A Comparison of Cognitive and Behavioral Approaches for Reducing Cost Bias in Social Anxiety

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Cognitive-behavioral theories suggest that anxiety is maintained in part by estimates of the probability and cost of feared negative outcomes. Social phobia may be unique among the anxiety disorders in that it is characterized by overestimates of the cost of events that are objectively noncatastrophic (e.g., committing social mishaps). As such, treatment approaches that target cost bias may be particularly effective in reducing social phobia symptoms. This study examined the efficacy of 2 cost-specific techniques in a single-session intervention for social anxiety. Individuals ($n = 61$) with elevated social interaction anxiety were randomly assigned to an expressive writing control condition, a cognitive restructuring condition, or a behavioral experiment condition. Results demonstrated that the cognitive restructuring condition produced significantly greater improvement in indices of social anxiety than the other conditions. Reduction in cost bias fully mediated the significantly greater improvement in social interaction anxiety in the cognitive restructuring condition relative to the behavioral experiment condition. The present findings highlight the value of techniques designed to reduce cost biases in social anxiety. Clinical implications are discussed.

Keywords: social anxiety; cognitive-behavioral treatment; cost bias; probability bias

Cognitive-behavioral models posit that anxiety in social phobia is the result of a complex interaction between various cognitive, behavioral, and attentional processes (e.g., Clark & Wells, 1995; Hirsch, Clark, & Matthews, 2006; Hofmann, 2007; Rapee & Heimberg, 1997). Among these interactive processes, cognitive biases related to the probability (likelihood) and cost (severity) of negative social outcomes are particularly important mechanisms (e.g.,

Hofmann, 2004; Rapee, Gaston, & Abbott, 2009). Although most anxiety disorders are characterized by fears of demonstrably catastrophic outcomes (e.g., heart attack, terminal illness, physical assault), social phobia is relatively unique in that sufferers tend to exaggerate the cost of objectively less severe outcomes such as committing social mishaps (e.g., mispronouncing a word, arriving late for a meeting) or displaying observable anxiety symptoms (e.g., blushing, shaky hands). Accordingly, the reduction of exaggerated cost estimates is considered an important goal of cognitive behavioral therapy (CBT) for social phobia (Hofmann & Otto, 2008).

Several studies have examined the role of cost bias in the treatment of social phobia. Exaggerated cost estimates have been shown to improve following CBT (e.g., Franklin, Huppert, Langner, Leiberg, & Foa, 2005; Lucock & Salkovskis, 1988; Poulton & Andrews, 1996), and reductions in cost bias are strongly associated with overall improvement in social phobia symptoms (Foa, Franklin, Perry, & Herbert, 1996; McManus, Clark, & Hackmann, 2000). Moreover, changes in cost estimates have been found to significantly predict long-term reductions in social anxiety (Hofmann, 2004). Rapee and colleagues (2009) found that an enhanced CBT protocol intended to specifically target cost bias was more effective than standard CBT for social phobia. The difference between treatments was mediated, in part, by greater changes in cost bias in the enhanced CBT protocol. Similarly, Hofmann and Scepkowski (2006) reported that an enhanced version of CBT designed to maximize reductions in cost bias yielded a stronger effect size than studies of comparable duration using traditional CBT approaches to social phobia (e.g., Hofmann, 2004). In summary, the current literature demonstrates the importance of modifying exaggerated cost estimates in the treatment of social phobia.

Two investigations have examined the efficacy of treatments designed specifically to reduce probability and cost biases in social anxiety. In the first, Voncken and Bögels (2006) employed a highly structured, nine-session cognitive therapy for 13 individuals with social phobia. Treatment consisted of cognitive reappraisal techniques aimed at reducing overestimates of the probability and the cost of negative social events. Participants worked with the therapist to construct five "target situations" in which the individual feared social rejection. Probability estimates were targeted by having participants generate several potential outcomes for each target situation, and comparing initial probability estimates to revised probability estimates that considered the possibility of alternative outcomes. Cost estimates were targeted by having participants create a list of negative characteristics a person could exhibit (e.g., rude) and by comparing their own presumed negative characteristics (e.g., blushing) with a broad spectrum of negative attributes. Thus, participants were able to see that negative personal attributes they associated with their performance in target situations were relatively benign. Results from this uncontrolled trial indicated that the cognitively based protocol produced significant reductions in probability and cost overestimates and larger effect sizes than traditional social phobia treatments.

Nelson, Deacon, Lickel, and Sy (2010) also examined the efficacy of an intervention targeting probability and cost biases in social anxiety. Employing a behavioral approach, these authors assessed the effects of probability-specific and cost-specific behavioral experiments in 37 undergraduate students with elevated public speaking anxiety. The behavioral experiments consisted of having individuals deliver a series of three speeches to a small audience. In the probability condition, participants delivered each speech as competently as possible in an effort to learn that social embarrassment was unlikely to occur. Individuals in the cost condition delivered each speech while purposely engaging in behaviors that would negatively affect their performance (e.g., stuttering, shaking hands, mumbling) in an effort to learn that the social cost of such behaviors and their associated embarrassment is acceptably low. Compared to the probability condition, the cost condition produced significantly greater reductions from pretreatment to posttreatment on measures of cost bias and public speaking anxiety. The superior efficacy of the cost condition on public speaking anxiety was fully mediated by the greater reduction in cost bias produced by this

treatment. These findings demonstrate the efficacy of a behavioral approach to probability and cost estimates in social anxiety, and further suggest that targeting cost bias rather than probability bias may produce more robust changes in important outcomes.

Although the existing literature suggests that cost bias may be effectively targeted through behavioral and cognitive techniques, the relative efficacy of these approaches is unknown. Given the promising efficacy of social phobia treatments that specifically target exaggerated estimates of social cost, it is important to identify which procedures are particularly effective in reducing cost bias. Accordingly, this study was conducted to examine the relative efficacy of cognitive and behavioral techniques specifically designed to reduce cost bias. Undergraduate participants with high levels of social interaction anxiety were assigned to one of three experimental conditions: (a) cognitive restructuring, (b) behavioral experiment, or (c) psychoeducation control. It was hypothesized that relative to individuals in the control condition, individuals in both active treatment conditions would demonstrate significantly greater reductions in social anxiety and cost bias. Owing to the absence of previous controlled comparisons, no hypothesis was offered regarding the comparative efficacy of cognitive restructuring and behavioral experiments in the reduction of social anxiety and in cost bias.

METHOD

Participants

Participants were recruited from undergraduate psychology and criminal justice classes at the University of Wyoming during Spring 2009 and Fall 2009 semesters. At the beginning of the semester, students completed a mass testing questionnaire for course credit that included the Social Interaction Anxiety Scale (SIAS; Mattick & Clark, 1998). Individuals who scored 1 standard deviation above the mean on this measure were invited to participate in the study via telephone and e-mail contacts. There were 955 individuals screened for the study, 154 of whom met the eligibility requirement. Of those invited to participate, 61 individuals agreed to participate and completed the study. Most participants were women (69.0%) and the mean age was 20 years old ($SD = 3.36$). The sample primarily consisted of White (83.6%) participants; fewer participants described themselves as Latino (8.2%), Asian American (4.9%), or other (3.3%).

Experimental Design

All procedures were reviewed and approved by the Institutional Review Board at the University of Wyoming. Graduate and undergraduate lab members served as experimenters and all procedures were scripted to ensure standardization. Following completion of the informed consent process, participants were randomly assigned using a computer-generated randomization list to a single-session cognitive restructuring ($n = 20$), behavioral experiment ($n = 20$), or psychoeducation ($n = 21$) condition. Participants received a condition-specific treatment rationale and then engaged in a brief treatment exercise. Assessments of social interaction anxiety, anxiety sensitivity, and probability and cost biases were collected at pretreatment and posttreatment.

Measures

Credibility and Expectancy Questionnaire (CEQ). The CEQ (Devilly & Borkovec, 2000) is a well-established measure of treatment expectancy and acceptance of treatment rationale. The CEQ asks participants to provide ratings of how logical the treatment seemed, of their expectations for treatment success, and of their confidence in recommending the treatment to others. Ratings are assigned on a 9-point Likert-type scale. The CEQ has good test–retest reliability and

high internal consistency (Devilly & Borkovec, 2000) and demonstrated adequate internal consistency in the present sample ($\alpha = .73$).

Probability Questionnaire and Cost Questionnaire (PQ and CQ). The PQ and CQ (Foa et al., 1996) are 20-item subscales, which together comprise a 40-item self-report inventory that assesses perceptions of both social and nonsocial hypothetical events. Because individuals with social phobia do not demonstrate probability and cost biases for nonsocial events (Lucock & Salkovskis, 1988; Stopa & Clark, 2000), for the purposes of this study only the 20 social items were used. Participants used a 10-point Likert-type rating scale to separately rate the probability (0 = *not at all likely*, 9 = *extremely likely*) and cost (0 = *not at all bad*, 9 = *extremely bad*) of scale items. The PQ and CQ have demonstrated good test–retest reliability and high internal consistency (Foa et al., 1996) and the scale correlates strongly with other self-report measures of social anxiety. Good internal consistency was established in the present sample for the PQ ($\alpha = .91$) and the CQ ($\alpha = .88$).

Anxiety Sensitivity Index-3 (ASI-3). Participants' fears of anxiety-related sensations were assessed with the ASI-3 (Taylor et al., 2007). The ASI-3 is an 18-item self-report measure comprising three 6-item subscales, measuring cognitive, physical, and social aspects of anxiety sensitivity. Participants provide ratings on a 5-point Likert-type scale ranging from 0 (*very little*) to 4 (*very much*). The ASI-3 possesses high internal consistency and good convergent and discriminant validity (Taylor et al., 2007). This study used the Social Concerns subscale of the ASI-3 to assess the perceived cost of appearing anxious to others. This subscale complements the Cost Questionnaire, which measures the perceived cost of negative social outcomes more generally. The ASI-3 Social Concerns subscale demonstrated satisfactory internal consistency in the present sample ($\alpha = .73$).

Social Interaction Anxiety Scale (SIAS). This 20-item questionnaire measures anxiety associated with general social interactions. Participants rate the degree to which statements are characteristic of themselves on a 5-point Likert-type scale. Published normative data indicates individuals with social phobia have a mean score of 40.0 ($SD = 16.0$) on the SIAS (Mattick & Clark, 1998). The SIAS possesses high internal consistency and test–retest reliability (Mattick & Clark, 1998), as well as good convergent and discriminant validity (Brown et al., 1997; Peters, 2000; Ries et al., 1998). The SIAS demonstrated good internal consistency in the present sample ($\alpha = .88$).

Acceptability and Aversiveness Questionnaire (AAQ). Participants' perceptions of treatment modalities were assessed with the 3-item AAQ. Following the treatment exercises, participants rated the aversiveness, acceptability, and likeability of the treatment on a 5-point Likert-type scale ranging from 0 (not at all) to 4 (extremely).

Procedure

Following informed consent, participants completed the pretreatment assessment measures, which included a demographic information questionnaire, the ASI-3 Social Concerns subscale, the PQ and CQ, and the SIAS. Participants in all treatment conditions were presented with a brief statement suggesting that thoughts and behaviors concerning the cost of negative social outcomes maintain social phobia. Participants then received a condition-specific treatment rationale (see the following text for further detail). Following the treatment rationale, participants completed the CEQ and then engaged in the treatment exercise. Participants then completed the posttreatment assessment battery, comprising the AAQ, the ASI-3 Social Concerns subscale, the PQ and CQ, and the SIAS.

Cognitive Restructuring Treatment Condition. Participants in the cognitive restructuring condition were provided with a treatment rationale suggesting that the best way to overcome social interaction anxiety was to logically consider and reevaluate beliefs about the consequences of acting in an embarrassing manner. It was further suggested that participants could reevaluate their beliefs about social interactions by comparing social embarrassment with other

nonsocial outcomes (i.e., being in a car accident), and by generating ways to manage or cope with embarrassing social interactions.

Participants were given a handout listing 20 social situations (derived from SIAS items) and were asked to select the three situations they feared most. For each situation, participants were asked to generate and record the worst possible outcome for the situation and to rate the cost of the outcome on a 0 (*not at all upsetting*) to 100 (*extremely upsetting*) point Likert-type scale. Participants were then asked to produce three ways of coping with or managing each outcome. To help participants reevaluate their beliefs, the experimenter worked with the participant to create a severity scale with which to measure negative social outcomes. This process started by showing participants a blank scale ranging from 0 (*inconsequential outcome*) to 100 (*worst imaginable outcome*). Participants were asked to generate negative nonsocial outcomes that corresponded with the 0, 25, 50, 75, and 100 point values. Using this severity scale, participants were asked to reconsider and re-rate the severity of the three negative social outcomes that were previously generated. These cognitive restructuring procedures were adapted from the protocol of Voncken and Bögels (2006).

Behavioral Experiment Treatment Condition. In the behavioral experiment condition, participants received a treatment rationale suggesting that the best way to overcome social interaction anxiety is to engage in a social interaction while purposely behaving in an embarrassing manner. It was proposed that by purposely acting foolishly, one could test predictions concerning the cost of social embarrassment and could subsequently learn that social embarrassment was not as catastrophic or unmanageable as may have been predicted. The treatment task was then described; participants were told that the treatment would consist of engaging in an unscripted 5-min social interaction while purposely engaging in embarrassing behaviors. Participants were instructed to perform three types of embarrassing behaviors during the social interaction, including stuttering, pausing for 10-sec periods, and saying something foolish (e.g., "I'm really nervous right now"). These behaviors were practiced prior to the social interaction task. Participants also ran in place for 1 min prior to the conversation to increase their physical appearance of anxiety. Participants were led into the experimental room and engaged in a social interaction with a confederate while performing the specified behaviors. An undergraduate student served as the confederate and conversational partner during the social interaction task. He was instructed to react genuinely to participants. The undergraduate confederate remained unaware of the study hypotheses and procedures until the conclusion of the study. Participants were informed that the confederate had not received training and, thus, his reactions to participants were genuine. The behavioral experiment condition was adapted from the protocol of Nelson et al. (2010).

Psychoeducation Treatment Condition. Participants in the psychoeducation treatment condition were given a rationale suggesting that the anxiety one feels during social interactions could be reduced by reading educational materials on social anxiety and developing a better understanding of the problem. Participants were instructed to carefully and thoroughly read an educational pamphlet on social interaction anxiety for a period of 5 min.

RESULTS

Baseline Equivalence

A series of one-way analyses of variance (ANOVAs) revealed no significant differences on demographic characteristics, including age, gender, or ethnicity (all $ps > .05$). Similarly, there were no significant between-group differences in pretreatment scores on the SIAS, PQ, CQ, or ASI-3 Social Concerns subscale (all $ps > .05$). There were also no group differences on perceived treatment credibility, $F(2, 60) = 1.64, p > .05$, or outcome expectancies, $F(2, 60) = 1.28, p > .05$. These findings suggest that the randomization procedure was successful in producing comparable groups at baseline.

Treatment Effects

A series of 2 (time: pretreatment vs. posttreatment) $\times$ 3 (condition: psychoeducation, cognitive restructuring, behavioral experiment) repeated measures ANOVAs were used to analyze treatment effects. The four main effects were tested using Bonferroni adjusted alpha levels of .0125 per test (.05/4). Descriptive statistics and the results of these analyses are displayed in Table 1. For the SIAS, there was a significant main effect of time ($p < .001$) and a significant time $\times$ condition interaction ($p < .01$). Pretreatment to posttreatment change scores were submitted to a series of follow-up independent samples t tests. The cognitive restructuring condition produced significantly greater change from pretreatment to posttreatment than the psychoeducation condition, $t(39) = 4.02, p < .001$, and the behavioral experiment condition, $t(38) = 2.74, p = < .01$. The psychoeducation condition and behavioral experiment condition did not differ significantly ($p > .05$). On the ASI-3 Social Concerns subscale, there was a significant main effect of time ($p < .001$) and a marginally significant time $\times$ condition interaction ($p = .08$). Follow-up t tests indicated that the cognitive restructuring condition produced significantly greater change than the psychoeducation condition, $t(39) = 2.58, p < .05$. Neither the psychoeducation condition and behavioral experiment condition ($p > .05$) nor the cognitive restructuring and behavioral experiment conditions ($p > .05$) differ significantly.

Participants' pretreatment scores on the PQ and CQ were examined using one-sample t tests to ensure the presence of probability and cost biases. Results indicated that participants demonstrated probability and cost biases as measured by the PQ ($t[60] = 32.64, p < .001$) and CQ ($t[60] = 24.56, p < .001$). Scores on the PQ and CQ were similarly submitted to 2 (time) $\times$ 3 (condition) mixed ANOVAs. For the PQ, there was a significant main effect of time ($p < .001$) and a significant time $\times$ condition interaction ($p < .05$). Follow-up independent samples t tests of change scores demonstrated that the cognitive restructuring condition produced significantly greater reductions in probability estimates from pretreatment to posttreatment than the psychoeducation condition, $t(39) = 3.25, p < .01$. No other significant differences in PQ change scores were noted between groups (all $ps > .05$). On the CQ, there was a significant main effect of time ($p < .001$) and a significant time $\times$ condition interaction ($p < .001$). Independent samples t tests indicated that the cognitive restructuring produced significantly greater reductions in cost estimates from pretreatment to posttreatment than the psychoeducation condition, $t(39) = 4.03, p < .001$, and the behavioral experiment condition, $t(38) = 2.80, p < .01$. The psychoeducation condition and behavioral experiment conditions did not differ significantly ($p > .05$).

Table 2 presents between-group effect size estimates (Kelley & Preacher, 2012) on each outcome variable from pretreatment to posttreatment. Effect sizes (d) were calculated using pretreatment to posttreatment change scores and standard deviations of change scores; the formula $d = (M_{\text{pre-post}\Delta\text{condition1}} - M_{\text{pre-post}\Delta\text{condition2}})/SD\Delta_{\text{pooled}}$ was used. Following the recommendations of Cohen (1988), effects of .2, .5, and .8 may be interpreted as small, medium, and large effects, respectively. Relative to the control condition, the cognitive restructuring condition produced medium-to-large effects on the outcome measures, whereas the behavioral experiment condition yielded small effects.

Given the significant advantage of the cognitive restructuring condition over the behavioral experiment condition on the CQ, an exploratory mediational analysis was conducted to determine whether changes in this variable accounted for the superiority of the cognitive restructuring condition over the behavioral experiment condition on the SIAS. SPSS macro and procedures for testing mediation (Preacher & Hayes, 2004; Preacher, Rucker, & Hayes, 2007) were used to determine whether improvement in cost bias from pretreatment to posttreatment mediated the effects of treatment condition on the SIAS. Change scores from pretreatment to posttreatment were used to represent changes in the mediator and outcome variable. The unique effect of treatment condition was represented by a dummy code. The difference between treatments accounted for

TABLE 1. Descriptive Statistics and Between-Group Comparisons on Outcome Measures at Pretreatment and Posttreatment Assessments

Measure	Cognitive Restructuring Condition M (SD)	Behavioral Experiment Condition M (SD)	Psychoeducation Condition M (SD)	Main Effect of Time $F(1, 58)$	Main Effect of Condition $F(2, 58)$	Time x Condition Interaction $F(2, 58)$
SIAS				28.25***	1.31	8.11**
Pretreatment	43.55 (11.51)	46.30 (9.80)	44.52 (13.04)			
Posttreatment	35.35 (10.39)	43.35 (11.55)	43.57 (13.63)			
ASI-3 Social				22.71***	4.07*	2.62
Pretreatment	12.35 (4.39)	15.25 (4.49)	14.62 (4.42)			
Posttreatment	9.50 (4.81)	13.65 (5.27)	13.81 (4.22)			
PQ				37.59***	3.06	4.62*
Pretreatment	68.10 (20.50)	83.37 (23.02)	75.38 (27.18)			
Posttreatment	50.05 (24.98)	71.32 (25.91)	71.05 (29.39)			
CQ				35.30***	8.31**	8.78***
Pretreatment	78.10 (21.84)	87.79 (17.30)	93.05 (20.72)			
Posttreatment	49.25 (25.48)	78.47 (27.74)	87.52 (26.30)			

Note. SIAS = Social Interaction Anxiety Scale; ASI-3 Social = Anxiety Sensitivity Index-3 Social Concerns Subscale; PQ = Probability Questionnaire; CQ = Cost Questionnaire.

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

TABLE 2. Between-Groups Effect Sizes and 95% Confidence Intervals for Pretreatment to Posttreatment Changes in Social Anxiety

Condition	Cognitive Restructuring vs. Psychoeducation	Behavioral Experiment vs. Psychoeducation	Cognitive Restructuring vs. Behavioral Experiment
Measure	Between-Group *d*	Between-Group *d*	Between-Group *d*
SIAS	1.26** [0.56, 1.90]	0.34 [−0.29, 0.95]	0.87* [0.20, 1.50]
PQ	1.05** [0.38, 1.68]	0.53 [−0.11, 1.15]	0.42 [−0.23, 1.04]
CQ	1.26** [0.57, 1.90]	0.23 [−0.39, 0.85]	0.90* [0.22, 1.53]
ASI-3	0.81* [0.16, 1.43]	0.28 [−0.34, 0.89]	0.38 [−0.25, 1.00]

Note. SIAS = Social Interaction Anxiety Scale; PQ = Probability Questionnaire; CQ = Cost Questionnaire; ASI-3 Social Concerns = Anxiety Sensitivity Index-3 Social Concerns Subscale.
* $p < .05$. ** $p < .01$.

significant variance in SIAS change scores, $B = -5.73$, $SE = 1.90$, $p < .01$. Following the addition of CQ change scores to the model, this path became nonsignificant, $B = -3.19$, $SE = 1.87$, $p > .05$. The total indirect path from treatment condition to change in SIAS via CQ change scores was significant, $B = -2.54$, $SE = 1.17$, $p < .05$. The full regression model accounted for 37.9% of the variance in SIAS change scores, $F(2, 36) = 11.00$, $p < .001$.

Perceptions of Treatments

The AAQ items were submitted to a series of one-way ANOVAs. There were no significant between-group differences on ratings of treatment acceptability, $F(2, 60) = 1.26$, $p > .05$, and treatment likeability, $F(2, 60) = 1.56$, $p > .05$. A significant between-group difference emerged in participant ratings of treatment aversiveness, $F(2, 60) = 3.67$, $p < .05$. Post hoc Tukey's Honestly Significant Difference (HSD) tests revealed that individuals in the behavioral experiment condition rated treatment as significantly more aversive ($M = 1.75$, $SD = .91$) than individuals in the psychoeducation condition ($M = .95$, $SD = .97$), $p < .01$. There were no significant differences in aversiveness ratings between the cognitive restructuring condition ($M = 1.25$, $SD = .97$) and other conditions ($ps > .05$).

DISCUSSION

This study examined the relative efficacy of two single-session interventions designed to reduce cost bias in a sample of socially anxious participants. Relative to the psychoeducation control, the behavioral experiment condition did not produce significantly greater improvement on any index of social anxiety. In contrast, the cognitive restructuring condition led to significantly greater reductions than the control condition on measures of probability bias, cost bias, and social interaction anxiety. The cognitive restructuring treatment also significantly outperformed the behavioral experiment treatment on social interaction anxiety, and this effect was fully mediated by greater reductions in cost bias in the cognitive restructuring condition. Although these findings do not necessarily indicate a causal relationship because data from the mediator and outcome variable were gathered concurrently, they are consistent with previous research in suggesting that treatments that reduce cost bias are particularly effective in the reduction of social phobia symptoms (e.g., Nelson et al., 2010; Rapee et al., 2009).

The cognitive restructuring technique in this study asked participants to rationally assess the extent to which feared social mishaps are as catastrophic as predicted. This simple, brief, and

face valid strategy encourages direct examination of the accuracy of exaggerated cost estimates and appears effective in reducing social anxiety symptoms as well as probability and cost biases. In contrast to previous research (e.g., Nelson et al., 2010), a behavioral approach to reducing cost bias was not particularly effective. The behavioral experiment treatment condition in this study was modeled after the procedures of Nelson et al. (2010) and involved conducting a 5-min social interaction with a confederate to test the cost of engaging in embarrassing behaviors (e.g., stuttering). The use of a single-trial exposure-based intervention represents a potentially important difference between this study and Nelson et al. who employed a series of three speeches in front of an audience. Although the behavioral experiment condition in this study was expected to provide corrective information regarding the cost of acting in an embarrassing manner, it is possible that use of a single exposure trial did not provide a sufficiently high dose of learning to accomplish this goal. Use of repeated trials may have provided a more compelling demonstration to participants that distress gradually diminishes over time during exposure to feared social situations, and that social catastrophes are less probable and costly than expected.

The behavioral experiment condition may also have had limited effect because of the manner in which it was structured. Specifically, the behavioral experiment involved three behaviors that are generally feared by socially anxious individuals (e.g., stuttering, pausing, saying something foolish) but may not have been feared by all participants. If these specific behaviors did not elicit fear for a given participant, one would expect little or no change in cost bias. Using behavioral experiments individually tailored to each participant's fears would have increased the validity of the study and been more representative of clinical practice.

The current findings highlight the potency of a specific cognitive technique for reducing cost bias and social interaction anxiety. These findings complement existing studies demonstrating the importance of targeting cost bias in the treatment of social phobia (Foa et al., 1996; McManus et al., 2000; Rapee et al., 2009). Compared to traditional CBT approaches for social phobia (e.g., Heimberg & Becker, 2002), contemporary CBT protocols emphasize cognitive and behavioral techniques for reducing exaggerated estimates of social cost (Hofmann & Otto, 2008). Indeed, treatments specifically designed to target cost bias appear more effective than traditional CBT approaches (Hofmann & Scepkowski, 2006; Rapee et al., 2009; Voncken & Bögels, 2006). The present findings suggest that the cognitive technique employed in this study adapted from Voncken and Bögels (2006) would be a useful addition to a cost-focused cognitive-behavioral treatment approach for social phobia.

Several limitations of this study should be noted. One chief limitation was small sample size. Results of a post hoc power analysis (completed using nQuery Advisor) suggested that the study was powered to find effects of approximately $d = 0.90$. A larger sample would have increased statistical power and allowed for more successful detection of significant between-group differences. Another limitation of our sample was the use of an analog sample of socially anxious undergraduate students, which potentially limits the generalizability of the findings to treatment-seeking individuals who meet diagnostic criteria for social phobia. The single-session interventions in this study were brief, delivered in isolation from other treatment components, and are not representative of the manner in which CBT is typically delivered in clinical practice. It is possible that the cost-specific techniques examined in this study are less effective when delivered in isolation from the broader therapeutic context in which they typically occur. The study is also limited in that cost bias was manipulated indirectly by the cognitive and behavioral techniques. The use of an experimental manipulation of cost bias (e.g., Amir, Weber, Beard, Bomyea, & Taylor, 2008; Heeren, Reese, McNally, & Philippot, 2012) would have allowed for more robust conclusions regarding reductions in this bias. An additional limitation concerns the fact that all outcome variables were self-report measures and, consequently, relationships among these variables may have been artificially inflated because of shared method variance. Lastly, because of the absence of follow-up assessment, the extent to which reductions in probability and cost biases and in social anxiety were maintained is unclear.

Contemporary cognitive-behavioral theories and treatments emphasize the importance of cost bias in the maintenance and treatment of social phobia (e.g., Hofmann, 2007; Rapee et al., 2009). This study adds to existing research by demonstrating the efficacy of a cognitive technique in reducing cost bias and social anxiety symptoms relative to a behavioral experiment technique and expressive writing control. These findings highlight the potential value of additional research designed to identify effective methods for reducing cost bias and the manner in which they may be incorporated into broader CBT protocols for social phobia.

REFERENCES

Amir, N., Weber, G., Beard, C., Bomyea, J., & Taylor, C. T. (2008). The effect of a single-session attention modification program on response to a public-speaking challenge in socially anxious individuals. *Journal of Abnormal Psychology*, *117*, 860–868.

Brown, E. J., Turovsky, J., Heimberg, R. G., Juster, H. R., Brown, T. A., & Barlow, D. H. (1997). Validation of the social interaction anxiety scale and the social phobia scale. *Psychological Assessment*, *9*, 21–27. http://dx.doi.org/10.1037//1040-3590.9.1.21

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Leibowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York, NY: Guilford Press.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Devilly, G. J., & Borkovec, T. E. (2000). Psychometric properties of the credibility/expectancy questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry*, *31*, 73–86. http://dx.doi.org/10.1016/S0005-7916(00)00012-4

Foa, E. B., Franklin, M. E., Perry, K. J., & Herbert, J. D. (1996). Cognitive biases in generalized social phobia. *Journal of Abnormal Psychology*, *105*, 433–439. http://dx.doi.org/10.1037//0021-843X.105.3.433

Franklin, M. E., Huppert, J., Langner, R., Leiberg, S., & Foa, E. B. (2005). Interpretation bias: A comparison of treated social phobics, untreated social phobics, and controls. *Cognitive Therapy and Research*, *29*, 289–300.

Heeren, A., Reese, H. E., McNally, R. J., & Philippot, P. (2012). Attention training toward and away from threat in social phobia: Effects on subjective, behavioral, and physiological measures of anxiety. *Behaviour Research and Therapy*, *50*, 30–39. http://dx.doi.org/10.1016/j.brat.2011.10.005

Heimberg, R. G., & Becker, R. E. (2002). *Cognitive–behavioral group therapy for social phobia: Basic mechanisms and clinical strategies*. New York, NY: Guilford Press.

Hirsch, C. R., Clark, D. M., & Mathews, A. (2006). Imagery and interpretations in social phobia: Support for the combined cognitive biases hypothesis. *Behavior Therapy*, *37*, 223–236. http://dx.doi.org/10.1016/j.beth.2006.02.001

Hofmann, S. G. (2004). Cognitive mediation of treatment change in social phobia. *Journal of Consulting and Clinical Psychology*, *72*, 392–399. http://dx.doi.org/10.1037/0022-006X.72.3.392

Hofmann, S. G. (2007). Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cognitive Behaviour Therapy*, *36*, 193–209. http://dx.doi.org/10.1080/16506070701421313

Hofmann, S. G., & Otto, M. W. (2008). *Cognitive behavioral therapy for social anxiety disorder*. New York, NY: Routledge.

Hofmann, S. G., & Scepkowski, L. A. (2006). Social self-reappraisal therapy for social phobia: Preliminary findings. *Journal of Cognitive Psychotherapy: An International Quarterly*, *20*, 45–47. http://dx.doi.org/10.1891/jcop.20.1.45

Kelley, K., & Preacher, K. J. (2012). On effect size. *Psychological Methods*, *17*, 137–152. http://dx.doi.org/10.1037/a0028086

Lucock, M. P., & Salkovskis, P. M. (1988). Cognitive factors in social anxiety and its treatment. *Behaviour Research and Therapy*, *26*, 297–302. http://dx.doi.org/10.1016/0005-7967(88)90081-2

Mattick, R. P., & Clark, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy*, *36*, 455–470. http://dx.doi.org/10.1016/S0005-7967(97)10031-6

McManus, F., Clark, D. M., & Hackmann, A. (2000). Specificity of cognitive biases in social phobia and their role in recovery. *Behavioural and Cognitive Psychotherapy*, *28*, 201–209. http://dx.doi.org/10.1017/S1352465800003015

Nelson, E. A., Deacon, B. J., Lickel, J. L., & Sy, J. C. (2010). Targeting the probability versus cost of feared outcomes in public speaking anxiety. *Behaviour Research and Therapy*, *48*, 282–289. http://dx.doi.org/10.1016/j.brat2009.11.007

Peters, L. (2000). Discriminant validity of the Social Phobia Anxiety Inventory (SPAI), the Social Phobia Scale (SPS), and the Social Interaction Anxiety Scale (SIAS). *Behaviour Research and Therapy*, *38*, 943–950. http://dx.doi.org/10.1016/S0005-7967(99)00131-X

Poulton, R. G., & Andrews, G. (1996). Change in danger cognitions in agoraphobia and social phobia during treatment. *Behaviour Research and Therapy*, *34*, 413–421. http://dx.doi.org/10.1016/0005-7967(96)00009-5

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, and Computers*, *36*, 717–731. http://dx.doi.org/10.3758/BF03206553

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*, *42*, 185–227. http://dx.doi.org/10.1080/00273170701341316

Rapee, R. M., Gaston, J. E., & Abbott, M. J. (2009). Testing the efficacy of theoretically derived improvements in the treatment of social phobia. *Journal of Consulting and Clinical Psychology*, *77*, 317–327. http://dx.doi.org/10.1037/a0014800

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy*, *35*, 741–756. http://dx.doi.org/10.1016/S0005-7967(97)00022-3

Ries, B. J., McNeil, D. W., Boone, M. L., Turk, C. L., Carter, L. E., & Heimberg, R. G. (1998). Assessment of contemporary social phobia verbal report instruments. *Behaviour Research and Therapy*, *36*, 983–994.

Stopa, L., & Clark, D. M. (2000). Social phobia and the interpretation of social events. *Behaviour Research and Therapy*, *38*, 273–283. http://dx.doi.org/10.1016/S0005-7967(99)00043-1

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B. J., Heimberg, R. G., Ledley, D. R., & Jurado, S. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3 (ASI-3). *Psychological Assessment*, *19*, 176–188. http://dx.doi.org/10.1037/1040-3590.19.2.176

Voncken, M. H., & Bögels, S. M. (2006). Changing interpretation and judgmental bias in social phobia: A pilot study of a short, highly structured cognitive treatment. *Journal of Cognitive Psychotherapy: An International Quarterly*, *20*, 59–73. http://dx.doi.org/10.1891/jcop.20.1.59

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