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Differentiating Emotions Across Contexts: Comparing Adults with and without Social Anxiety Disorder Using Random, Social Interaction, and Daily Experience Sampling

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Abstract

The ability to recognize and label emotional experiences has been associated with well-being and adaptive functioning. This skill is particularly important in social situations, as emotions provide information about the state of relationships and help guide interpersonal decisions, such as whether to disclose personal information. Given the interpersonal difficulties linked to social anxiety disorder (SAD), deficient negative emotion differentiation may contribute to impairment in this population. We hypothesized that people with SAD would exhibit less negative emotion differentiation in daily life, and these differences would translate to impairment in social functioning. We recruited 43 people diagnosed with generalized SAD and 43 healthy adults to describe the emotions they experienced over 14 days. Participants received palmtop computers for responding to random prompts and describing naturalistic social interactions; to complete end-of-day diary entries, they used a secure online website. We calculated intraclass correlation coefficients to capture the degree of differentiation of negative and positive emotions for each context (random moments, face-to-face social interactions, and end-of-day reflections). Compared to healthy controls, the SAD group exhibited less negative (but not positive) emotion differentiation during random prompts, social interactions, and (at trend level) end-of-day assessments. These differences could not be explained by emotion intensity or variability over the 14 days, or to comorbid depression or anxiety disorders. Our findings suggest that people with generalized SAD have deficits in clarifying specific negative emotions felt at a given point of time. These deficits may contribute to difficulties with effective emotion regulation and healthy social relationship functioning.

Keywords

social anxiety disorder; negative emotions; ecological momentary assessment; experience sampling

People with the generalized subtype of social anxiety disorder (SAD) experience an intense, persistent fear of drawing attention to themselves in social situations, believing that their flaws will be exposed and that they, in turn, will be evaluated negatively and rejected (Morrison & Heimberg, 2013). As one of the most common psychiatric disorders in the United States, epidemiological studies have demonstrated a lifetime prevalence rate as high as 12 to 16% (Kessler et al., 2005; Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996). This disorder is associated with significant impairment in social, occupational, and daily functioning (Schneier et al., 1994). In this study, we investigated a new mechanism that may play a role in the development or maintenance of excessive, impairing social anxiety. In particular, we explored the relationship between SAD and the degree to which people felt emotional experiences in the context of everyday life events.

People experience a constant stream of information—internal and external—throughout their daily lives that help them navigate the social world. Emotional experiences are one such source of information (Keltner & Kring, 1998). At times these experiences are distinct (e.g., intense anger with a clear cause), but at other times, emotions are diffuse and even muddled (e.g., a general sense of discomfort, dread, and anger, with no particular distinguishing features). *Emotion differentiation*, also referred to as emotional granularity, is the degree to which a person is able to classify felt experiences into discrete emotion categories (Barrett, Gross, Christensen, & Benvenuto, 2001; Tugade, Fredrickson, & Barrett, 2004). People vary in their ability to differentiate positive (Tugade et al., 2004) and negative emotions (e.g., Barrett, 2004; Kashdan, Ferrisizidis, Collins, & Muraven, 2010). People low in emotion differentiation are less attentive to and less able to describe how they feel at any given time; thus, their descriptions of emotional states tend to be limited to broader, non-specific terms such as “good” for people low in positive emotion differentiation or “bad” for people low in negative emotion differentiation.

The ability to recognize and label distinct emotional experiences with great specificity has been shown to buffer people from maladaptive behaviors and other adverse outcomes that often arise in response to stress. In general, the more differentiated people’s emotions are, the better able they are to use that emotion as a source of information to calibrate their behavioral responses to match the demands of a given situation (Barrett et al., 2001). High differentiators of negative emotions recover faster from induced negative mood states (Salovey, Mayer, Goldman, Turvey, & Palfai, 1995), employ a broader range of emotion regulation strategies (Barrett et al., 2001), and are less likely to use avoidant or impulsive coping strategies during stressful situations (Tugade et al., 2004; Zaki, Coifman, Rafaeli, Berenson, & Downey, in press). The ability to differentiate emotions provides people access to information about whether their goals are being met and—if not—about the particular strategies that would best help them pursue these goals (Carver & Scheier, 1990). Negative emotion differentiation may be particularly important in social situations, as emotions provide important information about the state of a relationship and help guide decisions to resolve conflict, communicate needs, enhance social bonds, or protect oneself from rejection.

Emotion differentiation is conceptually related to the broader construct of alexithymia—a deficit in insight into emotions, including difficulty identifying and labeling emotions,

verbally describing emotional states, and differentiating the subjective from the physiological arousal aspect of emotion. Alexithymia has been assessed with global self-report questionnaires, with occasional corroboration with observer-ratings in clinical settings (Taylor, Bagby, & Luminet, 2000). In a study comparing patients with SAD to patients with generalized anxiety disorder and a healthy comparison group (Turk, Heimberg, Luterek, Mennin, & Fresco, 2005), researchers found that patients with SAD endorsed greater difficulty identifying and describing their emotions than healthy controls, and greater difficulty describing their emotions than patients with generalized anxiety disorder. In another study, people with SAD could be distinguished from people without SAD based on their endorsement of global survey items indicating difficulty understanding emotions (Mennin, McLaughlin, & Flanagan, 2009).

While single occasion, self-report questionnaire studies hint at a relationship between SAD and negative emotion differentiation, the methodology of this line of research is limited by its reliance on people's ability to accurately recall and aggregate their emotional experiences. Such global self-report measures (e.g., Taylor, Ryan, & Bagby, 1985) require people to describe their metacognitive abilities without a specific time frame. For example, they may ask participants to indicate their agreement with items such as "I am usually very clear about my feelings" on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. Thus, the validity of this approach might be compromised when people have poor insight into their internal, felt experiences (as implied by anybody who has alexithymia).

To capture negative emotion differentiation more directly and in a naturalistic context, researchers have sought to observe how people actually distinguish among emotion categories over multiple assessments in their daily lives (Barrett et al., 2001; Demiralp et al., 2012; Pond et al., 2011; Zaki et al., in press). This methodology is not only grounded in people's actual experiences over time (i.e., more ecologically valid) but also minimizes bias due to social desirability, since questions about emotion and mood are time-limited. By calculating the associations between the emotion adjectives people endorse at any measurement instance, researchers capture the degree to which people use emotion categories to represent distinct felt experiences (e.g., Tugade et al., 2004). This measurement approach is consistent with literature on emotional complexity, which argues that people gain complexity in their understanding of emotional experiences as they learn to associate the activation of particular emotion circuits with a category tied to environmental conditions (Lindquist & Barrett, 2008).

In the only empirical investigation of global questionnaires of emotional clarity and/or alexithymia with the intensive repeated measure approach to assess emotion differentiation, there was virtually no association between these constructs ($r_s < .10$; Boden, Thompson, Dizén, Berenbaum, & Baker, 2013). This fits with the notion that emotions are short-lived experiences and best measured in the moment as opposed to a context-free retrospective assessment across time ("in general"). To date, the only two studies on constructs related to emotion differentiation relied on surveys asking people with SAD to reflect on how effective they are at paying attention to and clarifying their exact, specific emotions (Mennin et al., 2009; Turk et al., 2005). Instead of using measures that reflect an individual's *perception* of his/her skill in differentiating clearly among emotions categories, we measured people's

skills directly in multiple real-world social and non-social settings across a two-week assessment period. This novel methodological approach allows for a fine-grained analysis of whether people with SAD show emotion-related deficits across multiple contexts with an ability-based measure.

Negative emotion differentiation may be particularly important when stressors induce distress, creating a particular need for healthy emotion regulation strategies that increase the likelihood of desirable intrapersonal and social outcomes (Barrett et al., 2001; Gohm, 2003). For people with SAD, most social interactions tend to be stressful and anxiety-provoking. Thus, it is likely that they have difficulty identifying primary emotions such as sadness, fear, and anger, and instead experience their emotions as undifferentiated, confusing, and overwhelming. Turk et al. (2005) found that participants with SAD reported paying less attention to emotions (positive and negative) compared to healthy controls or participants with generalized anxiety disorder. Paying attention to proprioceptive cues during emotional arousal can help people make meaning from these sensations, aid encoding, and relate them to future situations, resulting in more differentiated experiences. Taken together, prior research suggests that people with SAD may fail to take advantage of the adaptive information that their emotions provide about social interactions and relationships.

Existing theoretical models of SAD offer insight into the potential relevance of negative emotion differentiation. When socially anxious people are hyper-focused on making a good impression on others, they often fear that they are deficient in some important way (Moscovitch, 2009) or doubt their ability to be successful in social situations (Schlenker & Leary, 1982). It appears that people with SAD experience primarily two kinds of negative emotions as they orient to preventing the public exposure of self-attributed flaws in social situations: (a) anxiety about the potential that such attributes would be exposed; and (b) embarrassment if exposure of flaws or failure to make a desired impression is perceived (Moscovitch, 2009). To reduce the possibility of being evaluated and rejected by other people, people devote considerable cognitive resources to anticipating, avoiding, and controlling anxiety-related thoughts, feelings, and behaviors. This includes engaging in safety behaviors, such as excessive rehearsal, self-censorship, and deflection of attention to minimize the possibility of feared consequences (Clark & Wells, 1995). Recurrent, intense efforts to control anxiety (i.e., acts of experiential avoidance) are essentially a mode of prevention where the avoidance of threat and failure dominates.

To the extent that people with SAD are oriented toward fearing and avoiding social situations, the range of possible negative emotions they tend to experience would necessarily be quite limited. Unfortunately, the prevention mode inherent to SAD disrupts the ability to pay attention to situational and proprioceptive cues when emotionally aroused (see Morrison & Heimberg, 2013). Excessive self-focused attention during anxiety-provoking situations combined with hypervigilance to threat and reliance on safety behaviors may serve to reduce the ability of people with SAD to attend to stimuli that may differentiate negative emotions. That is, with their information processing biases and reduced attentional control (e.g., Heimberg, Brozovich, & Rapee, 2010), people with SAD may be more likely to describe their emotional experience in a crude manner, focusing on the degree of distress instead of

the discrete types of emotions that are distressing (e.g., high anxiety, moderate anger, no sadness).

Prior research has found that people with SAD show overall elevations in negative emotions and deficits in positive emotions, as well as a tendency to view positive events as threatening, which may further contribute to the co-occurrence of (minimal) positive and (excessive) negative emotions (Kashdan, Weeks, & Savostyanova, 2011). Extending prior theorizing on SAD and emotions, we suspect that people with SAD will also show evidence of low differentiation of negative emotions. Because people with SAD generally experience fewer and less intense positive emotions, the presence of positive emotional experiences is expected to be fairly context-specific; thus, there is no reason to expect low positive emotion differentiation to be part of the phenomenology of SAD.

Lack of skill in discriminating between unpleasant states may contribute to people with SAD viewing emotions as upsetting and uncomfortable and, consequently, making efforts to suppress or avoid them. A growing body of evidence suggests that people with SAD possess a skill deficit in using healthy emotion regulation strategies such as cognitive reappraisal effectively (Werner, Goldin, Ball, Heimberg, & Gross, 2011). In one functional neuroimaging study, participants with SAD not only reported more difficulty employing cognitive reappraisal to reduce negative emotions, but also displayed less activation in brain regions related to this strategy (Goldin, Manber-Ball, Werner, Heimberg, & Gross, 2009). Additionally, people with SAD are more likely to view emotions, even positive emotions, as threatening compared to healthy controls (Turk et al., 2005). The combination of lack of skills for managing emotions and negative reactions to emotions suggest that people with SAD would likely make efforts to quash emotional experiences. Consistent with this, researchers have found people with SAD to be more likely to use emotion regulation strategies of avoidance and suppression, which tend to be ineffective or counterproductive for diminishing negative experiences (e.g., Farmer & Kashdan, 2012; Kashdan, Morina, & Priebe, 2009; Kashdan & Steger, 2006). Since negative emotions are most likely to be targeted in emotion regulation efforts, having difficulty distinguishing among discrete negative emotions may contribute to people with SAD failing to respond to emotional experiences in an appropriate manner given the environmental context.

Only a handful of published studies exist on the real-world emotions of people with SAD. Each of these studies has focused exclusively on intensity aggregated pleasant and unpleasant emotions, with the one exception that targeted the tendency of people with SAD to fear and avoid anxiety (Kashdan et al., 2013). However, other dimensions of emotion may also be relevant to the phenomenology of SAD. In particular, intraindividual variability in emotions over time and the degree to which people experience emotions in a discrete and differentiated manner may also be related to SAD symptomology. By gathering reports of emotions close in time in naturally occurring contexts, researchers increase the ecological validity and generalizability of findings by reducing the potential for retrospective bias. These issues are relevant to the basic understanding of emotion and especially important for the study of people with SAD, who are prone to negatively biased information processing (Clark & McManus, 2002). In fact, the only way to determine the relevance of emotion differentiation to emotional difficulties and functional impairment (such as SAD) is to

measure actual differentiation in naturalistic setting over time and compare this ability with other dimensions of emotion in the same study (i.e., simultaneous investigation of within-person variability and between-person differences in intensity of emotions).

The present study extends prior research by using an experience sampling design to directly assess emotion differentiation skills in people with SAD and a demographically matched group of healthy adults. The availability of a disordered and healthy sample allowed us to examine the importance of dynamic intra-individual emotion-related processes to the presence of SAD. Using portable electronic devices, we investigated the extent to which people discriminate among emotion categories in three contexts: during random prompts, during face-to-face social interactions (reported on immediately afterwards), and during end-of-day reports (i.e., reflecting on the whole day). Prior to addressing the primary research questions, we explored the relationship between three different indices of emotion structure: intensity, variability, and differentiation. We hypothesized that people who were better able to discriminate among specific emotions would derive greater benefits, defined as less intense and variable negative emotions and more intense and less variable positive emotions; fitting with prior research (e.g., Boden et al., 2013). Results consistent with our hypotheses would provide additional evidence for emotion differentiation being linked to psychological health. With regard to the primary research questions, we hypothesized that: (a) participants with SAD would display less differentiation of negative emotions than healthy controls across random, social, and end-of-day contexts; (b) these effects would not be attributed to group differences in average emotion intensity and variability over the 14-day assessment period; and (c) negative emotion differentiation deficits would be linked specifically to social anxiety severity, controlling for comorbid conditions—an important test of construct specificity given recent evidence of emotion differentiation difficulties in people with major depressive disorder (Demiralp et al., 2012). Given that people with SAD tend to experience broad deficits in positive emotionality (Kashdan et al., 2011), rare positive experiences are likely to be context-specific; thus, we expected group differences to be restricted to the ability to differentiate negative (and not positive) emotions.

Method

Participants

We recruited 86 adults from the Northern Virginia community, of whom 43 were diagnosed with Social Anxiety Disorder (SAD), generalized subtype, and 43 were a healthy control (HC) group with no psychological difficulties. All participants spoke English fluently and were familiar with using computers. During initial screening procedures, participants were excluded from the HC group if they endorsed symptoms consistent with any psychological diagnosis, and participants were excluded from the SAD group if they presented with symptoms of psychosis, substance misuse, or suicidality. We excluded one participant for not providing more than three entries for any of the data collection methods after the initial screening. This led to a final sample of 43 participants with SAD (26 women) and 42 HC participants (27 women), with an average age of 28.5 years ($SD = 8.6$). Of our sample, 46 identified themselves as White/Caucasian, 17 as Black/African-American, 9 as Hispanic/Latino, 4 as Asian/Asian-American, 1 as Middle Eastern, and 8 as “other”. As for

relationship status, 52 participants were single, 14 were married, 10 were cohabitating, 4 were divorced or separated, and 4 listed another relationship status. As for education level, 6 individuals had completed high school or less, 28 had finished some college, 6 completed an Associate's degree or professional school, 26 held a Bachelor's degree, and 18 had completed at least some graduate study. Notably, one participant in the HC group omitted questions on relationship and education status.

We used a semi-structured clinical interview to evaluate participants for the presence of Axis I psychological diagnoses. Of the SAD group, 19 people met criteria for a comorbid anxiety disorder (44%) and eight (19%) met criteria for a current major depressive disorder (MDD) episode or dysthymic disorder, and one participant met criteria for bipolar disorder. The average age of onset for social anxiety disorder was 12.5 years ($SD = 4.3$). Notably, 42% of participants in the SAD group had no comorbid diagnoses, and only 23% were receiving pharmacological treatment.

Procedure

Potential participants called our laboratory in response to online advertisements and bulletin board flyers in the community. Following a brief verbal informed consent procedure, trained research assistants conducted phone screens to assess for social anxiety, generalized anxiety, and depression symptoms, as well as functional impairment, suicidality, and psychotic symptoms. If potential participants endorsed social fears beyond public performance situations (or no clinically significant psychological difficulties for the HC group), the research assistant scheduled an initial face-to-face appointment. During these sessions (conducted with 122 potentials), participants provided informed consent, completed self-report measures, and underwent clinical interviews by doctoral-level students in clinical psychology. The *Structured Clinical Interview for DSM-IV Axis I Disorders* (SCID-I; First, Spitzer, Gibbon, & Williams, 2002) was used to assess for anxiety, mood, substance use, eating, and psychotic disorders. In addition, the SAD module of the *Anxiety Disorders Interview Schedule for DSM-IV: Lifetime Version* (Di Nardo, Brown, & Barlow, 1994) provided additional information to determine SAD subtype. To be eligible for the SAD group, generalized SAD had to be the primary or most severe diagnosis if other comorbid psychiatric conditions were present. Inter-rater reliability (based on 45 randomly chosen recorded interviews) suggested acceptable agreement for SAD diagnoses (Cohen's $\kappa = .87$).

After diagnostic interviews, participants received palmtop devices and a 1.5-hour session to instruct them on how to provide self-initiated recording of daily social interactions, respond to random prompts, and provide online end-of-day records for the following 14 days. To maximize compliance, we used an incentive structure, such that participants received a minimum payment of \$165 and could earn up to an additional \$50 for prompt and consistent reporting. Researchers sent multiple reminder e-mails each week to remind participants about instructions, data coding details, and confidentiality. Furthermore, we kept experience-sampling measures brief to maintain participant motivation and to minimize missing data (see Nezlek, 2012). At the end of the experience sampling data collection, participants were debriefed and data were downloaded from their palmtop devices.

Global Self-Report Measures

Social anxiety severity—The *Social Interaction Anxiety Scale* (SIAS; Mattick & Clarke, 1998) is a self-report measure of tendencies to fear and avoid social interactions due to concerns about being scrutinized by other people. Participants rated 20 statements using a 5-point Likert scale ranging from 0 (*not at all characteristic of me*) to 4 (*extremely characteristic of me*). Higher total scores represent greater social anxiety. This scale has demonstrated good test-retest reliability, convergent validity, and discriminant validity across clinical and community samples (Brown et al., 1997; Heimberg, Mueller, Holt, Hope, & Liebowitz, 1993; Mattick & Clarke, 1998). Prior work has shown that removing the three reverse scored items improves reliability and validity (Rodebaugh et al., 2011; Rodebaugh, Woods, & Heimberg, 2007). Thus, we used the 17-item SIAS-Straightforward (SIAS-S) scores for analyses for a more reliable and valid measure, although the 17- and 20-item versions in our sample had identical internal consistency ($\alpha = .971$) and correlated at .993, $p < .001$.

Experience Sampling Measures

Momentary emotion ratings—Five times per day, participants received a prompt to record their emotional experiences using their PDA devices. These prompts occurred three to five random times during the waking hours (minus blackout times provided by the participant, e.g., when driving to work). Participants were asked to rate their positive and negative affective experiences *at that moment* using a 5-point Likert scale from 1 (*very slightly or not at all*) to 5 (*extremely*). The four positive emotion items were *content*, *relaxed*, *enthusiastic*, and *joyful*. The four negative emotion items were *anxious/nervous*, *angry*, *sad*, and *sluggish*. These adjectives spanned both high and low energy quadrants of positive and negative emotions in the circumplex model of emotion (Barrett, 1998).

Social interaction emotion ratings—Social interaction recordings were participant-initiated recordings (via PDAs) of social interactions lasting at least 10 minutes (as soon as possible after the interaction). The positive and negative emotion items were identical to those used for random prompts, with the same 5-point Likert response scale. We used time stamps of social interaction entries to ensure that participants did not enter multiple interactions in one sitting. All but two entries (99.7%) were at least 25 minutes apart from each other.

End-of-day emotion ratings—Each evening during the data collection period, participants used a de-identified code to log on to a dedicated encrypted website to answer questions about that particular day. Participants rated their positive and negative affect experiences *on that particular day* using a 5-point Likert scale from 1 (*very slightly/not at all*) to 5 (*extremely*). The six positive affect items were *content*, *relaxed*, *enthusiastic*, *joyful*, *proud*, and *interested*. The six negative affect items were *anxious*, *angry*, *sluggish*, *sad*, *irritable*, and *distressed*. To minimize retrospective bias, participants were instructed to enter data between 6:00 P.M. on the day in question up to 11:59 A.M. of the following day. Entries submitted outside the requested times were excluded from analyses (checked via date-and-time stamps).

Calculating Emotion Differentiation, Intensity, and Variability

We computed indices of positive and negative emotion differentiation by calculating the average intraclass correlations (ICCs) with absolute agreement between the positive and negative adjectives, respectively, across all assessment points for each participant (see Kashdan et al., 2010; Tugade et al., 2004). Larger ICCs indicate greater relation between emotion categories (i.e., lower level of emotion differentiation), while lower ICCs indicate less relation between emotion categories (i.e., higher degree of emotion differentiation). Although it is possible that a person experiences both anger and anxiety on a particular occasion, a high differentiator should be less likely to report experiencing multiple negative emotions *consistently*. Notably, ICCs were not calculated when participants reported *no* variance in emotions (six participants gave lowest scores on all negative emotions in social interactions and one for random prompts); for similar procedures, see Demiralp et al. (2012). The average ICC for emotions in random prompts (positive: $M = .61$, $SD = .22$; negative: $M = .24$, $SD = .25$), social interactions (positive: $M = .64$, $SD = .27$; negative: $M = .29$, $SD = .29$), and end-of-day reports (positive: $M = .60$, $SD = .24$; negative: $M = .45$, $SD = .29$) suggested an acceptable level of variability for analyses. We multiplied scores by -1 to improve interpretation with larger scores reflecting greater emotion differentiation, and we performed Fisher r -to- z transformation prior to subsequent analyses (Corey, Dunlap, & Burke, 1998).

To answer questions as to whether emotion differentiation provides incremental information beyond other elements of emotion, we also calculated the average intensity and variability (standard deviation) of negative and positive emotions. We first created an average score of the positive and negative emotion ratings (separately) at each measurement. Then we averaged positive and negative scores, separately for random prompt, social interaction, and end-of-day entries for each participant. To capture variability of positive and negative emotions, we similarly aggregated the standard deviations of positive and negative emotion ratings within each context.

Results

Preliminary Analyses

Compliance—Overall 85% of participants completed at least one week of their end-of-day entries. After excluding six participants for providing less than three days of entries, 79 remaining participants provided an average of 12.2 end-of-day entries ($SD = 3.67$; range = 4 – 23). Overall, 77% of participants responded to at least $\frac{3}{4}$ of random prompts. After excluding 10 participants who provided less than three random prompt entries, we analyzed 76 participants who provided an average of 53.7 prompt responses ($SD = 11.0$; range = 19 – 81). After excluding 14 participants who provided fewer than three social interaction entries, 72 participants provided an average of 10.0 social interaction entries ($SD = 4.5$; range = 3 – 31). There were no significant differences between the SAD and HC groups in the number of entries provided for any of the contexts ($ps > .5$). Furthermore, groups did not differ in the percentage of random prompts to which participants responded ($t = 0.49$, $p = .63$) or time between responses ($t = -1.38$, $p = .17$). Proportion of missing data was unrelated to outcome variables ($ps > .15$). Groups also did not differ in age ($t = 0.46$, $p = .65$), gender, ($\chi^2 = 0.13$,

$p = .72$), ethnicity, ($\chi^2 = 2.63, p = .76$), relationship status, ($\chi^2 = 5.50, p = .24$), or level of education, ($\chi^2 = 4.24, p = .38$).

Social anxiety severity—The SIAS-S scores of our SAD group ($M = 43.81, SD = 8.72$) were commensurate with clients in treatment for SAD (Rodebaugh et al., 2011), and significantly higher than the healthy control group ($M = 8.89, SD = 6.53, t = 20.86, p < .001, d = 4.60$). In addition, 100% of the SAD sample scored above the optimal cut-off score of 34 on the 20-item SIAS for distinguishing people with SAD from a healthy community comparison group (Brown et al., 1997). SAD participants also scored significantly higher on the BDI ($M = 17.44, SD = 10.88$) than healthy controls ($M = 3.19, SD = 3.50, t = 8.17, p < .001, d = 1.79$).

Emotion intensity and variability—Table 1 displays group means in positive and negative emotion intensity and variability from each data collection method. Overall, the SAD group reported greater intensity of negative emotions ($ds = 1.03$ to 1.19) and less intensity of positive emotions ($ds = 1.39$ to 1.81). Additionally, the SAD group demonstrated greater variability of negative ($ds = 1.07$ to 1.28) but not positive ($ds = 0.0$ to 0.13) emotions.

Emotion differentiation measures—Prior to testing hypotheses, we examined the relationships of the emotion differentiation indices to rule out multicollinearity. Negative emotion differentiation indices were significantly correlated across all three contexts ($rs = .403 - .519, ps < .001$). Positive emotion differentiation during random prompts was positively correlated with positive emotion differentiation during social interactions ($r = .358, p = .002$) and end-of-day ($r = .333, p = .005$); social interaction and end-of-day positive emotion differentiation were not significantly correlated ($r = .205, p = .096$). These results suggest that, although related, the emotion differentiation indices are sufficiently independent to analyze as separate dependent variables when examining the effects of SAD diagnostic status.

Additionally, we examined the relationships between emotion differentiation and other indices of emotional structure within each context (see correlations in Table 2.). The small to moderate correlations of emotion differentiation indices with emotion intensity and variability indicate that these reflect different constructs. People who were better able to differentiate negative emotions tended to experiencing less intense negative emotions and more intense positive emotions on average, but this index was not related to emotion variability. In contrast, positive emotion differentiation was significantly related to greater variability in positive emotions, but not other aspects of emotional experiences. These results suggest that people whose positive experiences are more variable tend to be better at differentiating among discrete positive emotions, while those whose emotions are generally less negative (more positive) are better able to discriminate among specific negative emotions.

Are People with SAD Worse at Differentiating Emotions?

To minimize multiple comparisons, we conducted a three-way ANOVA of Group (SAD vs. HC) $\times$ Valence (positive vs. negative) $\times$ Context (random prompts vs. social interaction vs. end-of-day). This analysis yielded significant main effects of SAD group, $F(1, 60) = 6.84, p = .011, \eta_p^2 = .102$, valence, $F(1, 60) = 143.26, p < .001, \eta_p^2 = .705$, Group $\times$ Valence, $F(1, 60) = 4.66, p = .035, \eta_p^2 = .072$, context, $F(2, 59) = 3.99, p = .021, \eta_p^2 = .062$, and Valence $\times$ Context, $F(2, 59) = 11.30, p < .001, \eta_p^2 = .158$, but not Group $\times$ Context ($p = .376, \eta_p^2 = .016$) or Group $\times$ Context $\times$ Valence ($p = .795, \eta_p^2 = .004$). Post-hoc tests with Bonferroni correction revealed that participants exhibited worse emotion differentiation at end-of-day compared to random prompts ($p = .014$) but not social interactions ($p = .230$), and emotion differentiation for random prompts and social interactions did not differ ($p = .940$).

Participants were generally better at differentiating negative than positive emotions; however, while positive emotion differentiation was similar across contexts ($p = .22, \eta_p^2 = .050$), negative emotion differentiation differed across contexts ($p < .001, \eta_p^2 = .291$).

Participants were worse at differentiating negative emotions at the end of the day compared to random prompts and social interactions ($ps < .001$), fitting with the idea that distinguishing emotions is easier when referring to brief time frames.

In terms of group differences, we found a main effect of poorer emotion differentiation in the SAD group. However, the significant interaction showed that participants with SAD demonstrated poorer negative emotion differentiation ($p = .001, \eta_p^2 = .158$); there was no significant difference in positive emotion differentiation ($p = .290, \eta_p^2 = .019$). The presence of SAD predicted less negative emotion differentiation during random prompts ($\beta = -.30, p = .009, R^2 = .09$) and in social interactions ($\beta = -.29, p = .019, R^2 = .081$), but only marginally for end-of-day reflections ($\beta = -.20, p = .084, R^2 = .038$). See Table 1. for group means.

We ran additional construct specificity tests to determine whether effects of SAD could be found over and above the variance attributable to comorbid emotional disorders. In the first model, we added comorbid depressive and anxiety disorders as predictors (main and interactive effects). The SAD group and Group $\times$ Valence effects remained significant ($p = .011$ and $.049$, respectively). Comorbid depression predicted better emotion differentiation, $F(1, 58) = 4.45, p = .039, \eta_p^2 = .071$, and slightly more so for positive than negative emotions, $F(1, 58) = 3.07, p = .085, \eta_p^2 = .050$; there were no other significant effects with comorbid disorders ($ps > .15$). In the second model, we excluded the eight participants in the SAD group who also met criteria for comorbid depressive disorders. With this smaller sample, the SAD group effect remained significant and, in fact, increased in magnitude, $F(1, 53) = 10.22, p = .002, \eta_p^2 = .16$; the SAD Group $\times$ Valence interaction was no longer significant ($p = .24$).

In subsequent analyses, we explored whether SAD effects remain over and above the variance attributable to age and sex. Upon adding these demographic variables as predictors, age was not a significant predictor, $F(1, 60) = 0.19, p = .67, \eta_p^2 = .003$, but women were worse at differentiating emotions than men, $F(1, 60) = 4.88, p = .031, \eta_p^2 = .075$. When statistically controlling for these demographic variables, both the SAD Group and Group $\times$

Valence effects remained significant ($p = .008$ and $.036$, respectively), suggesting the robustness of SAD group effects.

Are These Differences Due to Emotion Intensity or Variability?

Given the group differences in intensity and variability (see Table 1.)Table 1., it was possible that these constructs accounted for observed differences in emotion differentiation. We used hierarchical regression models to predict negative emotion differentiation (separately for each context) after controlling for average intensity and variability in the first step. Notably negative emotion intensity and variability were both significant predictors in each context ($ps < .001$), together explaining a significant amount of variance in negative emotion differentiation during random prompts ($R^2 = .443$), social interactions ($R^2 = .245$), and at end-of-day ($R^2 = .360$). SAD group status significantly predicted negative emotion differentiation over and above intensity and frequency in random prompts ($\beta = -.23$, $t = -2.36$, $p = .021$, $R^2 = .041$) and social interactions ($\beta = -.27$, $t = -2.26$, $p = .027$, $R^2 = .057$); the end-of-day effect became non-significant ($\beta = -.07$, $t = -0.66$, $p = .51$, $R^2 = .004$). Thus, between-group differences for negative emotion differentiation (in-the-moment) could not be attributed to differences in intensity and variability.

Discussion

We sampled the emotional experiences of people with SAD over the course of two weeks using three different methods—random momentary prompts, self-initiated online recording of face-to-face social interactions, and end-of-day reflections. By calculating the degree of association between ratings of emotion adjectives, we determined that adults with generalized SAD displayed less differentiated negative emotions compared to healthy adults. This difference remained significant when controlling for comorbid depressive disorders and comorbid anxiety disorders. Furthermore, we tested whether the SAD group displayed poorer negative emotion differentiation after accounting for the greater average intensity and variability of negative emotions in people with SAD. Results demonstrated that negative emotions during random prompts and in social interactions were less differentiated in adults with SAD above and beyond the effects of other aspects of emotion structure (i.e., emotion intensity and variability) or individual variables (e.g., comorbid diagnoses, demographic variables). Our work offers novel contributions to understanding the phenomenology of SAD. Adding to prior research showing that low frequency/intensity of positive emotions and avoidance of anxious feelings distinguish people with SAD from healthy adults (Kashdan et al., 2013), we found that difficulty clearly differentiating what emotions one feels at a given moment in daily life is also linked to the presence of disorder.

This study was the first to investigate emotion differentiation in people with SAD with a demographically matched control group, finding deficits in the ability of participants with SAD to discriminate among negative emotions compared to healthy controls. Being able to identify discrete negative emotions helps people to make inferences about a problematic situation (Ekman, 1992) and to initiate behavioral or coping strategies to alter the situation (Barrett et al., 2001). Thus, poor differentiators of negative emotions are likely to suffer interpersonal costs, as well as detriments to self-regulatory resources due to inadequate

management of energy in stressful situations. Consistent with this idea, researchers have found people with self-reported difficulty identifying emotions (high in alexithymia) to use more distraction to cope with negative emotions compared with healthy cognitive reappraisal strategies to manage distress (Parker, Taylor, & Bagby, 1998). Our finding of reduced ability to differentiate negative emotions in people with SAD provides insights into a growing body of literature on the emotion regulation deficits in this population (e.g., Goldin, Manber, Hakimi, Canli, & Gross, 2009). An inability to classify negative emotions may make these experiences seem more threatening and uncomfortable, increasing the likelihood that people with SAD would use maladaptive emotion strategies such as avoidance and suppression—strategies shown to maintain and even exacerbate anxiety symptoms (Kashdan et al., 2011; Morrison & Heimberg, 2013).

It is worth noting that prior research has identified deficits in negative emotion differentiation in other populations, including one study that found such deficits in people with major depressive disorder (Demiralp et al., 2012). In our sample, neither controlling for comorbid depression and comorbid anxiety disorders nor removing the eight participants with both SAD and depression significantly impacted our findings. This suggests that deficient negative emotion differentiation is not specific to depression; instead, it may be a transdiagnostic factor associated with both SAD and depression. In contrast, we failed to find positive emotion differentiation to be relevant to SAD, whereas Demiralp et al. found depression to relate to less positive emotion differentiation; this suggests that positive emotion differentiation ability may help distinguish these two conditions. Future research using multiple relevant clinical comparison groups (e.g., SAD and major depressive disorder) in the same study is necessary to determine the potential transdiagnostic nature of these meta-cognitive processes.

While we expected to find significant differences in negative emotion differentiation in all three contexts, it is important to highlight that effects were only at trend level for end-of-day emotion reports and disappeared when we controlled for intensity and variability of negative emotions. One possible reason for this finding is that time-inclusive reports require some degree of retrospection, and thus may be influenced by some of the recall biases encountered in global self-report research (e.g., Fredrickson, 2000). A shorter duration of time retrospection is more likely to access experiential knowledge vs. semantic or belief-based knowledge (Robinson & Clore, 2002). In effect, random prompts for momentary emotional experiences and reports immediately following social interaction reports are more likely to reflect felt emotions than questions asking participants to aggregate their experiences over an entire day. With more time to ruminate and ponder on felt experiences, people with SAD may be able to better classify their emotions into specific categories. Notably, our results are consistent with research suggesting people with SAD have more difficulty forming on-line inferences about situations (e.g., Hirsch & Mathews, 2000).

Consistent with expectations, we did not find differences in positive emotion differentiation between participants with SAD and healthy controls. People with SAD have broad positivity deficits (see Kashdan et al., 2011), which was confirmed by our observation of lower intensity of positive emotions in the SAD group. A noteworthy finding was that participants with more variable positive emotions (i.e., a broader range of positive emotion intensity over

the sampling period) were better at differentiating those emotions. One way to interpret this association is that when people experience fluctuations, this might help people pay attention to and learn to associate response patterns with specific positive emotion categories.

Since prior research on emotion differentiation in SAD was limited to cross-sectional global self-report designs (e.g., Turk et al., 2005), our study's use of intense repeated assessments via experience sampling adds a novel approach to understanding the phenomenology of SAD. Feldman-Barrett et al. (2001) paved the way for studying emotion differentiation as a process in daily life, i.e., as a process derived from daily diary accounts of experiences as opposed to single-occasion questionnaires. This approach is advantageous for capturing experiences in the context they naturally occur instead of requiring participants to contemplate their emotion skills and aggregate across large time periods retrospectively. Scientists would never find it acceptable to measure skills such as analytical reasoning or creativity by asking people to self-report the strength of their abilities; in this vein, it makes little sense to assess meta-cognitive skills outside of the context in which they are used. Although our use of the intraclass correlation coefficient to capture the degree of relatedness of emotion categories is appropriate for studying individual differences in emotion discrimination, our findings are limited by our use of aggregate measures.

It is important to note that different methods for operationalizing emotion differentiation may have different correlates depending on the approach used (Grühn, Lumley, Diehl, & Labouvie-Vief, 2013). Despite our comprehensive examination of random prompts, face-to-face social interactions, and end-of-day records to understand emotional differentiation, future researchers need to also explore multiple operationalization strategies for each of these contexts. Our reliance on variability scores and granularity across all emotion adjectives reflected an attempt to match the analytic approach to existing conceptual models of SAD (e.g., Heimberg et al., 2010). Future investigations can use multilevel modeling to examine the temporal dependency and contextual importance of differentiated and undifferentiated emotional responses to study the mechanisms by which the ability to discriminate emotions confers resiliency, recovery, and well-being.

As the first study providing evidence of actual skill deficits in negative emotion differentiation in people with SAD (not just perceptions; Turk et al., 2005), this research has important clinical implications. Specifically, current treatment methods fail to help people with SAD achieve levels of functioning comparable to healthy adults and improvements in well-being often fail to maintain long-term (e.g., Eng, Coles, Heimberg, & Safren, 2001). Our study suggests that training people to be better at identifying and discriminating among negative emotions may be an important adjunct to existing therapeutic approaches, as this skill may lead to improvements in reacting to and repairing negative mood states (Kashdan et al., 2010; Zaki et al., in press). Mindfulness training has particular potential, as recent evidence suggests that greater mindfulness predicts better emotion differentiation and less difficulty using healthy emotion regulation strategies (Hill & Updegraff, 2012). In fact, these authors found emotion differentiation to mediate the relationship between mindfulness and emotion lability, confirming the importance of being able to discriminate among emotions as a precursor to the healthy management of emotions. It will be important for future SAD treatment research to include emotion differentiation not only as a target, but also as a

treatment outcome measure to clarify the role of this deficit in the trajectory of social anxiety difficulties over time. Beyond theory, research, and treatment of SAD, it will be important to continue research to determine whether emotion differentiation difficulty is a cause, correlate, and/or consequence of psychopathology.

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Figure 1. Effect of Diagnostic Group X Context on Negative and Positive Emotion Differentiation

Notes. These bar graphs demonstrate group differences in positive and negative emotion differentiation by context (i.e., random prompt, social interaction emotion reports, or end-of-day reports). Emotion differentiation values are scaled such that higher values represent better differentiation. Bars represent standard error of means. $*p < .05$, $**p < .01$.

Table 1

Emotion Differentiation Group Differences

Variable	SAD mean (<i>SD</i>)	HC mean (<i>SD</i>)	<i>t</i> -ratio	<i>d</i>
Positive emotion intensity				
Random prompts	2.33 (0.57)	3.19 (0.68)	5.96***	1.39
End-of-day	2.33 (0.66)	3.28 (0.55)	7.00***	1.60
Social interactions	2.32 (0.54)	3.38 (0.64)	7.70***	1.81
Negative emotion intensity				
Random prompts	1.74 (0.35)	1.36 (0.39)	-4.44***	1.03
End-of-day	1.97 (0.46)	1.43 (0.37)	-5.83***	1.33
Social interactions	1.80 (0.45)	1.31 (0.37)	-5.07***	1.19
Positive emotion variability				
Random prompts	0.76 (0.25)	0.76 (0.34)	-0.04	0.01
End-of-day	0.78 (0.25)	0.75 (0.23)	-0.57	0.13
Social interactions	0.69 (0.26)	0.69 (0.34)	-0.01	0.00
Negative emotion variability				
Random prompts	0.85 (0.31)	0.47 (0.41)	-4.59***	1.07
End-of-day	0.85 (0.26)	0.50 (0.30)	-5.65***	1.28
Social interactions	0.83 (0.36)	0.42 (0.38)	-4.78***	1.13
Positive emotion differentiation				
Random prompts	-0.80 (0.31)	-0.79 (0.46)	0.15	0.03
End-of-day	-0.81 (0.40)	-0.77 (0.40)	0.53	0.06
Social interactions	-0.98 (0.44)	-0.84 (0.56)	1.24	0.30
Negative emotion differentiation				
Random prompts	-0.36 (0.33)	-0.17 (0.24)	2.69**	0.63
End-of-day	-0.66 (0.43)	-0.49 (0.44)	1.75	0.40
Social interactions	-0.45 (0.41)	-0.22 (0.35)	2.40*	0.60

Note.

* $p < .05$,

** $p < .01$,

*** $p < .001$. All tests two-tailed. HC = healthy control; SAD = social anxiety disorder; *d* refers to Cohen's (1988) effect size, where large effects > .80. Range of *n* for SAD group = 38–40; range of *n* for HC group = 36–39.

Table 2

Correlations of Emotion Differentiation with Emotion Intensity and Variability

	<u>Positive Emotion Differentiation</u>			<u>Negative Emotion Differentiation</u>		
	Random	Social	End-of-Day	Random	Social	End-of-Day
Intensity						
Positive	.108	.088	-.127	.292 *	.239 †	.257 *
Negative	.211	-.066	-.164	-.449 ***	-.247 *	-.372 ***
Variability						
Positive	.445 ***	.464 ***	.368 **	.071	.157	.172
Negative	-.204	.070	.038	-.088	.008	-.064

Note.[†]
 $p < .06$,*
 $p < .05$,**
 $p < .01$,***
 $p < .001$.