being: at higher levels of mindfulness, rumination was less strongly associated with decrements in affective well-being from one measurement occasion to the next. For nonjudgmental acceptance, this was consistent across PA and NA, for present-moment attention this was only the case for NA. We interpret these results as pointing to the importance of both mindfulness facets in reducing rumination and in reducing the impact that rumination has on changes in affective well-being. However, as is the case for all interaction effects, it is a matter of interpretation as to which variable is considered to moderate the other. Our results could also be interpreted such that rumination moderates the association between mindfulness and changes in affective well-being. Seen in this way, the association between mindfulness and changes in affect may be rather low on occasions when individuals are low in rumination.

Neither nonjudgmental acceptance nor present-moment attention interacted with reflection in the hypothesized way. Instead, only at lower levels of nonjudgmental acceptance was the decrease in NA associated with reflection lower. It is our interpretation that, although present-moment attention was related to reflection, mindfulness facets may not further boost the effect of reflection on affective well-being. Instead, during moments of medium or higher nonjudgmental acceptance, reflection does not seem to additionally reduce NA. Again, viewed from a different angle, it could be concluded that while mindfulness was associated with higher levels of reflection, and while both mindfulness and reflection were associated with decreases in NA across measurement occasions, at higher levels of either a mindful attitude or higher levels of reflection, the additional benefit of the respective other construct seems to be rather small.

As our data is correlational, we cannot make any causal claims. We discuss these issues in more depth in the General Discussion. To test the robustness of our findings, we used data from a second study as we describe in the following.

Study 2

The goal of using data from this second study was to conceptually replicate the results obtained in Study 1. This study is part of a longitudinal project (Siebert, Blanke, & Brose, 2017). Even though we did not find interaction effects between mindfulness and reflection in the prediction of changes in affect in Study 1, we still tested these associations to see whether the pattern found in Study 1 replicated to the present study.[4]

Method

Participants. The participants in this study came from the innovation sample of the German Socio-Economic Panel (SOEP-IS). The SOEP-IS is a longitudinal survey in which participants are visited yearly in their private households in Germany (Richter & Schupp, 2015). The target sample size was $N = 180$ adults (for details, see Siebert et al., 2017); the final sample was $N = 179$ ($n = 94$ female; age range between 38 and 61 years, $M_{age} = 50.93$, $SD_{age} = 5.76$ years) as one participant did not meet the inclusion criteria. Of the 179 participants, 171 indicated that their nationality was German, the other eight reported various other nationalities. However, since participants were visited by the interviewers in person, it was ensured that all participants understood the materials.

Procedure. Participants were visited at their homes by interviewers from the Humboldt-Universität zu Berlin to give informed consent to participate, fill out questionnaires, and receive smartphones (Huawei Ascend G33). As in Study 1, the ESM phase started the following day. The ESM program was the same as in Study 1. However, it was programmed in such a way that the ESM phase included three assessment phases of four sampling days, which were followed by four pausing days. Up to two additional days were added to the ESM schedule if participants missed more than one assessment a day (leaving

only two pausing days). Participants received 20 Euros for the session, 60 Euros for

participation in the ESM phase, and a bonus of 10 Euros if they completed 60 ESM beeps or

more. On average, participants answered 69.33 beeps ($SD = 7.59$, range: 30–85).

Measures. All items were rated on 7-point-scales ranging from 0 *(does not apply at*

all) to 6 *(applies strongly).* Descriptive information including ICCs and reliability is depicted

in Table 1, lower half.

Mindfulness. Present-moment attention and nonjudgmental acceptance were assessed

with one item each adapted from the MSMQ. The item measuring present-moment attention

was: *I opened myself up to what was happening (e.g., a meal, conversation, music).* The item

measuring nonjudgmental acceptance was: *Things went through my mind that I should not*

really be engaging myself with (reversely coded).

Emotion regulation strategies. Rumination and reflection were measured with one

item each. The items were introduced in the following way: *Think about the most unpleasant*

or stressful things / feelings you have had since you woke up (for the first measurement

occasion on a given day) / since the last beep (for all other). How did you handle them? The

item for rumination was: *I could not stop thinking about it;* the item for reflection was: *I*

thought about it in a calm and relaxed fashion.

Affective well-being. Momentary PA and NA were assessed with six items each (see

Blanke et al., 2019). However, to stay closer to Study 1, only items that were the same or

similar to those used in Study 1 were included in our analyses: nervous, downhearted, and

distressed for NA, and happy, relaxed, and content for PA.

Data Analysis

The data analytic procedures in Study 2 were identical of that in Study 1.

Results

Present-Moment Attention, Nonjudgmental Acceptance, And Rumination.

Associations of mindfulness facets with rumination. We replicated the effect from Study 1 that timespans in which individuals reported more present-moment attention and more nonjudgmental acceptance were also timespans in which they reported less rumination (Table 2, lower half, left panel). Present-moment attention accounted for 2% of the unique within-person variance in rumination, nonjudgmental acceptance 15%. Both variables together accounted for 19% (2% shared).

Interaction effects of mindfulness facets and rumination in the prediction of change in affect. Results from the interaction analyses are depicted in Table 3 (lower half; see Table S2 in the supplement for random effects). We first again replicated the associations of the emotion regulation strategies with affect. In line with Study 1, rumination was associated with more NA (estimate = 0.23, *SE* = 0.01, *p* < .01, pseudo-R^2 = 23%) and less PA (estimate = -0.19, *SE* = 0.01, *p* < .01, pseudo-R^2 = 13%).

Interaction effects of mindfulness facets and rumination in the prediction of change in NA. As expected and in line with results from Study 1, both mindfulness facets significantly interacted with rumination in the prediction of change in NA at the within-person level. Increases in NA that were associated with rumination were smaller the higher both mindfulness facets were. We again probed the interactions and for both present-moment attention and nonjudgmental acceptance, all three slopes (mean levels and 1 *SD* above/below the mean) were significant (p_{slope}<.01). Simple intercepts/slopes for attention were: at lower levels: 1.08/0.20; at medium levels: 1.01/0.18; at higher levels: 0.94/0.16. Simple intercepts/slopes for acceptance were: at lower levels: 1.13/0.22; at medium levels: 1.01/0.18; at higher levels: 0.89/0.15. This again indicates that increases in NA (since the previous measurement) that were associated with rumination were smaller the higher both mindfulness facets were, even when mindfulness levels were lower than usual. It also indicates that even at higher levels of mindfulness, there was still an increase in NA that was associated with rumination.

Interaction effects of mindfulness facets and rumination in the prediction of change in PA. In contrast to Study 1, present-moment attention significantly interacted with rumination in the prediction of change in PA, whereas nonjudgmental acceptance did not. Decreases in PA that were associated with rumination were smaller when present-moment attention was higher. We again probed the interactions, and all simple slopes tested were significant (p_{slope}<.01; simple intercepts/slopes for attention at lower levels: 3.17/-0.18; at medium levels: 3.34/-0.16; at higher levels: 3.50/-0.13). This indicates that decreases in PA associated with rumination were smaller when present-moment attention was higher, even when present-moment attention was lower than usual. It also indicates that even at higher levels of present-moment attention, rumination was still associated with decreases in PA.

Present-Moment Attention, Nonjudgmental Acceptance, and Reflection.

Associations of mindfulness facets with reflection. As in Study 1, present-moment attention was associated with reflection above and beyond the effect of nonjudgmental acceptance, accounting for 3% unique variance. Nonjudgmental acceptance had no significant fixed effect (Table 2, lower half, right panel), accounting for only 2% unique variance. Both predictors together accounted for 6% of the variance in reflection (1% shared).

Interaction effects of mindfulness facets and reflection in the prediction of change in affect. Reflection was associated with less NA (estimate = -0.05, *SE* = 0.01, *p* < .01, pseudo-R^2 = 7%) and more PA (estimate = 0.11, *SE* = 0.01, *p* < .01, pseudo-R^2 = 7%). Results from the interaction analyses are displayed in Table 4 (lower half; see Table S2 in the supplement for random effects).

Interaction effect of mindfulness facets and reflection in the prediction of changes in NA. Present-moment attention did not interact with reflection in the prediction of change in NA. However, as in Study 1, nonjudgmental acceptance and reflection interacted in such a way that, at higher levels of nonjudgmental acceptance, the decrease in NA associated with reflection was lower than at lower levels of nonjudgmental acceptance.

Simple slope analyses revealed that the slopes at medium levels (simple intercept/slope: 1.03/-0.04, p_{slope}<.01) and at lower levels of nonjudgmental acceptance (1.23/-0.06, p_{slope}<.01), were significant, whereas the slope of reflection at higher levels of nonjudgmental acceptance was nonsignificant (0.83/-0.02, p_{slope} = .09). That is, reflection contributed to declines in NA at average and below average levels of nonjudgmental acceptance, but not at higher levels. At the same time, higher nonjudgmental acceptance was associated with more decline in NA regardless of reflection

Interaction effects of mindfulness facets and reflection in the prediction of changes in PA. As in Study 1, present-moment attention also did not interact with reflection in the prediction of change in PA. However, nonjudgmental acceptance and reflection interacted in such a way that, at higher levels of nonjudgmental acceptance, the increase in PA associated with reflection was lower than at lower levels of nonjudgmental acceptance. Simple slope analyses showed that this was the case for all slopes tested (at lower levels: 3.21/0.12; at medium levels: 3.33/0.10; at higher levels: 3.45/0.08; all p_{slope}<.01). That is, reflection contributed to change in PA even at higher levels of nonjudgmental acceptance. According to the region of significance of the simple slope analysis, nonjudgmental acceptance would need to be more than two *SD*s above the mean to nullify the association between reflection and PA. At the same time, higher levels of nonjudgmental acceptance were associated with higher increases in PA.

Discussion

The results from Study 2, in which we investigated a larger, older, and more diverse sample, were very similar to those obtained in Study 1. As in Study 1, nonjudgmental acceptance was more strongly related to less rumination, whereas present-moment attention was more strongly related to more reflection. Again, both mindfulness facets interacted with rumination in the prediction of changes in affective well-being in a way which we interpret as a buffering effect. In contrast to Study 1, present-moment attention interacted with rumination

regarding both changes in PA and NA – the negative association between rumination and affective well-being was smaller at higher levels of attention. Nonjudgmental acceptance only interacted with rumination in the prediction of change in NA. In this study, nonjudgmental acceptance interacted with reflection not only in the prediction of change in NA (as in Study 1), but also of change in PA. Specifically, moments with higher levels of nonjudgmental acceptance were moments in which decreases in NA/ increases in PA associated with reflection were lower. This gives further reason to suggest that during moments in which individuals are highly accepting, they do not additionally profit much from reflection (or the other way around).

General Discussion

The two present ESM studies give insights into within-person relationships between the core facets of mindfulness (present-moment attention and nonjudgmental acceptance), two emotion regulation strategies (rumination and reflection), and two dimensions of affective well-being (positive and negative affect) in everyday life. The findings largely converge across studies. Both state mindfulness facets were associated with more adaptive emotion regulation (less rumination, more reflection), and interacted with the emotion regulation strategies in the prediction of the changes in affective well-being.

State Mindfulness Facets are Associated with More Adaptive Emotion Regulation

Both state mindfulness facets were associated with a more adaptive way of regulating emotions at the within-person level, characterized by lower concurrent rumination and higher reflection. The strongest association was found between nonjudgmental acceptance and less concurrent rumination, which is in line with previous research at the trait level (e.g., Jha, Krompinger, & Baime, 2007; Ramel et al., 2004; Shapiro et al., 2008). We think that the within-person associations might be explained by the following bidirectional processes: Negative evaluations, which can be seen as the basis for ruminative thoughts (Rude et al., 2007), are reduced by being in a nonjudgmental state, where thoughts, feelings or sensations

are accepted as they are (Frewen et al., 2008). Therefore, nonjudgmental acceptance could help to stem further rumination. The second mindfulness facet, present-moment attention, was also related to less concurrent rumination. However, it accounted only for a small amount of additional variance beyond nonjudgmental acceptance (most of the explanative variance of attention was shared with acceptance). We suggest that in a state of present-moment attention, most attentional capacity is used for perceiving what is happening in that moment, leaving little capacity for ruminative thoughts. The ability to actively direct one's attention, inherent in present-moment attention, may thus help individuals to disengage from ruminative thoughts and from repetitively and passively letting thoughts circle around the same topic (Segal, Williams, & Teasdale, 2002, as cited in Nolen-Hoeksema et al., 2008).

Furthermore, there was a positive association between present-moment attention and reflection, which we interpret in two ways. First, we suggest that the same ability inherent in present-moment attention (i.e., active attention deployment), which supposedly helps individuals to disengage from unwanted ruminative thoughts, can also facilitate directing attention deliberately to reflective thoughts. In this case, present-moment attention and reflection may happen simultaneously: One may reflect in a mindful way, actively deploying one's attention to one's current thoughts. Second, we suggest that both can happen consecutively: Directing one's attention to the present moment, perceiving more aspects of an (inner) situation can inspire an individual to further reflect upon the newly gained impressions after they occurred. There was no strong theoretical background linking nonjudgmental acceptance and reflection, and indeed, acceptance did not explain variance above and beyond attention.

Of note, even though the association between mindfulness and reflection at the within-person level was positive in the current study, there are opposing theoretical positions on their assumed association as well as ambiguous results from previous correlational studies at the trait level (e.g., Feldman et al., 2007; Lau et al., 2006). We believe that differentiating

between the two mindfulness facets helps to better understand that the attentional focus of mindfulness may be most associated with (and, we suggest, potentially foster) reflection at the state level.

State Mindfulness Facets Partly Interact with Emotion Regulation in the Prediction of Changes in Affective-Well-being

Apart from the associations between mindfulness and adaptive emotion regulation, the mindfulness facets also interacted with rumination in the prediction of changes in affective well-being at the within-person level. We interpret these interactions as potentially indicating buffering effects — in the presence of high levels of mindfulness, the *deleterious* effect of rumination on negative affect is reduced. Similarly, albeit somewhat less consistently (only nonjudgmental acceptance in Study 1, only present-moment attention in Study 2), mindfulness could be interpreted as a buffer against the negative association between rumination and positive affect. This is in line with previous research at the trait level, as the negative association between rumination and affective well-being has been replicated repeatedly (Aldao, Nolen-Hoeksema, & Schweizer, 2010). The evaluative aspect in rumination in particular was shown to contribute to negative mood (Rude et al., 2007; Watkins, 2004). But not only does rumination seem to foster negative affect; negative affectivity also seems to enhance ruminative thoughts, leading into a negative spiral (see Moberly & Watkins, 2008). Active attentional control, as promoted through present-moment attention, may inhibit passively and uncontrollably processing negative ruminative thoughts and the further activation of negative associative networks, which would otherwise promote negative mood (Segal et al., 2002, as cited in Nolen-Hoeksema et al., 2008). Being in a state of mindfulness may thus disrupt ruminative thoughts and withdraw its evaluative basis for the negative spiral inherent in rumination. However, as noted before, our results could also derive from mindfulness being more strongly associated with changes in affective well-being at higher levels of rumination (i.e., rumination could moderate the association between

mindfulness and well-being). Rumination itself could be viewed as indicating stress, as it is associated with higher levels of negative affect and lower levels of positive affect. Hence, our findings could also be interpreted as an indication that mindfulness is especially helpful in times of stress. The present analysis does not allow for a conclusive interpretation regarding the directionality of the interaction effect.

We also explored the link between mindfulness, reflection, and affective well-being. The interaction analyses revealed that nonjudgmental acceptance interacted with reflection in the prediction of changes in affective well-being in an unexpected fashion: When individuals showed higher nonjudgmental acceptance, reflection was no longer associated with changes in affective well-being. However, when nonjudgmental acceptance was lower, reflection was associated with less decrease in negative and higher increase in positive affect. A similar trend occurred for present-moment attention. We interpret this finding as indicating that when individuals reported higher levels of mindfulness, reflection was of little additional value as a strategy. This may occur because levels of positive affect are already relatively high when individuals are mindful, and levels of negative affect are relatively low. It could also be the other way around: At higher levels of reflection, mindfulness may not be as helpful. Either way, the respective constructs do not seem to boost each other and the additional benefit of the other construct seems to be small. It is of note, that in line with previous research (Schroevers & Bradsma, 2010), mindfulness facets were associated with changes in positive and negative affect, indicating that a mindful state was associated with higher increases in well-being from one timepoint to the next. That is, mindfulness not only interacted with emotion regulation, but was independently positively associated with changes in affective well-being.

In the present studies, our participants were assessed in daily life, making it possible to investigate emotion regulation and mindfulness across a wide variety of different contexts. This speaks to the generalizability of our findings and suggests that emotion regulation and

mindfulness are related and interact in the prediction of affective well-being across a variety of contexts, which likely contain many diverse features. In addition, our findings could also be viewed as providing more evidence for the context-dependency of emotion regulation. It is argued that emotion regulation strategies are not adaptive or maladaptive per se, but their adaptiveness depends on environmental and subjective factors such as goals (Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013). For example, Haines et al. (2016) showed that reappraisal, a putatively adaptive strategy, is not adaptive when individuals perceive a situation as controllable. Thus cognitive appraisals are a contextual factor that can modify the adaptiveness of emotion regulation strategies; mindfulness could operate in a similar fashion. In situations, in which individuals were more mindful than usual, rumination was not as maladaptive and reflection was not as adaptive as when individuals were less mindful than usual.

Strengths, Limitations, and Future Directions

One strength of this study is that we conceptually replicated associations between mindfulness facets, emotion regulation strategies, and everyday affect in two studies with substantially different sample characteristics. One sample consisted of university students form the Berlin area; the other sample consisted of middle-aged adults from all over Germany. Moreover, we used data from intensive longitudinal studies with many measurement occasions to uncover within-person associations. Finally, the focal constructs were operationalized slightly differently across studies, but the results were strikingly similar across both studies. In particular, we think that the interaction between mindfulness and rumination is a finding that can be relevant for clinical studies. Thus, replicating the study with a sample of individuals with depression and including an intervention would be highly desirable and could provide promising insights for treating depression.

On the side of the limitations, it should be noted that the temporal order between mindfulness and emotion regulation remains unclear since both were measured by asking

participants to describe their behavior since the last measurement occasions. That is, we measured mindfulness and emotion regulation (and in Study 1 affect) during timespans instead of the exact moment at which participants were paged to avoid missing important information on the participants' states between measurements (thus we only approach the measurement of states in a narrow sense). We considered the temporal order of affect, however, by including affect at t-1 in our models. Hence, in these models additional variables (emotion regulation and mindfulness) predicted residualized change in affect from t-1 to t.

Relatedly, we examined whether mindfulness interacts with emotion regulation strategies in the prediction of changes in affective well-being. Others, however, have hypothesized that emotion regulation mediates associations between mindfulness facets and affect (e.g., Finkelstein-Fox et al., 2018; Garland, Gaylord, & Frederickson, 2011). This possibility should be followed up in future studies, potentially with experimental manipulations or shorter timespans between measurement occasions such that mediating effects become detectable. Also, related to the measurement of constructs in this study, while our ESM measures are in line with previous ways to measure these constructs, the lack of construct-validated measurement instruments for affect and emotion regulation for ESM research poses a problem in itself (Brose, Schmiedek, Gerstorf, & Voelkle, 2018). Furthermore, this study's focus on two emotion regulation strategies, rumination and reflection, emerged because both entail the deployment of attention towards mental processes. Yet, mindfulness is likely to be related to other emotion regulation strategies as well, for example, increased cognitive reappraisal (e.g., Garland et al., 2011). Therefore, further analyses of how mindfulness facets relate to different strategies would be desirable.

Lastly, our focus on higher levels of positive and lower levels of negative affect as indicators of affective well-being represents a simplified view on the subject. For one, we did not investigate individual's motives or goals to regulate their emotions. Although individual's motivation to regulate their emotions is usually pro-hedonic, there are occasions at which

individuals, for example, want to maintain negative affect (Riediger et al., 2009). Second, there is also research showing that not only the absolute level of positive and negative affect is important for well-being, but also the diversity of the emotional experiences, termed emodiversity (e.g., Quoidbach et al., 2014), and the differentiation of emotional experiences, termed emotion differentiation (Erbas et al., 2018).

Conclusion

The highly converging results from both presented ESM studies with two different samples contribute to a better understanding of how mindfulness relates to emotion regulation and affective well-being in daily live. The two studied facets of state mindfulness, present-moment attention and especially nonjudgmental acceptance, were associated with less rumination; present-moment attention was also associated with more concurrent reflection. Even if rumination occurred, mindfulness interacted with rumination in the prediction of changes in affective well-being. We interpret these findings as indicating that mindfulness buffered the detrimental effects of rumination on affective well-being. We thus propose that being in a mindful state may not only make rumination less likely, it may also reduce its impact. However, at higher levels of nonjudgmental acceptance reflection was not associated with further improvement of affect. A possible interpretation is that mindfulness may be particularly helpful in buffering the effect of maladaptive emotion regulation. Taken together, we suggest that mindfulness is a beneficial state for regulating emotions effectively in daily life. Moving forward, it would be highly desirable for future studies to identify the causal ordering between mindfulness, emotion regulation, and affect.

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Footnotes

[1] We use the term emotion regulation here, which is a broader term that not only pertains to the regulation of negative emotions or stress (coping), but also, for example, the regulation of positive emotions (Gross, 1998).

[2] While there are diverging definitions of rumination and reflection (see Nolen-Hoeksema et al., 2008), we used these definitions in line with Brans et al. (2013) who were among the first to investigate emotion regulation strategy use in daily life. In this conceptualization, reflection is not understood as a subcomponent of rumination (see Treynor et al., 2003), but reflection is a strategy at the same conceptual level as rumination (Trapnell & Campbell, 1999).

[3] In a previous publication (Blanke et al., 2019), we also reported within-person reliabilities of the measures, yet based on a different estimation procedure (Cranford et al., 2006). We decided to change our approach since Geldhof and colleagues (2014) make a compelling case for using ω as a measure of composite reliability (i.e., it acknowledges that item-construct relations can be heterogeneous and is thus based on factor loadings). Within-person reliabilities reported here are each based on two-factor models. The two-factor model for rumination and reflection only had two indicators for each strategy. These had to be restricted such that both indicators for each strategy/factor had the same loading to achieve identification of the model. The estimated reliabilities were comparable to estimates obtained with the method proposed by Cranford and colleagues.

[4] We pre-registered our initial approach of analysis (osf.io/dvyjx). To address comments made in the review process, we additionally included combined models and controlled for the lagged affect in the moderation models. We report the results of the pre-registered analyses in the supplement (Tables S1 and S3).

Table 1
Descriptive Information

	iM (SD)	iSD (SD)	ICC	Within-person reliability (ω)
Study 1				
Attention	3.88 (0.66)	0.94 (0.27)	0.30	0.72
Acceptance	4.30 (0.93)	1.02 (0.37)	0.42	0.65
Rumination	1.80 (0.95)	1.10 (0.39)	0.39	0.67
Reflection	2.49 (0.88)	1.02 (0.30)	0.40	0.62
Positive affect	3.26 (0.77)	0.98 (0.30)	0.36	0.77
Negative affect	1.40 (0.90)	0.84 (0.31)	0.49	0.67
Study 2				
Attention	3.79 (1.21)	1.22 (0.52)	0.45	-
Acceptance	4.52 (1.13)	1.17 (0.54)	0.43	-
Rumination	1.47 (0.94)	1.31 (0.48)	0.30	-
Reflection	2.91 (1.31)	1.32 (0.52)	0.46	-
Positive affect	3.32 (0.79)	1.00 (0.36)	0.35	0.73
Negative affect	1.04 (0.88)	0.83 (0.38)	0.48	0.72

Notes. iM = aggregated means; SD = standard deviation; iSD = within-person standard deviation; ICC = intra-class correlation; Attention = present-moment attention; Acceptance = nonjudgmental acceptance. Within-person reliabilities were estimated according to Geldhof et al., 2014.

Table 2

Fixed Effect Estimates from the Multilevel Models: Prediction of Rumination and Reflection Through Present-moment Attention and Nonjudgmental Acceptance

	Outcome					
	Rumination			Reflection		
	Estimate (*SE*)	95% CI	Unique Pseudo-R^2	Estimate (*SE*)	95% CI	Unique Pseudo-R^2
Study 1						
Fixed effects						
Intercept	1.80 (0.11)**	[1.57; 2.02]		2.48 (0.10)**	[2.27; 2.69]	
Attention	-0.10 (0.03)**	[-0.16; -0.05]	0.03	0.19 (0.03)**	[0.13; 0.24]	0.04
Acceptance	-0.35 (0.02)**	[-0.40; -0.30]	0.12	0.02 (0.02)	[-0.03; 0.06]	0.01
Full model Pseudo-R^2		0.22			0.07	
Study 2						
Fixed effects						
Intercept	1.47 (0.07)**	[1.33; 1.61]		2.91 (0.10)**	[2.72; 3.10]	
Attention	-0.08 (0.01)**	[-0.11; -0.06]	0.02	0.10 (0.02)**	[0.07; 0.14]	0.03
Acceptance	-0.38 (0.02)**	[-0.41; -0.34]	0.15	-0.01 (0.02)	[-0.04; 0.03]	0.02
Full model Pseudo-R^2		0.19			0.06	

Notes. Estimates are unstandardized coefficients. *SE* = standard error of the estimate; Attention = present-moment attention; Acceptance = nonjudgmental acceptance. Random effects are not depicted but were part of the model. See Table 1 in the supplementary materials.

** *p* <.01.

Table 3

Estimates from the Multilevel Interaction Models: Interaction Effects of Present-moment Attention and Nonjudgmental Acceptance with Rumination on Residualized Change in Affect

	Outcomes			
	NA		PA	
	Estimate (*SE*)	95% CI	Estimate (*SE*)	95% CI
Study 1				
Fixed effects				
Intercept	1.36 (0.11)**	[1.15; 1.57]	3.28 (0.09)**	[3.10; 3.46]
Affect t-1	0.23 (0.03)**	[0.18; 0.28]	0.26 (0.02)**	[0.21; 0.31]
Rumination	0.20 (0.02)**	[0.17; 0.24]	-0.11 (0.02)**	[-0.15; -0.07]
Attention	-0.08 (0.02)**	[-0.12; -0.04]	0.28 (0.03)**	[0.22; 0.33]
Acceptance	-0.17 (0.02)**	[-0.20; -0.13]	0.11 (0.02)**	[0.07; 0.15]
Rumination x Attention	-0.05 (0.02)**	[-0.09; -0.02]	-0.01 (0.01)	[-0.03; 0.02]
Rumination x Acceptance	-0.04 (0.01)**	[-0.06; -0.01]	0.05 (0.02)**	[0.02; 0.08]
Full model Pseudo-R^2	0.43		0.34	
Study 2				
Fixed effects				
Intercept	1.01 (0.06)**	[0.88; 1.14]	3.34 (0.06)**	[3.22; 3.45]
Affect t-1	0.23 (0.02)**	[0.20; 0.26]	0.26 (0.01)**	[0.23; 0.28]
Rumination	0.18 (0.01)**	[0.16; 0.20]	-0.16 (0.01)**	[-0.18; -0.14]
Attention	-0.06 (0.01)**	[-0.08; -0.05]	0.14 (0.01)**	[0.12; 0.16]
Acceptance	-0.11 (0.01)**	[-0.13; -0.09]	0.06 (0.01)**	[0.03; 0.08]
Rumination x Attention	-0.02 (0.01)**	[-0.03; -0.01]	0.02 (0.01)**	[0.01; 0.04]
Rumination x Acceptance	-0.03 (<0.01)**	[-0.04; -0.02]	0.01 (0.01)	[<0.01; 0.02]
Full model Pseudo-R^2	0.41		0.28	

Notes. Estimates are unstandardized coefficients. *SE* = standard error of the estimate; NA = negative affect; PA = positive affect; Attention = present-moment attention; Acceptance = nonjudgmental acceptance. Random effects are not depicted but were part of the model, see left panel of Table S2 in the supplementary materials, Study 1c) and Study 2c). The following random effects could not be modeled as the model did not

converge: Rumination x Attention predicting PA in Study 1; Rumination x Acceptance predicting NA in Study 2. ** *p* <.01.

Table 4

Estimates from the Multilevel Interaction Models: Interaction Effects of Present-moment Attention and Nonjudgmental Acceptance with Reflection on Residualized Change in Affect

	Outcomes			
	NA		PA	
	Estimate (*SE*)	95% CI	Estimate (*SE*)	95% CI
Study 1				
Fixed effects				
Intercept	1.38 (0.11)**	[1.17; 1.59]	3.27 (0.09)**	[3.08; 3.45]
Affect t-1	0.26 (0.02)**	[0.21; 0.31]	0.26 (0.02)**	[0.22; 0.31]
Reflection	-0.03 (0.02)	[-0.06; 0.01]	0.13 (0.02)**	[0.09; 0.17]
Attention	-0.12 (0.02)**	[-0.16; -0.07]	0.26 (0.03)**	[0.21; 0.31]
Acceptance	-0.25 (0.02)**	[-0.29; -0.20]	0.15 (0.02)**	[0.11; 0.19]
Reflection x Attention	<0.01 (0.01)	[-0.03; 0.03]	-0.02 (0.02)	[-0.05; 0.01]
Reflection x Acceptance	0.03 (0.02)*	[<0.01; 0.06]	-0.03 (0.02)	[-0.07; 0.01]
Full model Pseudo-R^2	0.36		0.35	
Study 2				
Fixed effects				
Intercept	1.03 (0.07)**	[0.90; 1.15]	3.33 (0.06)**	[3.21; 3.45]
Affect t-1	0.25 (0.02)**	[0.21; 0.28]	0.26 (0.01)**	[0.24; 0.29]
Reflection	-0.04 (0.01)**	[-0.06; -0.01]	0.10 (0.01)**	[0.08; 0.12]
Attention	-0.07 (0.01)**	[-0.09; -0.06]	0.14 (0.01)**	[0.12; 0.17]
Acceptance	-0.18 (0.01)**	[-0.21; -0.15]	0.11 (0.01)**	[0.08; 0.13]
Reflection x Attention	<0.01 (0.01)	[-0.01; 0.01]	-0.01 (0.01)	[-0.02; 0.01]
Reflection x Acceptance	0.02 (0.01)*	[<0.01; 0.03]	-0.02 (0.01)**	[-0.03; -0.01]
Full model Pseudo-R^2	0.37		0.27	

Notes. Estimates are unstandardized coefficients. *SE* = standard error of the estimate; NA = negative affect; PA = positive affect; Attention = present-moment attention; Acceptance = nonjudgmental acceptance. Random effects are not depicted but were part of the model, see right panel of Table S2 in the supplementary materials, Study 1c) and Study 2c).The random effect Reflection x Attention in predicting NA and PA in Study 1 could not be modeled as the models did not converge. **p <.01, * p <.05.
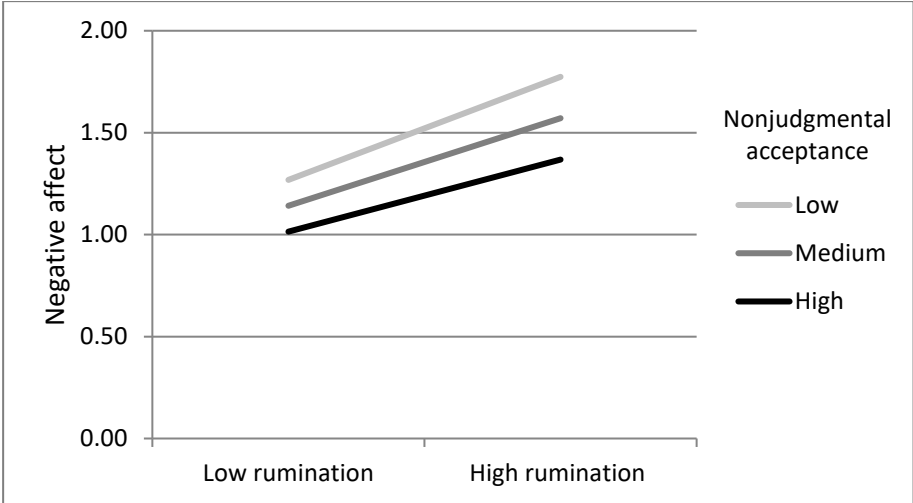
Figure 1. Study 1: Interaction effect of nonjudgmental acceptance and rumination on residualized change in negative affect. The model also includes present-moment attention, its interaction with rumination, and affect at t-1 as predictors. The graph presents predicted values in NA for timespans with rumination 1 *SD* below and above the within-person average, as well as the deviations from this association when nonjudgmental acceptance was above and below average (+ / - 1 *SD* above / below the within-person average).
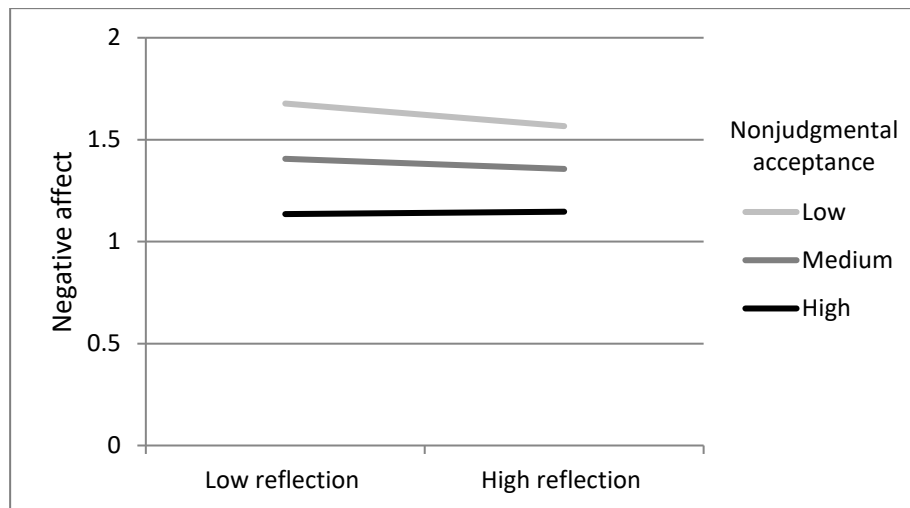
Figure 2. Study 1: Interaction effect of nonjudgmental acceptance and reflection on residualized change in negative affect. The model also includes present-moment attention, its interaction with reflection, and affect at t-1 as predictors. The graph presents predicted values in NA for timespans with reflection 1 *SD* below and above the within-person average, as well as the deviations from this association when nonjudgmental acceptance was above and below average (+ / - 1 *SD* above / below the within-person average).