

Interpersonal Constraint Conferred by Generalized Social Anxiety Disorder Is Evident on a Behavioral Economics Task

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Although social anxiety disorder appears to confer impairment in friendships, evidence beyond self-report is minimal. We used the flexible iterated prisoner's dilemma as a simulated interaction with a friend with 27 individuals with the generalized type of social anxiety disorder and 23 demographically equivalent individuals without the disorder. Participants with generalized social anxiety disorder were less giving on the task. Lower giving was also moderately associated with interpersonal variables (e.g., coldness). A trend was also found for participants with generalized social anxiety disorder to show lower assertiveness on the task. The connection between generalized social anxiety disorder and friendship impairment appears likely to be partially explained by interpersonal constraint that is perceived by others as coldness and manifests in a behavioral economics task.

Keywords: Social anxiety disorder, behavioral economics, interpersonal processes, interpersonal circumplex

Evidence suggests that friendships are impaired by social anxiety disorder (SAD) (Rodebaugh, 2009). Direct observation in laboratory studies of social anxiety has clarified the interpersonal behavior that might be responsible for this impairment. Across studies, individuals with higher social anxiety either appear colder (or less warm) during social interactions, display warm behaviors that are not synchronous with the behaviors of others, or both (see, e.g., Alden & Taylor, 2010, for a review). In social situations that would normally lead to greater disclosure or interpersonal investment, higher social anxiety may lead individuals to behave in an apparently cold manner (Alden & Bieling, 1998; Kachin, Newman, & Pincus, 2001). We hypothesize that lack of response to warmth might be a primary mechanism by which SAD impairs friendships.

Although the available experimental literature focuses largely on interactions with strangers (e.g., Alden & Bieling, 1998; Meleshko & Alden, 1993), we theorize that these same processes extend to friendships. In support of this reasoning, Rodebaugh and colleagues found that social anxiety was indirectly associated

(through negative reactions to favors) with less cooperation with imagined friends in a prisoner's dilemma game (Rodebaugh, Klein, Yarkoni, & Langer, 2011). However, no direct effects for social anxiety were found, which the authors speculated was because of the sample (i.e., undergraduates); therefore, the study requires replication and extension in a sample including participants with SAD.

The Flexible Iterated Prisoner's Dilemma (FIPD) simulation used by Rodebaugh and colleagues (2011) is of interest as a direct quantification of interpersonal behavior that allows the manipulation of partner response and does not require the presence of a relationship partner. Rodebaugh et al. provided some initial evidence of the external validity of the FIPD, including evidence that self-report of higher discomfort with friendly favors only related to behavior when participants were simulating an interaction with a friend (and not a stranger). Rodebaugh and colleagues also tested a wide variety of more general competing predictors (e.g., neuroticism) and found that when all of those predictors were entered in the same regression, only self-reported discomfort with favors was statistically significant in predicting FIPD behavior with a simulated friend, suggesting good specificity of the task. If the FIPD can indeed be used as a sample of interpersonal behavior, clinicians and researchers would have a new and inexpensive tool for collecting interpersonal behavior that ties directly into a large behavioral economics literature and an expanding clinical and neuroscience literature (e.g., Majolo et al., 2006; McClure-Tone et al., 2011).

The Current Study

The current study extends beyond Rodebaugh et al.'s (2011) study by using the FIPD to simulate interpersonal exchanges with a friend in a generalized SAD (GSAD) group versus a group of participants who showed no indication of having SAD (NOSAD). Further, we experimentally manipulated the behavior of the sim-

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ulated friend to examine whether individuals with GSAD show nonassertive behavior in simulated interactions with friends who behave in a less friendly manner. We expected GSAD participants would give less to their simulated friends (in a first round) and show less of an assertive reaction to noncooperative behavior (i.e., defection, in a second round).¹

Method

Participants

Participants included individuals diagnosed with GSAD ($n = 27$) and NOSAD participants (NOSAD; $n = 23$). Demographic characteristics are displayed in Table 1. GSAD participants were recruited through advertisement by website and flyers posted in public and at clinics in a Midwest metropolitan area. NOSAD participants were selectively recruited from a volunteer registry to be demographically equivalent. Participants were excluded for current psychosis, mania, or acute suicidality. Participants received \$10 for each hour of participation. One participant refused many self-report items concerning interpersonal functioning; the available n is thus 49 for several analyses noted below. Information from one participant's second round of play in the FIPD was lost because of an administrative error; the available n is reduced by 1 for relevant tests.

Measures

Diagnostic measures and procedure. Diagnosis was derived from a two-stage process using the following interview measures:

The Mini International Neuropsychiatric Interview Version 5.0.0 (MINI; Sheehan et al., 1998) is a brief diagnostic instrument that assesses numerous common psychological disorders. Sheehan et al. (1998) report evidence that the MINI compares favorably to the Structured Clinical Interview for DSM-III-R (SCID; Spitzer, Williams, Gibbon, & First, 1990). Regarding SAD, the instrument showed reasonable concordance with the SCID. The MINI version used for this study has been modified to assess *Diagnostic and*

Statistical Manual of Mental Disorders-IV (DSM-IV) criteria and was used to assess mental disorder diagnoses overall.

The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) is a standard clinician-administered interview assessing social anxiety symptoms. LSAS scores have shown excellent convergent validity and divergent validity in diverse tests (e.g., Heimberg et al., 1999). LSAS scores also distinguish between patients meeting criteria for GSAD, nongeneralized SAD, and controls without SAD (Mennin et al., 2002).

Diagnosis. Interviews were conducted by the first, second, third, and fourth authors after appropriate training. The first author reviewed at least the first five diagnostic interviews from each other rater as well as additional interviews as needed (e.g., to resolve difficult diagnostic issues). Participants were judged to have GSAD if the MINI and LSAS (using the cutoff of ≥ 60 derived by Mennin et al., 2002) agreed on GSAD as a diagnosis. Participants were included in the NOSAD group if they did not meet criteria for SAD on the MINI and met the cutoff for no SAD (an LSAS score < 30) derived by Mennin et al. (2002). The fifth author reviewed video footage for nine (18%) randomly selected cases as part of a broader, blind rating of reliability that included participants who did not qualify for this study. Agreement on diagnostic group for participants in this study was 100%.

Self-Report measures. To assess interpersonal impairment and examine correlations with FIPD indices, we used the following self-report measures:

The Beck Depression Inventory—II (BDI-2; Beck, Steer, & Brown, 1996) is a standard measure of depressive symptoms. Internal consistency was excellent in these data ($\alpha = .97$).

Overall friendship quality and comparison of friendship versus other relationship quality. Friendship quality and other relationship quality were assessed via composites created from subscales drawn from two scales. The first was the Quality of Life Inventory (QOLI; Frisch, 1994), a 32-item measure that assesses the importance given to and satisfaction with 16 life domains. Importance of the life domains is assessed with a 0 (*not important*) to 2 (*extremely important*) scale, and satisfaction with the life domains is assessed with a -3 (*very dissatisfied*) to 3 (*very satisfied*) scale. Scores derived from the QOLI exhibit sufficient reliability, internal consistency, and construct and criterion-related validity (Frisch, Cornell, Villanueva, & Retzlaff, 1992). For the current study, we utilized three subscales: the friendship subscale, the family subscale, and the love (which we will refer to as *romantic*) subscale; these subscales have no known Cronbach's α because each is the product of two items. The second source of subscales was the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988), a 12-item measure assessing social support. The scale uses a 1 (*very strongly disagree*) to 7 (*very strongly agree*) scale. Studies have confirmed the three-subscale structure of the MSPSS (Zimet, Powell, Farley, Werkman, & Berkoff, 1990). Internal consistency for the friendship subscale in the current sample was excellent ($\alpha = .92$). The family and romantic subscales were used as comparison

Table 1
Demographic and Diagnostic Information

Variable	GSAD ($n = 27$)	NOSAD ($n = 23$)
Age	35.41 (12.86)	33.42 (11.03)
Women	63%	57%
White	63%	74%
Years of education	14.85 (3.70)	15.09 (2.26)
Currently depressed or dysthymic	20 (63%)	1 (4%)
LSAS	82.67 (16.34)	15.22 (9.38)
BDI-2	23.78 (11.06)	3.35 (3.01)
Overall friendship quality	-1.01 (1.39)	1.19 (1.32)
Liking of current close friend ^b	79.44 (19.37)	90.70 (20.70)
IIP-64 Coldness ^a	16.42 (5.71)	4.91 (5.73)
IIP-64 Nonassertiveness	20.56 (7.20)	7.74 (6.47)

Note. The statistics consist of M (SD) unless a percentage is given, in which case they are number (percentage). Information about other diagnoses drawn from the MINI. Overall friendship quality = friendship composite (see text). Current Liking = total of Liking scale.

^a GSAD sample $n = 26$ for these measures. ^b Sample restricted to participants with a current close friend; GSAD: $n = 19$, NOSAD: $n = 20$.

¹ As a secondary aim, we examined whether participants in general were able to discern two different patterns of cooperation (one slightly more cooperative than the other), with the expectation that if participants without SAD could discern the two patterns, participants with GSAD might not (but see footnote 2).

measures and also had good internal consistency (α values $>.87$). The friendship subscales from the QOLI and MSPSS correlated moderately ($r = .49, p < .001$) and were therefore standardized and combined to form a composite. As a comparison, the family ($r = .61, p < .001$) and romantic ($r = .64, p < .001$) relationship sections of each measure were also standardized and composited.

The Liking Scale (Rubin, 1970) assesses the degree to which the participant likes the person in question with 13 items focusing on esteem (e.g., [the person] *is one of the most likable individuals I know*) and psychological closeness (e.g., *I think that [the person] and I are quite similar to each other*) rated on a 1 (*not true*) to 9 (*definitely true*) scale. Rubin reported that the scale showed good convergent validity. Only data from participants reporting a current close friend are reported here. Internal consistency ($n = 39, \alpha = .90$) was excellent.

The Inventory of Interpersonal Problems-64 (IIP-64; Horowitz, Alden, Wiggins, & Pincus, 2000) measures interpersonal difficulties based on a circumplex model of personality (Wiggins, 1979), which proposes that human behavior can be understood in part through tendencies toward warmth and affiliation on one axis and tendencies toward dominance on another axis (Gurtman, 1993). The IIP-64 includes eight scales based on the two axes, with each scale assessed by eight items. We focus here on the Cold and Nonassertive scales; both of these scales have been found to be elevated in participants with higher social anxiety (e.g., Kachin et al., 2001). The scales were selected because of expectations that they would correlate with the giving and response to defection indices on the FIPD. The subscales of the IIP-64 have shown good psychometric properties overall (Horowitz et al., 2000). In the current sample, internal consistency was very good for both subscales (α values $>.87$).

Apparatus

The same general FIPD program used by Rodebaugh et al. (2011) was used here; we describe the program briefly and highlight procedures specific to this study. Figure 1 displays the decision and feedback screens for the FIPD. On each turn, participants were asked to divide 10 tokens between their partner and themselves. Decisions were made simultaneously (e.g., by both the participant and computer). Reaction time (in seconds) was recorded for each turn. Feedback screens (e.g.,

tokens given by each player) were then displayed. During decisions, participants were shown the results of the prior trial. Tokens given to the other player were worth 2 points to each player and tokens kept were worth 3 points to the individual player only. Thus, the payoff matrix entailed a tension between the benefits of cooperating versus attempting to exploit the partner.

Each participant played two rounds of 40 turns: one round with a standard Tit for Tat (TFT; Axelrod & Hamilton, 1981) strategy and the other with the modified Raise the Stakes strategy described by Rodebaugh and colleagues (MRTS; Rodebaugh et al., 2011, based on Roberts & Sherratt, 1998). The TFT strategy began by giving the player five tokens and proceeded to do whatever the player had done on the previous turn, whereas the MRTS was more generous. Participants played both strategies, with the order of the strategies randomly assigned. See footnote 2 regarding the null effects of strategy manipulation. Analyses conducted below are by round (e.g., Hypothesis 1, giving less, for Round 1; Hypothesis 2, less reaction to defection, for Round 2) regardless of strategy type.

Participants' choices as well as computer responses were affected by simulated communication errors on 10% of trials causing anywhere between a 3-token decrease to a 3-token increase in intended donation within the bounds of 0 to 10 tokens. Information about errors affecting participant (but not computer) decisions was presented on the feedback screen. The errors were randomly generated, and it was intended that each participant would receive errors that were randomly distributed at the time of playing. Although the program did not execute this function properly in the first round, neither participants nor experimenters were aware of the turns on which errors were most likely. The communication errors were thus effectively random. Further, when noise pattern was entered as a factor in analyses regarding the first round of play, no main effect or interactions with diagnosis were found to be statistically significant (p values $>.15$).

To assess the degree of assertiveness in response to defection, participants were randomly assigned to defection and non-defection conditions. In the defection condition, the computer stopped cooperating by giving the participant 0 tokens on the final five turns played (i.e., of the second round). In the no-

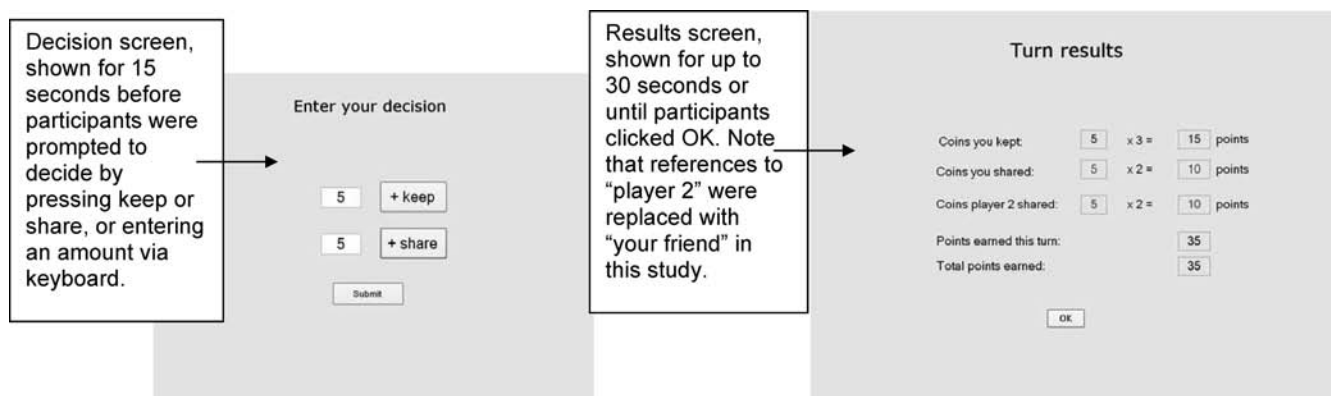


Figure 1. Screenshots from the FIPD task.

defection condition, the computer continued to play according to its strategy through the final five turns.

Variables derived from the FIPD: Giving and defection change. Intended giving (ignoring communication errors) across the first round was totaled and interpreted as a measure of giving. Giving across each quarter of the first round (e.g., turns 1–10, 11–20, 21–30, and 31–40) was also examined. Defection change was measured by totaling the intended responses on the final four turns (i.e., following the possible computer defections) for analysis along with intended responses on the previous four turns (i.e., before the possible computer defections).

Procedure

Participants completed the MINI and LSAS after giving informed consent. Approximately 1 week later, they returned to the laboratory. Participants completed self-report instruments unrelated to the FIPD at home in the interim. Participants were then oriented to the FIPD task, described as a social dilemma game in which they would play with two different friends. Participants were asked to act as if they were playing with a friend in general (e.g., not a specific friend). Although no attempt was made to hide the fact that they were playing a computer, experimenters always referred to the other player as a friend throughout the study. The pay-off matrix, including the relative benefit of sharing versus keeping coins, was explained, as was the possibility of communication errors. The experimenter showed participants an example of how each player would receive points in a hypothetical turn in which both players shared five tokens and kept five tokens (see Figure 1). Participants were intermittently asked to provide ratings, not used here, associated with the task. Participants played 40 turns with the first friend. Participants were then told that they would play with a different friend and completed a second 40 turns. The FIPD was completed in 1 hour or less.

In addition to the above procedures, GSAD participants were randomly assigned to (a) whether they played TFT or MRTS first (see footnote 2), and (b) whether the computer defected on the final five turns or not. NOSAD participants were assigned the same conditions as the most recent GSAD participant who had similar demographic characteristics. Assignment for NOSAD participants was therefore effectively random and promoted demographic characteristics remaining equivalent across all groups.

Results

Initial Equivalence

Table 1 displays demographic and descriptive information. GSAD and NOSAD participants did not differ in regard to demographics (p values $>.62$). Further, the defection ($n = 25$) versus no defection conditions ($n = 24$; 13 in each group GSAD) also did not differ, with the exception of gender, $\chi^2(1) = 7.78$, $p = .005$. However, tests for Hypotheses 1 and 2 were rerun with gender as a factor; no significant main or interaction effects were found for gender (p values $>.20$).²

Suitability of Sample and Validity of Task

Sample. A multivariate analysis of variance (MANOVA; $n = 49$) with dependent measures of the Cold and Nonassertive sub-

Table 2
Intercorrelations of Task Variables and Symptom and Interpersonal Measures

	Giving-10	Giving-40	Liking	FQ	LSAS	BDI-2	Cold NA
Giving-40	.76**						
Liking	.56**	.44**					
FQ	.43**	.28*	.28				
LSAS	-.35**	-.38**	-.21	-.60**			
BDI-2	-.24	-.27	-.17	-.60**	.70**		
Cold	-.35**	-.39**	-.13	-.58**	.70**	.63**	
NA	-.17	-.19*	-.10	-.45**	.59**	.55**	.63**
Defection	-.12	.05	.27	-.03	.26	.28	.30 .34

Note. Spearman correlations displayed because of non-normality of symptom measures. Reliability at least good for all self-report measures; see text. Giving-40 = giving across first round; Giving-10 = giving in first 10 turns; Liking = total of Liking scale; FQ = friendship quality composite; Cold = IIP-64 Cold subscale; NA = IIP-64 Nonassertive subscale; Defection = change in giving between the four turns before and four turns after defection, with lower indicating more of a decrease, and higher indicating less of a decrease. Pattern for LSAS is identical to the pattern for diagnostic group, which is therefore not shown. Overall $N = 50$, except for the following: Cold correlations have one fewer participant; Liking correlations computed for only participants with a current close friend (n values 38–39, except for defection $n = 17$); Defection correlations are only for those participants in the defection condition (n values 24–25, except for Liking = 17).

* $p < .05$. ** $p < .01$.

scales of the IIP-64 as well as the composite of the two measures of general friendship quality showed a large and statistically significant effect for diagnostic group, Wilk's $\Lambda = .30$, $F(3, 45) = 34.46$, $p < .001$, $\eta_p^2 = .70$, such that GSAD participants reported more problems because of being cold and nonassertive as well as lower quality friendships. Therefore, the diagnostic groups demonstrated the expected differences in interpersonal impairment (see also Table 1).

Task. Participants currently in a close friendship ($n = 39$, 19 of which were GSAD) were selected to test whether giving on the FIPD was correlated with current liking of a close friend, whereas all participants were selected to test whether giving was more generally related to friendship quality. The resulting positive correlations are displayed in Table 2. Further, exploration of effects in each quarter of the first round revealed that both liking and overall friendship quality were somewhat more strongly correlated with giving across the first 10 turns (see Table 2); the effect tended to weaken with subsequent turns. We therefore examined not only giving across the entire first round, but also giving across the first 10 turns due to that index's apparently higher external validity. When multiple regression was used to further assess whether giving was specific to friendship versus family and romantic subscales of the same scales (i.e., the QOLI and MSPSS), the

² Assignment to MRTS or TFT was performed to test an exploratory hypothesis that NOSAD participants might discern the MRTS and TFT conditions whereas GSAD participants would not. This hypothesis was rejected: No effects (including interactions) were found for strategy type in any analysis. We therefore present the remaining analyses without reference to strategy type. Additional tests, available from the first author, were conducted to determine if average time per turn and ratings of similarity of other player to a close friend could explain diagnosis effects; there was no evidence that they could.

friendship subscale predicted (part r values $>.31$, p values $<.02$), whereas the competing subscales did not (part r values $<.17$, p values $>.20$). As hypothesized, then, giving on the task was associated with quality of friendships above and beyond quality of other relationships.

Hypothesis 1: Giving Across First Friend Round (Warmth)

GSAD participants gave significantly less than NOSAD participants across the first round, both overall, $t(48) = 2.75$, $p = .008$, $d = .78$, and for the first 10 turns, $t(48) = 3.25$, $p = .002$, $d = .92$.³ Because of the modest sample size for examining moderately highly correlated predictors in regression, we examined correlations to determine the most likely predictors of interest for future research. As can be seen in Table 2, the most plausible candidates for predicting giving were friendship quality indices, social anxiety symptoms, and interpersonal coldness.

Hypothesis 2: Change in Giving in Response to Defection (Assertion)

We tested whether the interaction between diagnosis and defection condition predicted change in giving from predefection to postdefection turns ($n = 49$). A repeated-measures analysis of variance (ANOVA) was conducted with diagnosis and defection group as between-participants factors, time (pre and post possible defection turns) as the within-participant factor, and the dependent variables of giving on the first four turns before the possible defections began and giving on the four turns after defection.

A trend was found for the expected interaction among time, diagnostic group, and defection group, Wilk's $\Lambda = .92$, $F(1, 45) = 3.90$, $p = .055$, $\eta_p^2 = .08$. The effect is displayed in Figure 2. As expected, GSAD participants tended to show less reaction to defection. Follow-up tests revealed that the interaction attained full statistical significance when the final turn (vs. the turn before defections) was analyzed, Wilk's $\Lambda = .96$, $F(1, 45) = 7.55$, $p = .009$, $\eta_p^2 = .14$. Table 2 displays correlations with defection response in the defection group only. As can be seen in the table, nonassertiveness, coldness, and symptom measures appear to be the most viable predictors for assessment in future research.

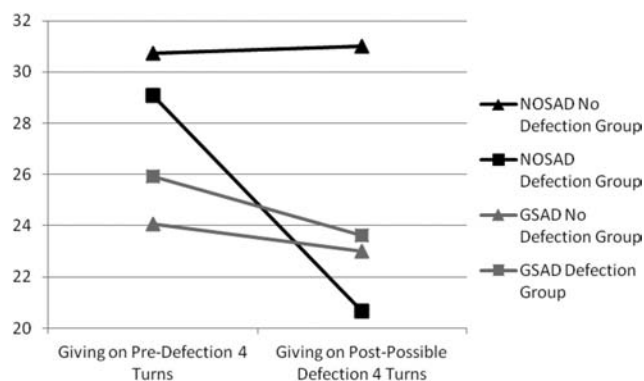


Figure 2. Mean giving on the four turns before and after possible defections by diagnostic and defection group. Possible range 0–40.

Discussion

The current study extends previous results (Rodebaugh et al., 2011) to a clinical population, demonstrating that interpersonal impairment in friendship conferred by GSAD is evident on a behavioral economics task. More specifically, GSAD appeared to constrain warm behavior toward a simulated friend, resulting in less giving across the task. Constraint in terms of low assertive behavior was preliminarily supported by a trend-level finding that GSAD constrains response to defection. Correlation tables suggested that interpersonal variables might ultimately partially explain these effects. The current study also extends the findings of Rodebaugh et al. (2011) regarding the FIPD, with demonstrations that, particularly in the first 10 turns of the task, participant behavior correlated with friendship quality generally and liking of a close friend in particular. Further, correlations with friendship indices were above and beyond correlations with quality of other types of relationships.

This study should be interpreted in light of its limitations, which include a relatively small sample size, lack of a psychiatric control group (e.g., depressed participants), and the fact that the hypothesis regarding assertion was supported by an effect that approached, but did not achieve, statistical significance. Replication with a larger sample and stricter control is a priority for future research (e.g., to determine whether these effects are specific to GSAD and friendship). In regard to the FIPD, we provided further evidence of its external validity, but clearly additional tests are called for (e.g., correlations with observed behavior in the same relationship). Finally, although our diagnostic algorithm was highly reliable, we would have preferred to use a full structured clinical interview such as the SCID (Spitzer et al., 1990).

Our current findings, although preliminary, suggest that people with GSAD display predictable interpersonal patterns in friendship and that these patterns can be detected by a behavioral economic task. The current study also adds to previous findings suggesting that interpersonal warmth may be an issue for people with SAD (Meleshko & Alden, 1993). Potential or current friends may interpret lower warmth as indicating coldness or lack of interest, both of which may reduce the likelihood that they will continue such interactions. Notably, although most interventions for SAD focus on reducing anxiety, the interpersonal literature overall suggests that the quality of friendships might be improved by a focus on warm, affiliative behavior and the role of such behavior in close relationships (see, e.g., Alden & Taylor, 2011). Future research could test this hypothesis directly and efficiently through the use of the FIPD to simulate behavior with friends.

³ Notably, significant effects for diagnosis were maintained in alternative tests that included the first 30 turns in the second round as well as all 40 turns in the first round.

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