

# An Experience Sampling Study Examining the Potential Impact of a Mindfulness-Based Intervention on Emotion Differentiation

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Research has shown that how well people can differentiate between different emotional states is an essential requirement for adaptive emotion regulation. People with low levels of emotion differentiation tend to be more vulnerable to develop emotional disorders. Although we know quite a lot about the correlates of emotion differentiation, research on factors or interventions which could improve emotion differentiation skills is scarce. Here, we hypothesize, and study empirically, whether a mindfulness-based intervention (MBI) may impact the differentiation of negative and positive emotions. A within-subjects pre-, post-, and follow-up design involving experience sampling was used. At each phase participants reported their current emotions and mindfulness skills up to 40 times across 4 consecutive days using smartphones. Multilevel modeling showed a significant improvement in negative emotion differentiation postintervention and at 4 months of follow-up, and a significant improvement in positive emotion differentiation at 4 months follow-up. The improvement in negative emotion differentiation, however, was no longer significant when controlling for levels of negative affect. A time-lagged mediation model showed that posttreatment changes in mindfulness skills mediated subsequent changes in negative emotion differentiation, also when controlling for levels of negative affect. These results suggest that MBI is a promising approach to improve people's emotion differentiation skills.

*Keywords:* emotion, emotion differentiation, mindfulness, mindfulness-based intervention, experience sampling

Emotion differentiation or emotional granularity refers to an individual's ability to distinguish between different forms of affective experience (Barrett, Gross, Christensen, & Benvenuto, 2001). Individuals scoring high on emotion differentiation label

their emotions in a differentiated, specific, and context-dependent way. They have the ability to clearly distinguish different emotions of the same valence. For instance, a high differentiator may report feeling sad on one occasion and feeling angry on a next occasion. Conversely, individuals scoring low on emotion differentiation have difficulties disentangling emotions of the same valence and tend to have less specific emotional experiences. For instance, a low differentiator may report feeling both sad and angry on different occasion across different contexts. Moreover, difficulties differentiating between similarly valenced emotions go hand in hand with perceiving larger differences between differently valenced emotions (Barrett, 1998; Erbas, Ceulemans, Koval, & Kuppens, 2015). As such, low differentiators have very polarized, bifurcative experiences that are either positive or negative, without differentiating much within such negative or such positive experiences.

This differentiating between emotions is subject to individual differences and is, based on correlational studies, related to (vulnerability for) psychopathology. Individuals with clinical disorders associated with affective problems, such as major depressive disorder (Demiralp et al., 2012), social anxiety disorder (Kashdan & Farmer, 2014), and borderline personality disorder (Suvak et al., 2011) show lower levels of negative emotion differentiation compared to healthy individuals. Also in healthy individuals, the level

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of emotion differentiation is related to traits such as self-esteem and neuroticism (Erbas, Ceulemans, Lee Pe, Koval, & Kuppens, 2014; Kashdan et al., 2014).

Being able to carefully perceive and distinguish the rich complexity in emotional experiences is a key component of psychological interventions in psychotherapy (Kashdan, Barrett, & McKnight, 2015). People's emotion differentiation skill helps transforming negative emotions and stressful experiences, and is an essential component of the emotion regulation process. Research shows that individuals who experience their emotions with more granularity are less likely to resort to maladaptive self-regulatory strategies such as excessive alcohol use (Kashdan, Ferrisizidis, Collins, & Muraven, 2010), aggression (Pond et al., 2012), self-injurious behavior (Zaki, Coifman, Rafaeli, Berenson, & Downey, 2013), and they show less neural reactivity to rejection (Kashdan et al., 2014). Despite its central role in mental well-being, there is scant, if any, research, that has been able to identify factors that may change an individual's level of emotion differentiation.

Theoretically, mindfulness should show a close relation with emotion differentiation ability. Mindfulness-based interventions actively train people to bring their attention on their inner mental states, and to stay with them (regardless of their valence) without evaluating or striving to change them. This shift in perspective might improve the ability to identify mental states and might increase the accuracy in labeling them. Key elements of mindfulness, such as awareness of inner experiences (thoughts, emotions, bodily experiences) and self-compassion (noticing these experiences with a compassionate, nonjudgmental, accepting attitude) are also regarded as potentially effective skills against overgeneralization. Also empirically, studies showed the effectiveness of mindfulness-based interventions (MBIs) on reducing overgeneralized thinking (Van der Gucht, Takano, Van Broeck, & Raes, 2015) and overgeneralization of autobiographical memories (Williams, Teasdale, Segal, & Soulsby, 2000). This suggests that mindfulness-based interventions could act to increase one's level of emotion differentiation.

Only few studies have directly examined the link between mindfulness and emotion differentiation, however. In an experience sampling study with young adults, higher levels of trait mindfulness were related to greater emotion differentiation for both negative and positive emotions (Hill & Updegraff, 2012). A study examining emotion differentiation under conditions of elevated stress found that more mindful participants versus less mindful participants differentiated more among discrete negative emotions (Fogarty et al., 2015). The authors concluded that more differentiated emotional responding was associated with trait mindfulness and facilitated more adaptive responding under stress. As such, the evidence for a link between mindfulness and emotion differentiation is hitherto limited to cross-sectional correlational data. What is missing, however, is whether a mindfulness based intervention would in fact also work to actually change people's level of emotion differentiation.

The current study is the first to investigate the impact of a mindfulness-based intervention (MBI) on emotion differentiation. The experience sampling method (ESM) was used to measure emotion differentiation and mindfulness in daily life. ESM enables repeated in-the-moment assessments of experiential

emotional and mindful states to measure detailed fluctuations, minimizing retrospective bias and enhancing reliability and ecological validity (Hektner, Schmidt, & Csikszentmihalyi, 2007). In addition, retrospective questionnaires were administered at each phase to assess trait mindfulness and its different facets, and emotional distress.

We hypothesized that after an MBI participants would show an improvement in their ability to differentiate among negative and positive emotions. We also hypothesized that this improvement in emotion differentiation was mediated by an improvement in mindfulness skills. Finally, we explored the mediating role of the different facets of mindfulness.

Our study sample is a group of people visiting the Stress Clinic (Hospital Network Antwerp, Antwerp, Belgium), a low-threshold mental health facility where mindfulness-based interventions are offered in group on a regular basis. Participants suffer from mental problems and/or physical problems—often referred to the stress clinic by their general practitioner—or they are healthy individuals showing an interest in mindfulness. This means that the sample consists of participants experiencing different levels of emotional distress.

## Method

### Participants

Participants were 61 adults (13 male, 48 female, one transgender) following a mindfulness-based intervention at the Stress Clinic (Hospital Network Antwerp, Antwerp, Belgium). Mean age was 42 years ( $SD = 9.9$ , range: 22–65). The sample was heterogeneous with regard to past/present emotional disorders (depression,  $n = 20$ ; anxiety disorder,  $n = 2$ ; burnout,  $n = 19$ ; adjustment disorder,  $n = 1$ ; posttraumatic stress disorder,  $n = 2$ ; bipolar disorder,  $n = 1$ ). Treatment (individual psychotherapy, medication, or a combination of both) for these emotional disorders was ongoing in 34% of the participants. This information is based on self-report.

Of the 61 participants who enrolled in the study, 43 (70%) completed two assessments and 34 (56%) completed all three assessments. Attrition resulted from nonattendance at one of the assessment time points. There were no significant differences on any of the baseline measures, including biogeographical and clinical characteristics, between participants who completed the study and those who did not.

### Procedure

Adults who registered to attend a mindfulness-based intervention between September 2014 and April 2016 at the Stress Clinic (Hospital Network Antwerp) were informed about the study by email. In total, 132 individuals expressed an interest. During an informal information session potential participants were screened to check for availability during the study period and were informed about the self-report measures and experience sampling procedure. Finally, 61 participants consented to take part. The most important

reason for not participating was time investment.<sup>1</sup> There were no restrictions in terms of age, or past/current psychopathology.

A baseline-, post-, and follow-up within-subjects design was used. All eligible participants were invited 1 week before the start of the intervention for a baseline assessment (T1). The baseline assessment phase consisted of administration of self-report questionnaires, including demographic data and information on past/present psychopathology. The assessment was followed by a one-on-one explanation of the ESM procedure. The ESM part consisted of 4 days of ESM assessment in the individual's own environment using smartphones. The postassessment phase (T2) took place 1 week after the end of the intervention and the follow-up assessment phase (T3) 4 months after the end of the intervention. At post- and follow-up assessment participants once more participated in a 4-day ESM assessment phase and administration of the self-report questionnaires. Participants received compensation in the form of a book on mindfulness and a free come-back session. The study was approved by the Ethics Committee of University of Leuven and Hospital Network Antwerp. All participants signed an informed consent form.

## Measures

The assessments consisted of both general self-report questionnaires and brief questions using the ESM at quasi-random times during 4 consecutive days.

**ESM.** ESM is a momentary assessment method to assess participants in their daily living environments, providing repeated in-the-moment assessments in an ecologically valid manner (Csikszentmihalyi & Larson, 2014). In the current study, participants' state emotions and state mindfulness were assessed. They received a smartphone programmed to emit a signal (beep) at semirandom moments between 9 a.m. and 10 p.m., on 4 consecutive days (with this period divided into 10 equal intervals and a random beep scheduled within each interval). This resulted in 40 beeps per assessment period. After each beep, participants were asked to report on their feelings and thoughts. The items included 12 questions on current affective state and six questions on current mindfulness state, all given on a scale from 0 to 100. Participants with less than 50% compliance per phase were excluded from the analyses. Because of attrition, this resulted in ESM data from 57 participants at T1, 37 at T2, and 27 at T3. The mean response rate was 75% ( $SD = 16\%$ ) with a range between 3% and 100%. Reliability was calculated based on ratings over time across individuals (Nezlek, 2017; Shrout & Lane, 2012). This contains both sources of variance, between-person and within-person. Reliability for NA ranged between .77 and .82, and for PA between .85 and .87 across all three assessments. Reliability for MFS was .49 at baseline, .64 postintervention and .61 at follow-up. The low score at baseline might be due to the fact that individuals without experience in mindfulness meditation misunderstood some of the items. A concise assessment of mindfulness is difficult to obtain and many questionnaires suffer from an ambiguous interpretation of some items (Bergomi, Tschacher, & Kupper, 2013).

**Emotion differentiation.** The ESM questions on current affective state were formulated as follows: "How much [emotion] are you experiencing in this moment?". Negative emotions assessed were anger, anxiety, depression, stress, sadness, and grief.

Positive emotions assessed were enjoyment, cheerfulness, happiness, satisfaction, relaxation, restfulness.

Negative and positive emotion differentiation indices were obtained by computing the intraclass correlation coefficient (ICC) measuring consistency, between the negative ratings and between the positive ratings separately of each individual across observations (Erbas et al., 2014). High ICCs reflect greater agreement between constituent variables, and indicate lower differentiation between these variables. Individual positive and negative ICC estimates were used as independent variables in our analytic models.

**Mindfulness: State.** The ESM questions on mindfulness focused on two facets, being present-moment attention/awareness, and nonjudgmental acceptance/decentering. Questions on present-moment attention/awareness were formulated as follows: "Since the last beep, to what extent . . . were you doing things with your full attention," ". . . have you been paying attention to how you feel," and ". . . have you been paying attention to what you feel in your body." The other three questions focused on the facet nonjudgmental acceptance/decentering: "Since the last beep, to what extent have you been accepting your feelings/emotions," ". . . were you able to observe stressing thoughts or images without getting caught in it," and ". . . were you trying to let negative thoughts and feelings be without suppressing them?" Cronbach's alpha for the total score ranged between .60 and .69 across the three assessment points, for the subscale present-moment attention/awareness scores ranged between .61 and .72, and for the subscale nonjudgmental acceptance/decentering scores ranged between .70 and .79.

**Retrospective questionnaires.** The 37-item Comprehensive Inventory of Mindfulness Experiences (CHIME) was used to measure mindfulness (Bergomi, Tschacher, & Kupper, 2014). Items are rated on a 6-point scale ranging from 1 to 6, with higher scores indicating greater mindfulness. The CHIME provides eight subscales: awareness of internal experiences (e.g., "I notice changes happening in my body"), awareness of external experiences (e.g., "I pay attention to the feeling of things like the wind in my hair or sunshine on my face"), acting with awareness (e.g., "It is easy for me to keep my attention on what I am doing"), accepting and nonjudgmental orientation (e.g., "I notice my mistakes without giving myself a hard time"), decentering and nonreactivity (e.g., "I am able to notice my thoughts and feelings without getting tangled up in them"), openness to experiences (e.g., "When I feel difficult emotions, I try to do something to take my mind off them"), relativity of thoughts (e.g., "I realize my thoughts aren't always facts"), and insightful understanding (e.g., "I notice it when my negative attitude makes things difficult"). Each subscale measures the experience over the preceding 2 weeks. The Dutch translation of the scale is currently being validated in Dutch speaking populations in Belgium and the Netherlands. In the present study Cronbach's alphas for the total score range between .87 and .91, for the subscales between .68 and .91, across all three time points except for acting with awareness at T1 ( $\alpha = .55$ ).

<sup>1</sup> Sample size was based on the 30/30 rule, used to determine sample size in multilevel modeling, which recommends sampling 30 participants with 30 observations per participant (Hox, Moerbeek, & van de Schoot, 2010). This sample size is known to achieve a sufficient statistical power to detect a moderate-to-large effect size for a single fixed effect (Scherbaum & Ferreter, 2009; see also Mathieu, Aguinis, Culpepper, & Chen, 2012).

Emotional distress was measured using the total score of the Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 consists of three 7 item scales designed to assess depression (DASS-21-D), anxiety (DASS-21-A), and stress symptoms (DASS-21-S). Items are scored on a 4-point scale, where higher scores indicate higher levels of emotional distress. The Dutch version was used in the present study (Beurs, Van Dyck, & Marquenie, 2001). In the present study Cronbach's alphas range between .89 and .93.

**Intervention**

The MBI program adhered to a standardized protocol developed from the *Mindfulness-Based Stress Reduction* (MBSR) manual (Kabat-Zinn, 1990) and is outlined in Maex (2009). The training consisted of six sessions of 3 hours each and is spread over 8 weeks. The training was delivered in groups of 15 to 25 participants. Sessions included guided formal meditation (e.g., body scan, mindful movement, sitting meditation), informal exercises which can be practiced during the day (e.g., mindful eating), experiential exercises and inquiry. During the training no explicit instructions are given to label emotions. Participants learn to become aware of the emotion and to feel the emotion in their body (examples of instructions are as follows: "Where in your body do you feel the emotion?" and "What kind of sensations do you feel?"). This means that participants are not actively trained to label their emotions in a discrete manner.

In addition to the weekly group sessions, participants received CDs with guided exercises and were assigned homework exercises (of 45 min daily including formal and informal exercises). Sessions were taught by Dr. Edel Maex (psychiatrist) and Jen Bertels (clinical psychologist) in the Stress Clinic (Hospital Network Antwerp) in Antwerp.

**Data Analyses**

A multilevel modeling approach was used for data-analysis. First, we estimated the "intervention effect model," using a piecewise model, in which change is described by using a discontinuous trajectory with separate slopes through two distinct phases of time. The assessment times were coded by two dummy variables, T2 and T3, with 1 indicating the posttreatment (T2; coded 0 1 0) or follow-up assessment (T3; coded 0 0 1). The model was specified as:

$$\gamma_{ij} = \beta_{0j} + \beta_{1j} \times T2_{ij} + \beta_{2j} \times T3_{ij} + r_{ij}$$

$Y_{ij}$  represents the outcome of the  $j$ -th participant at the  $i$ -th assessment time. The residual was represented by  $r_{ij}$ . The Level 1 intercept ( $\beta_{0j}$ ) and slopes for T2 and T3 ( $\beta_{1j}$ ,  $\beta_{2j}$ ) were allowed to vary randomly across persons at Level 2. This model was used to test whether there was a significant change in outcomes (ICC-PA, ICC-NA) and potential mediators (mindfulness skills) immediately after the intervention and at follow-up. The level of negative affect was added as a covariable to the model testing the change in negative emotion differentiation. The level of positive affect was added as a covariable to the model testing the change in positive emotion differentiation. The model was specified as (CV: covariable):

$$\gamma_{ij} = \beta_{0j} + \beta_{1j} \times T2_{ij} + \beta_{2j} \times T3_{ij} + \beta_{3j} \times CV_{ij} + r_{ij}$$

A corrected significance level was calculated for multiple comparisons according to the method described by Benjamini and Hochberg (1995).

To test the mediation effect we estimated a lower level time-lagged mediation model. Central to the analyses was that the proposed mediators (state and trait mindfulness) served as lagged time-varying predictors (i.e., change in  $M$  from T1 to T2) of subsequent changes in the outcome (emotion differentiation). This model was specified as:

$$M_{ij} = d_{Mj} + a_j \times Tslope2_{ij} + r_{Mij}$$

$$Y_{ij} = d_{Yj} + b_j M_{(i-1)j} + c' \times Time_{ij} + r_{Yij}$$

In the above equations,  $M_{ij}$  represents a putative mediator and  $Y_{ij}$  is the outcome of the  $j$ -th participant at the  $i$ -th assessment occasion. The coefficient  $a_j$  refers to the a-path, that is, the linear change in the mediator over time (i.e., from T1 to T2; as  $Tslope2_{ij}$  is coded as 0, 1 and 1 for pre-, post- and follow-up assessments, respectively). The coefficient  $b_j$  refers to the b-path, the time-varying lagged association between the mediator and the outcome, with control for the effect of time (coded as 0 1 2) on the outcome ( $c'$ ). This model was based on the procedure outlined by Bauer, Preacher, and Gil (2006). Time ( $T$ ), mediator ( $M$ ), and outcome ( $Y$ ) are measured at level 1. Random effects for both intercepts ( $d_{Mj}$  and  $d_{Yj}$ ) and coefficients ( $a_j$  and  $c_j$ ) were retained (Bauer et al., 2006). The mediation effect comprised the cross-product of the  $a_j$  and  $b_j$  coefficients and statistical significance of the product was determined by the indirect mediation effect confidence interval (MacKinnon & Luecken, 2008). This model was used to test whether the change in mindfulness skills and its different facets observed postintervention ( $a$ -coefficient), significantly mediated (product  $a \times b$  coefficient) the change in outcomes (ICC-PA, ICC-NA). The lme4 package (Bates, Maechler, Bolker, & Walker, 2015) in R (Team R. D. C., 2007) was used for the multilevel analysis.

**Results**

**Preliminary analyses**

Correlations among variables at baseline are given in Table 1. Negative and positive emotion differentiation are positively associated. Mindfulness-Trait is negatively associated with negative emotion differentiation. Mindfulness-State is positively associated with mindfulness-trait and positive affect. Negative affect is pos-

Table 1  
Correlations Among Variables at Baseline

Variable	1	2	3	4	5	6	7
1. ICC-NA	—						
2. ICC-PA	.421**	—					
3. MFS-Trait	-.341*	-.263	—				
4. MFS-State	-.029	.117	.441*	—			
5. NA	.464**	.202	-.032	-.179	—		
6. PA	-.118	-.017	.331*	.021	-.563**	—	
7. ED	.368*	-.109	-.126	-.148	.567**	-.394*	—

Note. ICC = intraclass correlation; MFS = mindfulness; NA = negative affect; PA = positive affect; ED = emotional distress.  
\*  $p < .05$ . \*\*  $p < .01$ .

itively associated with the negative emotion differentiation index. Negative affect is also negatively associated with positive affect. Emotional distress is positively associated with negative emotion differentiation and negative affect and negatively associated with positive affect.

Table 2 presents the detailed descriptive statistics of the outcomes at the three study data collection points. At baseline participants differentiated significantly more between negative emotions ( $M = 0.72$ ,  $SD = 0.14$ ) than between positive emotions ( $M = 0.82$ ,  $SD = 0.08$ ),  $t(110) = 3.53$ ,  $p < .001$ .

## Multilevel Analyses

**Intervention effect model. Is there a significant change in emotion differentiation?** The fixed effects of the direct slope models (see Table 3) indicate that there is a significant improvement in negative emotion differentiation immediately after the intervention (T2:  $B = -0.10$ ,  $p = .012$ ) and at follow up (T3:  $B = -0.12$ ,  $p = .028$ ). The change in positive emotion differentiation is only significant at follow-up (T3:  $B = -0.09$ ,  $p = .030$ ). When controlling for NA levels, the effect of time on ICCNA is no longer significant, the effect of NA on ICCNA is significant ( $B = 0.01$ ,  $p < .001$ ). When controlling for PA levels, the effect of time on ICCPA remained significant at follow-up (T3:  $B = -0.09$ ,  $p = .043$ ). There was no significant effect of PA on ICCPA.

**Is there a significant change in mindfulness state and trait (the potential mediator)?** A significant improvement in mindfulness–state is observed immediately after the intervention (T2:  $B = 11.46$ ,  $p < .001$ ) and at follow-up (T3:  $B = 16.03$ ,  $p < .001$ ). A significant improvement in mindfulness–trait is observed immediately after the intervention (T2:  $B = 23.82$ ,  $p < .001$ ) and at follow-up (T3:  $B = 32.12$ ,  $p < .001$ ). The observed significant changes remain significant after Benjamini and Hochberg (1995) correction.

**Mediation effect model. Is the observed change in emotion differentiation mediated by the change observed in mindfulness (state and trait)?** Table 4 presents the coefficients of the mediated pathway of mindfulness state and trait on emotion differentiation, and the confidence interval test for the indirect effect. Mindfulness (MFS; state and trait) was a significant mediator for negative emotion differentiation. There was no statistically significant effect on the b-paths for positive emotion differentiation. When controlling for NA levels and emotional distress (ED), the

mediating effect of MFS–State ( $B = -0.006$ ,  $p = .008$ ) remained significant, the mediating effect of MFS–Trait ( $B = -0.003$ ,  $p = .06$ ) became marginally significant. The effect of NA was significant in both models (MFS–State model:  $B = 0.013$ ,  $p < .001$ ; MFS–Trait model:  $B = 0.013$ ,  $p < .001$ ). There was no significant effect of ED.

## Which facets of mindfulness mediated the change in negative emotion differentiation?

Table 5 presents the coefficients of the mediated pathway of the different mindfulness facets (state and trait) on negative emotion differentiation, and the confidence interval test for the indirect effect. For state mindfulness, the indirect effect was only significant for nonjudgmental acceptance/decentering, meaning that the increase in nonjudgmental acceptance/decentering postintervention mediated the improvement in negative emotion differentiation. For trait mindfulness, the indirect effect was significant for accepting and nonjudgmental orientation, for decentering and non-reactivity, and for openness to experience. When controlling for NA levels and emotional distress, the indirect effect for acceptance/decentering (MFS–State model:  $B = -0.005$ ,  $p = .002$ ; MFS–Trait model acceptance:  $B = -0.011$ ,  $p = .041$  and decentering:  $B = -0.011$ ,  $p = .043$ ) remained significant. Only the indirect effect for openness to experience was no longer significant ( $B = -0.011$ ,  $p = .11$ ). The effect of NA was significant in the four models ( $0.011 \leq B \leq 0.014$ ,  $p < .002$ ). There was no significant effect of ED.

## Discussion

Using a pre-, post-, and follow-up within-subjects design, we tested the hypothesis that participation in a mindfulness-based intervention improves emotion differentiation skills. This prediction was based on theory and empirical studies showing a clear cross-sectional association between trait mindfulness and emotion differentiation (Fogarty et al., 2015; Hill & Updegraff, 2012; Mandal, Arya, & Pandey, 2014).

In line with our hypothesis, results showed a significant improvement in negative emotion differentiation (based on ICCs) postintervention and at 4 months follow-up. This improvement, however, was no longer significant when controlling for mean levels of NA. This means that the change in NA levels plays a role in enhancing emotional differentiation. The improvement in positive emotion differentiation was only significant at 4 months follow-up. This improvement in positive emotion differentiation remained significant after controlling for mean PA levels and mean PA levels did not have an impact on PA emotion differentiation. A possible explanation for this delayed effect in positive emotion differentiation might be that it takes more time to learn how to differentiate between positive emotions compared to negative emotions. However, a second explanation might be that in the current population, there is more room for improvement regarding negative emotion differentiation compared to positive emotion differentiation. Studies reporting indices on positive and negative emotion differentiation show that in general people differentiate more between negative emotions than between positive emotions (Erbas, Sels, Ceulemans, & Kuppens, 2016). This was also the

Table 2  
Outcome Scores at Each Assessment Point

Variable	T1	T2	T3
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
ICC-NA	.72 (.14)	.61 (.20)	.59 (.25)
ICC-PA	.82 (.08)	.81 (.09)	.74 (.17)
MFS–State	42.99 (14.26)	54.22 (10.90)	61.16 (23.93)
MFS–Trait	119.31 (18.67)	142.68 (29.30)	151.18 (21.12)
NA	25.79 (10.30)	14.91 (7.74)	16.41 (9.64)
PA	42.97 (9.94)	53.53 (8.98)	58.36 (13.93)
ED	22.98 (10.44)	12.32 (6.25)	10.32 (6.67)

Note. T1 = baseline; T2 = post-intervention; T3 = follow-up; ICC = intraclass correlation; MFS = mindfulness; NA = negative affect; PA = positive affect; ED = emotional distress.

Table 3  
*Estimates From the “Intervention Effect”: Multilevel Models*

Variable	Intercept	<i>B</i> ( <i>SE</i> ) T2	<i>B</i> ( <i>SE</i> ) T3	<i>B</i> ( <i>SE</i> ) NA/PA
ICC NA	.72 (.03)	-.10 (.04)* <i>p</i> = .012	-.12 (.05)* <i>p</i> = .028	
ICC-NA Controlled for NA	.47 (.05)	-.02 (.04) <i>p</i> = .578	-.03 (.05) <i>p</i> = .576	.01 (.002)*** <i>p</i> < .001
ICC PA	.82 (.02)	-.01 (.02) <i>p</i> = .445	-.09 (.04)* <i>p</i> = .030	
ICC-PA Controlled for PA	.83 (.04)	-.01 (.02) <i>p</i> = .722	-.09 (.04)* <i>p</i> = .043	-.0003 (.001) <i>p</i> = .756
MFS-State	42.99 (1.93)	11.46 (1.74)*** <i>p</i> < .001	16.027 (2.38)*** <i>p</i> < .001	
MFS-Trait	119.31 (2.48)	23.82 (4.41)*** <i>p</i> < .001	32.12 (3.84)*** <i>p</i> < .001	

*Note.* Significance level after Benjamini and Hochberg (1995) correction .04375. ICC = intraclass correlation; NA = negative affect; PA = positive affect; MFS = mindfulness.

\* *p* < .05. \*\*\* *p* < .001.

case in our study sample.<sup>2</sup> The higher index on negative emotion differentiation in our study sample might be explained by the high prevalence of emotional problems with more than 70% of the participants reporting an emotional disorder in the past and/or present. Therefore, the need to refine negative feelings in the current sample is high. In the context of well-being, studies with healthy individuals, individuals suffering from high emotional distress and clinical populations, show that especially the skill to differentiate negative emotions plays a role in mental well-being (Kashdan et al., 2015; Smidt & Suvak, 2015; Tomko et al., 2015). Although the evidence for positive emotion differentiation is less strong a study examining positive emotional granularity and psychological resilience shows that individuals characterized by higher positive emotional granularity reported less automatic and more engaged coping strategies during stressful times (Tugade, Fredrickson, & Barrett, 2004).

Another possibility is that there is a link between the concept of emotion differentiation and the concept of overgeneralization. Previous studies showed that depressed persons are more inclined to make negative generalizations and less inclined to make positive generalizations (Klar, Gabai, & Baron, 1997; van den Heuvel, Derksen, Eling, & van der Staak, 2012). Green et al. (2013) showed that in case of intense negative emotions people with major depressive disorder differentiate less in conceptual social knowledge and this was associated with overgeneralized self-blame. Also studies in the domain of fear generalization research find indications that the less well people can discriminate between (slightly) different stimuli, the more likely it is that people will respond with the same response to stimuli that are different, but not perceived as such (Struyf, Zaman, Vervliet, & Van Diest, 2015). A possible explanation for the difference in impact of mean level of NA and PA on respectively NA and PA emotion differentiation might be that when people are in a negative mood they habitually have the tendency to overgeneralize and therefore differentiate less between the felt negative emotions. This tendency to overgeneralize might be less when experiencing positive emotions and this might explain why the mean level of PA has no impact on PA emotion differentiation.

Evaluating the potentially mediating role of mindfulness skills in relation to emotion differentiation we found that both mindfulness state and trait mediates the intervention effect on negative emotion differentiation also when controlling for mean levels of NA and emotional distress. This is in line with our expectations and earlier findings showing that trait mindfulness is associated with better emotion differentiating skills (Fogarty et al., 2015; Hill

& Updegraff, 2012; Mandal et al., 2014). We could not find a mediating effect of mindfulness on the improvement of positive emotion differentiation.

As mindfulness is considered to be a holistic state of awareness, facilitated by the interplay of multiple components such as attention, attitude, and intention (e.g., Kabat-Zinn, 1990; Shapiro, 2009) we also explored which facets of mindfulness were the most important in the mediating role. Results show a significant effect of the constructs related to acceptance and decentering, in both state and trait observations, also when controlling for mean levels of NA and emotional distress. It is somewhat surprising that the improvement in attention/awareness, and more specific the awareness of internal experiences, was not a mediator. One would expect that an augmentation in self-awareness, in-turn, would improve the ability to identify and label emotional states (Gillespie, Mitchell, Fisher, & Beech, 2012).

The constructs related to acceptance and decentering are characterized by the way how individuals relate to their mental states and refer to the qualitative aspect of mindful attention (Kabat-Zinn, 1990). Openness to experiences refers to the ability to allow oneself to endure and “stay with” emotional states regardless of their valence. Acceptance and nonjudgmental orientation refers to staying with your experience while refraining from evaluating or striving to change them. Decentering and nonreactivity can be defined as a shift in perspective associated with decreased attachment to one’s feelings. It encourages the objectification of distressing emotions and helps individuals to see mental processes as ‘passing experiences’ (Shonin & Van Gordon, 2016). This shift in how individuals relate to their feelings might improve the ability to identify mental states and might increase the accuracy in labeling mental states.

Decentering had the largest mediating effect, followed by acceptance. After controlling for mean levels of NA and emotional distress, openness (nonavoidance, exposure) to experiences had no longer a mediating effect. Previous studies have also shown that decentering acted as a mediator of MBIs in improving psychological health outcomes (Pearson, Brown, Bravo, & Witkiewitz, 2015), depressive symptoms (Gecht et al., 2014), anxiety (Hoge et al., 2015) and emotional distress (Bogosian, Hughes, Norton,

<sup>2</sup> The mean ICC index for PA at baseline ( $M = 0.82$ ,  $SD = 0.08$ ) was similar to the PA index based on a normative sample as reported in the study by Erbas et al. (2016;  $M = 0.79$ ,  $SD = 0.13$ ) while there was a clear difference in indices for NA ( $M = 0.72$ ,  $SD = 0.14$  vs.  $M = 0.63$ ,  $SD = 0.26$ ).

**Table 4**  
*Mean Estimates of Multilevel Coefficients (SE) and Confidence Intervals for Cross-Lagged Mediation of Mindfulness Skills on the Associations Between Time and Emotion Differentiation*

Variable	a	b	ab [95 % CI]	c'
ICC-NA				
MFS-State	13.19 (1.91)*** <i>p</i> < .001	-.005 (.002)* <i>p</i> = .029	-.066 (.028) [-.125, -.014]	.049 (.04) <i>p</i> = .27
MFS-Trait	25.83 (4.30)*** <i>p</i> < .001	-.003 (.001)* <i>p</i> = .02	-.077 (.029) [-.139, -.025]	-.02 (.34) <i>p</i> = .950
ICC-PA				
MFS-State	13.19 (1.91)*** <i>p</i> < .001	-.002 (.002) <i>p</i> = .249		-.063 (.04) <i>p</i> = .08
MFS-Trait	25.83 (4.30)*** <i>p</i> < .001	-.001 (.001) <i>p</i> = .251		-.13 (.36) <i>p</i> = .720

*Note.* a = change in *M* (mindfulness skills) from T1 to T2; b = effect of *M* on the dependent variable (ICC-NA, ICC-PA); ab: indirect effect; c': direct effect; MFS = mindfulness.

\* *p* < .05. \*\*\* *p* < .001.

Silber, & Moss-Morris, 2016). This finding is also in line with theoretical models of the mechanisms of mindfulness (e.g., Bishop et al., 2004; Kabat-Zinn, 1990; Shapiro, 2009).

It is important to note that the reported beneficial effects of a training in mindfulness are undoubtedly driven by the synergetic effects of many different and related constructs. Future scientific research is needed to contribute to the understanding of these synergetic effects and of a more complete picture. Our study is the first to show that consolidating a shift in relation to feelings (accepting, decentering) via a MBI is effective to differentiate more among affective states. Previous successful intervention research targeting emotion differentiation is based on an expansion of a person's emotion vocabulary and the deployment of this vocabulary in a flexible, contextualized manner (Kashdan et al., 2015 and references in there). This study shows that a training in mindfulness skills might be another approach to successfully increase emotion differentiation.

**Limitations and Future Research**

Some limitations should be taken into account when interpreting the results of this study. One of the primary limitations is the lack

of a randomized controlled design, and the fact that participants were self-selected. Also important to note is that although we examined a large number of assessments within persons, the Level 2 sample size was restricted to 61. Therefore, it is recommended to conduct future studies with larger samples and a well-designed, randomized, controlled trial, with extended follow-up periods, to make findings more conclusive.

Despite the limitations of the present study, we believe our findings may have potentially relevant clinical implications. Accumulating evidence indicates that emotion differentiation is positively associated with adaptive emotion regulation and psychosocial functioning (Smidt & Suvak, 2015) and negatively associated with emotional disorders and features of emotional dysregulation and distress (Trull, Lane, Koval, & Ebner-Priemer, 2015). Recent research supports the consideration of undifferentiated negative affect as a transdiagnostic construct relevant for a wide range of mental disorders (Tomko et al., 2015). Our results show that MBIs are promising and feasible interventions to successfully increase emotion differentiation while they have the advantage of being popular and nonstigmatizing.

**Table 5**  
*Mean Estimates of Multilevel Coefficients (SE) and Confidence Intervals for Cross-Lagged Mediation of Different Aspects of Mindfulness Skills on the Association Between Time and Negative Emotion Differentiation*

Variable	a	b	ab [95 % CI]	c'
MFS-State				
Attention/Awareness	9.703 (1.88)*** <i>p</i> < .001	-.004 (.003) <i>p</i> = .174	—	.019 (.042) <i>p</i> = .65
Acceptance/Decentering	16.28 (2.48)*** <i>p</i> < .001	-.004 (.002)* <i>p</i> = .027	-.065 (.034) [-.136, -.0013]	.046 (.044) <i>p</i> = .297
MFS-Trait				
A-IE	2.82 (.57)*** <i>p</i> < .001	.000 (.0008) <i>p</i> = .992	—	-.001 (.004) <i>p</i> = .802
A-EE	1.79 (.48)*** <i>p</i> < .001	-.007 (.008) <i>p</i> = .345	—	.007 (.045) <i>p</i> = .874
Act-w-A	1.68 (.53)** <i>p</i> = .003	.000 (.0009) <i>p</i> = .995	—	-.001 (.005) <i>p</i> = .822
Accepting	5.49 (.66)*** <i>p</i> < .001	-.015 (.006)* <i>p</i> = .019	-.082 (.035) [-.153, -.017]	.07 (.05) <i>p</i> = .189
Decentering	7.33 (.80)*** <i>p</i> < .001	-.013 (.006)* <i>p</i> = .028	-.095 (.045) [-.188, -.009]	.10 (.06) <i>p</i> = .094
Openness	3.31 (.52)*** <i>p</i> < .001	-.02 (.007)* <i>p</i> = .015	-.066 (.026) [-.12, -.02]	.06 (.05) <i>p</i> = .24
Relativity	2.19 (.56)*** <i>p</i> < .001	-.006 (.008) <i>p</i> = .45	—	.002 (.047) <i>p</i> = .957
I-U	3.91 (.74)*** <i>p</i> < .001	-.011 (.006) <i>p</i> = .07	—	.03 (.045) <i>p</i> = .497

*Note.* A-IE = awareness of internal experiences; A-EE = awareness of external experiences; Act-w-A = acting with awareness; Accepting = accepting and nonjudgmental orientation; Decentering = decentering and nonreactivity; Openness = openness to experience; Relativity = relativity of thoughts; I-U = Insightful Understanding; MFS = mindfulness.

\* *p* < .05. \*\* *p* < .01. \*\*\* *p* < .001.

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