The Interaction of Extraversion and Anxiety Sensitivity on Social Anxiety: Evidence of Specificity Relative to Depression

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Neuroticism and extraversion have been linked to the etiologies and course of anxiety and mood disorders, such that neuroticism is broadly associated with numerous disorders and extraversion is most strongly associated with social anxiety and depression. While previous research has established the broad associations between temperament and emotional disorders, less is known about the specific, proximal factors that are associated with them, and very few studies have situated these risk factors into a larger etiological model that specifies how they may relate to one another. The current study examined the interaction of extraversion and anxiety sensitivity (AS) in predicting social anxiety symptoms in a large, diagnostically diverse clinical sample ($N = 826$). Symptoms were assessed with self-report and dimensional interview measures, and regression analyses were performed examining the main effects and interaction of extraversion and AS (examining both total and lower-order components) on social anxiety. Results showed that at higher levels of AS, the inverse relationship between extraversion and social anxiety was stronger, and the social concerns component of AS is responsible for this effect. This interaction was also observed with regard to depression symptoms, but the interaction was not present after accounting for shared variance (i.e., comorbidity) between depression and social anxiety symptoms. Clinical and theoretical implications of the results are discussed.

SOCIAL ANXIETY DISORDER IS CHARACTERIZED BY EXCESSIVE fear of social or performance situations in which embarrassment or humiliation may occur (American Psychiatric Association, 2013). Social anxiety disorder is one of the most common psychiatric disorders in the United States, after major depression and alcohol dependence (Kessler et al., 2005). The disorder tends to follow a chronic and unremitting course of illness (Brown, Campbell, Lehman, Grisham, & Mancill, 2001), and studies have shown that nearly two-thirds (62.9%) of people with lifetime social phobia meet criteria for at least one other *DSM-IV* disorder (Ruscio et al., 2008). Social anxiety disorder is a predictor of subsequent depression (Stein, Chavira, & Jang, 2001), and these two disorders have particularly high rates of comorbidity (Kessler et al., 2005).

Understanding how personality traits and related temperaments are associated with emotional disorders such as social anxiety disorder is important in order to explore the etiologies and high rates of comorbidity among these disorders. Two genetically based core dimensions of temperament have been shown to be involved in the etiology and course of emotional disorders: neuroticism (related to negative affectivity) and extraversion (related to positive affectivity) (e.g., Brown, 2007; L.A. Clark, Watson,

& Mineka, 1994; Hettema, Prescott, Myers, Neale, & Kendler, 2005). Neuroticism refers to a tendency towards negative emotions and stress reactivity, whereas extraversion refers to a tendency toward positive emotions, sociability, and assertiveness. The relationship between these traits in emotional disorders is relatively stable across samples, instruments, and data analytic strategies (e.g., Brown, Chorpita, & Barlow, 1998; D.A. Clark, Steer, & Beck, 1994; Watson, Clark, & Carey, 1988). High neuroticism and low extraversion have been linked to both social anxiety disorder and depression, and whether one or both conditions become manifest may depend on environmental determinants including direct experiences with rejection and humiliation (e.g., Barlow, 2002; Brown, 2007; L.A. Clark, 2005). Elevated levels of neuroticism and lower levels of extraversion characterize nearly all of the emotional disorders, according to a recent meta-analysis by Kotov and colleagues (Kotov, Gamez, Schmidt, & Watson, 2010). However, dimensional studies have found that low levels of extraversion are typically most marked in social anxiety disorder and depression, as compared to other emotional disorders, whereas neuroticism shows less specificity (e.g., Brown, 2007; Brown et al., 1998; Watson, Gamez, & Simms, 2005).

Previous research has established the broad associations between temperament and anxiety, mood, and substance use disorders (e.g., Kotov et al., 2010), but less is known about more specific, proximal factors that may mediate or moderate temperament's association with disorders. Several recent articles have suggested models for examining these associations in detail and argued for the import of a fine-grained, multivariate approach. For example, researchers have asserted that it is important to closely examine the precise intervening mechanisms between broad temperaments (e.g., neuroticism and extraversion) and symptoms in order to delineate specific mechanisms that lead to manifestations of different disorders (e.g., Barlow, 2000, 2002; Hong, 2013). Similarly, Nolen-Hoeksema and Watkins (2011) proposed a trans-diagnostic model of psychopathology that emphasizes distal and proximal risk factors. This model illustrates how distal risk factors (environmental context or congenital biological characteristics) contribute to disorders through mediating proximal risk factors (e.g., biological factors leading to emotional, cognitive, or behavioral tendencies). Moderators (e.g., environmental factors or biological characteristics) interact with proximal risk factors to determine which specific disorder the individual will experience (Nolen-Hoeksema & Watkins).

One vulnerability that is relevant to the above models is anxiety sensitivity (AS), which is the belief that physical sensations of anxiety will be associated with harmful consequences (Reiss, Peterson, Gursky, & McNally, 1986). Specifically, AS is thought to amplify anxiety responses by contributing to a self-perpetuating cycle in which symptoms of anxiety contribute to anxiety itself (Reiss et al., 1986). The higher-order trait can be broken down into three lower-order dimensions: physical concerns (fear of physical symptoms of anxiety; i.e., "it scares me when my heart beats rapidly"), cognitive concerns (fear of cognitive dyscontrol; i.e., "when I'm nervous, I worry that I may be mentally ill"), and social concerns (fear of publically observable anxiety symptoms; i.e., "it embarrasses me when my stomach growls") (e.g., Zinbarg, Barlow, & Brown, 1997). In a meta-analysis examining AS and emotional disorders, social anxiety disorder was shown to be strongly related to higher-order AS (ρ = .49) and also showed a strong and specific relation to the social component of AS (ρ = .70). Social anxiety disorder was also significantly, but more weakly, related to physical (ρ = .31) and cognitive (ρ = .45) components of AS. Depression was similarly related to higher-order AS (ρ = .46), with the strongest correlation for the cognitive component of AS (ρ = .53; ρ = .40 for physical; ρ = .38 for social) (Naragon-Gainey, 2010). A more recent study revealed that the social and cognitive components of AS (combined into a single factor) were uniquely related to social anxiety in a large sample of patients with anxiety and mood disorders (Drost et al., 2012).

While much research has focused on the association of broad traits (i.e., neuroticism and extraversion) and narrow social cognitive vulnerabilities (i.e., anxiety sensitivity) in relation to social anxiety, these risk factors have rarely been tested within a larger etiological model that specifies how they may relate to one another. In one comprehensive etiological model of social anxiety disorder, baseline temperamental vulnerabilities (e.g., extraversion) combine with an overestimation of the degree to which anxiety is visible and an increased attentional allocation to threat (e.g., negative perception by others; Rapee & Heimberg, 1997). Individuals with low levels of extraversion (and particularly, low levels of the sociability and ascendance components of extraversion; Naragon-Gainey, Watson, & Markon, 2009) may tend to feel less comfortable or more anxious in social situations overall. However, the above model would suggest that this trait is likely to be more problematic when greater attention is focused on anxiety sensations and others' perceptions of the anxiety symptoms, suggesting an interaction between these two vulnerabilities. AS (and particularly the social concerns component) seems to describe this

latter vulnerability well, wherein higher levels of AS would strengthen the association between extraversion and social anxiety disorder by increasing anxiety sensations.

The present study examines the interaction[1] of extraversion and AS in predicting social anxiety symptoms in a large, diagnostically diverse clinical sample. We focus on extraversion, rather than neuroticism, because of its robust and relatively specific link to social anxiety, whereas neuroticism is a broader, less specific risk factor. We also examine the interaction of extraversion and AS when predicting depression as a comparison and test of specificity, given the strong comorbidity and similar patterns of association with extraversion and AS. At the lower-order level, we hypothesized that the social concerns component of AS will be most strongly associated with social anxiety, and that the cognitive concerns component will be most strongly associated with depression. We expected to find main effects of extraversion and AS, indicating that extraversion and AS both uniquely contribute to social anxiety and to depression. We also hypothesized that the relationship between extraversion and social anxiety will be stronger at higher levels of anxiety sensitivity, and that this same interaction will be present in predicting depression, due to the high rates of comorbidity between depression and anxiety. We expected that the main effects and interactions for social anxiety will remain when holding depression constant. In contrast, we hypothesized that the Extraversion × AS interactions will not remain significant predictors of depression after accounting for social anxiety. This hypothesis is based on previous research that has found that the positive affect component (rather than sociability components) of extraversion is largely responsible for extraversion's association with depression (e.g., Naragon-Gainey et al., 2009), and theories of depression do not suggest that the association between low positive affect and depression would be moderated by concern about anxiety sensations. Finally, we expected that after accounting for shared variance among the lower-order AS components and disorders, social anxiety will be predicted by social AS only (main effects and interactions), whereas

depression will be predicted by cognitive AS only (main effect only).

Method

PARTICIPANTS

Archival data from a larger study were used, for which participants were 826 adults who presented for assessment and/or treatment at the Center for Anxiety and Related Disorders (CARD) at Boston University.[2] Women constituted the majority of the sample (60.4%). The average age was 33.6 years old (SD = 12.5, range = 18 to 79). Most participants identified as Caucasian (86.3%), and the remaining participants identified as African-American (4.0%), Asian (4.8%), Latino/Hispanic (4.5%), or Other/Multiple (0.4%).

Participants underwent a semistructured interview and completed a series of self-report questionnaires at the time of their assessment. Current and past diagnoses were established with the Anxiety Disorders Interview Schedule for *DSM-IV*-Lifetime version (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994), a semistructured interview designed to ascertain reliable diagnosis of the *DSM-IV* anxiety, mood, somatoform, and substance use disorders, and to screen for the presence of other conditions (e.g., psychotic disorders, sleep disorders, and eating disorders). A reliability study entailing two independent administrations of the ADIS-IV-L indicated good-to-excellent interrater agreement for current disorders (range of κs = .67 to .86) except dysthymia (κ = .31; Brown, Di Nardo, Lehman, & Campbell, 2001). In the course of the current study, a subsample of 74 cases underwent two independent administrations of the ADIS-IV-L to evaluate interrater reliability (intraclass correlations for the interview indicators = .84 for Social Anxiety and .78 for Depression). The rates of current clinical disorders occurring frequently in the sample were as follows: social phobia (47.6%), major depressive disorder (30.4%), generalized anxiety disorder (29.4%), panic disorder with or without agoraphobia (24.5%), obsessive-compulsive disorder (16.7%), specific phobia (15.4%), and dysthymic disorder (7.7%).

MEASURES

Multiple indicators were selected for social anxiety and depression to create latent variables, whereas extraversion and AS were observed variables

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[1] We considered both a mediating and moderating relationship for extraversion and AS, but decided a moderation model was most appropriate because of the conceptualization and empirical finding that these two constructs are relatively independent of one another (r = −.20 or less; e.g., Cox, Borger, Taylor, Fuentes, & Ross, 1999), without evidence of a hierarchical association (i.e., AS does not appear to be a lower-order component of extraversion) or conceptually compelling intervening mechanisms that account for the main effect of extraversion on social anxiety.

[2] Analyses from this sample were previously published by Brown and Rosellini (2011) and Naragon-Gainey, Gallagher, and Brown (2013), but these reports addressed different research questions (i.e., life stress and depression, and mood-state distortion, respectively).

(i.e., single measures) in the current study. A latent variable model was used for the disorders in order to synthesize information from self-report and interview measures, and to enhance reliability and validity by removing sources of measure-specific error (e.g., Brown, 2006). The measures described below have been used successfully in the literature previously to construct latent depression and social phobia variables, in this sample and other independent samples (see Brown, 2007; Brown & Naragon-Gainey, 2013; Brown & Rosellini, 2011; Naragon-Gainey, Gallagher, & Brown, 2013). In each of these manuscripts, fit indices indicated that the latent variable model was a good fit to the data and factor loadings were strong, suggesting that each measure was assessing the same underlying construct.

Social Phobia

A latent variable of social phobia severity was formed using composite scores of (a) the Social Interaction Anxiety Scale (Mattick & Clarke, 1998; cf. E.J. Brown et al., 1997); (b) the sum of ADIS-IV-L dimensional ratings of the fear of 13 social situations (e.g., initiating a conversation, participating at meetings and/or classes), ranging from 0 = *no fear* to 8 = *very severe fear*; and (c) the Social Phobia Scale of the Albany Panic and Phobia Questionnaire (Rapee, Craske, & Barlow, 1994/ 1995; cf. Brown, White, & Barlow, 2005).

Depression

A latent variable of unipolar depression was formed using the following indicators: (a) Depression scale of the 21-item version of the Depression Anxiety Stress Scales (DASS-D; Lovibond & Lovibond, 1995; cf. Antony, Bieling, Cox, Enns, & Swinson, 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997); (b) Beck Depression Inventory (BDI; Beck & Steer, 1987); and (c) the sum of ADIS-IV dimensional ratings of the nine-symptom criteria of *DSM–IV* major depression, which ranged from 0 (*none*) to 8 (*very severe*). Similar to prior studies (e.g., Brown, 2007; Brown et al., 1998; Brown & Rosellini, 2011), the BDI was scored using the 10 items that load on a Cognitive/Affective factor (Items 1–9, 13) because they are more specific to the unipolar mood disorders.

Extraversion

Extraversion was assessed with the NEO Five-Factor Inventory (NFFI; Costa & McCrae, 1992). NFFI is a 60-item self-report measure of the five-factor model personality including self-descriptive statements rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The extraversion scale consists of 12 items. The five-factor structure of the NFFI has been supported in clinical samples (Rosellini & Brown, 2011), and each domain of the NFFI has been found to possess adequate internal consistency (Costa & McCrae, 1992) and temporal stability (Robins, Fraley, Roberts, & Trzesniewski, 2001).

Anxiety Sensitivity

Anxiety sensitivity was assessed with the Anxiety Sensitivity Index (ASI; Reiss et al., 1986), which is rated on a 5-point Likert scale. The measure has good internal consistency (α ranges from .82 to .91) and acceptable test–retest reliability of .75 over 2 weeks (Reiss et al., 1986) and .71 over 3 years (Maller & Reiss, 1992). Factor analyses have revealed a multidimensional structure for the ASI. Factor structures are inconsistent across studies, but a three-factor solution is the most robust (Zinbarg, Mohlman, & Hong, 1999). The current consensus is that anxiety sensitivity is structured hierarchically, with the higher-order trait breaking down into these three lower-order dimensions: physical concerns, cognitive concerns, and social concerns (e.g., Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004; Zinbarg et al., 1997). Although there has been conflicting evidence as to whether AS is taxonic or dimensional in nature, recent analyses using factor mixture modeling have found evidence of both categorical and dimensional variability (e.g., Bernstein, Strickle, & Schmidt, 2013). Because dimensional measures tend to be more reliable and valid than categorical measures (Markon, Chmielewski, & Miller, 2011), we scored AS dimensionally in all analyses.

DATA ANALYSIS

The raw data were analyzed using a latent variable software program and maximum-likelihood minimization functions (Mplus 6.0; Muthén & Muthén, 1998–2010), and the metric of each disorder latent variable was set with marker indicators (i.e., the first measure listed above for each disorder). The error terms of the interview measures of the latent variables (i.e., the ADIS-IV dimensional ratings) were allowed to correlate to account for their shared method variance. Missing data were accommodated in all analyses using direct maximum likelihood (cf. Allison, 2003; Raykov, 2005). Goodness of fit of the models was evaluated using the root mean square error of approximation (RMSEA), the Tucker–Lewis index (TLI), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). Acceptable model fit was defined in part by the criteria described by Hu and Bentler (1999): RMSEA values close to 0.06 or below, CFI and TLI values close to .95 or above, and SRMR values close to .08

or below. The acceptability of the models was further evaluated by the presence/absence of salient localized areas of strains in the solutions (e.g., modification indices) and the strength and interpretability of the parameter estimates. Given our hypotheses that, of the three lower-order AS dimensions, the social component would be most strongly correlated with social anxiety and the cognitive component would be most strongly correlated with depression, we used the Steiger z-test procedure (Meng, Rosenthal, & Rubin, 1992) to test the differential magnitudes of these correlations.

A series of structural regression models was conducted to evaluate the contributions of the main effects and interaction of extraversion and AS in the prediction of social anxiety and depression. The structural models were specified in a hierarchical fashion. In the first model, Social Anxiety or Depression was regressed on the main effects of AS and extraversion. The Extraversion × AS interaction term was added as a predictor in the second model to test its incremental predictive utility. In all regressions, the main effect variables were mean centered prior to calculating the interaction term to facilitate interpretation and limit the potential impact of multicollinearity. Separate analyses were conducted for higher-order (i.e., total) AS, as well as for each of the three lower-order AS dimensions. Next, regressions that include the main effect of the noncriterion disorder construct (i.e., predicting Depression while holding Social Anxiety constant, and predicting Social Anxiety while holding Depression constant) were run to account for shared variance between the disorder constructs. Last, the three lower-order dimensions of AS were entered simultaneously (i.e., three AS main effects and extraversion in the first structural model, and the addition of three interaction terms

in the second structural model) into regression models for both disorder constructs, while holding constant Depression or Social Anxiety. These latter analyses tested the hypotheses that (a) among the AS components, only the main effect of social AS will remain predictive of Social Anxiety; (b) among the interaction terms, only the Social AS × Extraversion interaction will remain predictive of Social Anxiety; and (c) among the AS components, only the main effect of cognitive AS will remain predictive of Depression.

Results

DESCRIPTIVE STATISTICS

The indicators of Social Anxiety (rs = .78 to .83) were strongly correlated with one another, as were those of Depression (rs = .68 to .80). The latent variable model for Social Anxiety and Depression provided a good fit to the data based on most fit indices: $\chi^2(7)$ = 83.63, p < .001; CFI = .98; TLI = 0.95; RMSEA = 0.11 (90% confidence interval = .09 to .14); SRMR = .05. Because all overall fit indices indicated good fit, no salient areas of strain were identified in the model, and the model is near saturation (df = 7), the high RMSEA value likely reflects the fact that the RMSEA strongly penalizes greater model saturation, as opposed to indicating a problem with model fit. All standardized factor loadings were large and highly significant (loadings = .72 to .91; p < .001), and Depression and Social Anxiety were moderately correlated with one another (r = .42).

Means, standard deviations, and zero-order correlations among the disorder latent variables, AS, and extraversion are shown in Table 1. As expected in a clinical sample, mean levels of AS (M = 26.67, SD = 13.14) were significantly higher (p < .0001) than published normative levels of AS (M = 18.70, SD = 9.11). Both disorder construct

Table 1
Descriptive Statistics and Correlations among Constructs

	M	SD	1	2	3	4	5	6
1. Depression	0.00	5.03						
2. Social Anxiety	0.00	19.06	.42***					
3. Total AS	26.67	13.14	.34***	.26***				
4. Physical AS	13.33	8.06	.17***	.06	.90***			
5. Cognitive AS	5.42	4.31	.44***	.25***	.79***	.54***		
6. Social AS	7.94	3.52	.35***	.51***	.68***	.41***	.50***	
7. Extraversion	25.61	4.79	-.09*	-.23***	.18***	.18***	.13***	.08*

Note. N = 826. AS = anxiety sensitivity. Depression and Social Anxiety are latent variables with the mean set to zero and the scale set by the marker indicator (see text).
* p < .05; ** p < .01; *** p < .001.

Table 2
Interaction of Extraversion and Anxiety Sensitivity in Predicting Social Anxiety and Depression

Predictors	Social Anxiety			Depression		
	Path coefficient	SE	Total R^2	Path coefficient	SE	Total R^2
Higher Order AS						
Main effects			.15			.13
Extraversion	-.29***	.03		-.16***	.04	
Total AS	.31***	.03		.36***	.04	
Gender						
Interaction effects			.17			.14
Extraversion X Total AS	-.16***	.03		-.08*	.04	
Lower Order AS						
Main effects			.07			.04
Extraversion	-.26***	.04		-.13**	.04	
Physical AS	.10**	.04		.18***	.04	
Interaction effect			.08			.04
Extraversion X Physical AS	-.12**	.04		-.07	.04	
Main effects			.14			.21
Extraversion	-.28***	.03		-.15***	.03	
Cognitive AS	.29***	.03		.46***	.03	
Interaction effect			.16			.22
Extraversion X Cognitive AS	-.15***	.03		-.09**	.03	
Main effects			.34			.13
Extraversion	-.28***	.03		-.12***	.04	
Social AS	.54***	.03		.35***	.03	
Interaction effect			.36			.14
Extraversion X Social AS	-.16***	.03		-.10**	.04	

Note. N = 826. AS = anxiety sensitivity; SE = standard error. Path coefficients are completely standardized. Two structural regression models were run for each analysis: the first had main effects only, and the second added the interaction terms. However, the parameter estimates for the main effects are only shown from the first structural model for presentational clarity.
* $p < .05$; ** $p < .01$; *** $p < .001$.

latent variables were correlated with total AS (rs = .26 and .34), and extraversion was correlated with Social Anxiety ($r = -.23$) but only negligibly correlated with Depression ($r = -.09$). Consistent with hypotheses regarding differential associations of AS components with the disorders, the social component of AS was most strongly associated with Social Anxiety (zs = 13.14 and 8.40; $p < .0001$) and the cognitive component was most strongly associated with Depression (zs = 2.88 and 8.74; $p < .01$). Physical AS was not significantly associated with Social Anxiety ($r = .06, p > .05$). Extraversion and AS were only weakly associated ($r = .18$), and the three AS components were moderately correlated with one another (rs = .41 to .54).

INTERACTION OF ANXIETY SENSITIVITY AND EXTRAVERSION

Basic Model
We examined the main effects and interaction of extraversion and AS in the prediction of social

anxiety and depression (see Table 2).[3] The main effects of total (i.e., higher-order) AS and extraversion were significant predictors of both disorder constructs. Furthermore, the interaction of AS and extraversion was a significant predictor of Social Anxiety ($\beta = -.16, p < .001$), whereas the interaction term was significant but weak for Depression ($\beta = -.08, p < .05$). Consistent with our hypothesis, the nature of the interactions was such that the strength of the relationship between extraversion and each disorder construct increased as levels of AS increased (see Figure 1

[3] Because gender is differentially associated with anxiety sensitivity (e.g., Stewart, Taylor, & Baker, 1997) and internalizing psychopathology, we ran models in which gender was included to evaluate whether it moderated the interaction of extraversion and AS, or interacted individually with either extraversion or AS. None of these interaction terms were significant in predicting social anxiety or depression, and the other parameter estimates were largely unchanged.
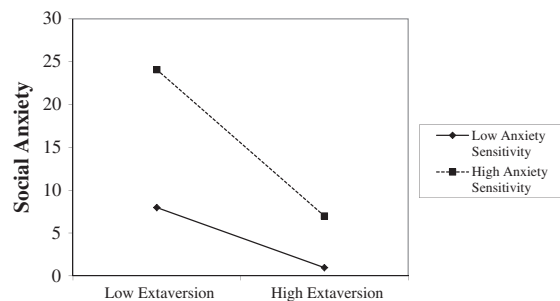
FIGURE 1   Interaction of extraversion and anxiety sensitivity (total score) on social anxiety. "High" and "low" values are one standard deviation above and below the mean, respectively.

for an illustration).[4] The addition of the interaction term explained a relatively small proportion of the variance, accounting for 2% additional variance in Social Anxiety and 1% additional variance in Depression. At the lower-order level of AS, the main effects of each of the AS dimensions were significant predictors of both disorder constructs (Table 2). In particular, social AS strongly predicted Social Anxiety ($\beta = .54$, $p < .001$) and cognitive AS strongly predicted Depression ($\beta = .46$, $p < .001$). The interaction between extraversion and physical AS was significant for Social Anxiety ($\beta = -.12$, $p < .01$; $\Delta R^2 = .01$), but not for Depression ($\beta = -.07$, $p > .05$; $\Delta R^2 < .01$). In contrast, the Cognitive AS × Extraversion and Social AS × Extraversion interactions were significant predictors of both disorder constructs (βs = $-.09$ to -.16, $p < .01$; $\Delta R^2 = .02$ for Social Anxiety and .01 for Depression). In all cases, the interactions were in the same direction as in the higher-order AS analyses (i.e., higher levels of AS were associated with a stronger relationship between extraversion and Social Anxiety or Depression).

Models Accounting for Shared Variance Among Predictors and Outcomes

Next, we examined the impact of accounting for (a) shared variance between Social Anxiety and

Depression, and (b) shared variance among the three AS components. Results are shown in Table 3. Consistent with our hypothesis, when higher-order AS or the lower-order components were examined and Depression was held constant, all of the Extraversion × AS interactions remained significant for Social Anxiety (βs = $-.10$ to -.13, $p < .01$; $\Delta R^2 = .01$ to .02). However, none of these interactions predicted Depression (βs = $-.02$ to -.05, $p > .05$; $\Delta R^2 < .01$) after holding levels of Social Anxiety constant, suggesting that that the contribution of the Extraversion × AS interaction to Depression is due to variance that Depression shares with Social Anxiety. Of note, when Social Anxiety was included in the models, extraversion no longer had a main effect on Depression.

Last, we entered the three lower order dimensions of AS simultaneously (i.e., three main effects of AS components, main effect of extraversion, and three AS component interactions with extraversion) to account for shared variance among them (see the bottom portion of Table 3). Our hypothesis that among the AS components, only the main effect and interaction of social AS would remain predictive of Social Anxiety was partially supported, in that social AS had the only significant positive main effect on Social Anxiety among the AS components ($\beta = .51$, $p < .001$). However, physical AS did have a significant *negative* main effect (i.e., a suppressor effect) on Social Anxiety ($\beta = -.15$, $p < .001$). As expected, the only interaction term that remained a significant predictor of Social Anxiety was the social concerns component of AS with extraversion ($\beta = -.13$, $p < .001$), after accounting for shared variance among the three AS interaction terms. In contrast, cognitive AS, but not physical or social AS, had a significant main effect on Depression ($\beta = .40$, $p < .001$), and none of the interaction terms was significant (βs = .02 to -.06, $p > .05$). These models accounted for 43% of the variance in Social Anxiety and 31% of the variance in Depression.

Discussion

We examined one element of an etiological model of social anxiety disorder— specifically, that temperament (i.e., extraversion) and catastrophic responses to anxiety (i.e., anxiety sensitivity) interact to contribute to social anxiety—in a large, diagnostically diverse clinical sample. Disorder constructs were assessed with multiple self-report and interview measures. At higher levels of AS, the inverse association between extraversion and social anxiety was stronger, and the social concerns component of AS appears to drive this effect.

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[4] To further probe this interaction, we calculated simple slopes for the model examining the interaction between extraversion and anxiety sensitivity in predicting social anxiety. We did this in two ways: (a) simple slopes at one standard deviation below the mean, at the mean, and one standard deviation above the mean; and (b) using theoretically meaningful values by examining simple slopes at the ASI scores of normative control samples (18.7) and at the mean for social phobia according to a meta-analysis (30.5; Naragon-Gainey, 2010). In all of the above cases, the simple slope values were significantly different from zero at $p < .001$ and indicated a negative association between extraversion and social anxiety. As suggested by the interaction term in the regression model, the coefficients were larger at higher values of anxiety sensitivity. More detailed results from these analyses are available from the first author upon request.

Table 3

Interaction of Extraversion and Anxiety Sensitivity in Predicting Social Anxiety and Depression, Holding the Other Disorder Constant

Predictors	Social Anxiety			Depression		
	Path coefficient	SE	Total R^2	Path coefficient	SE	Total R^2
Higher Order AS						
Main effects			.25			.24
Extraversion	-.24***	.03		-.05	.04	
Total AS	.18***	.03		.26***	.04	
Depression or Social Anxiety	.34***	.04		.34***	.04	
Interaction effect			.26			.24
Extraversion X Total AS	-.13***	.03		-.03	.03	
Lower Order AS						
Main effects			.22			.20
Extraversion	-.20***	.03		-.02	.04	
Physical AS	.03	.03		.15***	.03	
Depression or Social Anxiety	.40***	.03		.41***	.03	
Interaction effect			.23			.20
Extraversion X Physical AS	-.10**	.03		-.02	.03	
Main effects			.23			.30
Extraversion	-.22***	.03		-.06	.03	
Cognitive AS	.13**	.04		.37***	.03	
Depression or Social Anxiety	.35***	.04		.31***	.04	
Interaction effect			.24			.30
Extraversion X Cognitive AS	-.12***	.03		-.05	.03	
Main effects			.39			.20
Extraversion	-.25***	.03		-.03	.04	
Social AS	.45***	.03		.18***	.04	
Depression or Social Anxiety	.25***	.03		.32***	.04	
Interaction effect			.41			.20
Extraversion X Social AS	-.13***	.03		-.05	.04	
All Lower Order AS Dimensions Together						
Main effects			.41			.31
Extraversion	-.23***	.03		-.06	.03	
Physical AS	-.15***	.04		-.07	.04	
Cognitive AS	.00	.04		.40***	.04	
Social AS	.51***	.03		.03	.04	
Depression or Social Anxiety	.25***	.04		.30***	.04	
Interaction effects			.43			.31
Extraversion X Physical AS	.02	.02		.02	.04	
Extraversion X Cognitive AS	-.02	.04		-.03	.04	
Extraversion X Social AS	-.13***	.04		-.06	.04	

Note. N = 826. AS = anxiety sensitivity; SE = standard error. Path coefficients are completely standardized. Two structural regression models were run for each analysis: the first had main effects only, and the second added the interaction terms. However, the parameter estimates for the main effects are only shown from the first structural model for presentational clarity.

* $p < .05$; ** $p < .01$; *** $p < .001$.

However, it should be noted that the magnitude of the effect sizes of the interactions was small (Cohen & Cohen, 1983), accounting for 1% to 2% of the variance in social anxiety. Although this interaction was also observed with regard to depression, the interaction was not present after accounting for shared variance between depression and social anxiety, and therefore appears to show specificity to social anxiety.

These findings inform our understanding of the etiology of social anxiety by providing a more nuanced view of how two distinct risk factors may contribute to social anxiety. Consistent with cognitive-behavioral models of social anxiety (e.g., Rapee & Heimberg, 1997), anxiety about how others might perceive one's anxiety (i.e., the social component of AS) is specifically linked to social anxiety disorder, independently and in interaction

with extraversion. Etiological models such as the triple vulnerability model (Barlow, 2000, 2002) suggest that emotional disorders develop as the result of generalized biological vulnerabilities (such as temperamental traits), generalized psychological vulnerabilities (such as low perceived control), and specific psychological vulnerabilities (such as anxiety sensitivity) that determine the focus of distress. This model posits that these risk factors interact with one another, above and beyond the main effects of each, suggesting that a full understanding of the processes relevant to emotional disorder requires a consideration of multiple risk factors, both narrow and broad. While the triple vulnerability model has not yet been extensively empirically investigated, the current study joins several others in establishing the utility of investigating more than one level of vulnerability simultaneously (Bentley et al., 2013; Brown & Naragon-Gainey, 2013).

Anxiety sensitivity is most frequently and strongly associated with panic disorder (e.g., Naragon-Gainey, 2010), and CBT for panic disorder routinely includes interoceptive exposures. In addition, treatments have been developed that specifically aim to decrease levels of anxiety sensitivity and can do so effectively even within the context of brief treatments (e.g., Keough & Schmidt, 2012; Schmidt et al., 2007). Recently, several treatments have been developed that target transdiagnostic processes associated with numerous emotional disorder, in part to better address comorbidity that is common across these disorders. For example, the Unified Protocol for the emotional disorders (Barlow et al., 2011) is a CBT treatment that has numerous modules that are given to all clients, regardless of which specific emotional disorder(s) they may have. There is evidence that the interoceptive exposure component of the Unified Protocol reduces anxiety sensitivity across numerous emotional disorders (including social anxiety disorder), and reductions in AS were correlated with reductions in symptoms (Boswell et al., 2013). Given that social AS is particularly focused on attributions about other's perceptions (e.g., that they will notice and view anxiety symptoms negatively), cognitive restructuring and behavioral experiments focused on how and to what degree others notice symptoms of anxiety may be especially helpful in conjunction with interoceptive exposures.

Social anxiety and depression are closely related in terms of associations with temperament (e.g., Naragon-Gainey & Watson, 2011; Naragon-Gainey et al., 2009) and anxiety sensitivity (Naragon-Gainey, 2010), as well as high rates of comorbidity (e.g., Kessler et al., 2005). Consistent with past literature (Naragon-Gainey, 2010), the current study found

that social anxiety was most strongly related to the social AS component, whereas depression was most strongly associated with cognitive AS, both when examining one disorder at a time and after holding the other disorder constant. We also found evidence of specificity of the interaction of extraversion and anxiety sensitivity, in that this interaction was no longer predictive of depression after accounting for social anxiety, whereas the reverse was not true. Thus, it appears that anxiety sensitivity functions differently in these two disorders, and that anxiety sensitivity may not be as closely and specifically linked to depression. It is noteworthy that cognitive AS remained a strong independent predictor of depression, even after accounting for social anxiety. This is consistent with some prior research (e.g., Cox, Enns, Freeman, & Walker, 2001; Schmidt, Lerew, & Joiner, 1998), although others have failed to find a specific association with depression after accounting for sources of comorbidity (e.g., Lewis et al., 2010). One explanation for these mixed results may be that depression is not specifically associated with cognitive AS, but rather depression's large component of general distress/dysphoria is primarily responsible for the observed association (Lewis et al.; Watson et al., 2005).

Several limitations should be noted when interpreting our results. First, this study is cross-sectional in design and therefore we were not able to determine the directionality of associations or how these vulnerabilities may interact with one another over time. This is particularly relevant given that both extraversion and AS are self-reported constructs that overlap to some degree (as opposed to biological or environmental risk factors and moderators, as suggested by Nolen-Hoeksema and Watkins, 2011). Longitudinal studies are important in gaining a better understanding of the dynamic nature of these vulnerabilities. Second, we only included two disorders and two risk factors in the current study, and the effect sizes for the interactions were small; it will be important to examine larger networks of disorders and vulnerabilities to draw more precise conclusions about the specificity of associations and the robustness of these findings. Last, participants all presented for psychological treatment and almost all had one or more current psychological disorders. Future research should prospectively examine these risk factors and symptoms in a sample that is not currently disordered to assess the generalizability of our findings. Despite these limitations, the current study adds to the literature by simultaneously evaluating the interaction of multiple, individual differences that confer risk for social anxiety and depression within a large clinical sample, finding evidence of an interactive effect that is specific to social anxiety.

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