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Social Phobia and Response to Challenge Procedures: Examining the Interaction Between Anxiety Sensitivity and Trait Anxiety

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Abstract — Anxiety sensitivity (AS) has been posited to amplify anxiety reactions, because anxiety itself may become a fear stimulus in high AS persons. Based in part on theoretical statements by McNally (1989), we predicted that AS and trait anxiety would *interact* to produce anxiety following potentially threatening experiences. To investigate this possibility, we examined the responses of 62 social phobics to two challenge procedures: (1) a modified Stroop task consisting of socially threatening, physically threatening, and color comparison words and (2) a behavior test in which subjects were exposed to a simulation of a personally relevant feared situation. The combined main effects of AS and trait anxiety were not predictive of anxiety response to either procedure. Nevertheless, in two of five cases, the interaction between AS and

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trait anxiety accounted for a statistically significant increment in variance relative to the combined main effects of these two variables; in a third case, the increment in variance was marginally significant. Moreover, in all three cases, the direction of this interaction was in the predicted direction. Although these results are preliminary and require replication, they illustrate the potential utility of examining the interaction between AS and trait anxiety and the relevance of the AS construct to social phobia.

Anxiety sensitivity (AS) is an individual difference variable consisting of beliefs concerning the consequences of one's anxiety and anxiety-related sensations. Specifically, individuals with elevated AS tend to believe that their anxiety and anxiety-related sensations (e.g., rapid heart beat) portend harmful or noxious consequences (e.g., heart attack) (Reiss & McNally, 1985; Reiss, Peterson, Gursky, & McNally, 1986). In turn, such individuals tend to develop fear of their anxiety, which can then become a stimulus for further fear. AS is thus posited to be a *reactive* construct that amplifies anxiety responses (Reiss, 1991; Reiss et al., 1986). Because of its reactive property, AS has been hypothesized (e.g., McNally, 1990) to increase risk for the "fear-of-fear" cycles (Goldstein & Chambless, 1978) that can culminate in panic attacks.

Reiss et al. (1986) have operationalized the AS construct by means of the Anxiety Sensitivity Index (ASI), a self-report measure consisting of 16 items dealing with beliefs concerning, and in some cases fears of, the consequences of anxiety (e.g., "It scares me when my heart beats rapidly"). As noted by Peterson and Reiss (1987) and Reiss (1991), the ASI exhibits theoretically meaningful relations with a number of variables. For example, the ASI scores of panic disordered patients tend to be elevated (Reiss et al., 1986) and to normalize following cognitive-behavioral treatment (McNally & Lorenz, 1987). The ASI has also been found to predict high scores on both self-report and physiological measures of anxiety in response to challenge (i.e., potentially anxiety-provoking) procedures, such as hyperventilation (e.g., Holloway & McNally, 1987; but see Lilienfeld, Jacob, & Turner, 1989, for a critique), speaking about one's own experiences with anxiety (Maller & Reiss, 1987), and mental arithmetic (Shostak & Peterson, 1990). Moreover, the ASI predicts anxiety in response to hyperventilation even among subjects with no prior history of panic attacks (Donnell & McNally, 1989).

Nevertheless, the construct validity of the ASI and the construct of AS have not gone unchallenged (Lilienfeld et al., 1989; Lilienfeld, Turner, & Jacob, in press). Specifically, Lilienfeld et al. and other investigators (e.g., Brown & Cash, 1990) have conjectured that at least some of the findings attributed to AS might be more parsimoniously explained by trait anxiety. The ASI and measures of trait anxiety, such as the trait version of the State-Trait Anxiety Inventory (STAI-T; Spielberger, Gorsuch, & Lushene, 1970), have generally been found moderately intercorrelated (Lilienfeld et al., 1989; Reiss, 1991), which is consistent with the possibility that the ASI and trait anxiety indices assess overlapping constructs. Moreover, like the ASI, trait anxiety measures tend to be elevated among panic disordered patients (Barlow, 1988) and to be sensitive to the effects of treatments for panic disorder (Michelson, 1987).

In response to Lilienfeld et al.'s (1989) commentary, McNally (1989) reported new data (from Holloway & McNally, 1987) suggesting that the ASI contributes to the prediction of postchallenge anxiety over and above a trait anxiety index (the STAI). He pointed out that trait anxiety is a general predisposition to react anxiously to anxiety-provoking stimuli, whereas AS is a more specific predisposition to react anxiously to one's anxiety and anxiety-related sensations. Pursuing this line of reasoning, McNally (1989) posited that:

> Although trait anxious individuals respond with excessive fear to threatening stimuli, by definition they will not respond fearfully to anxiety symptoms unless they construe them as threatening. In other words, anxiety symptoms should not evoke further fear in trait anxious persons who do not have concurrent high anxiety sensitivity. (p. 193)

Implications of this statement seem to have been largely or entirely overlooked in the AS literature. Specifically, McNally's statement appears to imply that individuals with *both* elevated trait anxiety *and* elevated AS will be prone to considerably more marked anxiety reactions in response to challenge procedures than individuals with *either* elevated trait anxiety alone *or* elevated AS alone (or neither) (McNally has acknowledged that he concurs with this prediction; personal communication, February, 1992). This prediction is consistent with the claim that AS is an amplifier of preexisting anxiety (Reiss, 1991; Reiss & McNally, 1985).

The reasons for the above prediction are as follows. First, because individuals with low trait anxiety should experience little or no anxiety immediately following challenge, presence of high AS should exert minimal influence upon postchallenge anxiety (because there is little or no initial anxiety to amplify). Second, although individuals with high trait anxiety should experience at least mild anxiety immediately following challenge, *absence* of high AS should tend to inhibit further anxious responding (because no AS-related amplification of the initial anxiety should occur).

If McNally's conjecture is correct, the *interaction* (i.e., multiplicative effects) of AS and trait anxiety should account for a significant increment in variance in anxiety reactions following challenge procedures over and above the *main effects* (i.e., additive effects) of these two variables. This prediction could be tested using moderated multiple regression techniques (e.g., Stone, 1988; Zedeck, 1971), which permit assessment of statistical interactions among predictor variables. Corroboration of this prediction would provide support for both the construct validity of the ASI and the nomological network (Cronbach & Meehl, 1955) surrounding the AS construct, and would indicate that AS theory had survived a fairly rigorous theoretical risk (Meehl, 1978; Popper, 1959).

The primary purposes of the present investigation were twofold. First, we investigated the interactional hypothesis implicit in the writings of McNally (1989) by examining the responses of subjects to two challenge procedures: an individualized behavioral test (BT) and a modified Stroop (1938) color-naming task. Five indices were derived from these two procedures, allowing several independent tests of this hypothesis.

Second, we examined the interactional hypothesis in a sample rarely utilized in AS research — social phobics — as we believed that our findings would have implications for the use of the ASI in this population. Although the ASI appears to possess at least some degree of specificity for panic disorder (McNally, 1990), ASI scores have also been found to be elevated among social phobics (Jones & Barlow, 1991; Taylor, Koch, & McNally, 1992). These findings corroborate our anecdotal observation that many social phobics are frightened of the physical sensations they experience when confronted with interpersonally threatening stimuli. Moreover, these findings are consistent with scattered reports that beta-blockers alleviate symptoms of some socially anxious individuals (Levin, Schneier, & Liebowitz, 1989), perhaps because these medications reduce the intensity of certain physical sensations (e.g., palpitations). Finally, both panic attacks and panic disorder frequently occur among social phobics (Barlow, Vermilyea, Blanchard, Vermilyea, DiNardo, & Cerny, 1985; also see Barlow, 1988). Thus, AS appears to be a relevant construct for examining the responses of social phobics to potentially anxiety-provoking procedures.

METHOD

Subjects

Subjects were 26 females and 36 males who met DSM-III-R (American Psychiatric Association, 1987) criteria for social phobia. Their mean age was 36.53 (SD = 9.56). All subjects were outpatients who presented for treatment at the Center for Stress and Anxiety Disorders at the University at Albany, State University of New York. The data analyzed in the present study were extracted from a comprehensive pretreatment assessment battery that was administered as part of a larger study comparing treatments for social phobia. Diagnoses were assigned on the basis of a structured clinical interview, the Anxiety Disorders Interview Schedule-Revised (ADIS-R; DiNardo & Barlow, 1988), which was administered by either an advanced graduate student or a clinical psychologist. ADIS-R interviewers underwent a program of training that consisted of observing three interviews, and then matching diagnoses with trained interviewers on three interviews within one point of severity on a 9-point scale. Among trained interviewers, the ADIS-R has yielded high rates of interrater reliability for the diagnosis of social phobia ($K = 0.87$; Barlow & DiNardo, 1991).

Of the 62 subjects with social phobia, 11 had secondary diagnoses of panic disorder (6 with agoraphobia, 5 without agoraphobia). One subject had a history of agoraphobia without panic disorder. The other secondary diagnoses in the sample were generalized anxiety disorder ($N = 16$), simple phobia ($N = 13$), major depressive episode ($N = 7$), depression not otherwise specified ($N = 5$), dysthymia ($N = 4$), posttraumatic stress disorder ($N = 2$), obsessive-compulsive disorder ($N = 1$), bipolar disorder ($N = 1$), alcohol dependence ($N = 1$), and female sexual arousal disorder ($N = 1$).

Measures

Prior to the challenge procedures, subjects were given a battery of questionnaires to complete at home. Included in this battery were the trait version of the STAI (STAI-T) (Spielberger et al., 1970) and the ASI (Reiss et al., 1986). Data on the relations between the ASI and other self-report measures of personality and psychopathology in this sample will be reported in a forthcoming communication.

Procedures

As part of the pretreatment assessment, subjects were asked to participate in two challenge procedures. In both procedures, experimenters were blind to subjects' STAI-T and ASI scores.

Behavior Test (BT). The first challenge procedure was an individualized BT, which required each subject to participate in a laboratory simulation of a personally relevant phobic event (e.g., public speaking, one-on-one conversation) while being videotaped. During a preliminary interview, subjects were instructed in the use of a 0–100 subjective units of discomfort scale (SUDS) (see Wolpe, 1958) and, in collaboration with the interviewer, constructed a hierarchy of real-life situations that evoked anxiety. BT situations were selected from those stimuli reported by the subject to elicit a SUDS of at least 75.

During the anticipatory phase, beginning two and one-half minutes before the BT, the subject was informed of the nature of the upcoming performance, asked to give an initial anticipatory SUDS rating, and solicited for additional anticipatory SUDS ratings at minutes 1 and 2. A mean anticipatory SUDS rating (MNASUDS) was calculated from these data. Thereafter, the subject was escorted into a second room and asked to stand before the camera and role-play the situation with research assistants, who played the role of audience or interaction partners. Performance SUDS ratings were solicited initially, and once a minute for the duration of the four-minute BT. A mean performance SUDS rating (MNPSUDS) was calculated from these data.[1]

Stroop task. The second challenge procedure was a modified, computerized version of the traditional Stroop (1938) color-naming task. Modified versions of the Stroop task have been utilized in a number of studies (e.g., Foa, Feske, Murdock, Kozak, & McCarthy, 1991; Lavy, van den Hout, & Arntz, 1993; Mathews & MacLeod, 1985; McNally, Riemann, Louro, Lukach, & Kim, 1992; Watts, McKenna, Sharrock, & Trezise, 1986) to examine the hypothesis that anxious individuals selectively attend to potentially threatening stimuli. Anxious subjects have consistently been found to exhibit greater amounts of Stroop interference when asked to name the color of threat-related words whose content is relevant to their disorder than when asked to name other words (Heimberg, 1994). Social phobics, for example, have been reported to exhibit longer latencies than comparison subjects when naming the color of socially threatening words (Hope, Rapee, Heimberg, & Dombeck, 1990; Mattia, Heimberg, & Hope, 1993).

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[1]In addition to mean SUDS scores (anticipatory and performance) in the BT, peak scores were also calculated. Given the extremely high correlations between mean and peak anticipatory SUDS $r = .95$, $p < .001$) and mean and peak performance SUDS ($r = .91$, $p < .001$), only mean findings are reported in the text of the paper. Moderated multiple regression analyses using the two peak SUDS indices as dependent variables yielded virtually identical results to those using mean SUDS.

The modified Stroop task used in this study contained two types of stimuli in addition to color names: (1) socially threatening words (e.g., failure), and (2) physically threatening words (e.g., fatal). These threat words were matched for number of syllables, letters, and frequency of usage with two groups of neutral comparison words (Carroll, Davies, & Richman, 1971). Color names were matched with groups of five *X*s. The colors of the stimuli were blue, green, red, white, and yellow (for additional technical information regarding this task, see Mattia et al., 1993).

After a sample presentation, which also assessed for color blindness, subjects were presented with the first screen and told to name the colors as quickly and accurately as possible. Five subjects were excluded or had missing data on the entire Stroop task due to partial color blindness (3), dyslexia (1), and severe speech impediment (1), leaving a maximum of 57 subjects for the analyses of the Stroop data. In addition, computer difficulties resulted in missing data for three subjects on the color screen and for two on the social threat screen. Time was kept by the experimenter, who pressed the keyboard at the beginning and end of each trial.

Three indices were computed from the Stroop procedure: color name index (latency for color names minus latency for *X*s), social threat index (latency for social threat words minus latency for matched comparison words), and physical threat index (latency for physical threat words minus latency for matched comparison words).

RESULTS

Descriptive Statistics

The means and standard deviations of the ASI, STAI-T, and the challenge measures are presented in Table 1. The mean scores for both the ASI and STAI-T were roughly comparable with those of social phobics in other studies. Taylor et al. (1992), for example, reported that the mean ASI score of a sample of social phobics was 24.9 (also see Jones & Barlow, 1991). Kanter and Goldfried (1979) reported that the mean STAI-T score of a sample of socially anxious community residents was 50.9 (also see McNally, Taylor, Koch, & Louro, 1991).

The mean ASI scores of subjects with a secondary diagnosis of panic disorder (26.27) did not differ significantly from those of subjects without panic disorder (22.29) ($t(60) = 1.29$, ns; Cohen's $d = .43$). In addition, the mean STAI-T scores of subjects with panic disorder (51.00) did not differ significantly from those of subjects without panic disorder (51.27) ($t(60) = .08$, ns; Cohen's $d = .06$).

Zero-Order Correlations

Because we predicted that (1) the self-report anxiety indices (ASI and STAI-T) would be positively correlated, (2) the five challenge variables would be positively correlated with each other, and (3) the self-report anxiety indices would be positively correlated with the challenge variables, one-tailed tests were used for the correlational analyses. Table 2 presents the intercorrelations

TABLE 1
MEANS AND STANDARD DEVIATIONS FOR SELF-REPORT MEASURES AND CHALLENGE VARIABLES

Variable	Mean	Standard Deviation
ASI	23.00	9.31
STAI-T	51.23	10.55
MNASUDS	43.99	22.88
MNPSUDS	58.99	21.19
COLOR	31.26	33.39
SOCIAL	5.69	10.87
PHYSICAL	4.74	9.16

N varies between 54 and 62 because of missing data. ASI = Anxiety Sensitivity Index; STAI-T = State-Trait Anxiety Inventory-Trait Form; MNASUDS = mean SUDS from the anticipatory phase of the behavior test; MNPSUDS = peak SUDS from the performance phase of the behavior test; COLOR = color names index from the modified Stroop task in seconds; SOCIAL = social threat index from the modified Stroop task in seconds; PHYSICAL = physical threat index from the modified Stroop task in seconds.

among the measures. Correlations were computed using the maximum sample size available (*N*s ranged from 54 to 62).

The correlations among measures were all positive, but in most cases fairly low. Consistent with previous findings, the ASI was significantly positively correlated with the STAI-T ($r = .23$), although this correlation was slightly lower in magnitude than that reported by other researchers (most previously

TABLE 2
INTERCORRELATIONS AMONG VARIABLES

	STAI-T	MNASUDS	MNPSUDS	COLOR	SOCIAL	PHYSICAL
ASI	.23*	.21	.08	.09	.24*	.15
STAI-T		.22*	.04	.10	.04	.06
MNASUDS			.56**	.04	.26*	.23*
MNPSUDS				.03	.03	.11
COLOR					.25*	.07
SOCIAL						.29*

N varies between 54 and 62 because of missing data. ASI = Anxiety Sensitivity Index; STAI-T = State-Trait Anxiety Inventory-Trait Form; MNASUDS = mean SUDS from the anticipatory phase of the behavior test; MNPSUDS = peak SUDS from the performance phase of the behavior test; COLOR = color names index from the modified Stroop task in seconds; SOCIAL = social threat index from the modified Stroop task in seconds; PHYSICAL = physical threat index from the modified Stroop task in seconds.
*$p < .05$, one-tailed; **$p < .001$, one-tailed.

reported correlations between the ASI and trait anxiety indices are in the .3 to .6 range; see Lilienfeld et al., 1989; Reiss, 1991). The ASI was significantly correlated with one of the five challenge variables, the social threat index from the Stroop task. Similarly, the STAI-T was significantly correlated with one of the challenge variables, MNASUDS from the BT.

Differences Between Correlations

Comparisons of the within-sample correlations of the STAI-T versus the ASI with the challenge procedure measures were performed using the test of the significance of the difference between dependent correlations (Cohen & Cohen, 1983). No significant differences emerged (two-tailed), indicating that the STAI-T and ASI were approximately equivalent in their correlations with the challenge variables.

Moderated Multiple Regression Analyses

The data were submitted to five two-step hierarchical (moderated) multiple regression analyses in which the two SUDS ratings and the three Stroop indices served as dependent measures. In each case, the combined main effects of the ASI and STAI-T were entered first (ASI + STAI-T), followed by an interaction term (ASI × STAI-T). A significant increase in the amount of variance at the second step would indicate that the interaction between the ASI and STAI-T accounted for variance over and above the combined main effects of these two variables.

For two of the five dependent measures, entry of the interaction term accounted for a statistically significant increment in the amount of variance. For MNASUDS, the combined main effects of the ASI and STAI-T at the first step did not account for a significant amount of variance: $r^2 = .07$, $F(2, 58) = 2.34$, ns. At the second step, however, the interaction term accounted for an additional 7% of the variance, boosting the r^2 to 14%, F-change $(3, 57) = 4.56$, $p < 0.04$. For the Stroop social threat index, the combined main effects of the ASI and STAI-T at the first step again failed to account for a significant amount of variance: $r^2 = .06$, $F(2, 58) = .19$, ns. Addition of the interaction term at the second step accounted for an additional 10% of the variance, boosting the r^2 to 16%, F-change $(3, 52) = 6.06$, $p < .02$.

In the case of Stroop physical threat index, the increment in variance at the second step was marginally significant. As in the other regression equations, the combined main effects of the ASI and STAI-T at the first step did not account for a significant portion of variance: $r^2 = .02$, $F(2, 54) = .65$, ns. The entry of the interaction term at the second step accounted for an additional 6% of the variance, boosting the r^2 to 8%, F-change (3, 51), $p = .07$.[2]

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[2]The state form of the STAI was also administered as part of the BT challenge. Immediately after subjects completed the role-play, they were escorted to another room and administered the STAI-S. This variable was not included in the main text of the paper because of its similarity to the STAI-T (the correlation between these two variables in this sample was .46, $p < .001$). Indeed, in multiple regression analyses with STAI-S as a dependent variable, only STAI-T was a significant predictor. Neither the addition of the ASI nor the interaction term significantly increased the proportion of variance in the STAI-S accounted for by the STAI-T.

To determine whether interactions followed the predicted pattern, such that individuals with both high STAI-T and ASI scores would be especially prone to react with excessive anxiety to challenges, subjects were placed into two groups based on a median split of STAI-T scores. Thirty-three subjects with a score of 52 or greater were classified as high STAI-T, and twenty-eight subjects scoring 51 or lower were classified as low STAI-T. ASI scores were then correlated with MNASUDS, Stroop social threat index, and Stroop physical threat index within each group.

The ASI was correlated .28 with MNASUDS among high STAI-T subjects, compared with .08 among low STAI-T subjects, although the test for the difference between independent correlations (Cohen & Cohen, 1983) was not significant (z = 1.00, ns, one-tailed). The ASI was correlated .48 with the Stroop social threat index among high STAI-T subjects, compared with –.28 for low STAI-T subjects. These correlations were significantly different from each other ($z = 2.99$, $p < .001$, one-tailed). Finally, the ASI was correlated .28 with the Stroop physical threat index among high STAI-T subjects, compared with .10 among low STAI-T subjects. These correlations were not significantly different from each other ($z = 1.16$, ns, one-tailed). Thus, in all three cases, the correlation between the ASI and response to challenge was higher among subjects with high than with low trait anxiety (although this difference was significant in only one of three cases), indicating that the interactions were in the predicted direction.

DISCUSSION

Our findings provide preliminary support for the hypothesis that the interactive effects of AS and trait anxiety are important in the prediction of response to challenge procedures, and are thus consistent with the assertion that AS is an amplifier of anxiety responses (e.g., Reiss, 1991). In addition, our results lend support to the possibility that these variables are useful for understanding the anxiety responses of social phobics. Specifically, the interaction between the ASI and STAI-T accounted for a significant increment in variance over and above the main effects of these variables for mean anxiety anticipating a behavior test and the social threat index of the Stroop task. For the physical threat index of the Stroop task, this increment in variance was marginally significant.

Our results are particularly impressive given that moderated multiple regression techniques tend to have low statistical power for detecting interactions, particularly with small sample sizes (Stone, 1988). Failure of the other two interaction terms to reach significance, however, is probably not entirely attributable to Type II error, as increments in variance at the second step were very small in magnitude. Specifically, r^2 changes for the interaction terms were .01 and .00 for MNPSUDS and the Stroop color name index, respectively. The latter negative finding does not necessarily speak strongly against our interactional hypothesis, as color-naming may not be highly threatening for most social phobics. On the other hand, social phobics have been reported to exhibit longer Stroop latencies compared with normals irrespective of stimulus type (Mattia et al., 1993). This finding may indicate that social phobics experience anxiety regarding being evaluated on the Stroop task (and perhaps many other performance tasks) in general (Heimberg, in press).

Several limitations to the present findings should be noted. As mentioned above, interaction effects were significant in only two of the five equations tested. Although two of five rejections of the null hypothesis at $p < .05$ differs significantly ($p < .03$) from chance (Siegal & Castellan, 1988, p. 326), our results clearly require replication. From the behavior test data, only MNA-SUDS was significantly predicted by the interaction term. Failure to find a similar result for MNPSUDS cannot be accounted for by restricted variance for this measure, as variances for MNASUDS and MNPSUDS were comparable (see Table 1). Further research will be required to clarify the negative finding with respect to MNPSUDS.

In addition, given that the AS construct appears to have particular relevance for panic disorder (McNally, 1990), an examination of subjects with panic disorder may provide a stronger test of our hypotheses. Because our sample size was small, we were unable to compare social phobics with panic disorder versus without panic disorder to determine whether our hypotheses would be corroborated in both groups. In addition, because virtually all of our social phobics had a history of panic attacks, we were unable to subdivide the sample meaningfully in terms of presence or absence of this variable. Clearly, replication and extension of our findings using a sample of individuals with panic disorder is warranted.

Despite these limitations, our results suggest that interaction between AS and trait anxiety should be assessed for its potential importance in the prediction of challenge response. Thus, future research on the role of AS as a predictor of anxiety responses should assess not only the contribution of AS over and above trait anxiety (e.g., Lilienfeld et al., 1989), but also the interactive effects of these two variables. Moreover, our findings suggest that AS may be a useful construct for understanding the anxiety responses of social phobics.

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