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ATTITUDES AND SOCIAL COGNITION

INNOVATIONS IN SOCIAL PSYCHOLOGY

Why I Don't Always Know What I'm Feeling: The Role of Stress in Within-Person Fluctuations in Emotion Differentiation

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Emotion differentiation, the ability to make fine-grained distinctions between emotional states, has mainly been studied as a trait. In this research, we examine within-person fluctuations in emotion differentiation and hypothesize that stress is a central factor in predicting these fluctuations. We predict that experiencing stress will result in lower levels of emotion differentiation. Using data from a 3-wave longitudinal experience sampling study, we examined the within-person fluctuations in the level of emotion differentiation across days and months and tested if these fluctuations related to changes in stress levels. On the day-level, we found that differentiation of negative emotions varied significantly within individuals, that high stress levels were associated with lower levels of emotion differentiation, and that stress on 1 day negatively predicted the level of differentiation of negative emotions on a next day (but not vice versa). On the wave-level, we found a concurrent, but not a prospective relationship between stress and emotion differentiation. These results are the first to directly demonstrate the role of stress in predicting fluctuations in emotion differentiation and have implications for our theoretical understanding of emotion differentiation, as well as for interventions.

Keywords: emotion, emotion differentiation, emotional granularity, stress

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Imagine you have a huge and important project at work. The deadline is tomorrow, but you are far from finished and very stressed. Then your partner walks in, shows you a few color samples of different shades of white, and asks you which you like the most. You see little difference between them and say "*They're all white to me!*" Indeed, research shows that the way we process information changes during stressful times: while some information becomes more relevant (your project), other information becomes less relevant (Shors, 2006). In the current study, we examine how this notion translates to how we perceive our emotions. We hypothesize that, as in the example with paint colors, experiencing stress can result in a less specific way of perceiving our emotions and, thus, in lower levels of emotion differentiation.

Emotion differentiation refers to how well people are able to differentiate between specific emotions, and label their emotions in a differentiated fashion, and is considered to play a central role in psychological well-being (Kashdan, Barrett, & McKnight, 2015). However, it is not yet well-understood which concepts underlie variations in emotion differentiation. In this research, we investigate the role played by stress. Investigating how variability in emotion differentiation may be a function of stress, would allow us to better understand when and why emotion differentiation varies. This is important because insight into the malleability of emotion differentiation, and predictors

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of this malleability, could prove crucial to understand the role of emotion differentiation specifically, and emotional processing in general, in the etiology and prevention of emotion dysregulation and psychological maladjustment.

Emotion Differentiation

Knowledge of one's own emotional experience is thought to be a cornerstone of healthy psychological functioning. One of the primary elements of emotion knowledge is emotion differentiation (Barrett, Gross, Christensen, & Benvenuto, 2001). Emotion differentiation is the ability to experience and label emotions with a high degree of complexity (Kashdan et al., 2015). Individuals high in emotion differentiation label their emotions in differentiated, specific, and context-dependent ways, whereas individuals low in emotion differentiation tend to have less specific emotional experiences. For instance, while a high differentiator may report feeling sad on one occasion and feeling angry on a next occasion, a low differentiator may report feeling both sad and angry on both occasions, and even use more abstract labels (e.g., I feel bad) to refer to such undifferentiated feeling states.

Being able to differentiate between emotions, especially negative emotions, facilitates emotion regulation (Barrett et al., 2001). According to the feelings as information perspective (Schwarz, 1990), individuals use their emotions as a source of information about the environment. Experiencing discrete emotions can provide specific information about the emotional situation, enabling the individual to react upon it in a more adaptive and effective way. Moreover, recent research on affect labeling shows that even the mere process of labeling one's emotional experiences is beneficial for emotional regulation (Kircanski, Lieberman, & Craske, 2012). As such, higher levels of emotion differentiation, thus, promote psychological and social well-being (Kashdan et al., 2015).

A number of recent studies evidence the prominent role of emotion differentiation in healthy emotional functioning. For instance, on the one hand, high levels of (negative) emotion differentiation seem to protect individuals from maladaptive behaviors such as aggression and binge-drinking. On the other hand, affect related psychological disorders such as borderline personality disorder, major depressive disorder, and anxiety disorder, as well as schizophrenia and autism spectrum disorder, have been associated with deficits in emotion differentiation (see Kashdan et al., 2015, and Smidt & Suvak, 2015 for reviews). Furthermore, emotion differentiation is also related to well-defined personality characteristics: high levels of negative emotion differentiation are associated with lower levels of neuroticism and alexithymia, and higher self-esteem (Erbas, Ceulemans, Lee Pe, Koval, & Kuppens, 2014). Finally, more recently, emotion differentiation was also studied in the context of interpersonal relationships, and related positively to empathic accuracy, the ability to accurately judge the feelings of others (Erbas, Sels, Ceulemans, & Kuppens, 2016).

The Variability of Emotion Differentiation Across Time

Emotion differentiation is generally studied as a between-person variable, and it is implicitly considered a stable characteristic of the individual that does not significantly or meaningfully change across time. However, contemporary trait theories argue that individual differences in behavior, thoughts, and feelings (e.g., personality traits) consist of a stable part and a variable part (e.g., Fleeson, 2001). According to such theories, traits like emotion differentiation should be viewed as reflecting density distributions: the same individual behaves differently on different occasions, and it is through the distribution of these behaviors that we can understand the traits of the individual (e.g., Fleeson, 2001; Fleeson & Jayawickreme, 2015). In line with such theories, understanding when and why emotion differentiation increases or decreases is crucial for developing better interventions to train this skill, as well as for better understanding its antecedents and consequences, and the role it may play in the development and maintenance of psychopathology.

Despite the research attention emotion differentiation has received over the last few years, and the central role it plays in well-being (Kashdan et al., 2015), there is very little research examining whether and why emotion differentiation varies across time. However, it has been suggested that one's level of emotion differentiation can be a function of resource-bound factors (do people have the capacity to differentiate between emotions?), which can vary over time and contexts within individuals. Thus, despite generally being studied as a stable characteristic or skill, it stands to reason that emotion differentiation is likely to vary meaningfully from one moment to another. Indeed, in a few recent studies, emotion differentiation has been conceptualized as a variable characteristic: a study by Tomko and colleagues (2015) used a novel measure of emotion differentiation in which momentary differentiation indices were computed. In two recent projects, Grossmann and colleagues (Grossmann, Gerlach, & Denissen, 2016; Grossmann, Huynh, & Ellsworth, 2016) used an entropy index to assess the diversity with which emotions are experienced at the momentary level. While both of these measures are not the same as the traditional emotion differentiation index, they are related in that they attempt to understand the relationships between specific emotions. As the articles demonstrate within-person variability, these findings suggest that the relationships between emotions within an individual may vary across time in important ways, suggesting that a similar process may unfold with the classical conceptualization of emotion differentiation. This variability suggests that emotion differentiation can be targeted for intervention. In line with this idea, a recent study by Van der Gucht et al. (2018) showed that a mindfulness based intervention can positively influence individuals' level of emotion differentiation, both at the end of the intervention as well as after a few months, again hinting at the malleability of emotion differentiation over time.

In summary, recent studies suggest that emotion differentiation can vary within individuals across time and contexts. In the present article, we aim better understand this variability of emotion differentiation by examining whether within-person variation in emotion differentiation is a function of fluctuating levels of stress.

Emotion Differentiation and Stress

There are two reasons why we believe that stress may affect emotion differentiation: stress is associated with reduced cognitive resources, and changes in emotional architecture. In what follows, we detail the research that led us to hypothesize that stress plays a key role in emotion differentiation.

Cognitive Resources

Stress has repeatedly been linked to diminished cognitive resources. For instance, elevated levels of stress are linked to reduced working memory capacity (Klein & Boals, 2001), and impaired memory retrieval for affective words (Kuhlmann, Piel, & Wolf, 2005). Both these resources are necessary to process emotional information. Furthermore, there is evidence that stress reduces attention to irrelevant stimuli (Booth & Sharma, 2009), while increasing memory for stressor-related stimuli, pointing toward an information processing bias during stressful times (Shors, 2006). As such, experiencing stress may lead to more accurate processing of stressor-related information, but to less accurate processing of other information, resulting in lower emotion differentiation. This is in line with research showing that stress increases goal shielding to minimize interference from other stimuli (Plessow, Fischer, Kirschbaum, & Goschke, 2011).

Indeed, research has directly demonstrated that these capacity-related factors can shape individuals' ability to attend to affective states, and to access and efficiently utilize conceptual emotion knowledge during emotion formation (Barrett, Tugade, & Engle, 2004; Lindquist & Barrett, 2008). To describe their emotions, people need to hold information about their current affective state in mind, while retrieving their conceptual emotion knowledge. Then, they need to meld these different types of information to categorize their current feeling. This process requires cognitive capacity, and as such, greater cognitive capacity can result in the experience and reporting of more discrete emotional states. In contrast, a lack of such cognitive resources can lead to less specific experiences and reports of emotions (Barrett et al., 2004; Lindquist & Barrett, 2008). If stress directs cognitive efforts toward the stressor and away from other information, given that stress is linked to a reduction in cognitive resources, it is likely that stress will be associated with reductions in emotion differentiation.

Affective Architecture

According to the dynamic model of affect, when an individual is confronted with a stressful event (i.e., a potential threat to well-being), information processing is narrowed to aid successful coping with the stressor (Reich, Zautra, & Davis, 2003). Thus, during stressful times, the way we process emotional information changes (Davis, Zautra, & Smith, 2004). For instance, research on the relationship between positive and negative affect shows that stress increases the inverse correlation between positive and negative emotions (Davis et al., 2004; Reich et al., 2003; Zautra, Reich, Davis, Potter, & Nicolson, 2000). This increased inverse correlation suggests that stress may elicit a higher valence focus (Barrett, 1998). Individuals who have a high valence focus mainly tend to attend to the hedonic component of their affective experiences, and not so much to other characteristics of emotion (e.g., arousal). A high valence focus leads individuals to perceive unpleasant emotions as similar to each other and pleasant emotions as similar to each other, which can result in low levels of differentiation between similarly valenced emotions (Barrett, 1998; Erbas, Ceulemans, Koval, & Kuppens, 2015). Moreover, the negative relationship between affective bipolarity and emotion differentiation has recently been demonstrated in different samples and across different cultures, and seems to be rather robust (Grossmann, Huynh et al., 2016). Thus, there is suggestive evidence that stress increases the bipolarity of affect, and as such can decrease differentiation between similarly valenced emotions. In summary, the research suggests that stress reduces affective complexity. In line with this research, we can expect stress to also reduce emotion differentiation.

The Present Study

While the relationship between stress and emotion differentiation has not yet been directly studied, the research we discuss above suggests stress is likely to play an important role in the emotion differentiation process. In this study, we aim to provide the first comprehensive test of the relationship between stress and emotion differentiation, examining how this process plays out both on a day-to-day timescale as well as over the longer timescale of months. We expect stress to influence the level of emotion differentiation mainly on a shorter time-frame (day-to-day), as typical daily life stressors are likely processed relatively quickly (within days or perhaps weeks) and, therefore, the effects of stress would less likely flow on to emotion differentiation over longer periods of time such as months. We expect stress to primarily have implications for differentiation of negative emotions and not so much for positive emotions for several reasons. First, it is mainly negative emotions that are associated with stressful situations. Second, as shown recently in a meta-analysis on emotion dynamics (Houben, Van den Noortgate, & Kuppens, 2015), as well as evidenced in many studies on emotion differentiation specifically (Kashdan et al., 2015), it is mainly the processes regarding negative emotions that are consistently important in the context of well-being. Therefore, the focus of the current project is specifically on negative emotions.

Based on data from a three-wave longitudinal measurement-burst study, we tested the within-person relationship between emotion differentiation and stress across days and across waves. We investigated whether stress prospectively predicts emotion differentiation or vice versa, allowing us to begin to understand the direction of these relationships. A measurement burst design refers to a design that incorporates bursts of intensive repeated assessment within a relatively short period of time that are repeated longitudinally, over more widely spaced temporal intervals. Such a study design lends itself to the study of short-term variability, long-term change, and the individual differences in these two types of variability (Stawski, MacDonald, & Sliwinski, 2015), and is, therefore, very suited to investigate the hypothesized prospective relationships.

The study consisted of three waves of data collection across a 1 year period. Each wave involved 1 week of experience sampling (ESM), in which participants reported their momentary levels of negative emotions (that were used to extract indices of emotion differentiation) and stress, as well as lab sessions in which participants performed computer tasks and filled in questionnaires, including a subjective self-report measure of stress in the past month. On the basis of these data, we first in preliminary analyses examined the presence of within-person fluctuations in the level of emotion differentiation across both days and across months. Next, we examined the extent to which such fluctuations go hand in hand with changes in stress levels at the concurrent level. Finally, and most importantly, we examined whether higher levels of stress on one day would predict lower levels of emotion differentiation on the next day, but not vice versa. Similar prospective analyses were performed to see whether stress levels at one wave predict change in emotion differentiation to the next wave, but not vice versa. With respect to these last analyses, however, it must be noted that the study only included three waves (and, thus, only two time-points in the lagged analyses), resulting in low power for the wave-level prospective models. Therefore, our main focus is on the day-to-day models, and the prospective wave-level analyses should be interpreted with caution.

In the following part, we discuss three subsidiary analyses that help to establish the robustness of our models. Above, we argued that stress has an important and unique relationship with emotion differentiation. However, as low levels of emotion differentiation have repeatedly been linked to negative outcomes, it could also be the case that negative emotion in general, rather than stress specifically, predicts emotion differentiation. Therefore, to establish the robustness of our model, it is crucial to examine that these effects are in fact specific to stress. As such, we tested whether stress has a unique status in predicting emotion differentiation. We did this by including competing models assessing the predictive role of the other emotions. If only stress, and not the other emotions, is associated with fluctuations in emotion differentiation, then this will support the unique role of stress in our proposed models.

Next, we tested whether time plays a role in predicting emotion differentiation. Sometimes, variables systematically covary with time (e.g., gradually increase or decrease as time goes by). Therefore, in longitudinal designs with participants doing the same task for long periods of time, it is important to test for such an alternative hypothesis. To this end, we examined the effect of the time variable (filling out the ESM questions on Day 1, Day 2, etc.) as a predictor and moderator of the relationships between stress and emotion differentiation.

In a final series of secondary analyses, we explored the potential moderating effect of theoretically relevant individual difference variables on the relationship between emotion differentiation and stress. These analyses were exploratory in nature. A list of all measures that were included in each wave of the larger longitudinal study can be found in the online supplementary materials. From this list, we tested the moderating effect of a number of person-level variables that, based on previous research and theory, could be implicated in emotion differentiation. More specifically, we tested whether higher levels of depression, borderline personality disorder characteristics, neuroticism, and alexithymia, made individuals more vulnerable to the negative effects of stress, and as such were linked with a stronger relationship between stress and emotion differentiation. Finally, we tested whether higher cognitive capacity, specifically the ability to update emotional information, protected individuals from the negative effects of stress, and resulted in a weaker relationship between stress and emotion differentiation.

Method

Participants

To obtain enough power to detect small to medium effect sizes ($d = .30$, $\alpha = .05$), we aimed to recruit 200 participants (allowing for 25% attrition over the course of the study) who were about to start their first year at university, and varied in terms of emotional well-being. We selected this sample because the transition to tertiary education is a turbulent period, involving important life changes (e.g., moving to a new city, living by yourself for the first time, and having to make new friends) that can lead to changes in psychological adjustment (e.g., Tamir, John, Srivastava, & Gross, 2007). Potential participants were recruited through online and paper advertisements, and were directed to a Web site where they completed the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), which was used as a prescreening tool for emotional well-being. Initially, 686 students completed the CES-D prescreening questionnaire. By using a stratified sampling approach (Ingram, Siegle, & Steidtmann, 2009), an equal number of participants from each quartile of the CES-D distribution was selected to participate in the study. Using this approach, we were able to recruit 180 participants with a relatively broad range of CES-D prescreening scores. Twenty-two additional participants were enrolled after the study had already started and, therefore, did not complete the prescreening questionnaire. There were 202 participants who took part in the first wave of the study, but two participants had low compliance with the ESM protocol (less than 50%) and were, therefore, excluded from further analyses. This led to a sample of 200 participants in Wave 1 of the study (90 male, mean age = 18.32, SD = 0.97), 190 participants in Wave 2 of the study (84 male, mean age = 18.64, SD = 1.03) that took place 4 months after the first wave, and 177 participants (79 male, mean age = 19.28, SD = 1.00) in the third wave of the study which took place 8 months after the second wave. Participants received €60 per wave for completing all measures, and an additional €60 for completing all three waves. The study received approval from the KU Leuven ethics committee (Commissie Medische Ethiek van de Universitaire Ziekenhuizen KU Leuven).

Materials and Procedure

In each of the three waves, the data collection for our measures was identical. Each wave started with a lab session in which participants completed computerized self-report questionnaires and cognitive tasks. Next, they received instructions on how to use the smartphone for the ESM part, after which they left the lab with a smartphone. After 7 days of ESM, participants returned to the lab, gave back the smartphones, completed additional self-report questionnaires (including the experienced stress questionnaire) and lab tasks, and were paid and debriefed.

ESM protocol. During the ESM period, participants carried Motorola Defy plus smartphones that were programmed to signal 10 times a day for seven consecutive days. At each signal, participants were asked to report how they felt at that moment, as well as a limited number of other questions not related to the present research. The signals were programmed according to a stratified random-interval scheme: the waking hours (from 10 a.m. to 10 p.m.) of each day were divided in 10 equal intervals, and in each interval, a signal was programmed randomly. At each signal, the smartphone prompted participants to rate their responses to a number of questions (in randomized order) including how stressed, angry, sad, anxious, depressed, lonely, relaxed, happy, and cheerful they felt at the moment of the signal, using a slider scale ranging from 0 (*not at all*) to 100 (*very much*). Compliance was good: participants responded to 87.27% of the programmed signals in Wave 1 (SD = 9.05%), to

87.87% (SD = 8.98%) in Wave 2, and 88.35% (SD = 8.69%) in Wave 3.

Emotion differentiation. Typically, emotion differentiation is inferred from the strength of the correlation between different like-valenced emotions across different occasions within a person (e.g., Barrett et al., 2001; Tugade, Fredrickson, & Barrett, 2004). Low within person correlations between like-valenced emotions across situations indicate greater emotional specificity, as people are reporting more divergent emotions depending on the circumstances. In contrast, high correlations indicate that the individual does not strongly distinguish between emotion terms to describe how he or she feels and is, therefore, low in emotion differentiation. In line with previous research, an emotion differentiation index was computed by calculating the intraclass correlation (ICC; e.g., Kashdan, Ferssizidis, Collins, & Muraven, 2010) measuring average consistency between the negative emotions (Shrout & Fleiss, 1979), where a high ICC reflects low levels of emotion differentiation. Because the range for ICCs is between 0 and 1, ICCs with a negative value were excluded from further analyses as they are considered to be unreliable, and are theoretically impossible to interpret (Giraudeau, 1996). We calculated negative emotion differentiation on two levels: the day-level, enabling us to measure changes in emotion differentiation on a relatively short time-scale (from day-to-day), and on the wave-level, allowing us to assess changes in emotion differentiation on a larger time-scale (across months). The day-level indices were computed using the data from each day separately. As a sufficient number of time points is needed to calculate a reliable day-level ICC, an ICC was only computed for the days a participant had responded to at least 6 of the 10 ESM signals. For each participant, this resulted in a maximum of seven day-level ICCs per wave; thus, 21 day-level ICCs across waves, and a total of 3,112 ICCs across participants and waves. The wave-level emotion differentiation index was computed across all the time-points per wave, resulting in (maximum) three wave-level indices per person. Because ICCs do not have a normal sampling distribution, in line with previous research on emotion differentiation, resulting ICCs were transformed using a Fisher's Z-transformation (Barrett et al., 2001), and reversed ($-1 \times$ ICC) so that high indices indicate high levels of differentiation. Finally, as argued before, we did not assess differentiation of positive emotions because we expected stress to primarily have implications for differentiation of negative emotions. However, because of the relatively small number of positive emotions included in the ESM protocol, it was at the same time also not possible to estimate positive emotion differentiation as accurately as the level of differentiation of negative emotions.

Day-level stress. To compute a day-level index for stress, the intensity of the ESM stress item was averaged per day, with higher scores indicating higher stress levels. Similar to the day-level emotion differentiation index, this resulted in a maximum of seven day-level stress scores per wave; thus, 21 stress scores across waves.

Wave-level stress. Two wave-level stress indices were computed. The first wave-level stress score was derived from the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), which is a 10-item scale that measures how often an individual has experienced stress in the past month. It includes items such as "In the last month, how often have you felt nervous and 'stressed'?", which are rated on 5-point Likert scales ranging from 0 (*never*) to 4 (*very often*), with higher values being indicative of higher experienced stress levels. The internal consistency for the PSS questionnaire was .86, .82, and .87 for Waves 1, 2, and 3, respectively. The second wave-level index was computed by averaging the intensity of the ESM stress item per wave, with higher scores indicating higher stress levels.

Moderators. While the collected data included a large number of individual difference variables, we only tested the moderating effect of those variables that may be implicated in emotion differentiation, as suggested by theory or as demonstrated through previous research. Specifically, we examined whether the following variables moderated the relation between emotion differentiation and stress: neuroticism (measured with the Ten Item Personality Inventory, Gosling, Rentfrow, & Swann, 2003), depressive symptoms (measured with the CES-D; Radloff, 1977), emotional clarity (measured with the Difficulties Identifying Emotions subscale of the Toronto Alexithymia Scale [TAS-20]; Bagby, Parker, & Taylor, 1994), borderline personality traits (measured with the Assessment of *Diagnostic and Statistical Manual for Mental Disorders* [*DSM–IV*] Personality Disorders–Borderline Scale [ADP-IV]; Schotte, de Doncker, Vankerckhoven, Vertommen, & Cosyns, 1998), and the ability to update emotional information in working memory as measured with an affective two-back task (for a more in-depth description of this task, see Pe, Koval, & Kuppens, 2013; Pe, Raes, & Kuppens, 2013). The affective updating task consisted of 96 trials (and 24 practice trials that were not scored), and at each trial participants were presented with an emotional word that was either positively or negatively valenced (e.g., love). In this task, participants had to indicate whether the current word (trial n) had the same or a different valence as the word two trials back (trial n-2). Participants' emotional updating capacity was measured by taking their mean accuracy scores across all trials. For the questionnaires, a higher score indicates higher levels of neuroticism and depression, lower emotional clarity, and more borderline personality characteristics. For the emotional updating task, a higher score indicated better updating capacity.

Results

In the following section, we first examine whether there is variability in emotion differentiation within individuals. The findings for day-level emotion differentiation are reported first, followed by the wave-level findings. Next, we examine how variability in emotion differentiation relates to variability in stress levels, both concurrently, and predictively (using lagged models). Again, the day-level findings are reported first, followed by the wave-level findings. Finally, we test the robustness of some of these models. All multilevel analyses were conducted using HLM 7 (Raudenbush et al., 2011). Table 1 reports the descriptives for the (raw) day- and wave-level emotion differentiation and stress indices.

Variability in Emotion Differentiation

Day level. To determine whether emotion differentiation varies between days, we first examined the amount of variance in the day-level emotion differentiation index because of differences between days, between waves, and between individuals. To this

Table 1
The Means and Standard Deviations of the (Raw) Day- and Wave-Level Emotion Differentiation and Stress Indices

	Wave 1		Wave 2		Wave 3	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
ED-day	.55	.26	.54	.27	.53	.27
ED-wave	.63	.20	.61	.22	.62	.21
ESM stress-day	23.36	15.79	19.28	15.95	19.55	15.28
ESM stress-wave	23.25	11.78	19.35	12.61	19.55	12.11
PSS	1.53	0.60	1.42	0.58	1.37	0.61

Note. ED = emotion differentiation.

end, we predicted the transformed day-level emotion differentiation ICC with an empty three-level model (i.e., without predictors), with days, waves, and persons modeled at Levels 1, 2, and 3, respectively:

Level-1 (days)

$$\text{Day-level ICC}_{\text{days d, Waves w, Person p}} = \pi_{0wp} + e_{dwp}$$

Level-2 (waves)

$$\pi_{0wp} = \beta_{00p} + r_{0wp}$$

Level-3 (persons)

$$\beta_{00j} = \gamma_{000} + u_{00p}$$

Most of the total variance observed in the day-level ICCs (total variance = 0.22), was explained by the day-level (81.30%), while smaller portions of the variance were explained by the wave-level (6.47%), and person-level (12.23%).

Wave level. We examined the amount of variance present in the wave-level emotion differentiation index by predicting the transformed wave-level ICC with an empty two-level model (i.e., without predictors), with waves and persons modeled, respectively, at Levels 1 and 2:

Level-1 (waves)

$$\text{Wave-level ICC}_{\text{waves w, } Persons,\ p} = \pi_{0p} + e_{wp}$$

Level-2 (persons)

$$\pi_{0p} = \beta_{00} + r_{0p}$$

The total amount of variance was 0.13, of which 76% was explained by the wave-level, and only 24% by the person-level. This suggests that with an overall emotion differentiation index based on the data from a whole week, there is again a high level of within-person variability.

Emotion Differentiation and Stress

Next, we examined how variability in emotion differentiation relates to fluctuations in stress levels, both on the day- and on the wave-level.

Day level. To examine the concurrent role of stress, we examined whether within-person variations between days in the level of emotion differentiation were related to stress levels. To this end, we predicted emotion differentiation with stress by conducting multilevel analyses. Day-level ICCs were predicted by day-level stress (centered per person) in a three-level model (with days nested in waves, waves nested in persons) where stress was entered as a Level-1 predictor together with an intercept, and Levels 2 and 3 of the model consisted of random intercepts and slopes:

Level-1 (days)

$$\text{Day-level ICC}_{\text{days d, waves w, person p}} = \pi_{0wp} + \pi_{1wp} \times (\textit{day-level stress}_{dwp}) + e_{dwp}$$

Level-2 (waves)

$$\pi_{0wp} = \beta_{00p} + r_{0wp}$$

$$\pi_{1wp} = \beta_{10p} + r_{1wp}$$

Level-3 (persons)

$$\beta_{00p} = \gamma_{000} + u_{00p}$$

$$\beta_{10p} = \gamma_{100} + u_{10p}$$

The results showed that day-level ICCs were significantly related to day-level stress, with high stress levels predicting lower ICCs and, thus, lower emotion differentiation (Table 2, Model 1, day-level).

We next examined the prospective relationship between day-level emotion differentiation and day-level stress. Emotion differentiation at day (t) was predicted by stress at the previous day (t-1), while simultaneously adjusting for the level of emotion differentiation at the previous day (t-1; with both predictors centered per person). This was examined again in a three-level model in which lagged stress and lagged emotion differentiation variables were entered at Level-1, and Levels 2 and 3 consisted of random intercepts and slopes:

Level-1 (days)

$$\text{Day-level ICC}_{\text{days d, waves w, person p}} = \pi_{0wp} + \pi_{1wp} \times (\textit{lagged day-level stress}_{dwp}) + \pi_{2wp} * (\textit{lagged day-level ICC}_{dwp}) + e_{dwp}$$

Level-2 (waves)

$$\pi_{0wp} = \beta_{00p} + r_{0wp}$$

$$\pi_{1wp} = \beta_{10p} + r_{1wp}$$

$$\pi_{2wp} = \beta_{20p} + r_{2wp}$$

Level-3 (persons)

$$\beta_{00p} = \gamma_{000} + u_{00p}$$

$$\beta_{10p} = \gamma_{100} + u_{10p}$$

$$\beta_{20p} = \gamma_{200} + u_{20p}$$

Table 2
Multilevel Models of Emotion Differentiation Predicted by Stress (Model 1), Lagged Stress While Controlling for Lagged Emotion Differentiation (Model 2), and Lagged Stress While Controlling for Stress and Lagged Emotion Differentiation (Model 3), at the Day-Level and at the Wave-Level, and Stress Predicted by Lagged Emotion Differentiation While Controlling for Lagged Stress (Model 4), at the Day-Level and the Week-Level

	Day-level ESM stress					Wave-level ESM stress					Wave-level PSS				
Predictors	Fixed effect at Level 1	Robust *SE*	*t*	*p*	95% CI	Fixed effect at Level 1	Robust *SE*	*t*	*p*	95% CI	Fixed effect at Level 1	Robust *SE*	*t*	*p*	95% CI
Model 1															
Intercept	−0.703	0.015	−46.873	<.001	[−.732, −.674]	−0.803	0.019	−42.896	<.001	[−.840, −.766]	−0.803	0.019	−42.993	<.001	[−.840, −.766]
Stress	−0.005	0.001	−4.521	<.001	[−.007, -0.003]	−0.009	0.003	−3.077	.002	[−.015, −.003]	−0.126	0.043	−2.906	.004	[−.210, −.042]
Model 2															
Intercept	−0.718	0.016	−45.376	<.001	[−.749, −.687]	−0.797	0.023	−35.120	<.001	[−.842, −.752]	−0.797	0.003	−35.033	<.001	[−.803, −.791]
Lagged stress	−0.003	0.001	−2.608	.010	[−.005, −.001]	0.001	0.002	0.580	.563	[−.001, .003]	−0.047	0.049	−0.957	.340	[−.143, .049]
Lagged ED	−0.144	0.023	−6.132	<.001	[−.189, −0.099]	−0.334	0.074	−4.494	<.001	[−.479, −.189]	−0.349	0.074	−4.696	<.001	[−.494, −.204]
Model 3															
Intercept	−0.718	0.016	−45.418	<.001	[−.749, −.687]										
Stress	−0.004	0.001	−3.102	.002	[−.006, −.002]										
Lagged stress	−0.003	0.001	−2.634	.009	[−.005, −.001]										
Lagged ED	−0.149	0.023	−6.363	<.001	[−.194, −.101]										
Model 4															
Intercept	20.308	0.792	25.627	<.001	[18.756, 21.860]	19.323	0.832	23.216	<.001	[17.692, 20.954]	1.389	0.040	34.886	<.001	[1.311, 1.467]
Lagged ED	0.757	0.461	1.642	.102	[−.147, 1.661]	−2.178	1.835	−1.187	.237	[−5.775, 1.419]	−0.007	0.080	−.084	.933	[−.165, .150]
Lagged stress	0.060	0.025	2.428	.016	[.011, .109]	−0.521	0.130	−3.995	<.001	[−.776, −.266]	−0.352	0.077	−4.555	<.001	[−.503, −.201]

Note. ED = emotion differentiation; CI = confidence intervals. The models also contained also a random intercept at Level 2 for the wave-level models, and random effects at Level 2 and Level 3 for the day-level models.

The results showed a significant negative relation between day-level emotion differentiation and lagged day-level stress[1] (Table 2, Model 2, day-level). This finding indicates that relatively high stress levels on one day are associated with relatively low levels of emotion differentiation on the next day. To investigate how robust these findings were, we next added day-level stress to the previous model as a Level-1 predictor (centered per person). Results showed that after controlling for day-level stress, lagged day-level stress still significantly related to day-level emotion differentiation (Table 2, Model 3, day-level).

The prospective relationship between emotion differentiation and stress was also tested in the opposite direction. Here, we tested a model in which lagged day-level emotion differentiation predicted day-level stress, adjusting for lagged day-level stress (both predictors centered per person). However, the predictive effect of emotion differentiation was nonsignificant (Table 2, Model 4, day-level).

Wave level. Next, we examined whether wave-level variations in the level of emotion differentiation were related to longitudinal fluctuations in stress levels. To this end, we predicted wave-level emotion differentiation with wave-level stress (centered per person). The wave-level ICCs were predicted by the perceived stress scale (PSS) scores, as well as the average ESM stress score across the wave, by applying separate two-level models (waves nested in persons) where stress was entered at Level-1 together with an intercept, and Level-2 of the model consisted of a random intercept and slope:

Level-1 (waves)

$$\text{Wave-level ICC}_{waves\ w,\ person\ p} = \pi_{0p} + \pi_{1p} \times (\textit{wave-level stress}_{wp}) + e_{wp}$$

Level-2 (persons)

$$\pi_{0p} = \beta_{00} + r_{0p}$$

$$\pi_{1p} = \beta_{10} + r_{1p}$$

Results showed that wave-level ICCs were indeed significantly related to both wave-level stress indices (the PSS and the ESM stress index), with high stress levels predicting lower ICCs and, thus, lower emotion differentiation (Table 2, Model 1, wave-level). These findings indicate that also on the larger time-scale and using a different stress measure, fluctuations in emotion differentiation and stress go hand in hand.

Finally, we examined the prospective relationship between wave-level emotion differentiation and wave-level stress. Emotion differentiation at wave (t) was predicted by stress at the previous wave (t-1), while controlling for the level of emotion differentiation at the previous wave (t-1) with a two-level model in which the lagged stress and lagged emotion differentiation variables (both centered per person) were entered at Level-1, and Level 2 consisted of a random intercept:

[1] There was a negative autocorrelation for day-level emotion differentiation. We conducted a series of analyses to explain this finding, and to show that it does not impact the main parameters of interest for the current study. These analyses can be found as online supplemental material.

Level-1 (waves)

$$\text{Wave-level ICC}_{\text{waves w, person p}} = \pi_{0p} + \pi_{1p} \times (\textit{lagged wave-level stress}_{wp}) + \pi_{2p} \times (\textit{lagged wave-level ICC}_{wp}) + e_{wp}$$

Level-2 (persons)

$$\pi_{0p} = \beta_{00} + r_{0p}$$

$$\pi_{1p} = \beta_{10}$$

$$\pi_{2p} = \beta_{20}$$

There was a nonsignificant relation between emotion differentiation and lagged stress at the wave level (Table 2, Model 2, wave-level). This indicates that on the larger time-scale, stress does not predict how much an individual differentiates between emotions at the next measurement occasion. This analysis was also conducted in the opposite direction, with lagged emotion differentiation predicting wave-level stress. This relationship was also not significant (Table 2, Model 4, wave-level).

Testing the Robustness of Our Findings

The findings above show that there are considerable within-person fluctuations in emotion differentiation, both from day-to-day and from wave to wave. Furthermore, these fluctuations go hand in hand with changes in stress levels at both levels of analysis. More interestingly, day-to-day changes in differentiation of negative emotions are prospectively predicted by stress, meaning that stress levels on one day predict the level of negative emotion differentiation on the next day (bot not vice versa).

In this section, we will examine the robustness of the day-level model in two ways: we will test (1) if the predictive relation between stress and emotion differentiation is unique to stress, or if other emotions also predict emotion differentiation in a similar way; and (2) if there is an effect of time on the predictive relation between stress and emotion differentiation.

The predictive effect of other emotions on emotion differentiation. In line with multiverse analysis, which involves performing all analyses across the whole set of alternatively processed data sets corresponding to a large set of reasonable scenarios (Steegen, Tuerlinckx, Gelman, & Vanpaemel, 2016), we tested whether stress was unique in predicting emotion differentiation, or whether the other negative emotions included in the ESM protocol also predicted emotion differentiation. To this end, we repeated the day-level analyses for the other emotions by computing an ICC for each combination of five negative emotions, and then testing whether this ICC was predicted by the mean of the sixth negative emotion at the same day (for the concurrent analyses), and at the previous day (for the prospective analyses). For instance, to test the predictive effect of anger on emotion differentiation, we calculated the mean anger level for each day as the predictor, and the ICC between the other five emotions (i.e., sad, depressed, lonely, anxious, and stressed) as an index for emotion differentiation. We then looked at how these two variables related to each other.

The results are summarized in Table 3 and show that concurrently, other emotions were also predictive of emotion differentiation. However, prospectively, our results uniformly demonstrated that other emotions were not predictive of emotion differentiation; the ICC at one day was only predicted by mean stress-levels of the previous day, but not by mean levels of any of the other emotions (all p values $>.07$). Thus, our results indicate that prospectively, stress is indeed unique in predicting emotion differentiation. For the sake of brevity, we only report the results for the concurrent and prospective fixed effect of each of the (lagged) emotions on the ICC (calculated on the remaining five emotions), instead of reporting the full model.

The effect of time. If variables systematically covary with time (e.g., gradually increase or decrease as time goes by), this time covariation may be an alternative explanation of our relationships. In the present study, it could be possible that emotion differentiation would decrease with time, for instance because of boredom caused by repeatedly having to complete the ESM questionnaire. To examine this, we tested whether time (i.e., Day 1, Day 2, Day 3, etc.) was a relevant variable in the day-level models, by including it as a (centered) predictor at Level 1. We also assessed whether it interacted with stress to predict emotion differentiation. Results showed that there was no main effect of time, but it did interact with stress in predicting emotion differentiation, both concurrently and prospectively. This interaction indicates that the longer into the ESM part of the study (per wave), the relationship between stress and emotion differentiation becomes slightly attenuated. A possible explanation could be that participants' motivation to comply to instructions decreases toward the end of an ESM period, resulting in more noise in the data. However, the interaction effect

Table 3

The Predictive Effect of Other Emotions on Emotion Differentiation in the Concurrent and Prospective Day-Level Models

	Concurrent					Prospective				
Predictor	Level 1 fixed effect	Robust *SE*	*t*	*p*	95% CI	Level 1 fixed effect	Robust *SE*	*t*	*p*	95% CI
Anger	−0.014	0.002	−9.005	<.001	[−.018, −.010]	−0.001	0.002	−0.603	.547	[−.005, .003]
Anxiety	−0.019	0.002	−9.348	<.001	[−.023, −.015]	−0.002	0.002	−1.092	.276	[−.006, .002]
Sadness	−0.016	0.001	−10.478	<.001	[−.018, −.014]	−0.003	0.001	−1.832	.068	[−.005, −.001]
Depression	−0.015	0.002	−9.062	<.001	[−.019, −.011]	−0.002	0.001	−1.440	.151	[−.004, 0]
Loneliness	−0.007	0.001	−6.395	<.001	[−.009, −.005]	−0.001	0.001	−0.539	.590	[−.003, .001]

Note. Only the Level-1 fixed effects of the predictors are reported. The effect of each predictor was tested in a separate model.

Table 4
Concurrent (Model 1) and Prospective (Model 2) Multilevel Models in Which Day-Level Emotion Differentiation is Predicted by Stress, Time, and the Interaction Between Stress and Time (and in the Prospective Analyses, Also the Lagged Emotion Differentiation Index)

Predictors	Fixed effect at Level 1	Robust *SE*	*t*	*p*	95% CI
Model 1					
Intercept	−0.701	0.015	−46.339	<.001	[−.730, −.672]
Stress	−0.006	0.001	−4.083	<.001	[−.008, −.004]
Time	0.004	0.004	.919	.359	[−.004, .012]
Stress × Time	0.001	0.000	2.153	.033	[.001, .001]
Model 2					
Intercept	−0.715	0.016	−44.942	<.001	[−.746, −.684]
Lagged ED	−0.200	0.021	−9.497	<.001	[−.241, −.159]
Lagged stress	−0.003	0.001	−3.035	.003	[−.005, −.001]
Time	0.010	0.007	1.422	.156	[−.006, .024]
Lagged stress × Time	0.001	0.001	2.056	.041	[−.001, .003]

Note. ED = emotion differentiation; CI = confidence intervals.

was not very strong, and the main effect of stress remained unchanged. Results are presented in Table 4.

Exploring Moderators

In the final part, we explored the potential moderating effect of individual difference variables on the relation between emotion differentiation and stress. A model was computed separately for each individual difference variable. To assess a potential moderating effect, for the day-level analyses, we added the moderator (centered per wave across individuals) at Level 2 of the three-level model. For the week-level models, we added the moderator and the interaction between the moderator and the stress variable at Level 1 of the two-level model. The results are reported in Table 5 for the day-level concurrent and prospective models, and Table 6 for the concurrent wave-level models (the prospective models are not reported because of a lack of power). For the sake of brevity, instead of reporting the full models, we only report the results of the Level-2 fixed effects of the moderator on emotion differentiation for the day-level models, and the results of the Level-1 interaction between the moderator and stress on emotion differentiation for the wave-level models.

For the day-level concurrent models predicting emotion differentiation, the TAS-dif and CES-D scales were significant moderators of the effect of stress on emotion differentiation. For the day-level prospective models, there were no significant moderators. There were no significant moderators for the wave-level concurrent models.

In summary, the effects of the moderators are relatively rare and are very inconsistent across the day- and wave-level models, as well as across the concurrent and predictive models. Given this inconsistency, and the exploratory nature of these analyses, we do not believe that the few significant results we find provide strong evidence for these variables moderating the stress-emotion differentiation relationship. Indeed, given the total number of relationships tested, it is possible that these effects are simply Type I errors. Finally, it is important to note that the week-level models should be interpreted with caution, as there are only a maximum of three observations at Level 1, making it difficult to estimate the interaction effects.

Discussion

Emotion differentiation is a fast-growing field of research (Kashdan et al., 2015). Typically, emotion differentiation is considered and studied as a stable characteristic of individuals, akin to personality (e.g., Conley, 1984; Roberts & DelVecchio, 2000). To complement this research on emotion differentiation, in line with contemporary trait theories (e.g., Fleeson, 2001), the current study

Table 5
Concurrent and Prospective Multilevel Models in Which Day-Level Emotion Differentiation is Predicted by Stress (and in the Prospective Models the Lagged Emotion Differentiation Index) at Level 1, and a Moderator at Level 2

	Concurrent					Prospective				
Moderator	Coefficient	Robust *SE*	*t*	*p*	95% CI	Coefficient	Robust *SE*	*t*	*p*	95% CI
CES-D	0.006	0.002	2.402	.017	[.002, .010]	0.003	0.003	1.175	.241	[−.003, .009]
Neuroticism	0.001	0.001	1.463	.145	[−.001, .003]	−0.000	0.001	−0.573	.567	[−.002, .002]
TAS-dif	0.003	0.001	2.004	.046	[.001, .005]	0.001	0.001	0.602	.548	[−.001, .003]
ADP-IV	−0.000	0.001	−0.331	.741	[−.002, .002]	−0.000	0.001	−0.275	.784	[−.002, .002]
Updating capacity	−0.009	0.007	−1.294	.197	[−.023, .005]	0.003	0.008	0.331	.741	[−.013, .019]

Note. CI = confidence intervals; CES-D = Center for Epidemiologic Studies Depression Scale; TAS-dif = Difficulties Identifying Emotions sub-scale of the Toronto Alexithymia Scale; ADP-IV = Assessment of DSM-IV Personality Disorders–Borderline Scale.

Table 6
Concurrent Multilevel Models in Which Week-Level Emotion Differentiation is Predicted by the Interaction Between Stress and a Moderator (While Controlling for Stress, and the Moderator)

	ESM stress					PSS				
Moderator	Coefficient	Robust *SE*	*t*	*p*	95% CI	Coefficient	Robust *SE*	*t*	*p*	95% CI
CES-D	−0.010	0.010	−1.013	.312	[−.012, −.008]	0.110	0.152	0.709	.479	[−.188, .408]
Neuroticism	0.005	0.004	1.321	.187	[−.003, .013]	0.092	0.077	1.203	.230	[−.059, .243]
TAS-dif	−0.006	0.006	−1.018	.309	[−.018, .006]	−0.058	0.133	−0.439	.661	[−.319, .203]
ADP-IV	−0.000	0.006	−0.023	.982	[−.012, .012]	−0.032	−0.080	−0.403	.687	[−.048, −.016]
Updating capacity	0.041	0.025	1.630	.104	[−.008, .090]	0.019	0.805	0.023	.982	[−1.559, 1.597]

Note. CI = confidence intervals; CES-D = Center for Epidemiologic Studies Depression Scale; TAS-dif = Difficulties Identifying Emotions sub-scale of the Toronto Alexithymia Scale; ADP-IV = Assessment of DSM-IV Personality Disorders– Borderline Scale.

assessed whether within-person fluctuations in emotion differentiation are a function of stress.

The Role of Stress in Emotion Differentiation

In this research, using two measures of stress (ESM and a retrospective questionnaire), we showed that within-person fluctuations in emotion differentiation were related to changes in stress levels. In addition, on the day-level, stress predicted the level of emotion differentiation of the next day, but emotion differentiation did not predict stress on the next day. This suggests that stress may be an antecedent of emotion differentiation, although this idea would need to be directly tested in an experimental paradigm. More important, we demonstrated that stress has a unique function in predicting negative emotion differentiation: other emotions predicted emotion differentiation concurrently, but they did not predict emotion differentiation prospectively. This indicates that our prospective findings are to do with stress specifically, rather than negative emotion more generally.

However, we only found the predictive effect of stress on negative emotion differentiation on the day-level, and not on the wave-level. As discussed earlier, this could be explained by the fact that the study was not powered enough to test such wave-level effects. However, it can also be that the time course of the link between stress and emotion differentiation is typically short, and that the effects of stress do not flow on to emotion differentiation over large periods of time. For example, facing some significant stress might lead to an immediate reduction in cognitive resources, or the feeling of being overwhelmed and, thus, result in a simplified experience of emotions while the stress is processed. As such, if a person gets stressed today, it may affect their current level of emotion differentiation, but it could also occur overnight since the person may still have to deal with it tomorrow. However, the stress that a person experienced several months ago may have already been processed, and by this logic, is unlikely to affect emotion differentiation several months later. It is of course possible that in certain cases, stress that occurs at a given point in time (e.g., failing to get tenure, a break-up) may have emotional repercussions over many months. While the current study shows the acute effects of daily life stress on emotional processing, future research should also focus on the long-term consequences of chronic stress on emotion differentiation. This research could use a sample facing significant stressors, rather than the daily hassles that were likely to be experienced in our study. Such a study would provide more definitive evidence regarding the time-scale of these relationships.

Implications of Our Findings

First, our findings have implications for our general understanding of emotions. According to emotion theorists, emotions convey information to us. For instance, according to the feelings as information perspective (Schwarz, 1990), we rely upon our feelings when appraising or judging our world and, thus, use our feelings as a source of information. However, our findings show that individuals do not always retrieve the same information from their emotions. Depending on their level of differentiation, this information can either be very specific, or generalized across valence.

An important question is whether lower emotion differentiation can have adaptive value under stressful conditions. Perhaps, under stressful circumstances, when all attention is directed toward dealing with the stressor, it is more adaptive for the individual to not focus on details, but instead simply process if an emotion is positive or negative. As such, it is possible that variable levels of emotion differentiation are functional: under ideal circumstances, a high level of emotion differentiation may be optimal (as shown by numerous studies linking emotion differentiation to well-being), but under stressful circumstances, maybe a lower level of differentiation (of specifically negative emotions) is more adaptive. The present findings do not speak directly to this point, but the fact that we were not able to (consistently) identify indicators of well-being as moderators of this stress-emotion differentiation relationship, provides preliminary evidence that this negative relationship is not necessarily a sign of emotional dysfunction. Future lab research manipulating emotion differentiation across stressful and nonstressful contexts will be an important step in determining the potential adaptiveness of lower emotion differentiation in response to stress.

Finally, the current findings implicate that emotion differentiation may be malleable. This is important in the context of therapies and interventions because it suggests that individuals can possibly be taught to differentiate more between their emotions. As such, to fully understand the nature, determinants, and consequences of emotion differentiation, it is important also study emotion differentiation from a within-person perspective.

Limitations and Future Directions

One limitation of the current study is that we did not examine how stress relates to differentiation of positive emotions. However, it is possible that the level of positive emotion differentiation is influenced in the same way as negative emotion differentiation. Alternatively, a reduction in the level of differentiation could also be a strategy to deal more efficiently with adversities (Davis et al., 2004; Reich et al., 2003; Zautra et al., 2000), which would make this strategy inherently more relevant for negative emotional stimuli. Assessing how differentiation of positive emotions is related to stress could therefore potentially clarify why stress relates to emotion differentiation, and would be an interesting avenue for future research.

Furthermore, the large amount of day-to-day variability in emotion differentiation could suggest that an individual's level of differentiation also fluctuates from moment to moment. As stress levels can also change from one moment to the next, this would be in line with the current findings. However, as emotion differentiation currently is measured across time-points, is it impossible to capture its moment-to-moment variability using the methods applied in our research, which is an important limitation. To capture this state component of emotion differentiation, two different indices have recently been proposed. Grossmann, Huynh, et al. (2016) used an entropy measure to compute indices for emodiversity for each separate measurement occasion, but found this index to be largely unrelated to the traditional emotion differentiation index. Tomko et al. (2015) used momentary ICCs that indicated how consistently negative emotion items were rated across fear, hostility, and sadness subscales. However, this index requires multiple scales, and it is not clear how it relates to the traditional index. Moving forward, such momentary emotion differentiation indices could be a solution to this problem, but they need further investigation.

Another important potential shortcoming of the current study is its reliance on first-year students. We selected this sample because the first year at university is often turbulent because of several potentially large changes in important life domains (Tamir et al., 2007). These changes can lead to adjustment problems in some individuals, making it a valuable period for researchers to study emotional processes in relation to well-being. However, it is unclear to what extent the findings from such a student sample can be extended to other populations (e.g., other age-groups or other cultures).

Furthermore, to our knowledge, emotion differentiation has primarily been studied in Western European countries or in the United States. However, a recent study by Grossmann, Huynh, et al. (2016), in which different operationalizations of emotional complexity, including emotion differentiation, were studied across different cultures, showed that individuals from the United States differentiated the least between their negative emotions, whereas individuals from Japan and India had the highest levels of differentiation. Furthermore, based on the sociocultural perspective on emotions (e.g., De Leersnyder, Boiger, & Mesquita, 2015), it would not be surprising if the ability to differentiate between certain emotions is more adaptive than the ability to differentiate between other emotions, depending on the cultural context. For instance, based on cross-cultural research, (Kitayama, Mesquita, & Karasawa, 2006) we could expect the ability to differentiate more between socially disengaging emotions to be more adaptive in the European American context, and the ability to differentiate between socially engaging emotions to be more adaptive in the Japanese context. In summary, this suggests that emotion differentiation is a topic worthy of cross-cultural study.

Another limitation of the present research is that while it showed a prospective relation between emotion differentiation and stress, it is still unclear through which processes stress influences emotion differentiation. Investigating the pathways, as well as contextual factors that can drive these fluctuations, will help to validate the current findings, and will add important knowledge to our understanding of emotion differentiation.

Conclusion

Taken together, the current findings demonstrate that day-to-day variability in emotion differentiation co-occur with stress, and at the day-level, are predicted by stress. As such, the present study opens new doors for emotion differentiation research, showing that within-person fluctuations are a crucial and meaningful part of emotion differentiation. Future research should be directed toward investigating the processes through which stress influences emotion differentiation, and whether this relationship is adaptive or maladaptive.

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