

DAILY STRESS REACTIVITY IN SOCIAL ANXIETY DISORDER: A TEMPORAL
PROCESS APPROACH

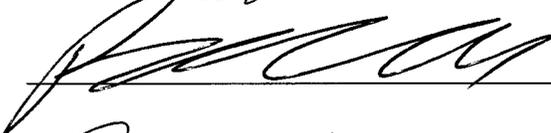
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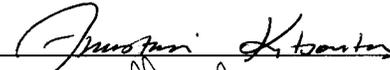
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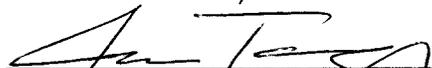
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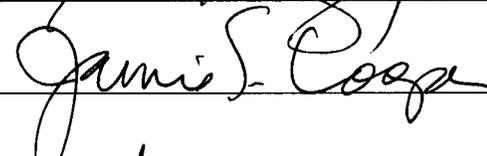




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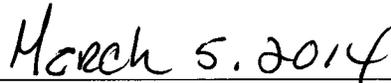


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Daily Stress Reactivity in Social Anxiety Disorder: A Temporal Process Approach
A Dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at George Mason University

by

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Master of Arts
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DEDICATION

This dissertation is dedicated to my mother, Natalia, for her unwavering support and encouragement of all my endeavors.

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ABSTRACT

DAILY STRESS REACTIVITY IN SOCIAL ANXIETY DISORDER: A TEMPORAL PROCESS APPROACH

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Dominant theoretical models of social anxiety disorder (SAD) suggest that people who suffer from function-impairing social fears are likely to react more strongly to interpersonal stressors. Researchers have examined the reactivity of people with SAD to stressful laboratory tasks, but there is little knowledge about how stress affects their daily lives. We asked 79 adults from the community, 40 of whom were diagnosed with SAD (based on structured clinical interviews) and 39 matched healthy controls, to self-monitor their social interactions, positive and negative social events, and emotional experiences over two weeks using electronic diaries. These data allowed us to examine associations of interpersonal events and emotional well-being both within-day and from one day to the next. Using hierarchical linear modeling, we found all participants to have significant within-day reactivity to social stressors, i.e., they reported increases in negative affect and decreases in positive affect and self-esteem on days when they experienced more stressful

interpersonal events. However, people with SAD displayed greater reactivity of their negative emotions compared to healthy controls. Additionally, the groups differed in how previous days' events influenced well-being. The results did not suggest that people with SAD experience more interpersonal stress on days following more intense negative emotions. Overall, the findings support the role of elevated reactivity to interpersonal stress in SAD. These findings shed light on theoretical models of emotions and self-esteem in SAD and present important clinical implications.

INTRODUCTION

Social anxiety disorder (SAD) is characterized by intense distress in anticipation, during, and after social situations in which an individual may be scrutinized or devalued in the eyes of others (American Psychiatric Association, 2013). This is one of the most common psychological disorders in the United States affecting 10–15% of the general population at some point during life (B. F. Grant et al., 2005; Kessler et al., 2005). SAD is associated with a detrimental impact on an individual's well-being, relationship functioning, and achievements in educational and career domains (Schneier et al., 1994), contributing to a financial burden that rivals that of depression (Tolman et al., 2009). By its nature SAD is a condition inextricably tied to an individual's social environment, and theorists have recognized the importance of interpersonal events to the disorder's symptomology. However, we know little about how interpersonal stress in the natural course of daily life affects people with SAD. This study aimed to better understand the temporal processes involved in interpersonal event, emotion, and self-esteem experiences of adults diagnosed with SAD in comparison to adults with no psychopathology.

A Theoretical Framework

Dominant theories of SAD have emphasized the role of interpersonal stress in the onset and maintenance of social fears (e.g., Clark & Wells, 1995; Heimberg, Brozovich, & Rapee, 2010; Hofmann, 2007). These models argue that people with SAD have

unhelpful beliefs and assumptions about social interactions (e.g., unattainable social standards, high likelihood of rejection) that lead them to excessively focus on minimizing behaviors or expressions that might elicit judgment. This self-focus in turn increases physiological arousal (e.g., sweating) and negative social-evaluative thoughts. Thus, stressful social situations are presumed to increase negative emotions and decrease self-esteem—the emotional evaluation of one’s worth—in people with SAD.

Occurrence of Daily Interpersonal Stress in SAD

Since social situations are particular sources of stress for people with SAD, it stands to reason this may be in part because they experience more negative social events in their daily lives. For example, people with higher levels of trait negative affectivity (David, Green, Martin, & Suls, 1997; Marco & Suls, 1993) and behavioral inhibition (Gable, Reis, & Elliot, 2000) appear to be predisposed to more frequent negative events. However, research is mixed about whether people diagnosed with SAD actually experience more frequent social stressors.

Daily diary methodology, which assesses individuals’ experiences over time with a series of daily self-reports, can give us a glimpse into people’s daily lives (Csikszentmihalyi & Larson, 1987). Using this method, researchers found children with SAD to report more frequent socially stressful events (Beidel, Turner, & Morris, 1999). In the only study on interpersonal stress in adults with SAD, Yeganeh (2005) compared the daily occupational experiences of people with and without SAD and found those with SAD to report greater hardship in their work relationships. Notably, this study was

limited in context to a work environment, so we still know little about interpersonal experiences across contexts in the lives of adults with SAD.

Only one study has examined social anxiety in the context of daily interpersonal events for adults. Farmer and Kashdan (2012) found no association between social anxiety (on a continuum) and the frequency of daily negative social events. However, this study used an undergraduate sample in which participants did not undergo careful diagnostic interviews. It is worth noting that people with elevated social anxiety tend to engage in fewer social interactions than less anxious counterparts (Dodge, Heimberg, Nyman, & O'Rien, 1987). Avoidance of social situations, particularly stressful ones, is part of the criteria for a diagnosis of SAD (American Psychiatric Association, 2013). Consistent with this, elevated social anxiety is also associated with fewer daily positive events, particularly on days when people feel most socially anxious and make attempts to suppress their emotions (Kashdan & Steger, 2006). Together, these studies suggest that there may be an increased occurrence of social stressors for people with SAD, and they may be less likely to experience positive social events.

Beyond the frequency of stressful events, it may be important to consider how an individual evaluates and remembers the event. Past research suggest that how people perceive a stressor in everyday life may be more relevant to their well-being than just whether or not a stressor occurs (Bolger & Schilling, 1991). Thus, it is important to consider both the occurrence of events and subjective importance of these events when analyzing their impact on well-being. Furthermore, the question of whether people with SAD experience more frequent negative social events is complicated by interpretive and

memory biases. People with SAD tend to interpret ambiguous social information as negative or threatening (Amin, Foa, & Coles, 1998) and mildly negative information as having catastrophic consequences, even in comparison to people with other anxiety disorders (Stopa & Clark, 2000). Even social events that most people would consider pleasant (e.g., being praised) are more likely to be distressing for people with SAD (Alden & Wallace, 1995). This may be due to concerns about managing anxiety during the course of the event or a general discomfort with positive evaluation (Weeks, Heimberg, Rodebaugh, & Norton, 2008). This research suggests that people with SAD are likely to perceive daily interpersonal events (even positive ones) as more distressing.

Reactivity to Interpersonal Events

Daily stressors, particularly in the form of interpersonal conflict, can have a profound impact on daily mood and self-esteem in the general population (Bolger, DeLongis, Kessler, & Schilling, 1989; Nezlek & Plesko, 2001). Some people are likely to be more reactive to such events than others. People with SAD have a stronger physiological response (e.g., sweating, increased heart rate) to stressful tasks in the laboratory like giving an impromptu speech (Roelofs et al., 2009; Kagan, Reznick, & Snidman, 1987). They also exhibit greater neural activation in response to social threat compared to healthy controls (P. R. Goldin, Manber, Hakimi, Canli, & Gross, 2009). These studies suggest that people with SAD will also be more reactive to daily social stressors in their lives than their nonanxious counterparts.

Atypical reactivity to daily interpersonal events has been demonstrated in other forms of psychopathology, and reactivity patterns appear to differ among specific

disorders. Myin-Germeys and colleagues (2003) compared patients with major depressive disorder (MDD), bipolar disorder (BD), and psychosis without mood disturbances to a healthy control group. In comparison with control subjects, the authors found that patients with MDD reported more negative affect associated with stressors, while patients with BD reported reduced positive affect, and those with psychosis reported more intense changes in both positive and negative mood in response to stress. Other studies have found patients with MDD to experience stronger responses to positive events (decreasing negative affect), while reactions to negative events were blunted (Peeters, Nicolson, Berkhof, Delespaul, & deVries, 2003) or similar to those of controls (Thompson et al., 2012). These differences highlight the importance of considering effects of both positive and negative events on both positive and negative affect reactions.

Although stress reactivity has not been examined in people with SAD to date, researchers have found increased vulnerability to stress in people with features associated with SAD. Sociotropy—a tendency to have unrealistic expectations about social interactions and intensified needs to be accepted and make a positive impression on others—predicts stronger reactions for daily interpersonal and noninterpersonal stressors on emotions and self-esteem (Dasch, Cohen, Sahl, & Gunthert, 2008). Impaired social support, a factor often attributed to people with SAD (Davidson, Hughes, George, & Blazer, 1993), has also been associated with more intense reactions to daily stressors (Affleck, Tennen, Urrows, & Higgins, 1994; DeLongis, Folkman, & Lazarus, 1988). Additionally, neuroticism, trait negative affectivity, self-critical perfectionism, and behavioral inhibition are all associated with increased stress reactivity (Bolger &

Schilling, 1991; David et al., 1997; Dunkley, Zuroff, & Blankstein, 2003; Gable et al., 2000; Marco & Suls, 1993), as well as with SAD (Bienvenu, Hettrema, Neale, Prescott, & Kendler, 2007; Juster et al., 1996; Stemberger, Turner, Beidel, & Calhoun, 1995).

Though this research is only indirectly relevant, it supports the hypothesis that people with SAD will experience greater emotional and self-esteem reactivity to stressful social events in their daily lives.

Spillover of Reactions to Interpersonal Events

Thus far, we have discussed reactivity influences of interpersonal events on same-day emotions and self-esteem (i.e., *concurrent* effects). There are also individual differences in how affect and self-esteem reactions maintain into the following day (i.e., *lagged* effects). For example, those with low self-esteem or lacking in social support suffer more lasting effects to stress, with mood changes lasting into the following day or longer (Caspi, Bolger, & Eckenrode, 1987; DeLongis et al., 1988). Peeters et al. (2003) also found that patients with MDD experience more prolonged negative affect in reaction to daily stressors compared to healthy controls. In fact, one study found no evidence for same-day reactivity but evidence for affective spillover in patients with depression (Gunthert, Cohen, Butler, & Beck, 2007).

Following social situations, people may engage in post-event processing, a thought process in which they recall and analyze their own and others' behaviors in the situation. For people with elevated social anxiety, this process most often focuses on their flaws or mistakes that might have led to negative evaluation (Brozovich & Heimberg, 2008). This negative self-focus is likely to maintain or intensify negative

emotions. Since this process occurs over hours or even days following negative events, people with SAD are likely to experience longer lasting reactions to interpersonal stressors.

Thus far, only one study has examined spillover of reactions to stressful events in people with anxiety difficulties. Starr and Davila (2012) assessed 55 individuals with generalized anxiety disorder over 21 days for affective, cognitive, and interpersonal experiences. They found participants to experience spillover of anxious mood ($T - 2$) into later depressed mood (T), particularly when they experienced more interpersonal stressors and more perceived rejection ($T - 2$). Taking a longitudinal approach, Auerbach, Richardt, Kertz, and Eberhart (2012) assessed adolescents every six weeks for six months on stressors and social anxiety symptoms. The authors found interpersonal and non-interpersonal stress at each occasion ($T - 1$) to significantly predict higher social anxiety levels on the following assessment (T) for girls. Taken together, these studies support the hypothesis that daily stressors may influence not only same-day emotional and self-evaluative experiences but also following days' experiences.

An Alternative Hypothesis: Stress Generation

Most stress research has focused on the causal pathway between stressful events and emotional experiences as unidirectional whereby the stress is presumed to impair well-being. However, a growing body of literature suggests that the presence of some psychopathology also contributes to increased frequency of stressors, particularly events of an interpersonal nature where the situation is dependent on the individual (see Hammen, 2005 for review). While some studies suggest that this effect is specific to

depression (Joiner, Wingate, Gencoz, & Gencoz, 2005), one study comparing adolescents with depression, anxiety, or both found comorbidity to be associated with most interpersonal stressors in the past year, compared to either disorder type alone (Connolly, Eberhart, Hammen, & Brennan, 2010). These studies suggest that the stress generation models originally developed to understand depression (Hammen, 1991) may also be useful to understanding anxiety disorders, including SAD.

Although most literature on stress generation uses retrospective or longitudinal methods, a daily diary approach brings a number of methodological advantages to the study of stress generation (Liu & Alloy, 2010). Most importantly, emotions and perceived interpersonal stress tend to have rapid fluctuations, with quick rebounds to baseline levels (Stader & Hokanson, 1998). In the first stress generation study to take a daily approach, hostility (but not sadness) experienced in the morning predicted later occurrence of dependent stressors, while neither emotion predicted independent stressors (Sahl, Cohen, & Dasch, 2009).

There are several reasons for the possible applicability of the stress generation model to SAD. On the one hand, stress generation occurring in anxiety and depressive disorders may be due to common vulnerability factors. Specifically, recent studies have found cognitive vulnerability factors associated with both anxiety and depression to predict stress generation (Riskind, Black, & Shahar, 2010; Safford, Alloy, Abramson, & Crossfield, 2007). Additionally, both depression and anxiety disorders significantly overlap in general affective distress (Watson, Clark, & Carey, 1988), which may similarly contribute to stress generation in these disorders.

On the other hand, stress generation may be particularly relevant for SAD given the interpersonal dysfunction reported by most sufferers. When anxious, people with SAD are more likely to engage in safety behaviors or interpersonal styles, like unassertiveness, conflict avoidance, restriction of emotional expression, and interpersonal dependency (Davila & Beck, 2002; D. M. Grant, Gayle Beck, Farrow, & Davila, 2007). These behaviors aim to protect them from negative evaluation, but they paradoxically make people with high social anxiety less likeable to their interaction partners and even produce discomfort in confederates (Alden & Bieling, 1998; Alden & Taylor, 2004). Not only do these interpersonal styles tend to aggravate relationships with friends, romantic partners, and family, but they also have been shown to mediate the relationship between social anxiety levels and interpersonal stress, even accounting for depressive symptoms (Davila & Beck, 2002). In effect, what people with SAD do to avoid negative evaluation may actually increase relationship dysfunction, reinforcing their social anxiety symptoms.

The Present Study

The literature reviewed highlights the importance of stressful social events to the symptoms of SAD and thus the daily experiences of people with this disorder. The present study used daily diary methodology to capture day-to-day fluctuations in affect, self-esteem, and interpersonal events in people with and without SAD. This approach is particularly useful for studying the impact of frequently occurring stressors (Stone & Shiffman, 2002), and it minimizes problems associated with biased recall (Tourangeau, Rips, & Rasinski, 2000). Daily diaries allow us to use statistical analyses that

simultaneously estimate between- and within-person effects, and the oscillations from one day to the next allow us to measure spillover effects of affect and events as they unfold over time (Bolger, Davis, & Rafaeli, 2003). The temporal sequencing of events and reactions will allow us to more strongly infer direction of influence. Given the possible stressful nature of both negative and positive social events in people with SAD (Weeks et al., 2008), we investigated the temporal processes associated with both types of events.

There are several ways in which people with SAD may differ in how interpersonal stressors influence their emotional and self-evaluative experiences. First, we hypothesized that participants with SAD would experience more frequent negative social events and less frequent positive social events; we also expected them to evaluate negative social events as having greater importance and positive events as having less importance compared to the healthy comparison group. Second, we hypothesized that participants with SAD would be more reactive to negative social events in the form of heightened negative affect and lowered self-esteem on the day of the event. Notably, the reviewed studies suggest that people with SAD would be more reactive to negative events, but less reactive to positive events, given their tendency to discount positives (Alden & Taylor, 2004) and experience distress during positive evaluation (Weeks et al., 2008). Third, we hypothesized that participants with SAD would experience greater reactivity spillover in the form of social stressors being associated with prospective fluctuations in daily emotions and self-esteem. Lastly, we tested the alternative hypothesis that participants with SAD would experience prospective increases in negative

interpersonal events following times of increased negative emotions or low self-esteem. Evaluating these pathways may explain the mechanisms by which social fears are maintained, given the unremitting course of SAD without treatment (Wittchen & Fehm, 2003).

METHOD

Participants

Participants were 86 adults from the Northern Virginia community recruited through online advertisements and flyers on local bulletin boards. Of these, 43 participants were diagnosed with generalized SAD, while 43 adults with no psychological difficulties composed our healthy control (HC) group. After excluding seven participants who provided less than three daily diary entries, the final sample ($n = 79$) included 40 participants diagnosed with SAD and 39 age- and gender-matched healthy controls. The sample was 64.6% female with an average age of 28.9 ($SD = 8.8$), and diverse in terms of self-identified race/ethnicity (54.4% “Caucasian/White”, 19% “African-American/Black”, 12.7% “Hispanic/Latino”, 5.1% “Asian-American”, 8.9% “Other”). Groups did not differ on demographic variables (see Farmer & Kashdan, 2013 for details).

Procedure

Complete details of this procedure can be found in Kashdan et al. (2013). Briefly, potential participants underwent initial screening by phone with trained research assistants. During the first face-to-face appointment ($N = 122$), participants completed trait measure questionnaires, participated in a thorough semi-structured clinical interview, and (qualified participants) learned how to complete online end-of-day questionnaires (and additional experience sampling data not used for these analyses) for the 14 days

following the baseline assessment. Participants were asked to complete entries every day between 6:00 P.M. of the day in question and 11:59 A.M. on the following day, preferably as close to bedtime or waking as was convenient to minimize memory bias. To maximize compliance, 1) we kept measures brief, 2) we used an incentive structure in payment for participation (minimum payment of \$165 up to \$215 with regular, timely entries), 3) entries completed through the secure website were automatically date- and time-stamped, and 4) researchers sent reminder messages to participants several days into data collection. At the end of the data collection period, participants returned to the laboratory for debriefing.

Measures

Diagnostic status

Participants' diagnoses of SAD, MDD, and other Axis I disorders were assessed with the *Structured Clinical Interview for DSM-IV Axis I Disorders* (SCID-I/NP; First, Spitzer, Gibbon, & Williams, 2002), conducted by doctoral-level clinical psychology students and supervised by a clinical psychologist. The SCID has previously demonstrated good interrater and test-retest agreement (Zanarini et al., 2000). In our study, 45 of the videotaped interviews were randomly chosen to be evaluated by a second coder, and inter-rater agreement was good (Kappa = .87). Additionally, we administered the SAD module of the *Anxiety Disorders Interview Schedule for DSM-IV: Lifetime Version* (Di Nardo, Brown, & Barlow, 1994) to determine SAD subtype. Generalized SAD had to be the primary or most severe diagnosis if other comorbid psychiatric conditions were present. Participants with comorbid substance dependence, psychotic

symptoms, or active suicidal ideation were excluded from experience-sampling assessments due to risk and validity concerns. Only participants with no Axis I diagnoses will be included in the healthy control group.

The diagnostic status of SAD was corroborated by self-report with the *Social Interaction Anxiety Scale* (SIAS; Mattick & Clarke, 1998a), a 20-item self-report measure of discomfort in social situations. Participants rated statements relating to tendencies to fear and avoid social interactions using a 5-point Likert scale ranging from 0 (*not at all characteristic of me*) to 4 (*extremely characteristic of me*). This scale has demonstrated good reliability and validity across clinical, community, and student samples (Brown et al., 1997; Heimberg, Mueller, Holt, Hope, & Liebowitz, 1993; Mattick & Clarke, 1998b).

Diagnostic status of MDD was corroborated by self-report with the *Beck Depression Inventory—Second Edition* (BDI-II; Beck, Steer, & Brown, 1996a). Participants responded to 21 items on a scale from 0 to 3 to describe the degree to which they experience various symptoms associated with depression over the prior 2-week period. This measure has demonstrated excellent reliability and validity, including the ability to differentiate people with and without mood disorder diagnoses (Beck, Steer, & Brown, 1996b; Sprinkle et al., 2002). Our sample also had also acceptable internal reliability ($\alpha = .93$).

Daily emotions

Each evening, participants described the degree to which they experienced various emotions over the course of the day. Using a 5-point Likert-scale, participants

rated five positive emotion items (e.g., joyful, enthusiastic) and five negative affect items (e.g., sad, angry) from 1 (*very slightly/not at all*) to 5 (*extremely*) to indicate “how well each adjective described your mood *today*”. The items were selected from the *Positive and Negative Affect Schedule—Expanded Form* (PANAS-X; Watson & Clark, 1994) and reflected brief adjective sets used in prior daily diary studies (e.g., Nezlek & Kuppens, 2008). We evaluated the reliability of the scales using three-level unconditional models (i.e., 5 emotions nested within the 14 days, nested within the 79 participants), where the reliability of the Level 1 intercept is essentially a Cronbach’s alpha (α) adjusted for differences between days and people (see Nezlek, 2007). Since reliability was acceptable for positive ($\alpha = .89$) and negative ($\alpha = .81$) emotion items, we created daily sum scores for each participant.

Daily self-esteem

Participants’ described their self-esteem on the day in question by responding to two items: “I felt I had good qualities” and “I felt satisfied with myself”. They rated their experiences on a 7-point scale from 1 (*very uncharacteristic of me today*) to 7 (*very characteristic of me today*). This measure was adapted from prior experience-sampling research (e.g., Nezlek & Plesko, 2001). Since our sample demonstrated acceptable reliability ($\alpha = .742$), calculated as described above, we summed the item scores to create a daily self-esteem score for each end-of-day entry. Notably, the sample size for analyses involving self-esteem was 78 participants due to missing data (only on self-esteem) for one HC participant.

Daily social events

We also asked participants to describe the social events they experienced over the course of the day in question with a modified version of the *Daily Events Survey* (Butler, Hokanson, & Flynn, 1994). Participants were asked to “describe the events that occurred to you *today*” with 10 positive events (e.g., receiving a compliment, spending pleasant time in a social setting), and 10 negative events (e.g., having an argument, being criticized). Each item was assessed on a 6 point scale where 0 (*did not occur*) represented lack of exposure and 1 (*occurred, and not meaningful*) to 5 (*occurred, and very meaningful*) represented exposure with varying levels of importance. Reliability of positive ($\alpha = .637$) and negative ($\alpha = .559$) was adequate given that these items were meant to sample a range of positive and negative experiences, respectively. Thus, we averaged ratings to create a positive event score and negative event score for each end-of-day entry. We also calculated frequency of events by counting the number of positive or negative events the participant rated > 0 for that day. Unless specified (Hypothesis 1), we present here the analyses for the composite scores, because these scores had less heterogeneity of variance than the frequency counts, which assume all events to be equally meaningful. Notably, results were similar when we substituted event frequency in our models. To address possible buffering effects of positive and negative events, we calculated an interaction term of the daily event scores centered around each participant’s mean score (Aiken & West, 1991).

RESULTS

Preliminary Analyses

Overall, compliance was adequate, with an average of 87.1% of end-of-day entries ($n = 963$) completed within the requested time window ($M = 12.1$ entries per participant, $SD = 3.67$) and differences in compliance did not differ by diagnostic group (see Farmer & Kashdan, 2013). On the SIAS, all participants in the SAD group (100%) scored above the recommended cutoff score (34) for clinical levels of social anxiety ($M = 52.9$, $SD = 9.38$), while all HC participants scored below the cutoff ($M = 12.22$, $SD = 6.59$; $t = -22.07$, $p < .001$). Participants with an MDD diagnosis scored on average in the *moderate depression* range on the BDI-II ($M = 26.0$, $SD = 10.9$), while participants with no MDD diagnosis scored in the lowest range ($M = 8.41$, $SD = 9.20$; $t = -4.77$, $p < .001$). Based on previously published analyses (Farmer & Kashdan, 2013), the SAD group on average reported higher levels of negative emotions and lower levels of positive emotions and self-esteem over the two-week period ($ds > 1.3$).

Overview of Analyses

Given our inherently nested data (days within people), we used hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) to test our hypotheses: (1) Does SAD predict occurrence and subjective impact of interpersonal events?; (2) Does SAD moderate (i.e., strengthen) the day-to-day effects of stressors on emotions and self-esteem?; (3) Does SAD interact with interpersonal events experienced over time to

predict prospective fluctuations in emotions and self-esteem?; and (4) Does SAD interact with experienced emotions and self-esteem over time to predict prospective fluctuations in interpersonal events? Despite efforts to encourage regular questionnaire completion, missing entries are the norm in daily diary research (13% in our study). Since multilevel modeling is appropriate if data are missing at random (Fitzmaurice, Laird, & Ware, 2004), we confirmed that missing data were not predicted by any of our predictor or outcome variables. Furthermore, we conducted analyses with full maximum likelihood estimation with robust standard errors, which uses all available data to inform within- and between- person level parameters and their standard errors (Raudenbush & Bryk, 2002).

Multilevel models were constructed with separate Level 1 and Level 2 equations using HLM 6.08 software (Raudenbush, Bryk, Cheong, & Congdon, 2004). Level 1 regression equations were specified to model fluctuation in the daily measures over time. Predictors at this level were centered around each participant's average over the two weeks (see Nezlek, 2007). Level 2 equations were specified to model individual differences in Level 1 parameters as a function of diagnostic status which was contrast coded (i.e., SAD, MDD).

Descriptive Statistics and Reliability

We first examined unconditional models to determine the proportion of variance explained by between-persons factors in our outcome variables:

Equation 1 Unconditional Model

$$\text{Level 1 (within-person): } y_{ij} = \beta_{0j} + r_{ij}$$

$$\text{Level 2 (between-person): } \beta_{0j} = \gamma_{00} + u_{0j}$$

where y_{ij} is the daily measure (e.g., self-esteem) for participant j on day i , β_{0j} is the random coefficient for the intercept of y for participant j , r_{ij} is the within-person error in predicting y .

In the Level 2 model, γ_{00} is the average of all participants' mean levels of y (from Level 1), and u_{0j} is the error of β_{0j} .

Results from these unconditional models showed considerable within-persons (σ^2) and between-persons (τ) variability in our daily measures: positive emotions ($\sigma^2 = 8.67$, $\tau = 15.32$), negative emotions ($\sigma^2 = 8.47$, $\tau = 5.84$), self-esteem ($\sigma^2 = 4.15$, $\tau = 6.62$), positive events ($\sigma^2 = 46.54$, $\tau = 41.51$), and negative events ($\sigma^2 = 12.15$, $\tau = 7.37$). Thus, the random effects were retained in the remaining HLM analyses. To evaluate our models in the following analyses, we calculated the percentage of within-person or between-person variance explained over the null model (as appropriate), which approximates an R^2 statistic in multiple linear regression analyses (Snijders & Bosker, 1994).

Does SAD Predict Daily Interpersonal Events?

HLM was used to examine the hypothesis that SAD diagnosis (Level 2 variable) would predict more negative daily social events (and less positive daily social events), as well as whether the frequency of these events (ignoring subjective impact) also differed between groups. We used means-as-outcomes models (see Raudenbush & Bryk, 2002) predicting each outcome where we added SAD as a predictor at Level 2:

Equation 2 Means-as-Outcomes Model

$$\text{Level 2 (between-person): } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{SAD}) + u_{0j}$$

where y_{01} represents the change in β_{0j} (mean outcome) associated with a diagnosis of SAD (coded -1 and 1). The SAD group reported significantly more negative event impact on their daily lives ($\beta = 1.02$, $SE = .30$, $t = 3.39$, $p < .001$, $R^2 = .27$), and less positive event impact on their daily lives ($\beta = -3.37$, $SE = .67$, $t = -5.07$, $p < .001$, $R^2 = .13$). Furthermore, this represents not only a difference in subjective impact of events, as actual frequency of negative events was higher in participants with SAD ($\beta = 0.43$, $SE = .13$, $t = 3.40$, $p = .001$, $R^2 = .13$); positive events occurred less frequently in participants with SAD ($\beta = -0.94$, $SE = .19$, $t = -4.94$, $p < .001$, $R^2 = .25$). Figure 1 represents the frequency of events by group, with means and standard errors estimated from HLM models in which the diagnosis was recoded 0 and 1 (0 represented the diagnostic group in question). Notably, groups did not differ in the impact rating of negative events when they occurred ($\beta = 2.02$, $SE = .06$, $t = 1.10$, $p = .28$, $R^2 < .01$). However, participants with SAD rated the impact of positive events, when they occurred, on average at 2.45 ($SE = 0.10$), which was significantly lower than the HC group ($\beta = 2.85$, $SE = .07$, $t = -3.15$, $p = .003$, $R^2 = .11$).

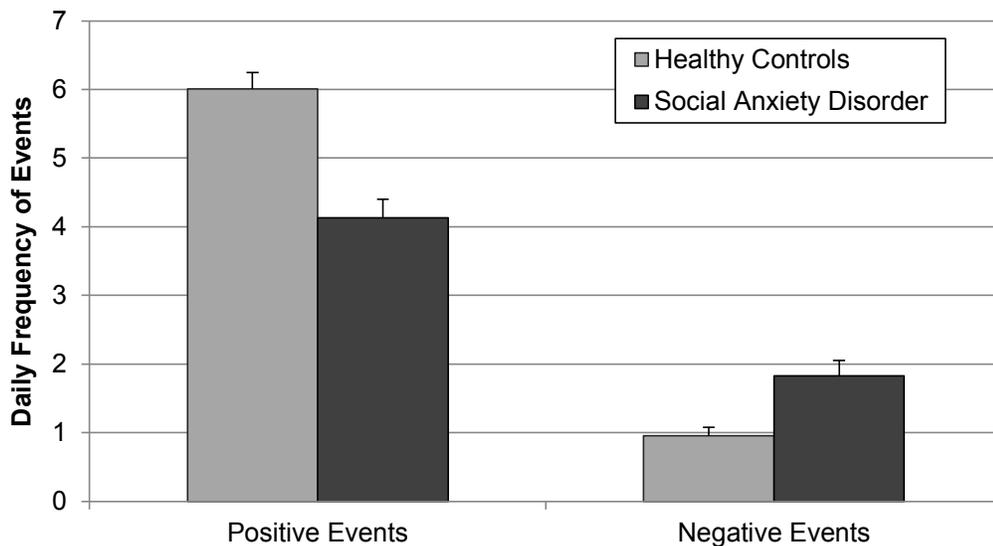


Figure 1: Social Anxiety Disorder Predicts Frequency of Daily Positive and Negative Social Events

Temporal Process Analyses

The next analysis examined the temporal relationships of daily social events and daily well-being (emotion and self-esteem). The majority of researchers study daily stress reactivity within-day, where the outcomes are regressed on the stressful events occurring on the same day. Some researchers extended the effects to outcomes occurring later that day or even the day following the stressor. Following Wickham and Knee’s (2013) recommendations, we addressed same-day (concurrent) and next-day (lagged) well-being sequelae of social events. We investigated concurrent effects by regressing the current day’s outcomes on the current day’s social events¹. Lagged effects were investigated simultaneously by regressing the current day’s outcome on the prior day’s

¹ Since many participants had missing data (days missed), temporal process analyses were based on 754 entries across the 79 people, including only those entries for it was possible to calculate a lagged predictor (i.e., back to back daily diary entries submitted).

events. This allowed us to examine the unique associations of well-being on a particular day with the same day's events (concurrent at time T) and the prior day's events (lagged at T-1). For each analysis, we accounted for expected autocorrelation of the outcome measure on adjacent days by including the prior day's outcome (i.e., emotion or self-esteem), since people's experiences at one point in time are likely to be more similar on days closer in proximity. This autocorrelation slope is a direct operationalization of emotional inertia (Kuppens, Allen, & Sheeber, 2010); by controlling it, we would be examining prospective fluctuations in experiences as a consequence of changes in events.

Additionally, we investigated potential interactions between concurrent and lagged events. Events that occur on one day can change how an individual reacts to events that occur on the following day. For example, an argument with a spouse on one day has the potential to change a person's interpretation of (and thus reaction to) criticism from a boss on the following day. Negative social events on the previous day may have a *sensitization* effect, magnifying the association between today's negative events and emotions. Alternatively, they may have an *attenuation* effect, where they dampen emotional responsiveness to today's negative events (e.g., "It's just another person criticizing me"). It is also possible for the previous day's positive events to have a magnifying or dampening effect on today's negative events. Thus, we investigated all two-way Concurrent \times Lagged interaction effects between positive and negative events. The Level 1 model was as follows:

Equation 3 Lagged Model

$$y_{ij} = \beta_{0j} + \beta_{1j}Outcome_{T-1} + \beta_{2j}NegEvent_T + \beta_{3j}PosEvent_T + \beta_{4j}NegPos_T + \\ \beta_{5j}NegEvent_{T-1} + \beta_{6j}PosEvent_{T-1} + \beta_{7j}NegPos_{T-1} + \\ \beta_{8j}(NegEvent_T * NegEvent_{T-1}) + \beta_{9j}(PosEvent_T * PosEvent_{T-1}) + \\ \beta_{10j}(NegEvent_T * PosEvent_{T-1}) + \beta_{11j}(PosEvent_T * NegEvent_{T-1}) + r_{ij}$$

in which the outcome y_{ij} is the outcome for person j on day i , β_{0j} represents the intercept for that person, β_{1j} represents the degree to which a person's level of the outcome measure on the previous day (T-1) predicts their current level of the outcome regardless of events (i.e., autocorrelation). β_{2j} , β_{3j} , and β_{4j} represent the concurrent (same-day) relationships between events (positive, negative, and their interaction, respectively) with the outcome; β_{5j} , β_{6j} , and β_{7j} are the lagged effects, testing the strength of the relationships between events one day before (T-1) and each day's well-being (y_{ij}). Predictors were centered around each participant's mean (Raudenbush & Bryk, 2002); thus, their coefficients represent the relationships between deviations from the person's mean event scores and short-term deviations in the outcome from the mean. To investigate possible sensitization or attenuation effects of previous days' events on the associations of outcomes with same-day events, we included all two-way event interactions (β_{8j} through β_{11j}). For example, β_{10j} represents the interaction of the previous day's positive events and current day's negative events on today's well-being. Temporal processes in positive emotions, negative emotions, and self-esteem were examined in separate models. SAD

was included as a Level 2 predictor of the intercept and all event slopes. For a conservative approach, all predictors were estimated with random slopes.

Table 1 lists the random coefficients and standard errors listed for each intercept and slope in these temporal process models. For example, the random coefficient for concurrent negative events on negative emotions was .25, meaning that on days when the negative event score was 1 point above an individual's average, the individual's negative emotions were on average .25 points above their mean daily negative emotions. For positive and negative emotions, we found a significant autocorrelation (inertia) effect of the previous day's emotion level on the current day's emotions, controlling for events occurring on those days ($ps < .01$).

Table 1: Temporal Analysis of Relationships Between Social Events and Daily Well-being

Coefficient	Negative Emotions	Positive Emotions	Self-esteem
Intercept	8.15 (.24)***	13.68 (.37)***	9.49 (.24)***
× SAD	1.37 (.24)***	-2.46 (.36)***	-1.36 (.24)***
Outcome _(T-1)	.13 (.04)**	.15 (.04)**	.08 (.05)†
NegEvents _(T)	.25 (.04)***	-.15 (.04)***	-.11 (.03)**
× SAD	.15 (.04)***	.02 (.02)	-.03 (.03)
PosEvents _(T)	-.13 (.04)**	.19 (.02)***	.09 (.01)***
× SAD	-.03 (.02)	.03 (.02)	.02 (.01)†
NegEvents _(T) × PosEvents _(T)	-.01 (.00)**	.00 (.01)	-.00 (.00)
× SAD	-.00 (.00)	.00 (.01)	.00 (.00)
NegEvents _(T-1)	.01 (.04)	.01 (.03)	.01 (.02)
× SAD	.00 (.00)	.07 (.03)*	.05 (.02)*
PosEvents _(T-1)	.04 (.01)*	-.02 (.02)	-.02 (.01)
× SAD	-.00 (.01)	.02 (.02)	.00 (.00)
NegEvents _(T-1) × PosEvents _(T-1)	.00 (.01)	.00 (.00)	.00 (.00)

× SAD	.00 (.00)	.00 (.00)	.00 (.00)
NegEvents _(T-1) × NegEvents _(T)	-.01 (.01)	-.02 (.01)*	-.02 (.00)***
× SAD	-.02 (.01)	.02 (.01)**	.02 (.00)***
PosEvents _(T-1) × PosEvents _(T)	-.00 (.00)	.00 (.00)	.00 (.00)
× SAD	-.00 (.00)	.00 (.00)	-.00 (.00)
NegEvents _(T-1) × PosEvents _(T)	.00 (.01)	.01 (.00)*	.00 (.00)
× SAD	-.01 (.01)	-.00 (.00)	-.00 (.00)
PosEvents _(T-1) × NegEvents _(T)	.00 (.00)	.01 (.01)	.01 (.00)
× SAD	-.00 (.00)	.01 (.01)	.01 (.00)
σ^2	4.32	4.70	2.48
τ	4.12	10.22	4.50

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .07$. Random coefficients from temporal

process analyses are presented with standard errors in parentheses. Significant moderation effects of SAD diagnosis are bolded.

Does SAD Moderate the Effect of Concurrent Events on Emotions and Self-Esteem?

We hypothesized that participants with SAD would experience greater same-day reactivity to social stressors. Consistent with previous research, we found significant within-day associations between concurrent social events (positive and negative) and all three well-being outcome variables (i.e., positive emotions, negative emotions, and self-esteem, all $ps < .01$). A diagnosis of SAD significantly moderated the relationship between negative events and negative emotions on the same day ($t = 5.76, p < .001$). Figure 2 depicts this interaction effect (using Shacham, 2009), where participants with SAD were significantly more reactive to negative events ($b = .40, p < .001$) than the HC group ($b = .09, p = .06$). We also found a trend interaction effect of Concurrent Positive

Events \times SAD on self-esteem ($t = 1.84, p = .07$), which suggested that participants with SAD were marginally more reactive to positive events ($b = .11, p < .001$) than HC participants were ($b = .07, p < .001$). These results partially supported our hypothesis that participants with SAD would react to same-day negative social events with more negative emotions, though they were not less reactive to positive events.

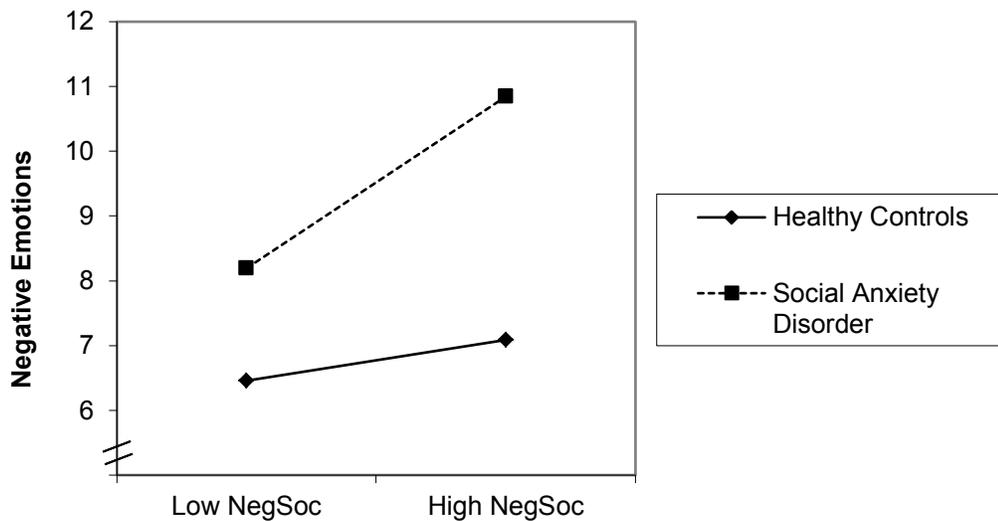


Figure 2: SAD Moderates the Relationship Between Concurrent Negative Social Events and Negative Emotions

Notably, we also found a significant Concurrent Negative Event \times Concurrent Positive Event interaction effect on same-day negative emotions ($t = -3.01, p = .004$). This interaction effect (see Figure 3) suggested a protective effect of positive events on the relationship between negative events and negative emotions, such that when participants experienced more positive events (one *SD* above their mean), the relationship

between negative events and negative emotions was less strong ($b = .15, p = .008$) than when they experienced fewer positive events on that day ($b = .34, p < .001$). This effect was not moderated by SAD diagnosis.

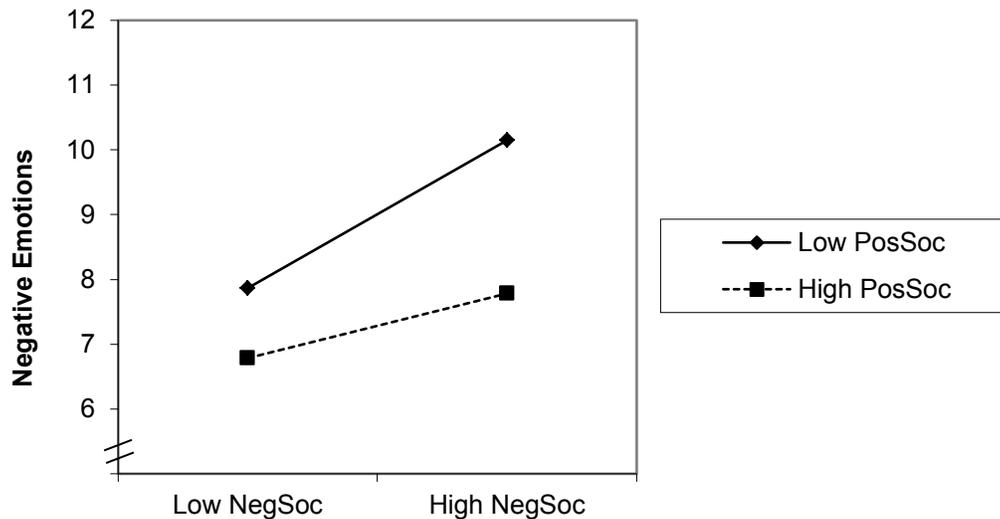


Figure 3: Concurrent Positive Social Events Moderate the Relationship Between Concurrent Negative Social Events and Negative Emotions

Does SAD Moderate Effects of Lagged Events on Emotions and Self-Esteem?

We hypothesized that participants with SAD would experience longer-lasting effects of social stressors on their well-being. We tested this analysis both with the lagged effects (unique contribution of prior day's events on the current day's outcome) and with interaction effects of lagged \times concurrent events to test sensitization and attenuation effects. The results partially supported our hypothesis. We did not find SAD to moderate the effects of lagged events on current day negative emotions. However, we

found a significant interactive effect of SAD \times Lagged Negative Events \times Concurrent Negative Events on positive emotions ($t = 3.06, p = .003$). As depicted in Figure 4, among HCs, on days after participants experienced more distressing social events (lagged), they were more sensitive to the occurrence of negative events ($b = -.31, p < .001$), whereas their positive emotions did not decrease in response to negative events if the prior day had a lower negative event score than average for the person ($b = -.05, p = .54$). In contrast, the SAD group was similarly reactive to concurrent days' negative events regardless of the previous day's events ($b = -.15$ vs $b = -.11, ps < .01$).

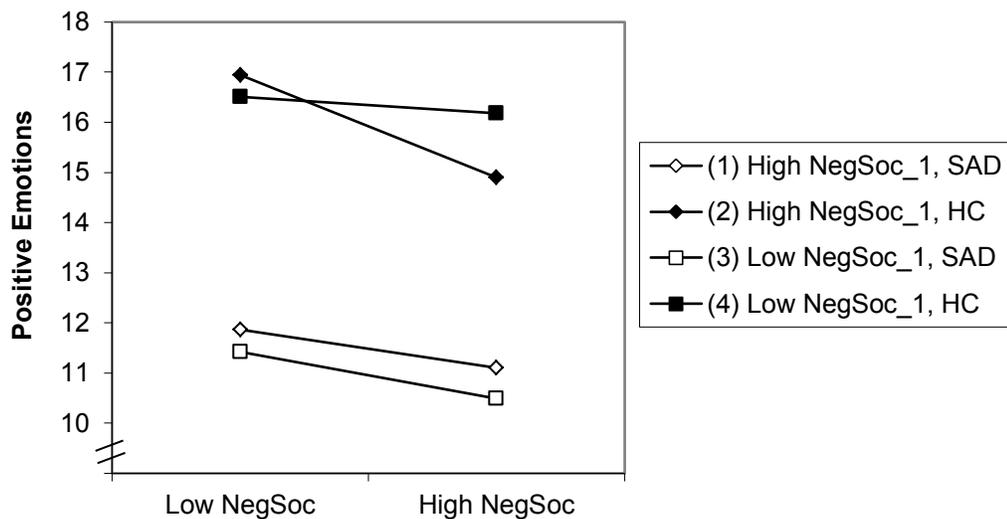


Figure 4: Three-way Interaction Between SAD, Concurrent Negative Social Events, and Lagged Negative Social Events on Positive Emotions

There was also a significant interactive effect of SAD \times Lagged Negative Events \times Concurrent Negative Events on self-esteem ($t = 4.15, p < .001$). The pattern of effects was similar to that for positive emotions (Figure 4). Among HCs, on days after

participants experienced more negative events, they were more sensitive to the occurrence of same-day negative events ($b = -.21, p < .001$), whereas their self-esteem was not affected in response to concurrent day's negative events if the prior day had fewer negative events than average ($b = .05, p = .26$). As with the effects on positive emotions, the self-esteem of the SAD group was similarly reactive to concurrent day's negative events regardless of the previous day's events ($b = -.12$ vs $b = -.15, ps < .05$). In sum, these analyses suggest that participants with SAD were more rigid in their reactivity to negative social events, whereas the HC group displayed more flexibility in their responding.

In addition to addressing our hypothesis, we found several other noteworthy effects. Participants in general reported more negative emotions on days following more positive social events ($t = 2.80, p = .007$); this likely reflects a rebound effect after the significant decreases in negative emotions participants generally experienced in response to same-day positive events ($t = -7.73, p < .001$). We also found a significant interaction effect of Lagged Negative Events \times Concurrent Positive Events for positive emotions ($t = 2.29, p = .025$), depicted in Figure 5. In general, participants were more reactive (i.e., sensitized) to same-day positive events on days after they experienced more distressing negative events compared to days after experienced less distressing negative events than average ($b = .22$ vs. $b = .15, ps < .001$). In other words, if a boy is particularly bullied one day, on the next day he will feel more enthusiastic and excited when someone invites him to a social event than had he not been bullied on the prior day.

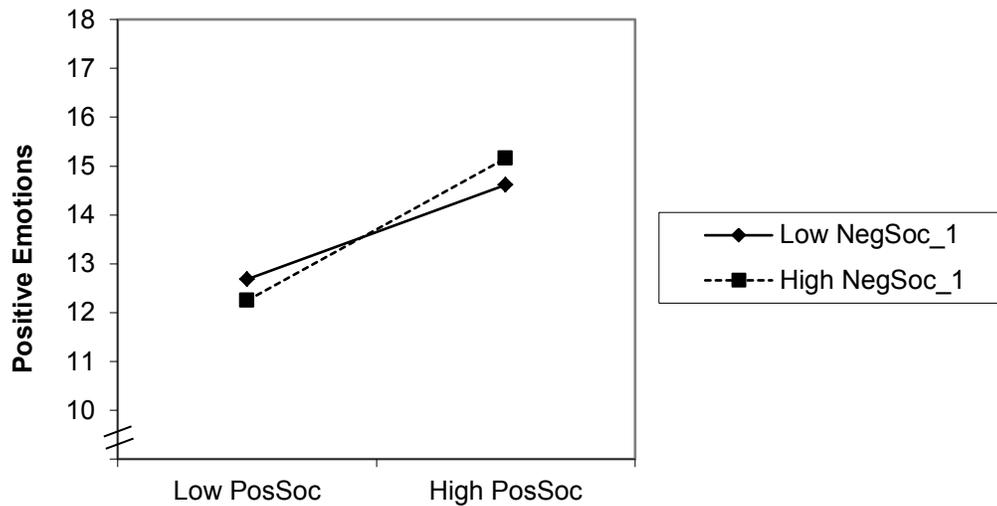


Figure 5: Lagged Negative Social Events Moderate the Relationship Between Concurrent Positive Social Events and Positive Emotions

Are Temporal Process Effects Due to Depression?

It is important to note that much of the previous research on stress reactivity has been in context of depression symptoms. There is considerable comorbidity between SAD and MDD, with estimated rates ranging from 20 to 37% in the population (Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996; Merikangas & Angst, 1995). Thus, to establish the specificity of our findings to SAD, we ran additional analyses including MDD diagnosis as an additional predictor in each Level 2 equation (given inclusion criteria, only the SAD group could have this additional diagnosis). Our results were similar with slight changes in the degree of significance; most significant effects remained significant and one became marginally significant ($p = .051$).

An Alternative Pathway: Does SAD Predict Daily Stress Generation?

With evidence of increased stress reactivity in participants with SAD, we sought to evaluate whether an alternative pathway may provide a better explanation for our data, i.e., that negative emotions prospectively contribute to contribute to interpersonal difficulties in people with SAD. Mirroring the temporal analyses above, we evaluated concurrent, lagged, and concurrent \times lagged effects of emotions on social events. Multilevel models were identical to those above with positive and negative emotions replacing positive and negative events as predictors. We conducted separate models predicting positive and negative social events, including, accounted for an autocorrelation of events on adjacent days (e.g., being criticized on one day is more likely to be followed by criticism on the next day for the same reason). As previously, SAD diagnosis codes were added to the model at the intercept and emotion slopes. These models explained 61.9% and 45.0% of within-person variance in negative social events and positive social events, respectively.

Outcomes of the temporal analyses predicting daily social events are summarized in Table 2. As noted earlier, groups significantly differed in the frequency and intensity of positive and negative events in their daily lives (participants with SAD reporting more negative and less positive events). Positive events (but not negative) had significant carryover from one day to the next ($t = 2.59, p = .012$). Although concurrent effects were not of interest for this study, we included them to examine Lagged \times Concurrent interactions (results summarized in Table 2).

Table 2: Temporal Analysis of Relationships Between Daily Negative and Positive Emotions and Daily Interpersonal Events

Coefficient	Negative Events	Positive Events
Intercept	2.76 (.30)***	13.93 (.67)***
× SAD	1.10 (.29)***	-3.53 (.64)***
Outcome _(T-1)	-.01 (.04)	.13 (.05)*
NegEmotions _(T)	.37 (.08)***	-.52 (.11)***
× SAD	.00 (.08)	.38 (.11)***
PosEmotions _(T)	-.02 (.04)	.82 (.11)***
× SAD	-.07 (.04)	-.04 (.11)
NegEmotions _(T) × PosEmotions _(T)	-.02 (.02)	-.08 (.03)**
× SAD	-.03 (.02)	.06 (.03)*
NegEmotions _(T-1)	.13 (.07)†	.34 (.12)**
× SAD	-.22 (.06)***	-.28 (.12)*
PosEmotions _(T-1)	.03 (.05)	.13 (.11)
× SAD	-.07 (.05)	-.04 (.10)
NegEmotions _(T-1) × PosEmotions _(T-1)	.01 (.02)	.02 (.04)
× SAD	-.04 (.02)*	-.03 (.04)
NegEmotions _(T-1) × NegEmotions _(T)	.04 (.05)	.02 (.04)
× SAD	-.00 (.05)	.04 (.04)
PosEvents _(T-1) × PosEmotions _(T)	.01 (.02)	.05 (.04)
× SAD	-.03 (.02)	.02 (.04)
NegEmotions _(T-1) × PosEmotions _(T)	.02 (.03)	.04 (.04)
× SAD	.01 (.03)	.02 (.04)
PosEmotions _(T-1) × NegEmotions _(T)	.04 (.04)	.07 (.05)
× SAD	-.05 (.04)	-.02 (.05)
σ^2	4.63	25.60
τ	6.99	32.84

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .07$. Random coefficients from temporal

process analyses are presented with standard errors in parentheses. Significant

moderation effects of SAD diagnosis are bolded.

Addressing the possibility that negative emotions may contribute to more negative social events prospectively, we examined the interaction effects of SAD and lagged effects. We found a significant SAD \times Lagged Positive Emotions \times Lagged Negative Emotions effect for negative events ($t = -2.14, p = .036$). As depicted in Figure 6, for the HC group, highly negative emotions on the prior day predicted more negative social interactions on the following day regardless of the positive emotions experienced ($b = .42, p = .002$ and $b = .29, p = .002$, respectively). However, for participants in the SAD group, the lagged positive emotions moderated the effect of lagged negative emotions such that experiencing mixed lagged emotions (high in positive and high in negative) was associated with marginally less frequent negative social events the next day ($b = -.24, p = .056$), but lagged negative emotions did not predict negative events the next day when participants with SAD experienced low levels of lagged positive emotions ($b = .06, p = .64$). This result is contrary to a stress generation hypothesis; it suggests that engaging in activities that have the potential enhance positive emotions as well as negative (e.g., social interactions for people with SAD) may lead contribute to less social stress over time.

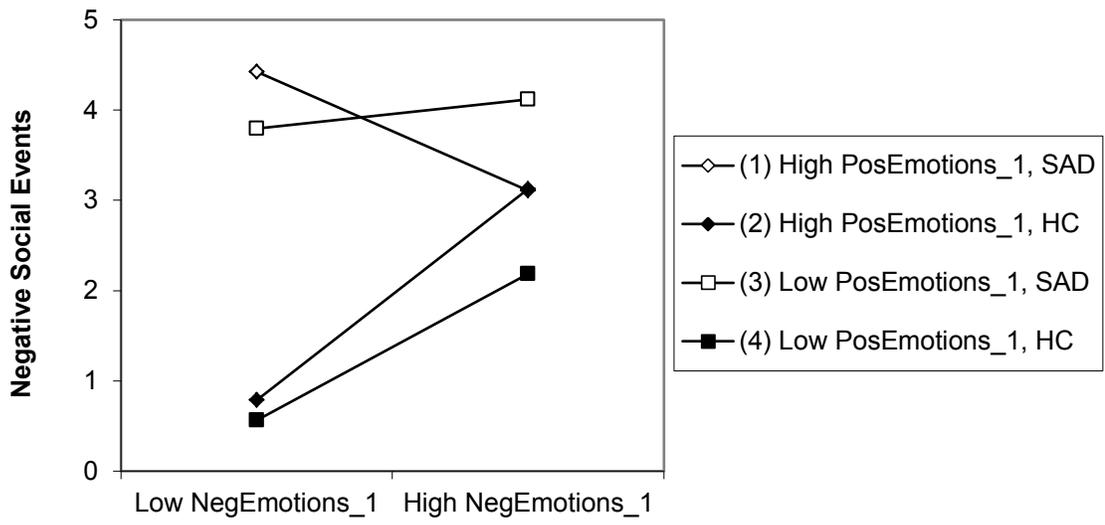


Figure 6: Three-way Interaction Between SAD, Lagged Negative Emotions, and Lagged Positive Emotions on Negative Social Events

With regard to daily positive social events, SAD moderated the relationship between the prior day’s negative emotions and current day’s positive events ($t = -2.43, p = .018$). As shown in Figure 7, only the HC group displayed more positive social events on days following negative emotions ($b = .62, p = .003$ vs. $b = .06, p = .60$ for the SAD group). This suggests that for people who are not socially anxious, on days following stressful social interactions an argument, they are likely to be engaging in *more* positive social events. We did not find any evidence of interactions between concurrent and lagged effects. Overall, these analyses did not support a daily stress generation temporal sequence in people with SAD. Instead, the SAD group appeared to experience less social stress on days following high negative emotions compared to HCs, who experienced both more positive and negative social events on days following negative moods.

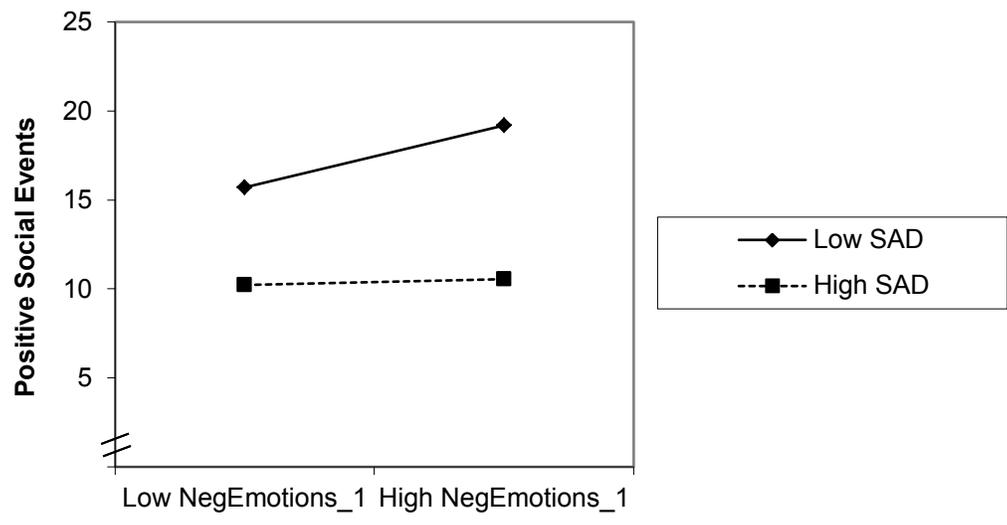


Figure 7: Social Anxiety Disorder Moderates the Relationship Between Lagged Negative Emotions and Positive Social Events

DISCUSSION

The goal of this study was to examine the temporal processes involved in how people with SAD respond to interpersonal events in their daily lives with a novel perspective on the complex nature of living in a social world with constantly changing stressors. Thus we looked not only at the extent to which positive and negative social events affected participants immediately (concurrent effects) and on the following day (lagged effects), but also accounted for the likelihood that the events they experience on one day are likely to influence their reactions to events on the following day. Compared to healthy adults, we found participants with SAD to experience more frequent and distressing negative social events, as well as less frequent and meaningful positive social events in daily life. In addition to being more reactive to negative events (with increases in negative emotions) on the same day, participants with SAD also had more rigid reactivity to stressful social events across days (i.e., consistently high reactivity). We also considered a reverse model where emotions concurrently and prospectively predicted social events. We did not find evidence for participants with SAD experiencing more social stressors on days following more intense negative emotion experiences. In fact, we found the opposite effect (i.e., less frequent negative social events). Our findings demonstrated that people with SAD experience intense emotional reactions to negative

interpersonal events that tend to be less influenced by contextual factors like recent social experiences and may, thus, contribute to maintenance of SAD symptomology.

Our finding that participants with SAD reported more distressing negative social events and less meaningful positive social events is consistent with experience sampling investigations on the daily lives of youth with SAD (e.g., Beidel et al., 1999) and on undergraduate samples looking at social anxiety on a continuum (e.g., Farmer & Kashdan, 2012). This difference in exposure suggests that people with SAD are not only missing out on possible rewarding social opportunities but also are encountering situations most people would find somewhat distressing at a higher rate. Importantly, these findings are not simply due to difference in subjective ratings of the stressors' impact. When looking at just frequency of events (did occur vs. did not occur for each item), the SAD group still reported nearly twice as frequent negative events and 30% less frequent positive events. In fact, the SAD and HC groups rated negative events at similar mean levels of meaningfulness. However, the SAD group did rate positive events as less meaningful than the HC group, which is important given the growing body of evidence showing people with SAD to experience a broad range of positivity deficits (Kashdan, Weeks, & Savostyanova, 2011).

Stress reactivity has been studied as a potential vulnerability factor for a number of psychiatric disorders (e.g., MDD, psychosis; Cohen, Gunthert, Butler, O'Neill, & Tolpin, 2005; Myin-Germeys et al., 2003). Our findings add to this understanding by demonstrating dysfunctional patterns of reactions to negative social events in a sample of carefully diagnosed adults with SAD and carefully screened healthy controls (using a

validated clinical interview). Similar to findings in other disorders, our participants with SAD experienced greater same-day negative emotion reactivity to negative social events. Notably, over half of our SAD group met criteria for at least one secondary psychiatric diagnosis, raising the possibility that our findings could have been driven by symptoms of another diagnosis. Our findings were unchanged when we accounted for MDD in our models, but there is significant overlap between anxiety, depression, and stress disorders. Thus, stress reactivity may be a transdiagnostic feature shared among commonly occurring disorders. This is supported by findings of stress reactivity associated with the serotonin transporter gene, which has been associated with several mood and anxiety disorders (Gunthert, Conner, et al., 2007).

There are some reasons to believe the phenomenology of SAD may make people particularly vulnerable to daily social stressors. First, stress reactivity may be related to people with SAD having biological vulnerabilities, including differences in patterns of biological responses to stress (e.g., Yoon & Joormann, 2011) and neural activation during emotional processing and efforts to manage emotions (Brühl, Herwig, Delsignore, Jäncke, & Rufer, 2013). Second, cognitive models of SAD (e.g., Clark & Wells, 1995) argue that biased interpretations are common in SAD contributing to more attention to threat-related stimuli and augmented perceived threat of social situations (Clark & McManus, 2002); thus, cognitive processes may contribute to intensifying negative emotions, as well as self-focused thoughts that tend to influence self-esteem. Third, recent SAD research has highlighted dysfunctional emotion regulation in people with SAD (Campbell-Sills & Barlow, 2007; Farmer & Kashdan, 2012; P. R. Goldin et al.,

2009). Since people with SAD often doubt their ability to cope with stressful social events, they expend significant energy on actions that aim to minimize distress and likelihood of rejection including avoidance of situations, emotional experiences, and thoughts (e.g., Kashdan, Morina, & Priebe, 2009; Werner, Goldin, Ball, Heimberg, & Gross, 2011). Because trying to suppress experiences is cognitively taxing and generally ineffective for managing negative emotions (Richards & Gross, 1999), people with SAD may be more likely to perceive situations as stressful and feel more negatively.

At a more general level, the present study complements and extends the growing body of literature on daily stress reactivity. Stressors and emotions do not occur in a vacuum but rather are influenced by recent experiences and influence subsequent experiences. Thus, we aimed to expand our understanding of day-to-day stress reactivity in people with emotional difficulties by testing for lagged effects (previous day's predictors), concurrent effects (same day's predictors), and their interaction (lagged \times concurrent) to describe a more dynamic pattern of relationships between daily social events and well-being. Compared to the SAD group, HC participants in our study were more sensitive to the prior day's events influencing their degree of reactivity to concurrent negative events. Specifically, both positive emotions and self-esteem were impacted when the participant experienced a high level of interpersonal stress after a prior day of high interpersonal stress. In contrast, the SAD group displayed similar (high) reactivity across days, suggesting of rigid, inflexible responding to stressors. Research on psychological inflexibility suggests that being able to adapt to contextual demands, as well as to choose behavioral and emotional responses from a wide repertoire, is important

to psychological and physical health (Kashdan & Rottenberg, 2010). Such differences in patterns of reactivity across time would not have been possible to capture with a simpler within-day analytic approach.

It is noteworthy to highlight that participants with SAD did not exhibit more intense self-esteem reactivity to negative social events. One of the most dominant models of SAD (Clark & Wells, 1995) theorizes that a core feature of the condition is self-esteem that is contingent on social experiences, such that people with SAD are likely to experience low self-esteem following situations that evoke social threat. In our sample, SAD and HC participants did not differ in their reactivity to negative events, though the SAD group displayed marginally stronger (positive) self-esteem reactivity to positive social events. It is possible that the events sampled did not necessarily tap situations in which participants experienced social threat or social anxiety. Additionally, it is also possible that, given the SAD group's overall lower mean levels of self-esteem, they may have had a smaller range to drop on the self-esteem measure on days with more negative social events. Future studies may ask follow-up questions about specific negative social events to gauge perceived threat or other cognitive variables that would help better understand the relationship of social threat to self-esteem reactivity.

Cognitive-behavioral models of SAD (Heimberg et al., 2010) suggest the likelihood that when people with SAD encounter anxiety during social interactions, they use ineffective emotion regulation strategies and avoidance techniques that may inadvertently make them seem disinterested or cold. Thus, there is some reason to suspect negative emotions predict negative social events prospectively. Our data did not

support this hypothesis. Instead, participants in the HC group experienced the greatest increases in negative and positive social events on days following high negative emotions. These results may reflect a tendency for participants in the HC group (but not the SAD group) to seek out more social interactions following low mood days. This is consistent with people's motivation to seek to reconnect to fulfill their need to belong following experiences of rejection (Baumeister & Leary, 1995). In contrast, participants in the SAD group may have been more likely to withdraw from social settings following high negative mood days, resulting in no changes in next day social events.

Our findings build on prior research on stress reactivity in SAD that focused almost exclusively on laboratory paradigms of stress tasks (e.g., Yoon & Joormann, 2011) and retrospective accounts and global self-report measures (e.g., Bandelow et al., 2004). To our knowledge, this was the first study to examine daily stress reactivity in adults diagnosed with SAD, adding novel understanding to the phenomenology of SAD by using a temporal process approach to investigate how interpersonal stressors and positive social events influence the trajectory of positive emotions, negative emotions, and self-esteem over time in people's naturalistic environment. Although participants had to aggregate their interpersonal and emotional experiences over a day, we took precautions (like date- and time-stamped entries) to maximize the ecological validity of the reports (Affleck, Zautra, Tennen, & Armeli, 1999). Future research may consider more frequent reporting to capture stressors that occur in smaller time windows and allow for more nuanced examinations of temporal processes within a day. Another limitation of our study is that missing data limited the number of observations that could be used in

temporal process analyses. Future researchers may consider ways to maximize data compliance, particularly on subsequent days, either by shortening data collection periods, making data entries less time-consuming or increasing ease of access (e.g., smartphone apps).

Although this research needs to be replicated, our findings highlight several possible implications for clinical practice and research. Specifically, we found that people with SAD to experience stronger negative emotion reactivity and more rigid reactivity of positive emotions and self-esteem to same-day negative social events. These findings highlight the need for clinicians who work with people with SAD to help them develop more effective and more flexible emotion regulation skills (Kashdan & Rottenberg, 2010). Additionally, emerging neuroimaging evidence suggests that mindfulness-based stress reduction may not only improve SAD symptoms but also improve emotion regulation ability and reduce physiological emotional reactivity (Philippe R. Goldin & Gross, 2010). Future studies that incorporate pre- and post-treatment experience sampling will help determine the role of daily stress reactivity in SAD symptomology as a risk factor, an associated symptom that improves with treatment, or a consequence of chronic social fears that maintains following recovery (Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2007).

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BIOGRAPHY

Antonina Savostyanova Farmer graduated valedictorian from Cape Henry Collegiate School, Virginia Beach, Virginia, in 2002. She received her Bachelor of Arts magna cum laude from Princeton University in 2006. She completed a two-year postbaccalaureate traineeship through an Intramural Research Training Award at the National Institute of Mental Health in Bethesda, MD. She earned her Master of Arts in Psychology from George Mason University in 2010, where she received a Ruth L. Kirschstein National Research Service Award through the from the National Institutes of Drug Abuse and Mental Health. She completed her predoctoral internship in clinical psychology at the Charleston Consortium of the Medical University of South Carolina and the Ralph H. Johnson Veterans Affairs Medical Center in Charleston, South Carolina.