DAILY FEAR IN SOCIAL ANXIETY DISORDER

A dissertation submitted
to Kent State University in partial
fulfillment of the requirements for the
degree of Doctor of Philosophy

by

Jessica J. Flynn

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INTRODUCTION

Fear is an adaptive state that has great survival value. However, fear\(^1\) becomes so intense and perseverative in the anxiety disorders that it causes distress and interferes with functioning. One disorder marked by intense and perseverative fear is social anxiety disorder (SAD; Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition: DSM-5; American Psychiatric Association [APA], 2013) or generalized social phobia (as referred to in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision: DSM-IV-TR; APA, 2000). SAD is characterized by “marked fear or anxiety about one or more social situations in which the individual is exposed to possible scrutiny by others. Examples include social interactions (e.g., having a conversation, meeting unfamiliar people), being observed (e.g., eating or drinking), and performing in front of others (e.g., giving a speech) (APA, 2013).

Additionally, people diagnosed with SAD often report feelings of inadequacy and fears that others will observe physiological responses of fear such as blushing or shaking (e.g., Bogels & Reith, 1999). This disorder is relatively common, with lifetime prevalence rates in Western cultures between seven and 12% of the population (Furmark, 2002; Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005). The 12-month prevalence rate of SAD is 6.8%, which ranks only second to specific phobia at 8.7% (Kessler, Chiu, Demler, Merikangas, & Walters, 2005).

---

\(^1\) Many theorists conceptualize fear and anxiety as different, in that fear is a more proximal and anxiety a more distal reaction to an aversive stimulus (e.g., Bouton, Mineka, & Barlow, 2001). However, many factors influence self-reported emotion, including beliefs about emotions and social stereotypes, that affect the accuracy of reporting (e.g., Robinson & Clore, 2002) and “anxiety” and “fear” have rarely been differentiated in anxiety disorder research. Thus, in this paper, these words will be used interchangeably.
Finally, the disorder leads to high personal and economic costs due to impairments in work, academic pursuits, as well as social life (Acarturk et al., 2009b; Aderka et al., 2012; Stein & Kean, 2000). If left untreated, this disorder can take a disabling, chronic, and unremitting course with significant impairments in vocational and social functioning (Stein & Kean, 2000). These impairments are more extreme when individuals with SAD also have major depressive disorder (MDD) (e.g., Erwin et al., 2002). MDD is a disorder that shares many underlying characteristics with SAD (e.g., interpersonal rejection sensitivity, lower levels of positive affect, focus on interpersonal relationships; Huppert, 2009) and is highly comorbid with SAD (estimated comorbidity rates of 50%; Fehm, Beesdo, Jacobi, & Fiedler, 2008; Kessler et al., 1994). Because fear is so central to SAD, it is important to better understand the nature of fear in SAD.

Fear, specifically of social situations, has been so prominent in SAD that the disorder was, until recently, considered a phobia. A phobia is characterized by avoidance of specific objects, activities, or situations (Bögels et al., 2010). Unlike most phobias, individuals with SAD are unlikely to avoid all social situations and what they fear is typically broad and contains a variety of stimuli. For example, it is typical for someone with SAD to have fears that involve experiences with people (e.g., looking “stupid”, making a mistake, or blushing), in many different situations (e.g., at parties, during an interview), with many different people (e.g., strangers, romantic partners, authority figures). Fear in SAD is very different from a specific phobia where fear is clearly linked to one specific stimuli. For example, someone afraid of flying will only experience fear when exposed to stimuli related to flying (e.g., airplanes). In contrast, individuals with SAD are likely to describe experiencing fear in any situation where they might think they “look stupid” or might “make mistakes.” Two large survey studies examining
symptoms of SAD using reliable and valid structured clinical interviews indicate that individuals with SAD typically report numerous social fears that they avoid rather than one circumscribed fear (e.g., performing a speech) (Ruscio et al., 2008; Acarturk et al., 2009). Based on this understanding of fear in SAD, the most recent DSM (DSM-5; APA, 2013) characterizes SAD as a disorder of varied social fears. DSM updates include making the title “social anxiety disorder” more prominent than “social phobia” and making the “generalized type” the dominant type (as opposed to one subtype). SAD is not simply a phobia (Bögels et al., 2010; Liebowitz, Heimberg, Fresco, Travers, & Stein, 2000). Further, describing SAD as a disorder of a variety of social fears facilitates our understanding of fear in this disorder. In fact, describing the disorder in this way suggests the possibility that fear generalization has an important role. However, there is still much we do not understand about fear generalization in this disorder, as well as how fear might manifest in individuals with SAD.

What is the evidence or theory positing that fear generalizes in SAD? Fear generalization describes a process by which fear, that was previously elicited by a conditioned stimulus or context, is now elicited by stimuli that only resemble the original stimulus or context along a formal, perceptual dimension (Honig & Urcuioli, 1981) or due to symbolically related cues (e.g., Kaczkurkin & Lissek, 2013). Contemporary theories of SAD and supporting data suggest that fear generalization, from social to non-social contexts, may be important in describing the distress related to this disorder. The dominant theoretical models of SAD posit that fear is facilitated by abstract thoughts and feelings, particularly negative thoughts about the self that lead to increased attention to or misperception of threat in social situations and misperception or avoidance of cues that would reduce the threat (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997). Additionally, individuals with SAD might ruminate after social events maintaining the
negative self-focus and abstract thoughts and feelings leading to misperception of social threat (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997). When looking at the current evidence, individuals with SAD report negative self-focused cognitions, such as recurrent memories and negative images about their failures in social situations (Hackmann, Clark, & McManus, 2000; Hackmann, Surawy, & Clark, 1998) and negative self-evaluative thoughts (Stopa & Clark, 2000). Compared to non-anxious controls, individuals with SAD also show enhanced vigilance to social threat in that they take longer to identify threat words when presented with an emotion Stroop task (Hope, Rapee, Heimberg, Dombeck, 1990; Lundh & Ost, 1996; Mattia, Heimberg, & Hope, 1993). Individuals with SAD are quicker to identify the presence of a probe when it is preceded by a social threat word (Asmundsen & Stein, 1994; Musa, Lépine, Clark, Mansell, Ehlers, 2003) or an angry face (Mogg, Philippot, & Bradley, 2004), and they detect emotional faces in a crowd more quickly than non-anxious controls (Gilboa-Schechtman, Foa, & Amir, 1999). Individuals with SAD have difficulty disengaging from information that signals a social threat, even when the information is irrelevant (Amir, Bower, Briks, & Freshman, 2003) and they direct attention away from emotional faces (Chen, Ehlers, Clark, & Mansell, 2002; Horley, Williams, Gonsalvez, & Gordon, 2003). Additionally, individuals with SAD report cognitions related to social events after the social event has ended, or engage in post-event processing (e.g., memories and thoughts of the event coming back into their mind after the event; Abbot & Rapee, 2004; Coles, Turk, & Heimberg, 2002; McEvoy & Kingsep, 2006; Perini et al., 2006). These cognitions are associated with state anxiety (e.g., McEvoy & Kingsep, 2006). Studies provide support for models of SAD that suggest individuals with this disorder exhibit cognitions that are likely to increase fear in social contexts. These theories also posit potential mechanisms by which individuals with SAD could experience fear outside of social contexts. Post-event
processing could lead to fear that extends beyond social contexts (e.g., Brozovich & Heimberg, 2008). Additionally, enduring negative thoughts about the self (e.g., memories about performing poorly in social situations; Hofmann, 2007) may predict fear that is not elicited in relation to any social context at all. For example, fear could be elicited simply by thoughts about the self (e.g., feeling like a failure when making a mistake) irrespective of whether or not it is cued by a particular social situation (e.g., when alone). This gap in the literature is notable in that the extent to which fear extends beyond social contexts is unclear. This is important because fear outside of social contexts could explain the considerable distress associated with the disorder. Because fear is central to the diagnosis and treatment of this disorder, understanding more about what contexts elicit fear may lead to more accurate diagnosis and application of treatment strategies.

What do we know about fear in SAD? There is only mixed evidence suggesting greater fear in SAD. Fear is a complex phenomenon that involves multiple response dimensions that serve to promote a broad range of behaviors to respond to threat (Lang, 1968; 1994; Bradley & Lang, 2000). Most commonly indexed are experiential reports and physiological response dimensions. Although theorists debate as to how these dimensions are related, most agree that both dimensions play an important role in the emotion of fear (e.g., Craske, Hermans, Vansteenwegen, 2006). Indeed, emotions are increasingly thought to be a natural system that arise out of complex interactions among component systems or response dimensions (Hollenstein & Lanteigne, 2014; Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Fear is a complex system that manifests dynamically as predictable muscle changes in the face and body, sympathetic nervous system activation, and an awareness or “feeling” of fear, all of which allow an individual to respond most efficiently and adaptively to threat. Methodologically, capturing the association among emotion response dimensions, or concordance (also called
synchronicity, response patterning, coherence) is quite challenging. However, the value of this approach is increasingly evident as evidence mounts demonstrating that not all response dimensions are under common influence or even operate on similar time scales (Bulteel et al., 2014; Evers, Hopp, Gross, Fischer, Manstead, & Mauss, 2014; Fischer & Roseman, 2007; Gentsh, Grandjean, & Scherer, 2014; Mauss et al., 2005). Many researchers opt instead to index one or two (rarely) response dimensions as a proxy for the system, despite potential limitations in this approach. In SAD, the most commonly measured dimension of fear has been self-reported experience of fear (anxiety, negative affect). Some studies have also examined electrodermal activity (e.g., skin conductance level; McTeague, Lang, Lapalante, Cuthbert, Strauss, & Bradley, 2009). Of the several commonly used measures of sympathetic nervous system arousal, electrodermal activity (EDA; also called skin conductance) is the most commonly used, likely because of the simplicity of measurement and its quick response in time to arousal eliciting stimuli (Boucsein, 2012) and its demonstrated clear association with fear (Kreibig, 2010).

The extant literature contains limited information about the nature of fear in SAD especially with respect to non-social contexts. The self-report research in this area shows that individuals with SAD report elevated levels of negative affect (Watson, Clark, & Carey, 1988) and self-reported anxiety during social tasks, such as recalling memories of social events (Coles, Turk, Heimberg, & Fresco, 2001), speech tasks (Beidel, Rao, Scharfstein, Wong, & Alfano, 2010; Morrison et al., 2016; see also Yoon and Joorman, 2012, who show this effect only in individuals with SAD and comorbid depression). Other studies have shown that individuals with SAD report greater increases in subjective anxiety to speech tasks, compared to non-anxious controls (Hofmann, Gerlach, Wender, & Roth, 1997; Levin et al., 1993). In contrast, few studies have examined fear in SAD by indexing sympathetic nervous system activity. One study
examined heart rate, skin conductance, and facial and neck temperatures continuously during four tasks (physical exercise, mental arithmetic, mental imagery, and social conversation) and baseline/rest and found that individuals with SAD showed no difference in skin conductance as compared to non-anxious controls (Edelmann & Baker, 2002). In another study, McTear and colleagues (2009) presented individuals with SAD with or without depression and non-anxious controls with social and physical threat images and measured their skin conductance level, skin conductance reactivity, and other physiological measures (eyeblink startle magnitude, heart rate, corrugator muscle movement). All patient groups exhibited higher skin conductance reactivity as compared to non-anxious controls, but only in relation to social threat images only. Despite the clear evidence for reported fear being elevated in SAD, the sympathetic nervous system findings are mixed. However, these studies may only provide limited information about fear in SAD because they look at fear uni-dimensionally, that is, through only one fear response dimension. A key exception is a study by Moscovitch and colleagues (2010) where they continuously measured sympathetic nervous system arousal (using skin conductance level) and asked participants to report negative and positive affect (using the PANAS; Watson, Clark, & Tellegen, 1988) before and after a series of tasks including anticipating a speech, performing a speech, and resting after the speech. Using hierarchical linear modeling, they showed that individuals with SAD exhibited a stronger concordance of fear (i.e., positive association between skin conductance level and reported negative affect), relative to the non-anxious control group. These findings are the strongest and most consistent with models of SAD suggesting fear, as a response system, is elevated during social threat. Like most other studies examining fear, the results were not able to speak to the question of fear generalization to non-social contexts.
Theory and empirical data in SAD indicate that fear is central to diagnosis and treatment. Theories of this disorder predict, and some empirical evidence supports, that fear primarily emerges from social contexts. Theories also suggest mechanisms by which fear may generalize to non-social contexts, but the research on this suggestion remains largely under developed. One of the most valid ways to measure fear in social and non-social contexts is using experience sampling in daily life. Although research using this methodology has not examined fear specifically, there is evidence that social contexts elicit more negative emotion in the daily lives of individuals with SAD compared to non-anxious controls. For example, Kashdan and Farmer, (2014) examined participant daily reports of social events for two weeks. Participants also reported negative and positive emotions that they felt during the day. This study revealed that individuals with SAD reported more negative emotion when experiencing a social event when compared to individuals in a non-anxious control group. Thus, this study supports the possibility that social contexts are particularly relevant for individuals with SAD even in daily life. Because negative emotions were only examined broadly, this research cannot tell us specifically about fear. Examining fear across contexts in daily life is integral to better understanding how theories of fear in SAD play out in the real world. With this understanding, we may be able to tailor diagnosis and treatment in a way that better reflects how fear is experienced in the daily lives of individuals with this disorder.

Present Study

In summary, SAD is a disorder that negatively affects many individuals and is difficult to treat. Fear is central to the theoretical models of this disorder, particularly fear elicited by social contexts. However, there is the possibility that fear extends to non-social contexts as well. The goal of the current investigation is to address this gap in the literature. In this study, fear in two
dimensions was examined across social and non-social contexts in the daily lives of people with SAD. Specifically, fear was indexed as self-report and electrodermal activity (EDA – an indicator of sympathetic nervous activation, also termed “skin conductance”) using experience sampling and ambulatory monitoring methods over five days in individuals diagnosed with SAD and healthy controls (HC). Both dimensions, self-reported fear (SR) and electrodermal activity (EDA), as context: social (i.e., with at least one other person) or non-social (i.e., with no other people) were assessed on a random schedule of five times a day for five consecutive days in all individuals. Although EDA was measured continuously throughout each day of the study, only the five minutes before each SR (and report of social context) was extracted to create mean EDA for each measurement so that these measurements could be synced in time. Social context was used as a moderating variable in all analyses to examine fear in and out of social contexts.

Statistical methods were used that would best capture fear in daily life as a multi-dimensional response system. First, dynamic systems methods (Gridware; Lamey, Hollenstein, Lewis, & Granic, 2004) were utilized to measure the frequency of fear expressed in two-dimensions (SR and EDA) at the same time, in and out of social contexts. Dynamic systems approaches effectively examine interacting components over time and “allow for the illumination of the structure or pattern of interactions in addition to their content” (Lunkenheimer, Hollenstein, Wang, & Shields, 2012; p. 270). This approach allows for the mapping of factors that contribute to variability in a system over time, variability which can be lost when the system is examined at only one time point. Dynamic systems methods have been shown to be increasingly useful in identifying important mechanisms of change in motor, language, and emotional development (Granic & Hollenstein, 2003). Second, hierarchical linear modeling (HLM) was used to examine the effect of group (SAD and HC) on the strength of the
relationship between SR and EDA (concordance), moderated by social context. Concordance can be distinguished from the frequency of fear in two response dimensions. Concordance measures the covariation of response dimensions (also called response synchronization; Bulteel et al., 2014) and frequency in two response dimensions measures a state of activation specific to fear (also called response patterning; Bulteel et al., 2014).

The following variables were included in the HLM model because of their relevance to fear: depression, gender, age, race, and height and weight. As mentioned earlier, depression is highly comorbid with SAD, with an estimated 50% of individuals with SAD also being diagnosed with major depressive disorder (Fehm et al., 2007). These individuals represent the most severe individuals with SAD, often experiencing the most chronic course of the disorder (e.g., Erwin et al., 2002). MDD is so commonly comorbid with SAD and likely to affect the level of impairment associated with the disorder, that excluding individuals with MDD would result in a sample that was not generalizable to typical SAD patient population. Self-reported emotional experience is also influenced by gender, age, and race. For example, females report more anxiety than males (e.g., Simon & Nath, 2004), older adults report more positive emotion and less negative emotion than younger adults (e.g., Mroczek, 2001), and cultural or racial differences even within an American sample affect emotion judgments and self-report emotion expressions (e.g., Matsumoto, 1993). Age, gender, and race, are also thought to influence electrodermal responding (Doberenz, Roth, Wollburg, Maslowski, & Kim, 2011). There is some support that Body Mass Index (BMI) affects electrodermal responding (Doberenz et al., 2011), thus, height and weight were also considered possible as covariates.

Hypotheses.
Hypothesis 1. Fear responses, when indexed as a high level state across response dimensions (high report, relative to sample and high EDA, relative to self) would be more frequent in the SAD group. Given some prior evidence that social context might elicit fear in SAD, we also predicted that individuals with SAD would exhibit more fear in Social Contexts. No specific prediction was made as to whether the SAD group would also show more fear in Non-Social contexts. This hypothesis was examined using dynamic systems methods (Gridware; Lamey et al., 2004), which allowed for the test of group (SAD and HC) on fear response (high SR and high EDA) in across contexts and within each context (Non-Social and Social).

Hypothesis 2. Fear responses, when indexed as a positive association between response dimensions (self-report and EDA) would be stronger in the SAD group. Again, given prior evidence that social context might elicit fear in SAD, this effect was predicted to be moderated by social context. This hypothesis was examined using HLM where the (maximum) 25 data points of SR, EDA, and Social Context were included as level 1 variables predicted by group (SAD and HC) as a level 2 variable. SR and EDA were both person-centered in this analysis².

Post-hoc analyses. Diagnostic criteria and prior research suggest that more impairment in SAD may be equivalent to more fear (e.g., Dryman, Gardner, Weeks, & Heimberg, 2016). Thus, clinical variables that are related to impairment may exert important influences on the manifestation of fear within the SAD group. Accordingly, we explored post hoc whether current engagement in treatment (psychotherapy and psychotropic medication), number of comorbid diagnoses, and reported symptoms of depression and anxiety symptoms explained any effects found in the study. Additionally, because comorbid MDD is also thought to be increase distress

² SR was also explored in the analysis as a grand mean-centered variable (with EDA remaining person-centered) but the overall results were unchanged.
and impairment in SAD (e.g., Erwin et al., 2002), fear responses were compared in the SAD group when it was split into SAD-only ($n = 6$) and comorbid SAD/MDD ($n = 15$).
METHOD

Participants and Procedures

This study was part of a larger project attempting to elucidate the underlying bio-behavioral mechanisms that differentiate mood from anxiety disorders. Participants were between the ages of 18 and 65 and were recruited from psychological clinics, primary care clinics, gyms, restaurants, and other public places in the surrounding area of a large Midwestern University in the United States. Individuals who responded to fliers were first evaluated by phone screen to determine if they might be eligible for participation. Using this phone screen, individuals likely to meet diagnostic criteria for one of the study groups were invited to the laboratory for a thorough diagnostic interview to determine eligibility for the remainder of the study. For this interview, participants received 25 dollars, regardless of their eligibility for the remainder of the study. Written informed consent was obtained prior to the diagnostic interview. If participants were eligible for, and participated in, the remainder of the study, they received an additional 135 dollars and a bonus of 25 dollars (total 160 dollars) if they completed more than 90% of the diary entries.

To progress beyond the phone screening and thus be scheduled for a diagnostic interview, participants must have reported multiple symptoms of SAD, and/or major depressive disorder (MDD), or no symptoms of SAD or MDD during the phone screen process. An in-person diagnostic interview was conducted to place participants in one of the following groups: 1) MDD \( (n = 5) \), 2) SAD \( (n = 11) \), 3) comorbid MDD/SAD \( (n = 18) \), and 4) healthy control (HC; \( n = 25 \)). Individuals not fitting into one these groups were excluded from the larger study. Although
MDD was of interest in the larger study, it was not of direct interest in the current study. Thus, MDD participants without SAD were excluded from analyses in the current study ($n = 5$). See the Appendix for full inclusion and exclusion criteria for each group. See Table 1 for demographics.

Table 1. 
**Participant Demographics by Full Sample and by Group**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample ($n = 54$)</th>
<th>HC ($n = 25$)</th>
<th>SAD ($n = 29$)</th>
<th>Test of Difference between Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>75.9</td>
<td>84.0</td>
<td>71.4</td>
<td>$\chi^2 = 1.19$, ns</td>
</tr>
<tr>
<td>Male</td>
<td>24.1</td>
<td>16.0</td>
<td>28.6</td>
<td></td>
</tr>
<tr>
<td>Employment Status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time</td>
<td>24.5</td>
<td>24.0</td>
<td>25.0</td>
<td>$\chi^2 = 13.12$, $p = .07$</td>
</tr>
<tr>
<td>Part-time</td>
<td>15.1</td>
<td>24.0</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>Full-time parent</td>
<td>5.7</td>
<td>8.0</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>1.9</td>
<td>0</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>School or training</td>
<td>22.6</td>
<td>32.0</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Applying</td>
<td>5.7</td>
<td>0</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>Illness/Disability</td>
<td>9.4</td>
<td>0</td>
<td>17.9</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>15.1</td>
<td>12.0</td>
<td>17.9</td>
<td></td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3.7</td>
<td>4.0</td>
<td>3.6</td>
<td>$\chi^2 = 0.85$, ns</td>
</tr>
<tr>
<td>Black or African</td>
<td>9.3</td>
<td>4.0</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>White or European</td>
<td>87</td>
<td>92.0</td>
<td>85.7</td>
<td></td>
</tr>
<tr>
<td>Age (18-63)</td>
<td>32.30</td>
<td>29.04</td>
<td>34.25</td>
<td>$t(51) = -1.47$, ns</td>
</tr>
<tr>
<td>(12.98)</td>
<td>(12.36)</td>
<td>(13.29)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. $n = $ sample size; HC = Healthy Control Group; SAD = Social Anxiety Group

Table 2 displays treatment status of all participants in the SAD group.

Table 2. 
**Treatment Status in Social Anxiety (SAD) Group ($n = 29$)**

<table>
<thead>
<tr>
<th>Treatment Status</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Psychotherapy ($n = 2$)</td>
<td>.07</td>
</tr>
<tr>
<td>Medications ($n = 6$)</td>
<td>.21</td>
</tr>
<tr>
<td>Both ($n = 14$)</td>
<td>.48</td>
</tr>
<tr>
<td>No Treatment ($n = 6$)</td>
<td>.21</td>
</tr>
<tr>
<td>Missing ($n = 1$)</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. $n = $ sample size
Table 3 displays frequencies with which SAD participants met diagnostic criteria for Axis I disorders. By definition the HC group had no Axis I diagnoses.

Table 3. **Frequency of Current Axis I Disorders in Social Anxiety (SAD) Group (n = 29)**

<table>
<thead>
<tr>
<th>Disorder</th>
<th>n</th>
<th>% (of sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Depressive Disorder</td>
<td>17</td>
<td>58.6</td>
</tr>
<tr>
<td>Dysthymic Disorder</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>Generalized Anxiety Disorder</td>
<td>19</td>
<td>65.5</td>
</tr>
<tr>
<td>Posttraumatic Stress Disorder</td>
<td>6</td>
<td>20.7</td>
</tr>
<tr>
<td>Panic Disorder</td>
<td>5</td>
<td>17.2</td>
</tr>
<tr>
<td>Agoraphobia Without Panic Disorder</td>
<td>4</td>
<td>13.8</td>
</tr>
<tr>
<td>Obsessive-Compulsive Disorder</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>Bulimia Nervosa or Binge Eating Disorder</td>
<td>5</td>
<td>17.2</td>
</tr>
</tbody>
</table>

Note. \( n = \) sample size

Participants came into the laboratory for two 2-hour sessions between which they completed a two-week experience sampling diary. The current study included data from the 1) diagnostic interview, 2) questionnaire packet that participants completed before the first laboratory session, and 3) five-day portion of the experience sampling diary measuring both sympathetic nervous system arousal (EDA) as well as self-report (SR). The self-report diary data were collected using a programmable Palm Centro personal desk assistant (PDA), programmed with the Purdue Momentary Assessment Tool (PMAT; www.cfs.purdue.edu/mfri/pages/PMAT/Index.html). The physiological data accompanying the diary data were collected using a Q-sensor (Affectiva, Inc.). Only five days of the 14-day diary were used because participants were not wearing ambulatory monitoring equipment for the
remaining nine days of the diary and thus were only providing self-report data. Each of the procedures used in the current study will now be described in turn.

**Phone screening.** Interested individuals were evaluated over the phone by trained members of the research team. The phone screen (see Appendix) included items adapted from the Structured Clinical Interview to Diagnose Axis I disorders - DSM-IV-TR (SCID I; First, Spitzer, Gibbon, & Williams, 2002) and the Interview Guide for Evaluating DSM-IV Psychiatric Disorders (Zimmerman, 1994) to evaluate symptoms of MDD and SAD. Individuals also answered questions relevant to the exclusion criteria which included psychosis, visual impairment, and use of psychiatric medication. Individuals were invited to participate in the diagnostic interview if they met at least four of the symptoms required for a diagnosis of MDD or who were reporting excessive anxiety in three or more social settings (or both). Interviewers told participants that participation in the diagnostic interview did not ensure entry into the study but that regardless of whether or not they are eligible, they would be compensated with 25 dollars at the end of the interview.

**Diagnostic interview.** Participants who were eligible after the screening process were scheduled to participate in a diagnostic interview. Before beginning the interview, each participant received a consent form to read and discuss with the interviewer. Participants then signed consent and the interview commenced. Trained and reliable doctoral students in clinical psychology conducted the interviews (1-3 hours). All students were supervised by a licensed clinical psychologist. The interview was video-taped for purposes of establishing validity of the interview and reliability with other interviewers. Each interviewer coded the same set of five randomly selected interview videos to determine reliability. Each interviewer had to have an overall reliability greater than a kappa of .90 at both the symptom and diagnostic level for DSM-
IV Axis I disorders. The interviewers began the interview with some brief questions evaluating current functioning as well as medical and psychiatric history. The remainder of the interview included interviewers asking relevant modules of the SCID-I, supplemented with modules from the Anxiety Disorders Interview Schedule – Lifetime Version (ADIS IV-L; DiNardo, Brown, & Barlow, 1994), in order to more accurately assess the presence of mood, anxiety, psychotic, eating, and substance use disorders. In addition, participants were evaluated with the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First, Gibbon, Spitzer, Williams, Benjamin, 1997).

**Questionnaire packet.** When eligible for the study based on the diagnostic interview, participants received a questionnaire packet to complete. Participants typically needed approximately an hour to complete the packet. Most relevant to the current study, were a demographic questionnaire (height, weight, age, gender, race), a dimensional measure examining symptom severity of social phobia, the Liebowitz Social Anxiety Scale-SR (LSAS-SR; Fresco et al., 2001) and a measure examining severity of depressive symptoms, The Center for Epidemiological Studies scale (CES-D; Radloff, 1977).

**Five-day experience sampling diary.** After completing the first session in the laboratory, participants received training on how to complete the experience sampling diary on a programmable Palm Centro personal desk assistant (PDA). Participants also received instructions on how to safely maintain the physiological monitoring devices throughout each day. Then, participants practiced with the PDA and answered questions about the PDA and the physiological monitoring devices. Participants also received a manual for both diaries and contact information for the laboratory if they had any questions or problems over the course of
the diary portion of the study. Participants received a bonus of $25 if they completed 90% or more of the diary entries, in order to increase compliance.

After being instructed in the use of the PDA and physiological monitoring devices, participants were asked to choose to begin the five-day diary at the beginning or the end of the two week period. During the 5-day selected period, participants came to the laboratory one hour before their chosen start time to be fitted with physiological monitoring equipment. Participants wore the ambulatory physiology equipment and carried the PDA throughout the day. The Purdue Momentary Assessment Tool (PMAT; www.cfs.purdue.edu/mfri/pages/PMAT/Index.html) was used to program the diary (on the PDA). Programming allowed participants to receive a series of questions by an alarm prompt at random intervals five times a day in a fourteen hour period. Participants were able to choose the fourteen hour period (e.g., 9am to 11pm) and whenever they were prompted in that time period they could choose to delay or stop a prompt if it occurred at an inconvenient time. The questions included various forced response options (yes/no; choose one; if yes, choose one). Participants typically took about five minutes to answer the questions each time they were prompted. See the Appendix for the series of questions used in the current study.

Fourteen hours after the start of the diary, at the end of the day, participants were prompted by the diary to remove the physiological monitoring equipment. Each subsequent morning, participants returned to the laboratory one hour before their chosen start time to be fitted with the physiological monitoring devices again. Participants followed the same procedure for the all of the diary. On the morning of the sixth day, participants visited the laboratory to return their equipment. All diary data were output to an excel file using PMAT. All
physiological data were output to an excel file using Q Sensor Software (Affectiva, 2014). All data were automatically time stamped and dated during acquisition.

**Measures**

**Global self-report measures.** The diagnostic interview was used to determine psychiatric diagnosis and treatment history. The questionnaire packet was used to obtain the following additional variables: depression, social anxiety, and demographics (i.e., gender, age, race, ethnicity, employment status, height, and weight).

**Psychiatric Diagnosis.** The SCID-I/P-DSM-IV-TR (First, Spitzer, Gibbon, & Williams, 2002), supplemented with modules from the Anxiety Disorders Interview Schedule – Lifetime Version (ADIS IV-L; DiNardo, Brown, & Barlow, 1994) and the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First, Gibbon, Spitzer, Williams, Benjamin, 1997) were used to classify individuals as belonging to the Healthy Control group (HC) or the Generalized Social Phobia Group (SAD). Inclusion criteria for the HC group included: Global Assessment of Functioning (GAF; rated from the SCID-I) greater than 79, English speaking, age 18-65. Exclusion criteria for the HC group included: any Axis 1 (DSM-IV) diagnosis in the past 12 months, any partially remitted Axis 1 diagnosis in the past 12 months, evidence of a personality disorder, use of psychiatric medications of any kind in the past 12 months, and elevated evidence of social desirability (scores greater than 25 on the Marlowe-Crowne Social Desirability Scale; Crowne & Marlowe, 1960). Inclusion criteria for the SAD group included: current diagnosis of generalized social phobia (DSM-IV), English speaking, and participants needed to be between the ages of 18 and 65. Exclusion criteria for the SAD group included: diagnosis of bipolar disorder (I or II), diagnosis of borderline personality disorder, current
psychosis, current substance abuse/dependence, and current use of medications in the following classes\(^3\) (Benzodiazepenes, Beta-Blockers, Tryciclic Antidepressants, Antipsychotics).

SCID interviews were conducted by four clinical psychology doctoral students who received formal training in psychopathology and diagnostic interviewing. Reliability was assessed by each interviewer coding the same set of five randomly selected interview videos. Overall reliability for the symptom and diagnostic level was good \(\kappa > .90\).

**Treatment History.** During the diagnostic interview, participants were asked if they were currently in psychotherapy treatment, were taking psychotropic medications, or both. Categories were created to indicate if participants were currently in treatment: psychotherapy (0 = no; 1 = yes), psychotropic medication (0 = no; 1 = yes), both psychotherapy and psychotropic medication (0 = no; 1 = yes).

**Depression.** The Center for Epidemiological Studies scale (CES-D; Radloff, 1977) was used to assess general tendencies toward depression. The CES-D is a 20-item questionnaire that measures the frequency of depressive symptoms using the following scale: 0 (rarely or none of the time; i.e., less than 1 day), 2 (occasionally or a moderate amount; 3-4 days), and 3 (most or all of the time; i.e., 5-7 days). See Appendix for the questionnaire. This scale has been shown to demonstrate good validity and reliability in both general and clinical populations (Radloff, 1977). The alpha was .96 for this sample. Means and standard deviations for each group in this sample: SAD \((M = 26.03, SD = 12.78)\) and HC \((M = 3.33, SD = 2.88)\) in this sample were comparable to clinical \((M = 24.42, SD = 13.51; \text{Radloff}, 1977)\) and general populations \((M = 9.25, SD = 8.58; \text{Radloff}, 1977)\).

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\(^3\) At the beginning of the study, three participants were included who were taking Benzodiazepenes. Results were tested with and without these participants (see Results).
**Social Anxiety.** The Liebowitz Social Anxiety Scale-Self Report (LSAS-SR; Fresco et al., 2001) was used to assess general tendencies to experience fear in, and avoid, social situations. The LSAS-SR provides a measure of the severity of participants’ social anxiety symptoms by asking participants to indicate how often they experience fear in social situations (e.g., participating in small groups) on a scale from 1 (*Almost Never*) to 4 (*Almost Always*). Participants also indicated how much they avoid the same situations from *Never* (0%) to Usually (67-100%). See Appendix for more details. The total score was calculated by summing both subscale totals. The total score on the LSAS-SR has been shown to have strong internal consistency in individuals with social anxiety disorder and non-anxious controls with Cronbach’s (1951) alpha coefficients of .95 and .94, respectively (Fresco, et al. 2001). Additionally, the total score has been shown to have good convergent and discriminant validity in both groups (Fresco et al., 2001). The alpha was .98 in this sample. Means and standard deviations for each group in this sample: SAD (\(M = 79.41, SD = 27.32\)) and HC (\(M = 21.92, SD = 16.02\)) were comparable to clinical samples (\(M = 74.53, SD = 23.31\); Fresco et al., 2001) and non-anxious controls (\(M = 13.49, SD = 12.70\); Fresco et al., 2001).

**Demographic Variables.** Gender, Age, Race, Height, and Weight were reported in a demographic questionnaire completed by participants at the beginning of the study. Gender was a categorical variable (“male” and “female”). Age was a continuous variable ranging from 18 to 65. Race was a categorical variable with the following categories: “American Indian/Alaska Native”, “Asian”, “Hawaiian/Pacific Islander”, “Black/African”, “White or European”, “More than One”, “Unknown/Unreported.” Height was reported continuously in inches and Weight was reported continuously in pounds.

**Missing data.** One participant in the healthy control group did not complete the relevant sections of the questionnaire packet.
**Diary measures**

Participants’ daily measures of self-reported fear, activity level, and social context were acquired by the PDA. Daily measures of electrodermal activity were extracted from continuous data gathered by a Q-sensor (Affectiva, Inc.) that participants wore 14 hours a day for the five days of the data collection.

*Self-report fear (SR)*. Participants rated emotional experience five times a day, at random intervals, for five days. This assessment schedule resulted in a maximum of 25 data points for each participant. Each emotion was rated on a 5-point scale from 1 (not at all) to 5 (extremely). To create the self-report fear variable, we chose three negative words of high activation corresponding to the area on the affective circumplex that fear occupies: fear, distress, and tension (Carver, 2001; Feldman Barrett & Russell, 1998; Larsen & Diener, 1992; Posner & Russell, 2005; Thayer, 1989; Watson & Tellegen, 1985). See the Appendix for the list of words that were used in the current study (negative affect words that are being used are bolded). For each rating, the ratings for all three emotions were averaged to create a SR variable representing self-reported fear. This resulted in a maximum of 25 reports of SR for each participant.

Reliability of the measure of self-reported fear was tested by examining internal consistency of the five reports of fear, made up of the words fear, distress, and tension, for Days 1 and 5. This analysis allowed for an examination of the reliability in reporting fear using that scale (fear, distress, tension) for Days 1 and 5. This analysis also allowed for an examination of if reliability in reporting fear changed from the beginning of the diary (Day 1) to the end of the diary (Day 5). A Cronbach’s alpha was calculated for each of the five reports of fear for Day 1 and for Day 5. These alpha values were than averaged for each day to create an average internal consistency for each day. This analysis revealed that reliability of self-reported fear was
acceptable for Day 1 (average Cronbach’s alpha = 0.77) and good for Day 5 (average Cronbach’s alpha = 0.82). A t-test was conducted to examine a possible difference between reliability from Day 1 to Day 5. This test revealed no significant difference in internal consistency of the self-reported fear measure between Days 1 and 5.

To gain descriptive information for fear, an average was made of the SR across all the days of the diary. For Hypothesis 1 (using Gridware), SR was categorized as low, moderate, or high relative to the sample mean SR. This was calculated in this way because there is no natural zero point for self-reported affect. For Hypothesis 2 (using HLM), each of the 25 data points (maximum) of SR (mean of fear, distress, and tension for each time point) was person-centered for each individual and entered into the HLM analysis.

Social Context⁴. On the PDA, participants were also asked to indicate the number of people they were around at the time of each prompt. Responses were categorized as alone (0) or around at least one person (1). Social Context was used in this format for both Hypothesis 1 and Hypothesis 2.

Electrodermal Activity (EDA). Data from each of the five days of continuous electrodermal activity were downloaded from the Q-sensor wristband onto a personal computer using custom software provided by Affectiva Inc. (Q V.10, 2010). The Q-sensor indexes electrodermal activity using two silver electrodes embedded in a wristband placed on the participant’s non-dominant wrist. The Q-sensor continuously measured skin conductance at a sampling rate of 2, 4, 8, or 32 Hz. The Q sensor technology has been validated with affective tasks and is highly correlated with FDA-approved sensors (Johnson & Lubin, 1966; Liguori et

⁴ In the HLM analysis, social context was also explored as a 3 level variable (0 people, 1 person, 2+ persons) but the overall results were unchanged.
al., 2000, Poh et al., 2010) and shown to be reliable in long-term measurements of EDA (Poh, Swenson, & Picard, 2010). The software output a value in microsiemens (μS) indicating change in electrical conductance on the skin, or EDA, for the 14 hours of each of the five days of data collection. A text file was automatically created from this analysis which included a time stamp in one column and electrodermal activity (in μS) in another column. Data were then extracted for the five minutes before each self-report entry in the diary (from the PDA). Due to the relatively low resolution of the Q-sensor, tonic activity was measured by taking an average across the 5-minutes. Each 5-minute segment was analyzed offline using Ledalab (Benedek & Kárnbach, 2010), a customized software based in Matlab (Mathworks, Natick, MA, USA). Any 5-minute segments that contained more than a third (33%) zero values or artifacts, were excluded from analyses (Cacioppo, Tassinary, & Berntson, 2007). Based on conventions developed by Roth and colleagues for the Q-sensor (Roth, Dawson, & Filion, 2012; personal communication with Roth), artifacts were identified as any quick spikes greater than .5 μS. These artifacts were then manually excluded using Ledalab. Two 5-minute segments were excluded because the data were out of the expected range (0-40 μS; Venables & Christie, 1980). For Hypothesis 1 (using Gridware), the usable 5-minute segments of EDA, matched to SR, were categorized as low, moderate, or high relative to each individuals’ mean EDA. This was calculated in this way because EDA is considered to have a natural zero point. For Hypothesis 2, each of the 25 data points (maximum) of EDA (mean of 5-minutes before each SR time point) were person-centered for each individual and entered into the HLM analysis.

**Missing Data**

Using conventions developed for experience sampling methods, we excluded any participants whose amount of missing data exceeded two standard deviations from the mean (c.f.,
Bolger, Davis, & Rafaeli, 2003). The participants that were excluded \( (n = 17) \) were not different on any study variables (i.e., age, gender, race, reported depressive and social anxiety symptoms, number of comorbid diagnoses, engaging in treatment). For the remaining participants, missing data were looked at in detail and reported in results, including if individuals with missing data differed from those without missing data.

**Self-reported fear (SR).** Six participants were considered missing for amount of missing SR data (HC = 5, SAD = 1). These missing data resulted in the following sample size for SR: HC = 20 and SAD = 28. Reasons for the missing data were either equipment error or participant non-compliance. See Figure 1 for a description of these issues. See the results section for a detailed analysis of the missing data within participants who remained in the sample.

Figure 1. *Description of missing self-reported fear data*
Electrodermal activity (EDA). Fifteen participants were considered missing due to amount of missing EDA data (HC = 7, SAD = 8). These missing data resulted in the following sample size for EDA: HC = 18 and SAD = 21. The missing EDA data were primarily due to equipment problems with acquisition. Another, less common, reason for missing data was participant non-compliance (i.e., not putting on equipment, not coming in for appointments to reset equipment). These issues, as well as a count of missing data is shown in Figure 2. See the results section for a detailed analysis of the missing data within participants who remained in the sample.

Figure 2. Description of missing electrodermal activity data
SR and EDA. In the main analyses, SR and EDA were examined together (as a two-dimensional representation of fear), thus participants were excluded if they were already excluded on one or more of SR or EDA. This decision resulted in a sample size of 36 for these analyses: HC = 16 and SAD = 21

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5 Sample sizes for HLM at level 1 (maximum n = 25) and level 2 (n = 36) were thought to be adequate due to approximating the 30/30 rule (i.e., indicating a convention of 30 data points at Level 1 for each 30 data points at Level 2; Kreft, 1996) and Maas and Hox (2005) rule of 50 data points at Level 2.
RESULTS

The goal of the current study was to explore fear in two dimensions (self-report and physiological) across social and non-social contexts in the daily lives of people with SAD as compared to people with no diagnosable disorder (healthy controls; HC). Specifically, fear in self-reported and electrodermal response (EDA) were examined using experience sampling and ambulatory monitoring methods over five days in individuals with SAD and HC. Social Context was also measured at each self-report time point to examine the effect of generalization of fear concordance across social and non-social contexts. However, before conducting analyses related to the study’s hypotheses, a series of preliminary analyses were conducted to demonstrate the fitness of the data to address the central questions of the study.

Preliminary Analyses

For descriptive purposes, means, standard deviation, range, and differences between groups for all variables are presented in Table 4.

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6 Comparing mean Social Context between the two groups may have obscured differences between groups at the level of the relative frequency of social contexts within each person in each group. Thus, the differences between groups were examined at the level of each individual. To do this, a relative frequency of being in Social and Non-Social contexts was calculated for each participant. This resulted in two values for each participant, one that represented the number of times an individual was in Social contexts/total number of reports and the number of times an individual was in Non-Social contexts/total number of reports. These values were then averaged across participants within each group and compared by t-test. This analysis revealed the same results as the original analysis in that there was no difference between groups on the proportion of time reportedly spent in Social and Non-Social contexts.
Table 4.
*Descriptive Data for Study Variables and Differences between Groups*

<table>
<thead>
<tr>
<th></th>
<th>Entire Sample (n = 54)</th>
<th>HC (n = 25)</th>
<th>SAD (n = 29)</th>
<th>t (df)</th>
<th>p</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>1.54 (.53)</td>
<td>1.29 (.26)</td>
<td>1.72 (.61)</td>
<td>-3.42</td>
<td>&lt; .01</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>1-3.22</td>
<td>1-1.88</td>
<td>1-3.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDA</td>
<td>.80 (.80)</td>
<td>.72 (1.03)</td>
<td>.88 (.55)</td>
<td>-.62 (37)</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.03-4.62</td>
<td>.30-4.62</td>
<td>.13-2.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Context</td>
<td>.62 (.18)</td>
<td>.60 (.19)</td>
<td>.63 (.18)</td>
<td>-.68 (47)</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.17-.93</td>
<td>.17-.84</td>
<td>.24-.93</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Activity Level</td>
<td>.62 (.23)</td>
<td>.71 (.23)</td>
<td>.56 (.22)</td>
<td>2.17 (46)</td>
<td>&lt;.05</td>
<td>0.67</td>
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<td></td>
<td>.04-1.00</td>
<td>.25-1.00</td>
<td>.04-.95</td>
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<tr>
<td>CES-D</td>
<td>15.75 (10.89)</td>
<td>3.33 (2.88)</td>
<td>26.03 (12.78)</td>
<td>-9.29 (31.41)</td>
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<td>2.45</td>
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<td>9-50</td>
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<tr>
<td>LSAS-SR</td>
<td>53.38 (36.75)</td>
<td>21.92 (16.02)</td>
<td>79.41 (27.32)</td>
<td>-9.53 (46.53)</td>
<td>&lt;.001</td>
<td>2.57</td>
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<td>69% Female</td>
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<td>ns</td>
</tr>
<tr>
<td>Race</td>
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<td>3.4% Asian</td>
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</tr>
<tr>
<td></td>
<td>9.3% Black</td>
<td>4% Black</td>
<td>13.8% Black</td>
<td></td>
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<tr>
<td></td>
<td>87% White</td>
<td>92% White</td>
<td>82.8% White</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Age</td>
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<td>29.5 (12.42)</td>
<td>34.62 (13.19)</td>
<td>-1.44 (51)</td>
<td>ns</td>
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<td>18-63</td>
<td>19-60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>66.64 (4.16)</td>
<td>66.44 (4.34)</td>
<td>66.81 (4.08)</td>
<td>-.32 (51)</td>
<td>ns</td>
<td></td>
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<tr>
<td></td>
<td>59-77</td>
<td>59-77</td>
<td>60-77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>169.17 (46.86)</td>
<td>150.08 (32.70)</td>
<td>184.97 (51.28)</td>
<td>-3.0 (48.13)</td>
<td>&lt;.01</td>
<td>0.81</td>
</tr>
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<td>110-240</td>
<td>120-330</td>
<td></td>
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</tr>
</tbody>
</table>

Note. SR = self-reported fear (1-5, averaged across maximum 25 data points); EDA = electrodermal activity (0-40 microseimens, averaged across maximum 25 data points); Social Context (alone = 1, with at least one person = 1, averaged across maximum 25 data points); Activity Level (none = 0, active = 1, averaged across maximum 25 data points); CES-D=symptoms of depression from the Center for Epidemiological Studies scale (0-60); LSAS-SR=symptoms of social anxiety from the Liebowitz Social Anxiety Scale-SR (0-120); Gender (0=male; 1=female); Age (18-65), Height (inches), Weight (pounds); SD = standard deviation; df = degrees of freedom; n = sample size; ns = nonsignificant.

As expected, the SAD group reported significantly more Depression and Social Anxiety.

Additionally, the SAD group indicated they weighed more on average than the HC group.
(Weight). The differences between groups on SR and EDA will be further explored in the main analyses. For the most part, correlational analysis revealed expected relationships between pairs of variables. The two DVs, SR and EDA were correlated at $r = .09$. To examine meaningful relationships for the remaining pairs of variables, only correlations meeting Cohen’s criteria (Cohen, 1988) for a medium correlation ($r = .24$) are mentioned. Spearman’s rank correlation coefficient was used to examine the relationship between categorical variables (Gender, Race) and the same criteria were used for reporting. For the DVs, SR was positively related to Depression ($r = .69$), Social Anxiety ($r = .45$), and Weight ($r = .56$). EDA was not more than minimally correlated with any other study variables. As for the moderating variable, Social Context, the only relationship was unexpected and was with Height ($r = .26$). Relationships between pairs of covariates were as follows: Depression was positively related to Social Anxiety ($r = .75$) and Weight ($r = .53$); Social Anxiety was positively related to Weight ($r = .33$) and negatively related to Activity Level ($r = -.42$); Height and Weight were correlated at $r = .36$; Gender was positively related to Weight and Height, in that men were heavier than women (Spearman’s $\rho = .35$) and taller than women (Spearman’s $\rho = .51$), and Age was positively related to Height ($r = .47$) and Weight ($r = .37$).

As mentioned earlier, covariates were chosen based on theoretical and empirical evidence for an important relationship with fear, as measured by SR and EDA. Covariates were only included in analyses, however, if they met the additional criteria for covariates as outlined by Tabachnik and Fidell (2007): 1) there was a significant relationship between the covariate and at least one of the DVs in the current study, 2) there was no redundancy in covariates (covariates were not more than minimally correlated), and 3) the distribution of the covariate was relatively equal across the levels of the independent variable (IV: Group).
**Missing data.** As mentioned above, several participants were excluded from the sample due to large amounts of missing data. Excluded participants were not different on any study variables (i.e., age, gender, race, reported depressive and social anxiety symptoms, number of comorbid diagnoses, engaging in treatment). The type of missing data and the effect on analyses is tested here.

*Self-report (SR).* A chi-square analysis revealed no significant difference between the amount of missing data in each group (HC and SAD). Using procedures outlined by Tabachnick and Fidell (2007), analyses were conducted to determine the type of missing data: missing not at random (MNAR), missing at random (MAR), or missing completely at random (MCAR), all of which have different implications for how to proceed with missing data in the main analyses. The data were first tested for missing not at random (MNAR) by creating a dummy variable to indicate “missingness” (dummy missing; 0 = not missing; 1 = missing) for SR. Using a t-test, the relationship between SR and the related construct of self-reported trait anxiety and the dummy missing variable was assessed. The results were not significant and effect sizes were small to medium. Based on these analyses, the missing data were considered not related to SR (not MNAR) and therefore it was possible that the missing data were either missing at random or missing completely at random.

The data were then tested for missing at random (MAR). Using the same dummy variables, the relationship between “missingness” and other measured variables including demographic (gender, race, employment status, educational level attained) and clinical variables (number of comorbid diagnoses, engaging in medical treatment or psychotherapy, reported symptoms of depression and social anxiety) was assessed. This analysis revealed a significant relationship between gender and “missingness” (chi-square = .673, p < .05) in that females
exhibited a higher proportion of missing data than males (36/41 vs. 11/13). There were no other significant relationships. Thus, gender was predictive of the missing SR data (suggesting the missing data was MAR) and was included as a covariate in all main analyses to control for its effect on the missing data.

*Electrodermal activity (EDA).* A chi-square analysis revealed no significant differences between the number of missing data in each group (HC and SAD). The same missing data analysis were then conducted for EDA as for SR. This analysis first revealed no significant relationship between EDA and the related construct of self-reported trait anxiety and a dummy missing variable was assessed. The results were not significant and effect sizes were small to medium. Based on these analyses, the missing data for EDA were not related to EDA (not MNAR) and therefore it was possible that the missing data were either missing at random or missing completely at random.

The data were then tested for missing at random (MAR). No significant relationships were found between missingness (dummy variable used above) and other measures including demographic (gender, race, employment status, educational level attained) and clinical variables (number of comorbid diagnoses, engaging in medical treatment or psychotherapy, reported symptoms of depression and social anxiety) assessed in the study. Thus, the missing EDA data were considered missing completely at random (MCAR).

**Main Analyses**

Two ANOVAs were conducted to examine if the SAD group evidenced more fear (SR and EDA) than the HC group across five days. Based on previous work, we expected that the SAD group would report more SR fear but would not exhibit higher EDA. Separate ANOVAs were run because SR and EDA were considered independent (correlated at $r = .09$). Gender was
included as a covariate because of its effect on missing data. No other study variables met criteria for covariates (see Preliminary Analysis section above). The results indicated that the SAD group reported more SR fear, averaged across the diary, than the HC group: F(1, 46) = 10.76, p < .01, partial eta squared = .19 (large effect). For the ANOVA on EDA, there was no significant difference between groups on SR. These results support previous findings that individuals with SAD report more fear but do not exhibit more sympathetic nervous system arousal consistent with fear.

**Study hypotheses.**

**Hypothesis 1.** Fear responses, when indexed as a high level state across response dimensions (high report, relative to sample and high EDA, relative to self) were expected to be more frequent in the SAD group. This hypothesis was tested by entering SR and EDA into Gridware (Lamey et al., 2004), which provided a value for the frequency of fear (mean number of events where the individual exhibited high SR and high EDA) and the total number of data points (maximum 25) for each participant. The relative frequency of fear responses (proportion of events for each individual that were high SR and high EDA) was then output for each individual and entered into SPSS where an ANCOVA was used to test differences by group (SAD and HC) with Gender as a covariate. Gender was included as a covariate based on its effect on the missing SR data. No other study variables met criteria for covariates (see Preliminary Analysis section above). A power analysis was conducted to estimate the necessary sample size to be likely to detect a medium effect size (f = .25; Cohen, 1992). When power was set to .80 and alpha set to .05, the power analysis revealed that a sample of n = 128 was needed to detect group mean differences with a medium effect size. The sample was n = 54 and thus

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7 No differences were found when testing for social context
possessed a power of .32 to detect medium effect sizes and a power of .80 to detect effect sizes as small as a medium to large effect (Cohen’s $f = .39$).

When running the ANCOVA, there was a significantly higher proportion of Fear events in the SAD group than the HC group, $F (1,34) = 14.32, p < .01$, partial eta squared $= .30$ (large effect). See Table 5 for means and standard deviations of relative frequency of fear in each group and for each context.

To examine social context as a possible moderator in the SAD group, SR, EDA, and Social Context data were entered into Gridware (Lamey et al., 2004) which provided a value for the frequency of fear (mean number of events where the individual exhibited high SR and high EDA) and the total number of data points (maximum 25) for each participant in both Social and Non-Social contexts. Thus, this analysis provided a relative frequency of fear for each participant in both contexts. These relative frequencies of fear in each of the contexts were then exported to SPSS where two ANCOVAs (one for Social contexts and one for Non-Social contexts) were conducted to compare relative frequency of fear by group (SAD and HC). Gender was included as a covariate based on its effect on the missing SR data. No other study variables met criteria for covariates (see Preliminary Analysis section above). The ANCOVA conducted for Social contexts revealed a significantly higher relative frequency of Fear events in the SAD group than the HC group, $F (1,34) = 17.00, p < .001$, partial eta squared $= .33$ (large effect). The ANOVA conducted for Non-Social contexts revealed no significant difference in relative frequency of Fear events between the SAD and HC groups. See Table 5 for means and standard deviations of relative frequency of fear in each group and for each context.
Table 5.  
*Means (SD) for Relative Frequency of Fear State and Difference between Groups*

<table>
<thead>
<tr>
<th>Context</th>
<th>HC (n = 16)</th>
<th>SAD (n = 21)</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Across Contexts</td>
<td>.07 (.10)</td>
<td>.21 (.12)</td>
<td>1.27</td>
</tr>
<tr>
<td>Social</td>
<td>.01 (.03)</td>
<td>.14 (.12)</td>
<td>1.45</td>
</tr>
<tr>
<td>Non-Social</td>
<td>.05 (.10)</td>
<td>.06 (.10)</td>
<td>0</td>
</tr>
</tbody>
</table>

**Hypothesis 2.** Fear responses, when indexed as concordance or positive association between response dimensions (self-report and EDA) were expected to be stronger in the SAD group. Social context was once again evaluated as a possible moderator. This hypothesis was examined using HLM where the (maximum) 25 data points of SR, EDA, and Social Context were included as level 1 variables predicted by group (SAD and HC) as a level 2 variable. SR and EDA were both person-centered in this analysis. Hierarchical linear modeling was conducted to examine the effect of group (HC and SAD) on concordance between SR and EDA across days, with the moderating variable of Social Context. SR, EDA, and Social Context were considered at one level of analysis (time) and nested within another level of analysis (person: SAD and HC). Both SR and EDA were person-centered. The data were analyzed using the program HLM (Bryk, Raudenbush, & Congdon, 1998; Student Version 7.01). Hierarchical linear modeling was chosen over ordinary-least squares (OLS) methods (e.g., repeated measures ANOVA) because HLM provides better parameter estimates than OLS methods when there is dependency among observations (Nezlek, 2001). Gender was included as a covariate based on its effect on the missing SR data. No other study variables met criteria for covariates (see Preliminary Analysis section above).

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8 As mentioned in the hypothesis section of the introduction, SR was also explored in the analysis as a grand mean-centered variable (with EDA remaining person-centered) but the overall results were unchanged.
Conventions suggested by Kreft (1996) and Maas and Hox (2005) were used to
determine the sample size needed for adequate power ($\beta = .80$) to detect a medium effect size ($f = .25$; Cohen, 1992). Kreft’s conventions suggest that a sample size of 30 at Level 1 and 30 at Level 2 is necessary to detect group mean differences with a medium effect size. Maas and Hox’s (2005) conventions suggest that a sample size of 50 at Level 2 is necessary to detect the same effects. The Level 1 sample for the current analysis was $n = 25$ and the Level 2 sample was $n = 54$ and thus was expected to possess adequate power to detect medium effect sizes. However, missing data resulted in a Level 1 sample of $n = 343$ and a Level 2 sample of $n = 38$. Thus, with missing data this analysis was likely underpowered to detect a medium effect.

The Level-1 and Level-2 equations are below. As illustrated at Level 1, EDA, Social Context (SoCo) and the interaction between EDA and SoCo, predict SR. As illustrated at Level 2, Group (GRP) predicts each coefficient at Level-1, with this hypothesis focusing on the effect of GRP on the relationship between EDA and SR ($\beta_{1j}$) and the relationships between the interaction of EDA and SoCo on SR ($\beta_{3j}$).

<table>
<thead>
<tr>
<th>Level-1 Model</th>
<th>Level-2 Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SR_{ij} = \beta_{0j} + \beta_{1j}<em>(EDA_{ij}) + \beta_{2j}</em>(SoCo_{ij}) + \beta_{3j}<em>(EDA</em>SoCo_{ij}) + r_{ij}$</td>
<td>$\beta_{0j} = Y_{00} + Y_{01}^{*}GRP_{j} + u_{0j}$</td>
</tr>
<tr>
<td></td>
<td>$\beta_{1j} = Y_{10} + Y_{11}^{*}GRP_{j}$</td>
</tr>
<tr>
<td></td>
<td>$\beta_{2j} = Y_{20} + Y_{21}^{*}GRP_{j}$</td>
</tr>
<tr>
<td></td>
<td>$\beta_{3j} = Y_{30} + Y_{31}^{*}GRP_{j}$</td>
</tr>
</tbody>
</table>

To examine the inter-individual variability in Concordance, we compared two models, one that conceptually allowed for random effects at Level 2 (Model 1) and one that did not (Model 2).
This meant that for Model 1, the magnitude of the association between the pair of variables at Level 1 (e.g., SR and EDA) was allowed to be different for each individual and for Model 2, the magnitude of the association between the pair of Level 1 variables was conceived of as a general fixed effect estimate that holds for all individuals. Below is the mixed model equation for Model 1 with the relationship between SR and EDA allowed random effects Level 2 (r1i * EDAi) and for Model 2 with no random effects allowed at Level 2:

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ SR_{ii} = \beta_{00} + \beta_{10} * EDA_{ii} + r_{0i} + r_{1i} * EDA_{ii} + \epsilon_{ii} ]</td>
<td>[ SR_{ii} = \beta_{00} + \beta_{10} * EDA_{ii} + r_{0i} + \epsilon_{ii} ]</td>
</tr>
</tbody>
</table>

To compare these two models, the deviance score of Model 1 was subtracted from the deviance score of the Model 2. The change in deviance has a chi-square distribution with the degrees of freedom equal to the discrepancy in the model degrees of freedom. If the change in deviance scores was significant, then it was concluded that there was significant inter-individual variability in concordance. When running this analysis, the deviance score for Model 1 was 654.00 (df = 2) and for Model 2 was 649.55 (df = 4). The change in deviance scores from Model 1 to Model 2 was 4.45 (ns), suggesting that there was no significant inter-individual variability in concordance between SR and EDA across the five days.

The main analyses were then run, examining the relationship between Group and concordance. In order to do this, Level 1 coefficients were analyzed at Level 2 (the person) with

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9 This method provides a more reliable test of whether there is systematic variation in level 1 slopes, compared to traditional tests (Longford, 1995).
Social Context and the interaction of Social Context with EDA as Level 1 moderators. In these models, variance in the Level 1 slope was examined as predicting variance in Group (HC and SAD) at Level 2. To examine the effect of Group on concordance, the coefficient associated with $\beta_{11} * \text{Group}_i * \text{EDA}_{ti}$ was examined to determine significance. To examine the effect of Group on the interaction between Social Context and concordance, the coefficient associated with $\beta_{31} * \text{Group}_i * \text{EDA} * \text{SocialContext}_{ti}$ was examined. If these coefficients were not significant, then the model was examined without the Level 2 interaction:

$$SR_{ti} = \beta_{00} + \beta_{01} * \text{Group}_i + \beta_{10} * \text{EDA}_{ti} + \beta_{20} * \text{SoCo}_{ti} + r_0i + e_{ti}$$

which represented the effect of Group on concordance at Level 1 ($\beta_{01} * \text{Group}_i$), that is, slope predicting one response mode from another.

In the current analysis, the interaction between Group and concordance between SR and EDA was not significant and there was no significant effect of Social Context. To determine if there was a main effect of concordance, Group was removed as a Level 2 predictor. This analysis revealed no significant effect of EDA on SR, suggesting a lack of strong fear concordance in this sample. Adding Gender as a covariate did not change the results.

**Post Hoc Analyses.** Several follow-up analyses were conducted to further understand what variables may have contributed to the SAD group exhibiting significantly more frequent fear responses. More fear in SAD is thought to be associated with severity (e.g., Dryman et al., 2016) and thus variables related to severity, including engagement in treatment (psychotherapy and psychotropic medication), number of comorbid diagnoses, and number of reported depressive and social anxiety symptoms, were expected to be associated with more frequent fear responses in the SAD group in social contexts. Additionally, individuals with comorbid SAD/MDD ($n =$}
15) were expected to show more frequent fear responses than individuals with SAD only \((n = 6)\). These analyses revealed that a higher relative frequency of fear across contexts was associated with comorbid SAD/MDD, \(t(19) = -2.83, p < .05\), cohen’s \(d = 1.24\) (large effect). Additionally, relative frequency of fear was associated with more reported depressive symptoms from the CES-D \(r = .51\). Also, individuals with SAD who were taking psychotropic medications exhibited a significantly higher relative frequency of fear than those who were not taking psychotropic medications; \(t(17.6) = -4.49, p = .001\), cohen’s \(d = 2.1\) (large effect)\(^{10}\). When examining the effect of severity on relative frequency of fear separately by social and non-social contexts, there were no longer any effects. Additionally, when examining relative frequency of fear responses across contexts and within social and non-social contexts, there were no effects of psychotherapy treatment, number of comorbid disorders, or reported social anxiety symptoms. No variables significantly predicted concordance (positive association between SR and EDA).

\(^{10}\) The results were similar when examining for the effect of SSRI/SNRIs \((n = 6)\) only. There was no significant difference when examining the effect of Benzodiazepines \((n = 3)\).
DISCUSSION

In this study, fear was explored as a natural system (i.e., in two dimensions) across social and non-social contexts in the daily lives of individuals with SAD. This analysis was conducted by indexing fear through self-report and sympathetic nervous system arousal (i.e., electrodermal activity) using experience sampling and ambulatory monitoring methods over five days in individuals diagnosed with SAD and healthy controls. Both self-report and sympathetic nervous system arousal were assessed across social contexts (i.e., with at least one other person) and non-social contexts (i.e., alone) on a random schedule five times a day for five days in all individuals. Social context was used as a moderating variable in all analyses to examine fear in social and non-social contexts. The SAD group was expected to show more frequent fear responses (high self-report and high sympathetic nervous system arousal) and stronger fear concordance (stronger association between self-report and sympathetic nervous system arousal) in social contexts. No prediction was made regarding how fear would manifest in non-social contexts in the SAD group. In the main findings of the study, individuals with SAD exhibited more frequent fear responses in social situations but not more fear concordance, or more intense fear in social situations. These findings have interesting implications for understanding the emotional experience in SAD. In particular, how to conceptualize the disorder, what aspects of fear might be most relevant to the nature of the disorder, and how social contexts might elucidate the impairing nature of fear in this disorder.

There is a common debate regarding SAD: should it be considered a fear disorder (e.g., specific phobia, panic disorder), a disorder of general distress (e.g., depression, generalized
anxiety disorder), or both? Resolving this debate is important because it has implications for understanding mechanisms that underlie the disorder and appropriate treatments. Some disorders are thought to be better categorized as fear disorders, such as specific phobia and panic disorder (Clark & Watson, 2006). A fear disorder, or phobia, develops through operant conditioning and thus full-system fear responses are elicited somewhat automatically and are treated with exposure. Thus, a phobia should involve a full-system fear response that is relatively short-acting, involves sympathetic nervous system arousal, and is elicited by specific stimuli. In this study, a phobia was characterized by high self-report and high sympathetic nervous system arousal occurring more frequently in social situations than would be expected for non-anxious individuals. In contrast, some disorders are considered better categorized as disorders of general distress (i.e., distress disorders) such as depression or generalized anxiety disorder (Clark & Watson, 2006). The underlying mechanisms in distress disorders are primarily cognitive, wherein individuals have developed ways of thinking that elicit negative emotion. These types of mechanisms are typically treated with cognitive restructuring, and more recently with meta-cognitive strategies such as cognitive defusion or acceptance. Thus, a distress disorder should involve feelings of distress that persist across contexts, do not have a clear beginning and end, and do not appear to be related to a specific stimulus. In this study, distress disorders were characterized by more fear reported overall across all contexts.

Dominant theories of SAD assume that it has characteristics of both a phobia (high self-reported fear and sympathetic nervous system arousal to social situations) and a distress disorder (pervasive and generalized fear, anxiety, and negative affect). However, existing research has not thoroughly explored this categorization of SAD as a disorder of either/both fear or distress. One possible interpretation of the findings in this study is that SAD does exhibit characteristics of
both a distress disorder and a phobia, which is more apparent when fear is measured in two dimensions and across social and non-social contexts. When examining fear in two-dimensions across contexts in daily life in the current study, findings provided evidence of both a distress disorder and a phobia. As expected, individuals with SAD reported more fear, collapsed across all diary entries. This finding is consistent with previous research and supports the idea that individuals with SAD experience high levels of persistent distress. This level of distress makes sense when considering the negative thoughts about the self which are prominent in SAD, such as negative thoughts about the self (e.g., Stopa & Clark, 2000) and memories about poor performance in past social situations (Hackmann, Clark, & McManus, 2000; Hackmann, Surawy, & Clark, 1998). Also, as expected, both sympathetic nervous system arousal and self-reported fear were high in more social contexts for individuals with SAD than healthy controls, suggesting that individuals with SAD also experience phobic responses to social situations. This finding also makes sense considering the fact that fear responses to social situations are central to the diagnosis (APA, 2013), we see fight-or-flight responses elicited by social situations, and fear tends to generalize to a variety of social situations in a way that suggests fear conditioning (e.g., Lissek, Powers, McClure, & Phelps, 2005).

Unexpectedly, self-report and sympathetic nervous system arousal were not more concordant, or positively associated, in social situations. A high degree of concordance across self-report and sympathetic nervous system arousal was expected during social situations. However, that effect was not found. One possible interpretation of this finding is that people with SAD are not experiencing more intense fear in social situations. However, participants reported a high degree of fear, as measured by both high self-reported fear and sympathetic nervous system arousal. This high level of fear in two dimensions in social situations but no concordance
suggests that intensity was consistently high across social situations. In other words, both dimensions of fear were not changing at the same rate consistently across all social situations for the SAD group. This suggests that frequency of intensity of fear is particularly relevant in SAD, rather than intensity of fear alone. In other words, how often individuals with SAD experience phobic responses may be more important than how much fear they experience.

The findings that individuals with SAD experience fear responses characteristic of a phobia and the intensity seems not to vary much by social context is particularly interesting considering the way social context was measured in this study. In this study, social situations came about as participants engaged in their daily lives and contexts were considered social if the participant was with at least one other person. Thus, participants were in social situations that they would come across in their daily lives and those situations could have included anything from being around a safe person to performing a speech in front of a crowd. However, when considering that people in general do not engage in intense social situations, like performing a speech, it is likely that the social situations were relatively benign. If this was the case, then social situations do not have to be intense in order for individuals with SAD to exhibit a phobic response. This would make sense based on the fact that individuals with SAD exhibit attentive and perceptual biases that lead to them to perceive threat in social situations that healthy controls view as unthreatening (e.g., Bögels & Mansell, 2004). Because fear, like any emotion, is adaptive, it is possible that what makes fear maladaptive in SAD is not how much fear is elicited in intensely distressing social situations but how often it is elicited in the more benign social situations. If this were the case, this would help explain inconsistencies in the literature on sympathetic nervous system arousal in SAD. The one study that did not find differences in sympathetic nervous system arousal between SAD and healthy control groups had participants
engaging in primarily performance tasks which would have been very stressful (e.g., speech) in the laboratory (Edelmann & Baker, 2002). The study that did find differences in sympathetic nervous system arousal between SAD and healthy control groups showed this difference when viewing social threat imagery in the laboratory (Mteague et al., 2009). Thus, it is possible individuals with SAD can be best differentiated from healthy controls by exhibiting intense fear in social situations that are not typically threatening to others. However, this is an open question and should be tested in future studies.

The main findings of this study provide evidence for both a distress disorder and a phobia. It also suggests that frequency of intensity of response may be more relevant to SAD than intensity on its own. Post-hoc analyses in the current study provide some interesting nuances to the main findings, specifically related to what aspects of the fear response are relevant to impairment in SAD. Post-hoc analyses revealed that individuals with comorbid MDD, high levels of depressive symptoms, and medication use exhibited more frequent fear responses. Because depression and medication use was thought to be associated with more impairment (e.g., Erwin et al., 2002), these findings support the idea that frequency of intensity is an important impairing aspect of fear in this disorder. However, what is interesting is that this was found across all contexts, not specifically in social contexts. Because number of depressive symptoms is related to more severity in the disorder, this finding suggests that individuals with more severe forms of the disorder, or at least comorbid with depression, are experiencing more frequent fear responses regardless of type of context (social or non-social). It is unclear why this would have occurred across contexts and not in social contexts, specifically. Thus, more research is needed to examine this effect.
Unexpectedly, other measures of severity including overall number of comorbid disorders, engagement in psychotherapy, and reported social anxiety symptoms were not associated with fear responses. When thinking in a more detailed way about engagement in therapy, it is possible that this variable was related to severity in many different ways and thus effects cancelled each other out. For example, engagement in therapy might have been related to higher severity if individuals going to therapy had more severe cases of the disorder or if they had just begun to go to therapy and thus were feeling worse (worse before feeling better). Or engagement in therapy could have been associated with less impairment because individuals were feeling better. However, it is strange that number of comorbid disorders and especially social anxiety symptoms did not predict frequency of fear responses. It is possible that the SAD group was too high on both reported social anxiety symptoms and number of comorbid disorders so that the range was too restricted to predict any variance in fear responses. However, future research is needed to further examine the relationship between social anxiety symptoms and number of comorbid disorders on frequency of fear responses.

All of the findings of this study taken together, within the context of the extant literature on SAD, suggest some important implications for understanding the nature of fear in SAD. The findings suggest that SAD is a unique disorder that is best described as a phobia and a distress disorder, the frequency of intense fear is particularly relevant to the fear response in this disorder, and types of social contexts may be relevant to understanding the impairing nature of fear in SAD. In general, this study reveals the importance of examining fear in an ecologically valid way to support and nuance the already well-developed theories of SAD. Because fear is the central emotional experience in this disorder, it is important to understand it in complex ways to
better inform our conceptualization of SAD and thus treatment of this chronic, impairing disorder.

**Clinical Implications.** In this study, the question of how fear manifests was tested in the real world for the first time. Thus, the study was primarily descriptive and future studies are needed to examine naturalistic data that includes more detailed information regarding fear and its manifestations across contexts in SAD. However, the primary findings are clinically meaningful in that they support the use of treatment strategies that address both general distress (e.g., cognitive restructuring) and phobic responses (i.e., exposure). This idea supports Hofmann’s (2004) finding that cognitive interventions with exposure are superior to exposure alone for SAD. Thus, the findings of this study in the context of previous work suggests that mechanisms that lead to general distress may also be linked to mechanisms underlying the phobic response and that both need to be treated. One way this may work is that the beliefs consistent with general distress may interfere with processing of the feared consequences, similar to what has been observed in post-traumatic stress disorder (PTSD; Foa & McLean, 2016). For example, feelings of inadequacy may lead to an individual with SAD to think that they have embarrassed themselves social situations when they are not engaging in behaviors others view as embarrassing. This would obscure that individual’s ability to benefit from exposure because the feared consequence (i.e., embarrassment) has not been removed, but only because of that person’s negative beliefs about themselves.

**Conclusion/Future Directions.** Overall, this study provides support for current theories of SAD, in that individuals with this disorder experience more fear in social contexts than psychologically healthy adults. These findings were shown using naturalistic techniques that represent fear in two-dimensions across social and non-social contexts in daily life. These findings provide a
better understanding of how fear manifests in the daily lives of individuals with SAD and what contexts are most relevant to the elicitation of fear in the real world. Future studies could extend this research by examining fear in more detail, by acquiring more frequent measures of self-report that can be closely linked to continuous physiological data, and by measuring other important dimensions of the fear response in SAD (e.g., cognitive processes such as attention biases or negative thoughts about the self). Studies like this could better examine how the intensity and frequency of fear responses relates to the cognitive mechanisms that have been predominantly examined in this disorder. For example, does a stronger threat bias to social stimuli predict a stronger fear response in social situations? Does a stronger threat bias predict a higher frequency of fear response? Subsequent research might also use the methods in this study to better elucidate context effects. For example, more information regarding what type of people (e.g., strangers, authority figures, intimate partners) and what situations (e.g., party, school presentation, interview) make up the social context would allow for researchers to make better predictions about when fear concordance would be expected. It will also be important to examine other emotions in the daily lives of individuals with SAD and how these relate to fear and to changes in context. In particular, shame and embarrassment are integral aspects of the experience of individuals with SAD (e.g., Gilbert, 2000; Fergus, Valentiner, McGrath, & Jencius, 2010). Based on the fact that shame is related to severity of the disorder, they may also be associated with more intense and frequent fear and/or increased generalization across contexts.
LIMITATIONS

This study has several notable strengths, including the collection of rich emotion data from daily reports of fear by self-report and ambulatory physiology, the inclusion of a clinical sample and a group of healthy controls, the measurement of social context, and the statistical analysis of two dimensions of fear at the same time. However, there are also some limitations. First, the demands of the study were great and therefore it was expected that there were some missing data and some zero data. However, these missing data also limited the number of participants included in the analyses. Second, although social context was measured and provided valuable information, the type of social context, particularly participants’ perception of safety in that context could not be discerned. Determining if individuals were in safe or threatening social contexts would allow for better predictions regarding when fear responses should occur. Additionally, based on how social context was measured, it was also impossible to differentiate if individuals were alone because they were avoiding a social situation. Third, as with any intervention, the procedure itself may have affected the results. In this case, the prompts on the palm pilots were loud and could have led individuals with SAD to feel more visible, and thus, more fearful, in social situations. Fourth, methodological problems may have interfered with the ability to find effects of concordance in social situations. Most importantly, there was a lack of power in the concordance analysis. Additionally, although self-report and SNS were matched in the concordance analysis in a way that was thought to index moments when they would be associated, it is possible that measuring SNS at different time points or more frequently
would have better elucidated concordance effects. For example, measuring SNS after the self-report or measuring SR more frequently could have allowed for a better exposition of the association between SR and SNS across contexts. Lastly, although several important clinical variables were measured that were valid proxies for severity in this disorder, it would have been beneficial to obtain more detail about some treatment variables. For example, type and duration of treatment may be particularly relevant to severity. Regardless of these limitations, the results of this study help to clarify one of the core aspects of SAD: fear in daily life.
REFERENCES


Fischer, A. H., & Roseman, I. J. (2007). Beat them or ban them: the characteristics and social functions of anger and contempt. *Journal of personality and social psychology, 93*(1), 103.


PMAT; www.cfs.purdue.edu/mfri/pages/PMAT/Index.html


Appendix A

Diary Questions (negative affect words that will be used are bolded)

Please check off your current position:

__standing  __sitting upright  __lying down

Please indicate if you engaged in any of the following activities in the past 20-30 minutes: (one screen of check boxes)

__walking  __climbing stairs  __lifting something heavy
__running  __other exercise  __arguing/conflict

RIGHT NOW, to what extent do you feel…
(Presented as individual questions on palm pilot, with 5 response options)
Response options:
• Not at all  • A little  • Moderately  • Quite a bit  • Extremely

RIGHT NOW to what extent do you feel:

<table>
<thead>
<tr>
<th>1) Interest</th>
<th>16) Shame</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Fear</td>
<td>17) Joy</td>
</tr>
<tr>
<td>3) Relief (reversed)</td>
<td>18) Pain</td>
</tr>
<tr>
<td>4) Sadness</td>
<td>19) Numb</td>
</tr>
<tr>
<td>5) Enjoyment</td>
<td>20) Discomfort</td>
</tr>
<tr>
<td>6) Distress</td>
<td>21) Confused</td>
</tr>
<tr>
<td>7) Tension</td>
<td>22) Content (reversed)</td>
</tr>
<tr>
<td>8) Guilt</td>
<td>23) Grounded</td>
</tr>
<tr>
<td>9) Happiness</td>
<td>24) Supported</td>
</tr>
<tr>
<td>10) Anger</td>
<td>25) Lonely</td>
</tr>
<tr>
<td>11) Amusement</td>
<td>26) Accepted</td>
</tr>
<tr>
<td>12) Disgust</td>
<td>27) Misunderstood</td>
</tr>
<tr>
<td>13) Affection</td>
<td>28) Rejected</td>
</tr>
<tr>
<td>14) Boredom</td>
<td>29) Satisfied</td>
</tr>
<tr>
<td>15) Fatigue</td>
<td>30) Calm (reversed)</td>
</tr>
</tbody>
</table>
Appendix B

Eligibility Criteria

Generalized Social Phobia (GSP) Group
- Inclusion:
  - Current GSP
  - English Speaking
  - 18-65
- Exclusion:
  - Current MDD, Dysthymia
  - Bipolar (past/current)
  - Current GAD
  - Current Borderline PD
  - Current Psychosis
  - Current Substance Abuse/Dependence
  - Current use of Meds in excluded classes (e.g. Benzos, Beta-blockers, Tryciclic Antidepressants, Antipsychotics)

Co-Morbid Group (MDD-GSP) Group
- Inclusion:
  - Current MDD
  - Current GSP
  - English Speaking
  - Age 18-65
- Exclusion:
  - Bipolar (past/current)
  - Borderline Personality Disorder
  - Current Psychosis
  - Current Substance Abuse/Dependence
  - Current use of Meds in excluded classes (e.g. Benzos, Beta-blockers, Tryciclic Antidepressants, Antipsychotics)

Healthy Control (HC) Group
- Inclusion:
  - High functioning individual with a GAF greater than 79
  - English Speaking
  - Age 18 -65
- Exclusion:
  - Axis 1 diagnosis in past 12 months; Partially remitted Axis 1 in past 12 months
  - Bipolar (past/current)
  - 16 or greater Personality Disorder questions endorsed “yes” on SCID 2 questionnaire
  - No more symptoms per specific PD then stated on SCID 2 questionnaire
  - Any use of psychiatric medications of any kind in past 12 months
  - Social Desirability score at 26 or above
Appendix C

Phone Screen

**NOTE:** If screener is unwilling to answer certain question(s), he/she should be aware that in order to participate, they must answer similar questions in the interview (if eligible) – See SOP.

Y  N  Q1.  **In the last year, have you taken any medication for anxiety or depression?**  
If yes, please list here:

________________________________________________________________________________________

(If yes, not eligible for HC; may be eligible for other groups so continue but BE SURE TO CHECK MED LIST OR GOOGLE EACH ONE TO SEE IF IT IS ALLOWED FOR OTHER GROUPS BEFORE TELLING CALLER IF ELIGIBLE.)

Y  N  Q2.  **In the last year, have you taken medication for any other emotional or psychiatric problem?**  
If yes, please list here:

________________________________________________________________________________________

(If yes, not eligible for HC; may be eligible for other groups so continue but BE SURE TO CHECK MED LIST OR GOOGLE EACH ONE TO SEE IF IT IS ALLOWED FOR OTHER GROUPS BEFORE TELLING CALLER IF ELIGIBLE.)

Y  N  Q3.  **Do you suffer from bipolar disorder OR manic-depression?**  
*(If yes NOT ELIGIBLE FOR ANY GROUP, but ask more questions before ending call).*

Y  N  Q4.  **Do you suffer from schizophrenia or schizoaffective disorder?** *(If yes, not eligible – but ask more questions before ending call.)*

---

**Now I’m going to ask a few questions about how you have been feeling in the last couple of weeks.**

*** Lately, have you been feeling depressed or down most of the day, nearly every day?  
*If Yes- Have you been feeling like that nearly every day for 2 weeks or longer? (Y)*

*** What about losing interest or pleasure in things you usually enjoy?  
*If Yes- Has that been nearly every day, for 2 weeks or longer? (Y)*

**If YES to ONE OR MORE OF THE ABOVE MDD ITEMS, AND Q3=NO, CONTINUE WITH MDD ITEMS**

**If NO TO BOTH OF THE ABOVE:  
SKIP TO SCREENING FOR GSP GROUP.**

**For all other symptomology, skip to determine ELIGIBILITY below**
The following questions are about how you have felt and behaved past few weeks. Answer “YES” if the question has been completely or mostly true over this time, or answer “NO” if it has been not true, or only rarely true.

### SCREENING FOR MDD GROUP

**MDD Y/N**

**NOTE:** If screener reports active suicidal thoughts/plans please refer to Emergency Script for Phone-Screens

### SCREENING FOR GSP GROUP

**GSP Y/N**

Now I’m going to ask you some questions about your mood and behavior during the past two weeks that you’ve been feeling ________________ [depressed and/or unable to enjoy things].

Has there been a change in your appetite, your weight, or how much you eat?

- If Yes- Has that been for 2 weeks or longer, nearly every day? (Y)

Have you had trouble sleeping or maybe sleeping too much?

- If Yes- Has that been nearly every day, for 2 weeks or longer? (Y)

Have you been unable to sit still? If no- Have you been moving and talking extremely slowly?

- If Yes to either- Has that been for 2 weeks or longer, nearly every day? (Y)

Have you been feeling tired all the time?

- If Yes- Has that been nearly every day, for 2 weeks or longer? (Y)

Have you been feeling worthless or terribly guilty about things?

- If Yes- Has that been for 2 weeks or longer, nearly every day? (Y)

Have you had trouble thinking, concentrating or making decisions?

- If Yes- Has that been nearly every day, for 2 weeks or longer? (Y)

**NOTE:** Stop as soon as 4 MDD criteria are endorsed, (including at least one starred item).

### MDD criteria

#### IF YES go on; IF NO Skip to screening for HC group unless met for MDD group

***IF YES:*** Let me ask you about some specific situations. Do any of the following make you feel more fearful, anxious, or nervous than most people? (check all that apply)

| a. Eating in front of others __ | IF the person indicated 3 or more areas then indicate Y and proceed |
| b. Writing in front of others __ |
| c. Public Speaking __ |
| d. Saying something when in a group of people __ |
| e. Asking a question when in a group of people __ |

If 2 or less, indicate N and proceed to HC screening unless met for MDD group

---

67
f. Urinating in public restrooms __
g. Work-related meetings ___
h. Socializing at Parties ___
i. Other _________________________

**IF YES**: Do you think you are much more anxious than other people?

---

**SCREENING FOR HC GROUP** - Do this only if Q1, Q2, Q3, and Q4 on page 1 were all answered “No” AND
Person does not meet for other groups

**HC Y/N**

Now I’m going to ask about your whole life.

Have you EVER had a mental or emotional disorder, such as depression or an anxiety disorder?
If yes: How long ago was that?

________________________________________________________

Has the condition caused you significant problems or distress in the past year?

*If unclear-* Would you characterize this condition as resolved or under control?

Have you EVER had an addiction to alcohol or drugs, or had other problems because of using these substances?
If yes: How long ago was that?

________________________________________________________

Have you had any significant problems or distress as a result of using alcohol or drugs within

---

*NOTE: To be ELIGIBLE for HC GROUP participants must have NO DISORDERS AND NO PSYCHIATRIC MEDICATIONS FOR 1 YEAR. Eligible participants may report history of past disorders in remission without medication for at least 1 year.*

---

**ELIGIBILITY**

****IF MDD criteria > 4, AND/ OR GSP criteria = 3, (must include 1 starred criteria) and No to Q3 and Q4 then caller is eligible for Interview session and potentially eligible for a clinical group. BUT CHECK MEDICATION LIST BEFORE CONFIRMING WITH CALLER

****IF Q1, Q2, Q3, Q4, and both HC items = N, then caller is eligible for the control group

---

**Phone Pre-Screening Outcome:** Check one and circle the applicable group(s) or reason(s)
Priority No. _________

__ Eligible for further diagnostic screening for the following groups
Please circle all that apply: MDD  GSP  MDD-GSP  Control

__ INeligible for further diagnostic screening  
Please circle all that apply:  
Not eligible because: subclinical GSP  subclinical MDD  psychosis  not HC  not believable
comprehension problem

other_________________________________

Comments:____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

NOTE: If screener reports active suicidal thoughts/plans please refer to Emergency Script for Phone-Screens
Appendix D

Liebowitz Social Anxiety Scale- Self Report (LSAS-SR)

If I were faced with this situation…

Instructions: This measure assesses the way that social anxiety plays a role in your life across a variety of situations. Read each situation carefully and answer two questions about that situation. The first question asks how anxious or fearful you feel in the situation. The second question asks how often you avoid the situation.

If you come across a situation that you ordinarily do not experience, we ask that you imagine "what if you were faced with that situation," and then rate the degree to which you would fear this hypothetical situation and how often you would tend to avoid it. Please base your ratings on the way that the situations have affected you in the last week.

<table>
<thead>
<tr>
<th>Fear or Anxiety:</th>
<th>Avoidance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = None</td>
<td>0 = Never (0%)</td>
</tr>
<tr>
<td>1 = Mild</td>
<td>1 = Occasionally (1—33%)</td>
</tr>
<tr>
<td>2 = Moderate</td>
<td>2 = Often (33—67%)</td>
</tr>
<tr>
<td>3 = Severe</td>
<td>3 = Usually (67—100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Situation</th>
<th>Fear/Anxiety</th>
<th>Avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Telephoning in public.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Participating in small groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Eating in public places</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Drinking with others in public places</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Talking to people in authority</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Acting, performing or giving a talk in front of an audience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Going to a party</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Working while being observed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Writing while being observed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Calling someone you don’t know very well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Talking with people you don’t know very well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Meeting strangers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Urinating in a public bathroom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Entering a room when others are already seated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Being the center of attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Speaking up at a meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Taking a test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>18. Expressing a disagreement or disapproval to people you don’t know very well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Looking at people you don’t know very well in the eyes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Giving a report to a group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Trying to pick up someone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Returning goods to a store</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Giving a party</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Resisting a high pressure salesperson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Using the scale below, indicate the number which best describes how often you felt or behaved this way **DURING THE PAST WEEK.**

<table>
<thead>
<tr>
<th>DURING THE PAST WEEK:</th>
<th>Rarely or none of the time (less than 1 day)</th>
<th>Some or a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of time (3-4 days)</th>
<th>Most or all of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I was bothered by things that don’t usually bother me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I did not feel like eating; my appetite was poor.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I felt that I could not shake off the blue even with help from my family or friends.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. I felt that I was just as good as other people.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I had trouble keeping my mind on what I was doing.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. I felt depressed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. I felt that everything I did was an effort.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. I felt hopeful about the future.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. I thought my life had been a failure.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10. I felt fearful.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. My sleep was restless.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix F

Demographics Scale

1. Sex: □ Female (1) □ Male (2)

2. Age _________

3. Ethnic / Racial origin (please check all that apply):
   □ American Indian or Alaska Native □ Black or African □ White or European
   □ Asian or Pacific Islander □ Hispanic/Latino □ Middle Eastern
   □ Other __________________________

4. Current employment status (please check all that apply)
   □ Employed full-time □ Attending school or a training program
   □ Employed part-time □ Looking/applying for jobs, school, or training programs
   □ Full-time parent/homemaker □ Not employed due to illness or disability
   □ Retired □ Other __________________________

5. Are you a parent (whether a biological, step-, adoptive, or foster parent)? □ Yes (1) □ No (2)

6. Are you currently involved in an intimate/romantic or dating relationship?
   □ No, and not dating
   □ Casual dating (not dating any one person regularly)
   □ Dating one person regularly but we can also see other people
   □ Steady relationship in which there is an expectation for exclusiveness/monogamy
   □ Living with a partner or husband/wife
   □ Other __________________________

7. If you are currently involved in an intimate/romantic relationship, how long have you been together?
   □ Less than a year (How many months? _________)
   □ A year or more (How many years? _________)
   □ Not applicable -- not currently in a relationship

8. If you are NOT currently involved in an intimate relationship, when was the last time that you were?
   □ Less than a year ago (How many months ago? _________)
   □ A year ago or more (How many years ago? _________)
   □ Never have been in a relationship
Not applicable -- currently in a relationship

9. What is the longest that any past or current intimate/romantic relationship of yours has lasted?
   □ Less than a year (How many months? _________)
   □ A year or more (How many years? __________)
   □ Not applicable - never have been in a relationship

10. Check the box that best describes the highest degree or grade level that YOU completed.
   □ Some elementary/ middle school (left school in grades 1-8) (1)
   □ Some high school (left school in grades 9-12) (2)
   □ Finished high school diploma or equivalency (GED) (3)
   □ Finished high school diploma or equivalency, and attended some college (4)
   □ Finished associate's / 2-year college degree (5)
   □ Finished bachelor's / 4-year college degree (6)
   □ Finished bachelor’s degree and attended some graduate school (7)
   □ Finished bachelor’s and graduate/professional degree (Specify type of degree: ____________________________) (8)
   □ Other (Please explain: ________________________________________________) (9)