

The Effects of Relaxation on Cognitive Bias Modification Training in Social Anxiety Disorder

BY

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THESIS

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This thesis is dedicated to my parents, Eric and Christina Stevens. Thank you for your unwavering belief in my dreams, and for the fortitude to persist until they are actualized.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BDI-II	Beck Depression Inventory - II
CBM	Cognitive Bias Modification (-A, of Attention; -I, of Interpretation)
CBT	Cognitive Behavioral Therapy
CCR	Cue Controlled Relaxation
CR	Cognitive Restructuring
GAD	Generalized Anxiety Disorder
MANOVA	Multivariate Analysis of Variance
MPSP	Modified Perception of Speech Performance
NA	Negative Affect
NT	Neutral Thinking
PA	Positive Affect
PANAS	Positive and Negative Affect Schedule
PTQ	Perseverative Thinking Questionnaire
RECT	Rational-Emotive Cognitive Therapy
SAD	Social Anxiety Disorder
SAT	Socially Anxious Thinking
SIAS	Social Interaction Anxiety Scale
SPDQ	Social Phobia Diagnostic Questionnaire
SST	Study Skills Training
SUDS	Subjective Units of Distress Scale

SUMMARY

Cognitive models of social anxiety disorder posit that these individuals often interpret social situations in maladaptive ways. Cognitive bias modification of interpretations (CBM-I; Mathews & Mackintosh, 2000) is a promising avenue of treatment that targets these maladaptive interpretations, and aims to train individuals to interpret ambiguous situations in more adaptive ways. However, the effect sizes associated with these paradigms are typically small (Hallion & Ruscio, 2011). Relaxation is a treatment component that has been utilized in previous studies to augment both exposure-based (e.g., Borkovec & Sides, 1979) and cognitive (e.g., Borkovec & Costello, 1993) treatments for anxiety. In the current study, we investigated whether relaxation can similarly enhance the efficacy of CBM-I for social anxiety disorder in terms of both cognitive and behavioral outcomes. Participants were randomly assigned to receive one of three inductions (relaxation, socially anxious thinking, or neutral thinking) prior to completing a CBM-I training that trained them to interpret ambiguous social situations in a benign manner. After assessing participants' interpretation bias (i.e., cognitive outcome), participants were asked to give an impromptu speech, during which we assessed self-reported anxiety and behavioral avoidance (i.e., willingness to give a speech, length of speech). We additionally assessed participants' perception of their speech performance in terms of overall speech elements and specific speech behaviors. Contrary to hypotheses, rather than participants in the relaxation condition, participants in the neutral thinking condition evidenced the most adaptive patterns of interpretation bias. There were no between-groups differences on behavioral outcomes, despite differential patterns of interpretation bias. However, relative to participants in the other two groups, participants in the socially anxious thinking condition rated their performance on global speech elements relatively higher than their performance on specific elements of the speech.

SUMMARY (continued)

Combined with evidence from another study in our lab (Stevens et al., in preparation), these findings first suggest that relaxation may not enhance *cognitive* flexibility. Second, combined evidence from this study and several prior investigations of CBM-I for anxiety-related concerns suggest that these paradigms may not exert effects at the behavioral level, which may pose a serious limitation of these paradigms in clinical practice.

1. INTRODUCTION

1.1 Cognitive Model of Social Anxiety Disorder

Social anxiety disorder (SAD) is characterized by a persistent fear of social situations in which there is potential for either embarrassment or critical evaluation by others (Rapee & Heimberg, 1997). Cognitive models of social anxiety posit that socially anxious individuals often attend to and interpret the social world in maladaptive ways (Stopa & Clark, 1993). For example, individuals with social anxiety preferentially focus on threatening cues both in the environment (Rapee & Heimberg, 1997; Schultz & Heimberg, 2008), as well as internally via their physiological reaction to situations (Stopa & Clark, 1993) and their self-images as poor social interactants (Hambrick, Weeks, Harb, & Heimberg, 2003; Schultz & Heimberg, 2008). The ambiguous nature of social environments enhances the tendency of individuals with social anxiety to find information consistent with the appraisal of threat (Schultz & Heimberg, 2008). Allocating so much attention to potential threat also limits socially anxious individuals' ability to seek out disconfirming evidence in the external environment (Stopa & Clark, 1993). Fear of negative evaluation is also associated with more negative perception of social performance (Cody & Teachman, 2010; Rapee & Heimberg, 1997) and preferential memory for negative evaluative feedback (Cody & Teachman, 2010). Attention for negative social cues, appraisal of anxiety as a sign of social threat or failure, and negative interpretation of social encounters are associated with the development of rigid schemas of the self as less competent in interactions and more likely to be criticized by others for ostensibly poor performance in social situations (Schultz & Heimberg, 2008).

1.2 Exposure and Relaxation

The traditional treatment for anxiety disorders is exposure therapy, in which clients are exposed to increasingly anxiety-provoking situations. According to Foa and Kozak's (1986) emotional processing model, *fear networks* are composed of information about the feared stimulus, the behavioral response to the stimulus (e.g., to escape from threat), and the general meaning assigned to the stimulus (i.e., danger and threat). Fear networks are activated by exposure to stimuli that are sufficiently similar to the feared stimulus or situation.¹ As the feared stimulus is repeatedly presented, reactivity to the stimulus decreases, and individuals are said to have habituated and experienced new learning (Foa & Kozak, 1986). For example, Borkovec and Sides (1979) observed that individuals successfully treated with exposure therapy had heightened initial cardiac response to feared stimuli, which gradually subsided over repeated presentations of the stimulus. After several sessions of exposure and habituation, clients' responses to the feared stimulus diminished (Borkovec & Sides, 1979). Foa and Kozak (1986) cite several studies that indicate that this habituation can only be achieved with long enough exposure durations, and they posit that initial physiological activation is essential for new learning to occur.

There are some clients, however, for whom the efficacy of exposure therapy and CBT treatments that incorporate exposure therapy is limited. For example, in an investigation of manualized CBT for SAD, 26.7% of participants were not classified as treatment responders (Ledley et al., 2009). Other investigations of CBT have yielded non-response rates of between 26%-50% for individual CBT (Goldin et al., 2012; Mörtberg, Clark, Sundin, & Wistedt, 2007;

¹ Craske et al. (2008) argue that there is limited support for the idea that initial physiological activation, within-session habituation, and between-session habituation are necessary for achieving fear reduction in exposure therapy. The authors instead propose an inhibitory learning, rather than extinction learning, model of exposure.

Stangier, Heidenreich, Peitz, Lauterbach, & Clark, 2003), 53%-87% for group CBT (Bjornsson et al., 2011; Hedman et al., 2011; Mörtberg et al., 2007; Stangier et al., 2003), and 55%-69% for internet-based CBT (Andersson, Carlbring, & Furmark, 2012; Hedman et al., 2011). Research on enhancing exposure treatment is thus warranted. One much-studied addition to behavioral and cognitive treatments for anxiety is relaxation (Francesco, Mauro, Gianluca, & Enrico, 2010), which has historically been utilized as a primary anxiety-reduction technique in conditions such as SAD (Goldfried & Trier, 1974). In isolation, relaxation offers a number of benefits, including decreasing sympathetic nervous system activity (Goldfried & Trier, 1974), increasing parasympathetic nervous system activity (Sakakibara, Takeuchi, & Hayano, 1994), providing a sense of control over anxiety (Francesco et al., 2010), reducing salivary cortisol levels (Pawlow & Jones, 2002), and reducing levels of state (Hazlett-Stevens & Borkovec, 2001) and trait (Francesco et al., 2010) anxiety. Finally, Thayer, Friedman, and Borkovec (1996) found that heart rate variability (as defined by inter-beat intervals) and high frequency spectral power (which is indicative of greater parasympathetic activity) were greater during a period of relaxation than during a period of worry.

One way of enhancing the efficacy of exposure-based treatment methods is to combine exposure with other components of treatment that for theoretical and/or empirical reasons may facilitate some of the mechanisms inherent in exposure-based approaches. For example, Butler, Cullington, Munby, Aimies, and Gelder (1984) randomly assigned individuals with SAD to either (a) exposure plus an anxiety management program that focused on progressive muscle relaxation, distraction, and rational self talk; (b) exposure plus an associative therapy control condition in which participants recalled thoughts and memories and were guided to a better understanding of themselves and their situational context; or (c) a waitlist control group. Results

indicated that participants receiving exposure plus anxiety management evidenced significantly greater improvement on measures of anxiety and social functioning relative to participants receiving exposure plus associative therapy and participants on a waitlist.

Similarly, Borkovec and Sides (1979) tested whether relaxation facilitates the processing of fear stimuli in exposure therapy, as indexed by greater heart rate reactivity to initial stimulus presentation, more vivid imagery associated with the stimulus, and greater habituation of fear. Socially anxious participants were randomly assigned to one of four treatment groups: (a) prior relaxation training followed by exposure, (b) exposure followed by relaxation, (c) exposure only with pleasant imagery employed to control for relaxation, or (d) no treatment. Participants receiving prior relaxation followed by exposure evidenced the greatest heart rate reactivity to initial imagery exposures and the highest ratings of imagery vividness. In addition, participants receiving prior relaxation followed by exposure evidenced the greatest reductions in subjective fear and greater rate of decline in heart rate across repeated exposures, suggesting greater habituation. A later study by Hazlett-Stevens and Borkovec (2001) also demonstrated that socially anxious participants who received relaxation training (relative to those who received a worry induction) prior to exposure reported decreased subjective anxiety during *in vivo* exposure to social anxiety-relevant cues. Individuals who received either the relaxation or a neutral induction additionally evidenced a steady pattern of habituation (as indexed by self-reports of subjective anxiety) over the course of repeated exposures, whereas individuals who received the worry induction reported alternating increases and decreases in subjective anxiety, but not overall habituation. These findings indicate that a prior period of relaxation seems to enhance the efficacy of exposure by producing greater fear habituation in socially anxious individuals.

1.3 **Cognitive Therapy and Relaxation**

Although many studies have examined the combination of relaxation and exposure-based therapy, others have studied the combination of relaxation and elements of cognitive therapy. For example, in a randomized clinical trial, Borkovec and Costello (1993) provided coping skills, modification of thoughts and beliefs related to anxiety, and applied relaxation training focusing on recognizing anxious cues and deploying relaxation techniques such as deep breathing. Participants with generalized anxiety disorder (GAD) were randomly assigned to receive either (a) CBT plus applied relaxation, (b) applied relaxation alone, or (c) nondirective therapy. Results indicated that only participants receiving applied relaxation alone showed significant reductions in daily diary anxiety measures, and only participants receiving CBT plus applied relaxation reported significant reductions in symptoms such as worry and depression. The authors theorized that CBT and applied relaxation target different aspects of anxiety. Therefore, receiving applied relaxation in addition to CBT may improve multiple domains of functioning affected by anxiety, resulting in greater overall treatment gains relative to receiving one element or the other alone (Borkovec & Costello, 1993).

The combination of relaxation and cognitive therapy has also been examined in conditions related to SAD. For example, Dendato and Diener (1986) randomly assigned participants with test anxiety to receive either (a) relaxation plus rational-emotive cognitive therapy plus study skills training (R+RECT+SST), (b) relaxation plus rational-emotive cognitive therapy alone (R+RECT-alone), (c) study skills training alone (SST-alone), or (d) no treatment. Although only participants receiving R+RECT+SST demonstrated improvements in academic performance, both this group and participants receiving R+RECT-alone reported reduced

anxiety. This suggests that the combination of relaxation with RECT was uniquely associated with anxiety reduction.

Additionally, Sweeney and Horan (1982) assigned participants with music performance anxiety to receive either (a) cue-controlled relaxation plus cognitive restructuring (CCR+CR); (b) cue-controlled relaxation alone (CCR-alone); (c) cognitive restructuring alone (CR-alone); (d) standard treatment, consisting of music analysis and sight-reading skills; or (e) a waitlist control group. The combination of CCR+CR was notably more efficacious than either component (i.e., CCR or CR) in isolation. Participants in the CCR-alone and CR-alone groups displayed equal reductions in state anxiety during a performance (as measured by pulse rate); however, although participants receiving either CCR-alone or CCR+CR reported less debilitation due to their anxiety and were rated by judges as more musically competent relative to the other groups, only participants receiving either CR-alone or CCR+CR exhibited reductions in behavioral indicators of anxiety, such as wringing their hands or biting their lips. These results indicate that participants in the CCR+CR group evidenced improvements in all of the outcome measures that had improved for the CCR-alone and CR-alone groups in isolation (i.e., debilitation, musical competence, and behavioral indicators of anxiety). As in other studies (Borkovec & Costello, 1993; Dendato & Diener, 1986), the combination of relaxation with cognitive interventions appears to be efficacious in reducing anxiety. This more broadly suggests that relaxation and cognitive treatment elements may offer unique contributions to the treatment of anxiety disorders. Investigating the incorporation of relaxation into other treatments targeting cognitive mechanisms of anxiety may therefore be valuable.

1.4 Cognitive Bias Modification Paradigms

More recently, theoretical and empirical approaches have focused on cognitive bias modification (CBM) training, a promising avenue of treatment. CBM paradigms function similarly to CBT in that they aim to reduce cognitive and interpretive biases in anxiety by modifying individuals' associations with and interpretations of threatening and ambiguous information (Amir & Taylor, 2012), but do so implicitly using computerized training approaches. There are two primary categories of CBM training paradigms. *Attention-oriented paradigms* (CBM-A; e.g., Amir et al., 2009; Beard, Weisberg, & Amir, 2011; Brosan, Hoppitt, Shelfer, Sillence, & Mackintosh, 2011) direct participants' attention toward benign or neutral stimuli and away from threat stimuli. This reduces anxious individuals' tendency to focus on threatening cues (Amir et al., 2009; Brosan et al., 2011). Alternatively, *interpretation-oriented paradigms* (CBM-I) present participants with ambiguous scenarios to resolve with a positive (or negative) outcome; one mediation analysis showed that this approach leads to more benign interpretations of ambiguous scenarios, which in turn reduces anxiety (Salemink, van den Hout, & Kindt, 2010a). A recent meta-analysis found small, but reliable, effects across both types of CBM paradigms on anxiety and depression symptom reduction, especially when outcomes were measured after exposure to a stressor rather than at post-training (Hallion & Ruscio, 2011). Additionally, CBM-I paradigms were found to be significantly more effective than CBM-A paradigms in the reduction of interpretation biases in anxiety and depression (Hallion & Ruscio, 2011).

CBM paradigms have been employed across a broad spectrum of anxiety and mood pathology, including GAD (e.g., Hayes, Hirsch, Krebs, & Mathews, 2010), obsessive-compulsive disorder (e.g., Clerkin & Teachman, 2011), anxiety sensitivity (e.g., Steinman &

Teachman, 2010), specific phobia (e.g., Teachman & Addison, 2008), and depression (e.g., Lang, Blackwell, Harmer, Davison, & Holmes, 2012). Importantly, CBM paradigms have also been demonstrated to be effective in targeting cognitive biases in social anxiety.

Three different methodological approaches have been utilized in recent investigations of CBM for SAD. First, Clerkin and Teachman (2010) targeted implicit associations of individuals with social anxiety (i.e., the self in social performance situations associated with negative evaluation by others). Participants were presented with pictures of the participants themselves (the “self”) engaging in social tasks, pictures of strangers engaging in nonsocial tasks, or nonsocial pictures, and were then presented with either a positive, negative, or neutral evaluation (via standard representations of happy, disgust, or neutral faces, respectively). Participants were randomly assigned to one of three conditions: (a) positive social (“self” always followed by positive evaluation, stranger followed by a random evaluation valence); (b) neutral social (both “self” and stranger followed by a random evaluation valence); or (c) no social performance (only nonsocial stimuli, all of which were followed by a random evaluation valence). Although there was no evidence for differences in state anxiety levels between training conditions either following training or following a behavioral speech task, participants who received the positive social training were more likely to fully complete the behavioral speech task than were participants in the other two training groups (neutral social and no social performance).

Second, Amir and colleagues (Amir, Bomyea, & Beard, 2010; Amir & Taylor 2012; Beard & Amir, 2008; Beard & Amir, 2009) have employed a word-sentence association paradigm. In this approach, socially anxious participants are presented with a threatening or benign word followed immediately by an ambiguous sentence related to social situations and must indicate whether the word and sentence are related or unrelated. In each of these studies,

participants were randomly assigned to either (a) an interpretation modification condition, in which reinforcing feedback was given for correct (i.e., benign/rejecting threat) interpretations and negative feedback was given for incorrect (i.e., threat/rejecting benign) interpretations, or (b) a control condition in which reinforcing feedback was given for 50% of benign/rejecting threat interpretations and 50% of threat/rejecting benign interpretations to avoid inducing either a positive or a negative interpretation bias. Results indicated that participants receiving the interpretation modification condition made more benign and fewer threat interpretations relative to the control condition (Amir et al., 2010; Amir & Taylor, 2012; Beard & Amir, 2008; Beard & Amir, 2009). Participants in the interpretation modification condition also reported decreased social anxiety symptoms (Amir & Taylor, 2012; Beard & Amir, 2008, Beard & Amir, 2009) as well as decreased trait anxiety, depression, and avoidance symptoms (Amir & Taylor, 2012). Reduced interpretation bias was additionally associated with faster disengagement from threatening stimuli (Amir et al., 2010).

Finally, Mathews and Mackintosh (2000) conducted a series of experiments in which socially anxious participants completed word fragments to resolve ambiguous scenarios. In the training phase, participants were presented with ambiguous social scenarios, which were resolved in either a positive or a negative manner via an incomplete key word in the final sentence. The positive training condition contained scenarios that resulted in predominantly positive outcomes, whereas the negative training condition included scenarios with predominantly negative outcomes. Participants then completed a test phase. Novel ambiguous scenarios were presented, but all of the key words resolved the scenario in a way that maintained its ambiguity. Participants were shown the title of a scenario and were instructed to rate each of four choices for similarity to the outcome of the original scenario: one positive social outcome,

one negative social outcome, one positive nonsocial “foil” outcome, and one negative nonsocial foil outcome. Interpretation bias was determined by the relative similarity participants ascribed to each type of choice for the resolution of the scenarios. Results indicated that participants who received positive interpretation training were more likely than those who received negative interpretation training to resolve novel ambiguous scenarios more benignly, in that they more frequently chose the benign social outcome as most similar to the original resolution. Moreover, effects were not simply due to mood changes or mood-congruent interpretation, as demonstrated by more frequent selection of social interpretations over foils. In subsequent studies, effects of interpretation training were found to endure despite a 20-minute delay between training and recognition testing (Yiend, Mackintosh, & Mathews, 2005). Effects were also maintained for at least 24 hours despite changes in situational context of testing, stimulus content, and sensory modality of stimulus presentation (Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006).

The investigation of alternative treatments for SAD is warranted by the imperfect rate of response to standard treatments, such as exposure therapy and cognitive interventions. Extant research has demonstrated the efficacy of relaxation in combination with exposure and/or cognitive treatments for various anxiety disorders, including SAD, but relatively few studies have examined relaxation as a facilitator of treatment effects. Relaxation may similarly enhance, and potentially facilitate, the effects of other cognitive treatments for anxiety, such as CBM. Based on previous research by Mathews and Mackintosh (2000), we predicted that participants would endorse relatively lower levels of negative interpretation and higher levels of positive interpretation of ambiguous social scenarios after undergoing the positive CBM-I training. Furthermore, we predicted that compared to participants who receive a socially anxious thinking or neutral induction, participants receiving a relaxation induction prior to CBM-I would evidence

fewer negative and more positive interpretations. Finally, we predicted that participants who received the relaxation induction would exhibit less behavioral avoidance and subjective anxiety relative to participants in the other conditions when confronted with a speech stressor task. Effects were measured both cognitively and behaviorally (via the speech stressor task) in an effort to examine implications for both laboratory and real life social settings.

2. METHODS

2.1 Design

Participants were randomly assigned to one of three induction conditions (relaxation, socially anxious thinking, or neutral thinking). All participants received positive CBM-I training.

2.2 Participants

Data were collected across three semesters from October 2013 to December 2014. Undergraduate students (aggregate $n = 2,123$) from a large, public, urban university underwent a mass screening procedure at the beginning of the semester through their Introduction to Psychology course, during which they were administered the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). Students were invited to participate if their SIAS scores were greater than or equal to 34, which is one standard deviation above the general population mean. Participants were excluded if they had ever or were currently receiving treatment for social anxiety related concerns. Participants ($n = 177$) were re-administered the SIAS at the study session and were excluded if their SIAS scores were less than 34 ($n = 63$); an additional four participants were excluded from analyses because their data were not properly recorded, and seven participants failed to complete all questionnaires and thus had incomplete trait questionnaire data.

The final sample was composed of 103 individuals (74.8% female, 20.4% male²) aged 19 to 28 ($M = 20.30$, $SD = 1.39$), who were predominantly in their freshman (47.6%) or sophomore (32.0%) year of college. The primary languages spoken by participants were English (68.9%), Spanish (12.6%), Chinese (3.9%), or another language (9.7%) including Korean, Farsi, Haitian,

² Five participants did not report gender.

Arabic, Hindi, Tagalog, Turkish, Urdu, and Vietnamese; 4.9% of participants did not report their primary language. All participants were highly socially anxious according to SIAS scores ($M = 47.23$, $SD = 9.07$).

2.3 Measures

2.3.1 Social Interaction Anxiety Scale

The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) is a 20-item self-report scale that measures social anxiety-relevant fears about and reactions to social interactions. The SIAS has been shown to have high internal consistency (Cronbach's $\alpha = .93$) and retest reliability over periods of four and 12 weeks (both $r_s = .92$). Using a cutoff score one standard deviation above the mean found in a community sample (i.e., ≥ 34), 82% of socially phobic participants were correctly classified as phobic (Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992). This study utilized this cutoff to obtain an analogue sample of highly socially anxious individuals. Internal consistency in the current sample was good (Cronbach's $\alpha = .78$).

2.3.2 Subjective Units of Distress Scale

Participants reported their subjective feelings of anxiety via the Subjective Units of Distress Scale (SUDS) on a scale from 0 ("not at all anxious") to 100 ("extremely anxious").

2.3.3 Positive and Negative Affect Schedule

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report measure consisting of 10 positive valence and 10 negative valence adjectives that provides an assessment of both positive affect (PA) and negative affect (NA). The PANAS has demonstrated good internal consistency (PA $\alpha = .89$, NA $\alpha = .85$) for momentary assessment of affect. Retest reliability is moderate for both subscales (PA $\alpha = .54$, NA $\alpha = .45$) for momentary assessment of affect. Factor analyses indicate that a two-factor

solution corresponding to PA and NA accounts for 73.3% to 75.4% of the total variance, and confirmatory factor analyses suggested excellent specificity of items to their designated subscale. The PA subscale (but not the NA subscale) is additionally associated with other constructs related to positive emotional states, including social activity, and the NA subscale (but not the PA subscale) is associated with measures of psychological symptoms (e.g., depression, general symptoms) and other measures of negative affect. In the current sample, the PA subscale demonstrated good internal consistency at baseline ($\alpha = .80$), post-induction ($\alpha = .89$), post-training ($\alpha = .89$), and post-speech ($\alpha = .81$), as did the NA subscale at baseline ($\alpha = .81$), post-induction ($\alpha = .87$), post-training ($\alpha = .79$), and post-speech ($\alpha = .87$).

2.3.4 **Social Phobia Diagnostic Questionnaire**

The Social Phobia Diagnostic Questionnaire (SPDQ; Newman, Kachin, Zuellig, Constantino, & Cashman-McGrath, 2003) is a 25-item self-report questionnaire that assesses the degree of fear and avoidance of various social situations, degree of interference caused by symptoms, and the degree of distress experienced as a result of symptoms. The SPDQ demonstrated high internal consistency ($\alpha = .95$), good two-week retest reliability ($k = .63$), and kappa agreement of .66 with interview-based diagnostic measures of SAD. The SPDQ has demonstrated 82% sensitivity and 85% specificity for diagnosing SAD. Internal consistency in the current sample was good for the total scale ($\alpha = .88$), the Fear subscale ($\alpha = .89$), and the Avoidance subscale ($\alpha = .82$).

2.3.5 **Perseverative Thinking Questionnaire**

The Perseverative Thinking Questionnaire (PTQ; Ehring et al., 2011, study 2) is a 15-item self-report measure that assesses broad characteristics (e.g., frequency, uncontrollability, distress) of repetitive negative thought processes consistent with worry,

rumination, and obsessions. However, it was designed to be independent of these specific content domains. The PTQ was found to have excellent internal consistency ($\alpha = .95$) in a community sample, and satisfactory retest reliability within a one-month period ($r = .69$; study 1). Scores on the PTQ are significantly associated with other measures of negative repetitive thought processes, measures of depression, and measures of trait anxiety, and are therefore elevated in individuals with a current diagnosis of depression or an anxiety disorder. Internal consistency in the current sample was excellent ($\alpha = .93$). We administered this questionnaire to ensure that participants across the three induction conditions had comparable levels of trait engagement in repetitive negative thought processes that might impact the efficacy of inductions.

2.3.6 **Beck Depression Inventory- II**

The Beck Depression Inventory- II (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item self-report measure that assesses features related to depression, such as pessimism and sadness, over the past two weeks. The BDI-II has high internal consistency in undergraduate samples ($\alpha = .90$; Osman et al., 1997) and excellent retest reliability over durations varying from one to 12 days after initial assessment in a university counseling center sample ($r = .82-1.00$; Sprinkle et al., 2002). Scores on the BDI-II are highly correlated with number of symptoms of *DSM-IV-TR* depression, and a cut-off score of 16 has 84% sensitivity and 82% specificity for identifying individuals who qualify for a diagnosis of major depression (Sprinkle et al., 2002). Internal consistency in the current sample was good ($\alpha = .79$).

2.3.7 **Relaxed, Anxious, and Depressed Affect**

Single-item measures of anxious, depressed, and relaxed affect were used as a manipulation check for the efficacy of the three induction conditions. Participants rated the degree to which they felt “anxious,” “depressed,” and “relaxed” on a 1 (“not at all”) to 5

(“extremely”) Likert scale. This procedure is similar to procedures utilized in other studies (e.g., Behar et al., 2012; Behar, Zuellig, & Borkovec, 2005).

2.3.8 **Modified Perception of Speech Performance**

The Modified Perception of Speech Performance (MPSP; Cody & Teachman, 2011) is a brief self-report questionnaire based on a measure used by Rapee and Lim (1992) that assesses perceived quality of public speaking performance and behaviors. Participants rate each item in terms of how present it was during a speech they performed. The MPSP contains equal numbers of positively- and negatively-valenced items as well as equal numbers of global evaluative items (e.g., “made a bad impression,” “generally spoke well”) and more specific items (e.g., “kept eye contact,” “had long pauses”), allowing for examination of four distinct subscales: positive indicators of performance, negative indicators of performance, global performance elements, and specific performance elements. Negative items in both the MPSP and the original measure are reverse-scored such that higher ratings on items indicate better speech performance. The original measure, which only included global elements and specific elements subscales, has good internal consistency for self-ratings of both global ($\alpha = .79$) and specific ($\alpha = .86$) items (Rapee & Lim, 1992). Rapee and Lim (1992) showed that relative to non-socially-anxious individuals’ ratings, socially anxious individuals rate their performance on speeches as being worse; observers also rated socially anxious individuals’ speeches as being worse than non-socially-anxious individuals’ speeches. In the current sample, internal consistency was good for the total MPSP scale ($\alpha = .75$), but was only acceptable for global items ($\alpha = .65$) and was poor for specific items ($\alpha = .54$).

2.4 Procedure

This study was approved by the University of Illinois at Chicago's Institutional Review Board. Upon arrival, participants were seated at a desk with a computer monitor and keyboard and gave their informed consent. They completed baseline assessments including a SUDS rating; baseline relaxed, anxious, and depressed affect ratings; and a baseline PANAS. They then completed the SIAS, as well as demographic information, the BDI-II, the PTQ, and SPDQ.

Figure 1 presents an outline of study procedures.

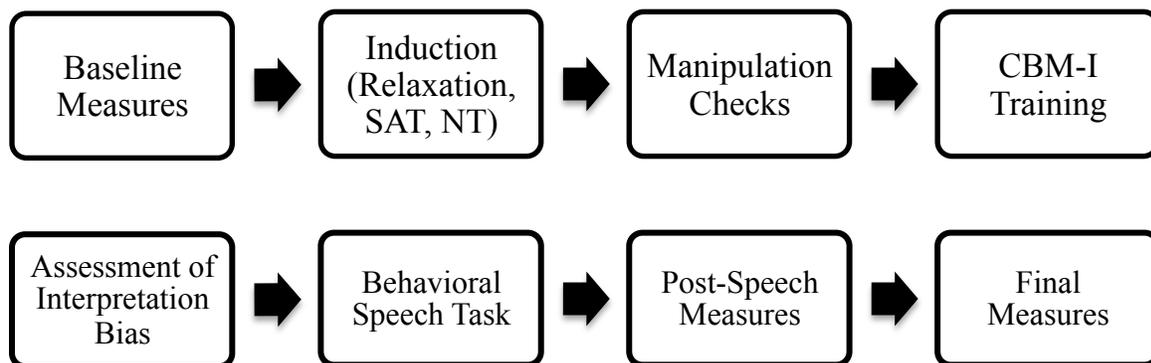


Figure 1. Outline of study procedures.

2.4.1 Assessment of Idiographic Stimuli

Participants were randomly assigned to one of the three induction conditions (relaxation, socially anxious thinking [SAT], or neutral thinking [NT]). Participants assigned to

undergo a relaxation induction were presented with a list of relaxing situations and rated how relaxing they would find each situation to be on a Likert scale from 1 (“extremely relaxing”) to 7 (“extremely tense”). The three situations with ratings closest to “extremely relaxing” ($M = 1.34$, $SD = 0.66$) were used as stimuli during the induction. Similarly, participants assigned to undergo the SAT induction were presented with a list of social situations, and rated how distressing they would find each situation to be on a Likert scale from 1 (“not at all distressing”) to 7 (“extremely distressing”). The three situations with the highest ratings of distress ($M = 8.27$, $SD = 0.66$) were selected as stimuli for the induction. Finally, participants assigned to undergo the NT induction were presented with a list of topics that most people would find to be relatively neutral, such as “you are thinking about what buildings or landmarks you will pass on your commute to school/work” or “you are thinking about what ingredients you will need to make a recipe.” Topics were future-oriented to closely parallel the SAT topics, but were neutral in valence. Participants rated the valence of each topic on Likert scale from 1 (“very positive”) to 7 (“very negative”). The three topics with ratings closest to a neutral valence (i.e., 4 on the Likert scale; $M = 4.93$, $SD = 0.36$) were selected as stimuli for the induction.

2.4.2 **Induction**

The experimenter then guided participants through a 9-minute induction. Participants assigned to undergo the relaxation induction were instructed to breathe deeply, in and out from their diaphragm, taking care to release the tension from their muscles and focus on calming thoughts related to the first most relaxing situation from the idiographic stimuli. After three minutes, participants were prompted to think about the second most relaxing situation they had indicated; the same procedure was utilized for the third most relaxing situation that was indicated. The same structure was utilized for both the SAT and NT inductions. Participants

assigned to undergo the SAT induction were instructed to think about the first, second, and third most distressing scenarios in the way that they usually do, but as intensely as they could.

Participants assigned to undergo the NT induction were instructed to think about the first, second, and third most neutral scenarios, and were asked to think about all of the details involved in the process or activity.

2.4.3 **Manipulation Checks**

Immediately following each of the three three-minute induction segments, participants indicated the percentage of time (0-100%) they were actually engaged in the assigned task; this served to assess whether participants were equally engaged in the task across induction conditions. To assess whether experimental inductions had the anticipated effects on participants' anxiety and affect, they then completed (a) the post-induction SUDS rating; (b) post-induction ratings of relaxed, anxious, and depressed affect; and (c) the post-induction PANAS.

2.4.4 **Training**

After the manipulation checks, participants underwent the computerized CBM-I training. The CBM-I training was modeled after procedures used by Mathews and Mackintosh (2000), and utilized identical stimuli to those used in that investigation. We chose a CBM-I paradigm rather than a CBM-A paradigm based on evidence suggesting that interpretation paradigms yield stronger effects (Hallion & Ruscio, 2011), and because participants tend to find CBM-I to be relatively less boring and more credible than CBM-A (Beard et al., 2011). This paradigm was also selected because evidence suggests that active generation of responses is crucial for successful modification of interpretation biases (Matthews & Mackintosh, 2000). Additionally, all participants received the positive version of the CBM-I training for two reasons.

First, the superiority of the positive training compared to either negative (e.g., Mathews & Mackintosh, 2000; Yiend et al., 2005) or neutral (e.g., Beard & Amir, 2008; Salemk, Kindt, Rienties, & van den Hout, 2014) training conditions has been consistently demonstrated. Second, the primary purpose of this study was to investigate the impact of the experimental manipulations rather than training type.

Participants read a series of ambiguous social scenarios. A fragmented key word in the last sentence of the scenario resolved the scenario in a positive manner. For instance, “Your partner asks you to go to an anniversary dinner that their company is holding. You have not met any of their work colleagues before. Getting ready to go, you think that the new people you will meet will find you fr__n_ly. Will you be disliked by your new acquaintances?” <Yes/No>.” Participants typed the letter that belonged in the first blank space of the word to complete the fragment. All 80 training scenarios were resolved in a positive manner. Training blocks also included 20 probe scenarios (10 positive and 10 negative) to mask the intention of the study and to examine the speed with which participants responded to scenarios with congruent or incongruent valence to the training.

2.4.5 **Assessment of Interpretation Bias**

Following the training portion of the CBM-I, participants completed a test phase. Twenty new ambiguous social scenarios were presented to the participant in the same format, but the resolution of these scenarios was ambiguous. One sample item was: “The Wedding Reception: Your friend asks you to give a speech at her wedding reception. You prepare some remarks and when the time comes, get to your feet. As you speak, you notice some people in the audience start to (1—gh) [laugh]. Did you stand up to speak? (Yes/No).” Afterward, the title of the scenario was displayed along with a randomized succession of four

response choices as to how the scenario was resolved: one positive social result, one negative social result, one positive nonsocial foil, and one negative nonsocial foil. Participants were instructed to rate each choice, independently of the others, on a scale of 1 (“very dissimilar”) to 4 (“very similar”) for similarity to the original resolution of the scenario. The efficacy of the CBM-I training was assessed by examining the relative similarity that participants ascribed to each type of outcome to the original resolution of the ambiguous scenarios. This allowed us to examine both a bias toward either positively valenced or negatively valenced outcomes (via both the foil outcomes and the social outcomes) and, more importantly, the participants’ positive or negative interpretations of ambiguous scenarios (via the social outcomes).

Participants then completed the post-training SUDS and the post-training PANAS.

2.4.6 **Speech task**

Next, participants completed a behavioral avoidance task in the form of an impromptu speech. This task was adapted from a task employed by Cody and Teachman (2011). Participants were informed that they would give a speech that would educate their peers on recent healthcare reforms in this country in front of the research assistant and a video camera; participants were told that they had up to five minutes to speak if they were willing to do so, and that they should try to plan their speech accordingly. Participants had two minutes to prepare their speech and write down notes on a blank piece of paper, during which time the experimenter left the room; participants were informed that they would not be allowed to use their notes during the actual speech. Upon re-entering the room, the experimenter took participants’ notes, set up the video camera, and asked participants to stand approximately five feet away from the camera. The experimenter reiterated the instructions and reminded participants that they could tell the experimenter if they would like to stop speaking at any point. Participants were informed that the

experimenter would be taking notes, and that the speech would later be viewed and evaluated by trained research assistants. Participants were asked to write down an *anticipatory SUDS rating* (i.e., how anxious they felt as they thought about giving their speech in front of the research assistant and the video camera) immediately before giving their speech. The experimenter then turned on the video camera, started a stopwatch, and told participants that they could begin speaking. While observing the speech, the experimenter maintained a neutral expression and consistent eye contact, and pretended to take notes. If participants stopped for more than ten seconds, ran out of things to say, or asked to stop, the experimenter said, “You have about X minutes remaining if you’d like to continue speaking.” Upon further refusal, the experimenter turned off the timer and camera, and asked participants to complete a *peak SUDS rating* (i.e., the highest level of anxiety they recalled experiencing during the entire speech task) and a *resolution SUDS rating* (i.e., the lowest level of anxiety they recalled experiencing during just the last minute of their speech). This was designed to assess both the maximum level of anxiety provoked by a social stressor (i.e., the speech), as well as the degree of habituation to fear achieved over the course of the stressor. The total speaking time was recorded and the video was saved for later behavioral coding.

Finally, participants sat down and completed the final PANAS and the MPSP. Participants were fully debriefed, and then reported their final SUDS rating. If a participant’s final SUDS rating was more than 20 points higher than his/her baseline SUDS rating, diaphragmatic breathing relaxation was administered until the participant’s SUDS level decreased to within 10 points of his/her baseline SUDS rating.

3. RESULTS

3.1 Preliminary Analyses

Pearson's chi-square statistics were used to examine between-groups differences in gender, ethnic, and primary language composition. Gender composition differed at trend levels between induction conditions, $\chi^2(2, n = 98) = 5.46, p = .065$, such that the number of males in the NT group was significantly greater than in the SAT group, $\chi^2(1, n = 62) = 4.31, p = .038$, and tended to be greater than in the Relaxation group, $\chi^2(1, n = 67) = 3.12, p = .078$; the gender composition did not differ between the Relaxation and SAT groups, $\chi^2(1, n = 67) = 0.19, p = .666$. No between-groups differences were found for primary language spoken, $\chi^2(2, n = 98) = 3.09, p = .798$. A univariate analysis of variance (ANOVA) indicated no significant between-groups differences in age, $F(2, 95) = 1.67, p = .193, \eta_p^2 = .034$.

A multivariate ANOVA (MANOVA) was then conducted on baseline affect measures (SUDS; single-item relaxed, anxious, and depressed affect ratings; PANAS), and yielded no between-groups differences, $F(12, 184) = 0.66, p = .784, \eta_p^2 = .041$ (see TABLE I). Univariate ANOVAs on baseline symptom measures (SIAS, SPDQ, BDI-II, and PTQ) likewise yielded no between-groups differences as measured by the SIAS, $F(2, 100) = 2.32, p = .104, \eta_p^2 = .044$, SPDQ, $F(2, 95) = 0.46, p = .633, \eta_p^2 = .010$, BDI-II, $F(2, 95) = 0.44, p = .647, \eta_p^2 = .009$; or PTQ, $F(2, 95) = 1.11, p = .335, \eta_p^2 = .023$. These results indicate that random assignment was successful in producing three groups with equivalent levels of trait symptoms and baseline state affect.

TABLE I. MEANS AND STANDARD DEVIATIONS OF MEASURES ADMINISTERED FOR EACH INDUCTION CONDITION

Measure	Relaxation	SAT	NT	Overall
PANAS PA				
Baseline	24.11 (6.68)	24.41 (5.51)	24.55 (6.13)	24.35 (6.09)
Manipulation	23.27 (7.74)	20.45 (6.97)	21.70 (7.54)	21.89 (7.46)
Training	19.38 (7.42)	17.72 (6.32)	19.30 (8.24)	18.83 (7.35)
Speech	16.89 (6.48)	15.40 (4.87)	16.47 (4.61)	16.30 (5.42)
PANAS NA				
Baseline	17.50 (6.63)	15.72 (4.54)	15.52 (5.18)	16.29 (5.58)
Manipulation	14.08 (6.52)	15.63 (5.64)	13.15 (3.64)	14.26 (5.49)
Training	14.49 (4.90)	14.84 (5.04)	13.06 (3.70)	14.14 (4.61)
Speech	23.31 (7.86)	22.00 (9.28)	23.22 (8.71)	22.88 (8.52)
SIAS	44.95 (7.09)	49.55 (10.15)	47.47 (9.56)	44.59 (8.31)
BDI	20.11 (10.24)	22.68 (11.97)	21.65 (11.88)	19.15 (9.88)
SPDQ	16.05 (3.09)	16.91 (4.08)	16.36 (3.93)	61.22 (11.71)
Fear	8.94 (2.19)	9.09 (2.84)	9.09 (2.84)	52.13 (10.37)
Fear	1.64 (0.70)	1.76 (0.72)	1.73 (0.81)	48.74 (9.53)
PTQ	30.11 (10.36)	32.42 (12.16)	33.97 (9.49)	46.80 (10.66)
MPSP	12.21 (6.21)	13.00 (7.28)	11.10 (5.92)	12.08 (6.43)
Positive items	3.30 (2.40)	3.85 (2.85)	3.83 (3.22)	3.64 (2.80)
Negative items	8.91 (4.98)	9.15 (5.33)	7.28 (4.23)	8.44 (4.88)
Global items	6.39 (3.69)	7.38 (4.26)	5.48 (3.48)	6.39 (3.83)
Specific items	5.82 (3.24)	5.62 (3.44)	5.62 (3.58)	5.69 (3.38)

3.2 Manipulation Checks

To assess degree of engagement in the inductions, we first conducted a univariate ANOVA (Induction) on the average percentage of time participants reported engaging in the induction. We used Bonferroni corrections to account for multiple comparisons, resulting in a critical p value of .017 for follow-up tests. Results indicated a significant main effect of Induction, $F(2, 102) = 4.36, p = .015, \eta_p^2 = .080$, such that participants reported engaging in the SAT induction ($M = 61.48, SD = 22.28$) a greater percentage of time relative to participants in the Relaxation induction ($M = 48.24, SD = 16.98$), $t(68) = -2.81, p = .006, d = .67$, and relative to

participants in the NT induction at a trend level. The percentage of time participants reported engaging in the inductions did not differ between the Relaxation versus NT ($M = 52.83$, $SD = 17.22$) inductions [$t(68) = -1.12$, $p = .266$, $d = .27$] and the SAT versus NT inductions [$t(64) = 1.77$, $p = .082$, $d = .43$].

Second, to examine the efficacy of the inductions, we conducted a 2 (Time: baseline, post-induction) x 3 (Induction: relaxation, SAT, NT) repeated-measures MANOVA on SUDS, relaxed affect, anxious affect, depressed affect, PA, and NA ratings. Results indicated that there was a significant multivariate main effect of Time [$F(6, 88) = 11.76$, $p < .001$, $\eta_p^2 = .445$] for all affect measures, which was qualified by a significant Time x Induction interaction [$F(12, 178) = 2.09$, $p = .019$, $\eta_p^2 = .124$]. The follow-up univariate tests indicated that this interaction was significant for SUDS ratings and NA, and approached significance for anxious affect and PA. For the SUDS ratings [$F(2, 93) = 6.56$, $p = .002$, $\eta_p^2 = .124$], participants in the Relaxation condition reported significant decreases from baseline to post-induction, [$t(35) = 6.59$, $p < .001$, $d = .90$] and participants in the NT condition reported decreases from baseline to post-induction at the level of a trend [$t(32) = 1.86$, $p = .073$, $d = .31$], whereas participants in the SAT condition did not report changes from baseline to post-induction [$t(31) = 0.11$, $p = .912$, $d = .02$]. Similarly, for the NA ratings [$F(2, 93) = 6.07$, $p = .003$, $\eta_p^2 = .115$], participants in both the Relaxation [$t(35) = 4.88$, $p < .001$, $d = .52$] and NT [$t(32) = 3.20$, $p = .003$, $d = .53$] conditions reported significant decreases from baseline to post-induction, but the SAT group did not report significant changes [$t(31) = 0.12$, $p = .907$, $d = .02$]. For the anxious affect ratings [$F(2, 93) = 2.71$, $p = .072$, $\eta_p^2 = .055$], participants in the Relaxation condition reported significant decreases from baseline to post-induction [$t(34) = 4.68$, $p < .001$, $d = .82$], and participants in the NT condition reported decreases at trend levels [$t(31) = 1.79$, $p = .083$, $d = .30$]; however, again

participants in the SAT condition did not report significant changes in anxious affect [$t(32) = 0.71, p = .484, d = .14$]. For the PA ratings [$F(2, 93) = 2.58, p = .081, \eta_p^2 = .053$], participants in the Relaxation condition did not report significant changes in PA [$t(35) = 0.87, p = .392, d = .14$], but participants in both the SAT [$t(30) = 4.74, p < .001, d = .68$] and NT [$t(32) = 3.85, p = .001, d = .41$] conditions reported significant decreases in PA. There was no Time x Induction interaction for Relaxed Affect [$F(2, 93) = 0.98, p = .378, \eta_p^2 = .021$] or Depressed Affect [$F(2, 93) = 0.42, p = .662, \eta_p^2 = .009$]. TABLE II lists more detailed results of univariate follow-up analyses for each induction condition, as well as between-groups differences in magnitude of affect change. In sum, participants in the Relaxation condition generally reported reduced anxiety and NA and no change in relaxed affect or PA; participants in the SAT condition reported decreased PA, but no changes in anxiety or NA; and participants in the NT condition reported affective changes that were in between those reported by participants in the Relaxation and SAT conditions.

TABLE II. RESULTS OF UNIVARIATE FOLLOW-UP ANALYSES: CHANGES IN SELF-REPORTED AFFECT FROM BASELINE TO POST-INDUCTION FOR EACH INDUCTION CONDITION

	<i>M (SD)</i> Baseline	<i>M (SD)</i> Post- Induction	t	p
Relaxation				
SUDS	35.82 (22.80)	16.91 (19.44)	6.31	< .001 ^{ab}
Relaxed affect	3.00 (0.98)	3.71 (1.06)	5.42	< .001
Anxious Affect	2.47 (0.79)	1.79 (0.91)	4.49	< .001 ^{ac}
Depressed Affect	1.65 (0.95)	1.38 (0.82)	2.32	.027
PA	24.06 (5.94)	23.03 (7.18)	0.84	.405 ^a
NA	17.82 (6.68)	14.24 (6.76)	4.85	< .001 ^a
SAT				
SUDS	30.07 (24.28)	29.20 (19.72)	0.20	.847
Relaxed affect	2.93 (0.91)	3.27 (1.08)	1.33	.194
Anxious Affect	2.40 (1.13)	2.30 (1.06)	0.44	.669
Depressed Affect	1.47 (0.78)	1.33 (0.71)	1.44	.161
PA	24.97 (5.22)	20.73 (6.90)	4.59	< .001
NA	15.63 (4.65)	15.80 (5.79)	0.20	.842
NT				
SUDS	31.69 (20.96)	24.84 (18.88)	2.02	.052
Relaxed affect	2.91 (0.96)	3.34 (1.07)	2.18	.037
Anxious Affect	2.47 (0.92)	2.19 (0.97)	1.79	.083
Depressed Affect	1.69 (1.12)	1.44 (0.84)	2.10	.044
PA	24.56 (6.23)	21.69 (7.66)	3.77	.001
NA	15.56 (5.25)	13.13 (3.70)	3.22	.003 ^d

^a degree of change in Relaxation condition > degree of change in SAT condition

^b degree of change in Relaxation condition > degree of change in NT condition

^c (trend) degree of change in Relaxation condition > degree of change in NT condition

^d degree of change in NT condition > degree of change in SAT condition

3.3 Efficacy of Training

Using the 10 novel ambiguous scenarios from the test phase of the CBM-I procedure, we ran a 3 (Induction: relaxation, SAT, NT) x 2 (Valence: positive, negative) x 2 (Target: target, foil) mixed model ANOVA on the similarity ratings participants ascribed to the four potential outcomes of each of the test scenarios. The between-subjects factor was Induction, and the within-subjects factors included Valence and Target. As expected, results indicated significant main effects of both Target [$F(1, 100) = 314.41, p < .001, \eta_p^2 = .769$] and Valence [$F(1, 100) = 61.06, p < .001, \eta_p^2 = .379$], both of which were qualified by a significant Target x Valence interaction [$F(1, 100) = 11.07, p = .001, \eta_p^2 = .100$]. Although participants ascribed higher similarity ratings to targets than to foils for both negative ($M_{Target} = 2.66, SD_{Target} = 0.44; M_{Foil} = 1.63, SD_{Foil} = 0.45$) and positive ($M_{Target} = 2.89, SD_{Target} = 0.48; M_{Foil} = 2.07, SD_{Foil} = 0.58$) endings, these effects were stronger for negative endings [$t(102) = 19.05, p < .001, d = 2.31$] than for positive endings [$t(102) = 12.47, p < .001, d = 1.54$].

Results also indicated an Induction x Valence interaction at a trend level [$F(2, 100) = 2.66, p = .075, \eta_p^2 = .050$]. However, follow-up tests indicated that there were no between-groups differences in similarity ratings ascribed to either positive [$F(2, 100) = 1.50, p = .228, \eta_p^2 = .029$] or negative [$F(2, 100) = 0.74, p = .480, \eta_p^2 = .015$] endings. We therefore examined the efficacy of training within each induction condition. Participants ascribed greater similarity ratings to positive outcomes relative to negative outcomes in the Relaxation [$F(1, 36) = 7.82, p = .008, d = .59$], SAT [$F(1, 32) = 22.69, p < .001, d = .82$], and NT [$F(1, 32) = 39.52, p < .001, d = 1.30$] conditions, but the magnitude of the effect was large in NT, large (albeit smaller) in SAT, and moderate in Relaxation. See TABLE III.

TABLE III. MEAN RATINGS OF POSITIVE VERSUS NEGATIVE ALTERNATIVE ENDINGS IN THE TEST PHASE OF CBM-I IN EACH INDUCTION CONDITION

Induction	Positive Endings $M(SD)$	Negative Endings $M(SD)$
Relaxation	2.39 (0.44)	2.16 (0.31)
SAT	2.51 (0.42)	2.18 (0.38)
NT	2.55 (0.38)	2.08 (0.35)

Contrary to hypotheses, we did not find a significant Induction x Target interaction [$F(2, 100) = 0.16, p = .856, \eta_p^2 = .003$] or an Induction x Valence x Target interaction [$F(2, 178) = 0.55, p = .579, \eta_p^2 = .011$].

3.4 Behavioral Speech Task

To examine the differential effects of Induction on speech duration, we conducted a univariate ANOVA on the total number of seconds participants spoke, coding participants who refused to complete the speech task as having spoken for 0 seconds. There was no effect of Induction on total speech time, $F(2, 100) = 1.84, p = .164, \eta_p^2 = .035$. Counter to the expected direction of effects, the SAT group spoke the longest ($M = 110.36, SD = 95.25$), followed by the NT group ($M = 94.09, SD = 76.29$), followed by the Relaxation group ($M = 73.62, SD = 68.65$), although these differences were not statistically different.

To examine reported anxiety during the speech task, we conducted a 3 (Induction) x 3 (Phase: anticipatory, peak, resolution) mixed model ANOVA on SUDS ratings. Post hoc tests examined both linear and quadratic trends over time between conditions. There was a significant main effect of Phase, $F(2, 83) = 30.87, p < .001, \eta_p^2 = .427$. Follow-up tests of this main effect indicated significant linear [$F(1, 84) = 47.10, p < .001, \eta_p^2 = .359$] and quadratic [$F(1, 84) = 46.29, p < .001, \eta_p^2 = .355$] effects. There was a significant increase in anxiety from anticipatory

to peak SUDS ratings [$t(86) = -3.15, p = .002, d = -0.17$], and there was a significant decrease in SUDS ratings from peak to resolution [$t(87) = 8.10, p < .001, d = .64$] (see Figure 2). Contrary to hypotheses, there was not a main effect of Induction [$F(2, 84) = 0.12, p = .885, \eta_p^2 = .003$] or a Phase x Induction interaction [$F(4, 168) = 0.46, p = .763, \eta_p^2 = .011$].

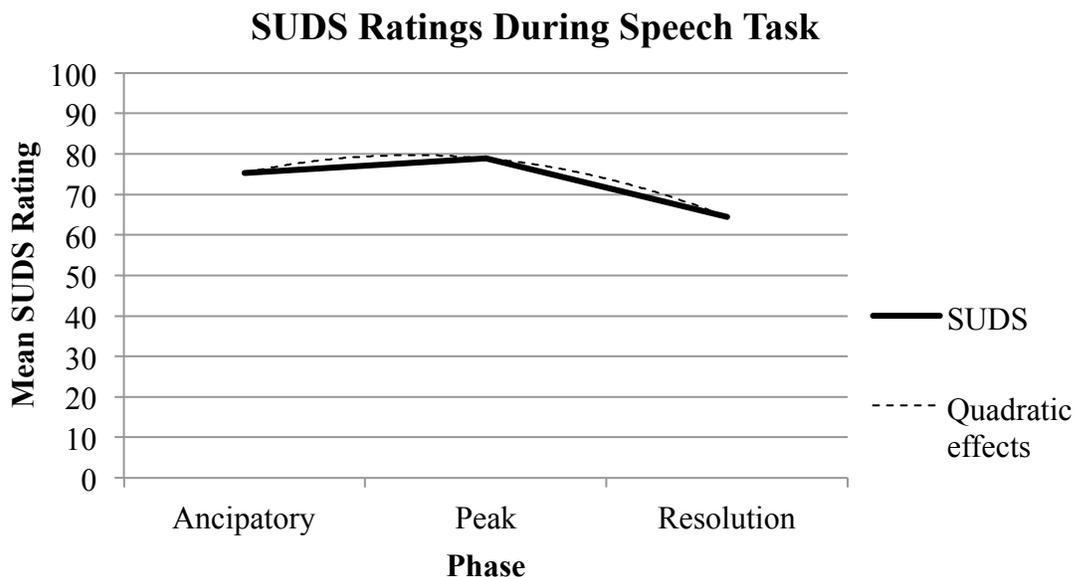


Figure 2. Quadratic effect of time on SUDS ratings during the speech task, collapsed across induction condition.

Finally, to examine the differential effects of Induction on participants' perceptions of their speeches, we conducted a 3 (Induction) x 2 (Item Valence: positive, negative) x 2 (Item Specificity: global, specific) mixed model ANOVA on mean MPSP item ratings. The between-subjects factor was Induction, and within-subjects factors were Item Valence and Item Specificity. Negative items were reverse-scored so that higher ratings indicated better perceived

performance. Results indicated a main effect of Item Valence [$F(1, 85) = 92.87, p < .001, \eta_p^2 = .522$], such that perceived performance on negative items ($M = 1.41, SD = 0.81$) was better than perceived performance on positive items ($M = 0.61, SD = 0.47$), and the effect was large ($d = 1.21$). There was also a main effect of Item Specificity [$F(1, 85) = 4.47, p = .038, \eta_p^2 = .050$], such that perceived performance on global items ($M = 1.07, SD = 0.64$) was better than perceived performance on specific items ($M = 0.95, SD = 0.56$), but the effect was small ($d = 0.20$). There was also a trend-level Induction x Item Specificity interaction [$F(2, 85) = 2.39, p = .097, \eta_p^2 = .053$]. Specifically, participants in the Relaxation [$t(32) = 1.06, p = .296, d = .17$] and NT [$t(28) = -0.19, p = .848, d = -0.04$] conditions rated their performance on global and specific items comparably; however, participants in the SAT condition rated their performance on global items ($M = 1.23, SD = 0.71$) as being better than their performance on specific items ($M = 0.94, SD = 0.57$), $t(25) = 3.41, p = .002, d = 0.46$ (see Figure 3).

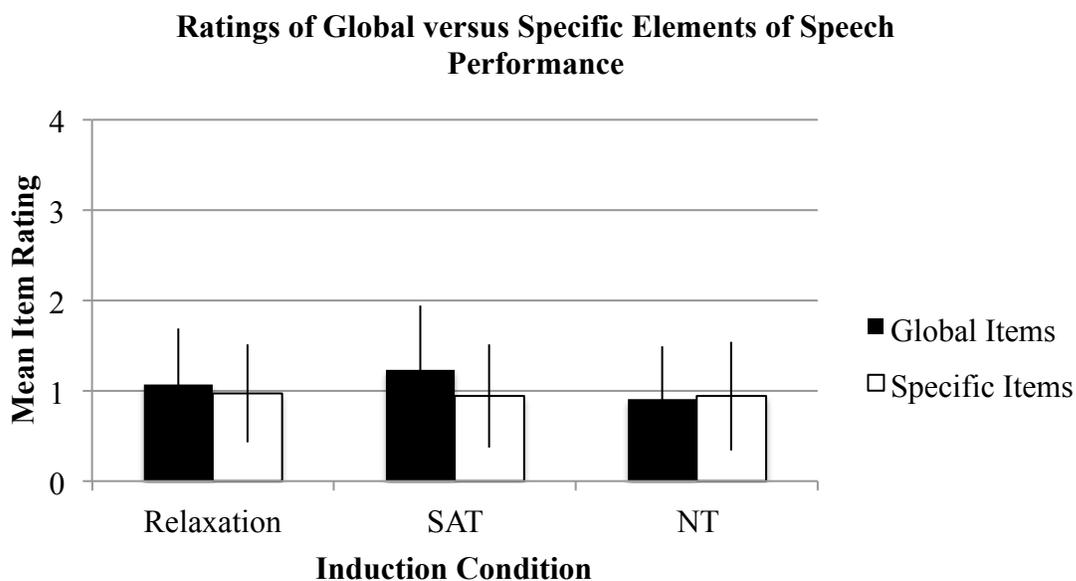


Figure 3. Mean global and specific item ratings on the MPSP.

4. DISCUSSION

This study compared the effects of prior relaxation, socially anxious thinking, and neutral thinking on the efficacy of CBM-I training for SAD, as measured by both cognitive (i.e., test phase of the CBM task) and behavioral (i.e., speech task) outcomes. Based on previous literature demonstrating the efficacy of relaxation in increasing physiological flexibility among anxious individuals (e.g., Thayer et al., 1996), and enhancing both behavioral (e.g., Borkovec & Sides, 1979) and cognitive (e.g., Borkovec & Costello, 1993) components of treatment for anxiety, we hypothesized that engaging in relaxation prior to completion of CBM-I training would result in more positive and reduced negative interpretations of novel ambiguous social scenarios, as well as greater peak anxiety and greater habituation during a subsequent speech task.

4.1 Cognitive Bias Modification

All participants, regardless of condition, ascribed higher similarity ratings to positive endings relative to negative endings, as would be expected in positive CBM-I training. Additionally, participants rated target endings as being more similar to the original scenario outcome relative to nonsocial foil endings, suggesting that participants were specifically making *social interpretations* of ambiguous scenarios rather than simply responding according to training-induced affective states. However, this selective effect of ending type was stronger among negative relative to positive endings, suggesting that participants continued to exhibit maladaptive interpretive biases when interpreting ambiguous scenarios. This overall pattern of effects is consistent with those found in previous investigations of this task (Mathews & Mackintosh, 2000), but our effects were somewhat weaker. This may be due in part to our selection of analogue socially anxious individuals, whose cognitive biases may be more firmly

ingrained relative to individuals from the general population, and for whom such biases may be more difficult to alter in a single session of CBM-I.

We did observe trend-level between-groups differences in participants' interpretation of ambiguous scenarios. However, the pattern of results did not support our initial hypotheses; rather, they were nearly the inverse of what we predicted. Rather than individuals in the relaxation condition, it was individuals in the NT condition who exhibited the greatest bias toward positive interpretations compared to negative interpretations. Even more surprising was that the smallest effect size was observed among individuals who had engaged in relaxation prior to the training, despite evidence that relaxation enhances other components of treatment.

In interpreting these unexpected results, a potentially promising explanation can be found in the literature on arousal and learning/performance, particularly on cognitive tasks. The Yerkes-Dodson Law (Yerkes & Dodson, 1908) states that the relationship between arousal and learning/performance is quadratic, such that intermediate (rather than low or high) levels of arousal are related to optimum learning of and performance on cognitive tasks. As previously reviewed, relaxation serves to decrease sympathetic nervous system activity (i.e., arousal) and increase parasympathetic nervous system activity. In contrast, engaging in either real or imagined exposure to feared situations has been demonstrated to produce increases in sympathetic activation (e.g., Gerlach, Wilhelm, & Roth, 2003; Mauss, Wilhelm, & Gross, 2003; Mauss, Wilhelm, & Gross, 2004). Thus, our relaxation and anxiety-inducing inductions may represent the "too low" and "too high" portions of the arousal-performance curve, respectively, resulting in suboptimal learning or cognitive flexibility on the CBM-I paradigm. In contrast, the NT induction may have produced an optimal level of activation that allowed learning of more flexible and adaptive interpretations, but not so much as to tax the system or limit flexibility.

This interpretation is further supported by the fact that participants in the NT condition reported affect changes that were in between those produced by the Relaxation and SAT inductions, which suggests an intermediate degree or type of activation.

Another possible explanation for our findings is that participants in each group may have differed in their levels of baseline cognitive bias. The results therefore might not capture improvement in adaptive interpretations as a result of engaging in CBM-I training, but instead reflect non-equality on initial bias. Participants were randomly assigned to conditions, which should ensure equivalence of groups, but without measures of baseline cognitive bias we cannot ensure that this was the case. However, symptoms of both social anxiety and depression are moderately related to interpretation bias (Huppert, Foa, Furr, Filip, & Mathews, 2003); because there were no between-groups differences on these symptom measures in the present sample, the likelihood of groups having differing levels of cognitive bias at baseline is reduced.

Although our results need to be replicated before we draw conclusions about the inefficacy of relaxation for enhancement of cognitive flexibility, preliminary analyses of data from ongoing studies in our laboratory have indicated similar patterns of results. For example, one study (Stevens et al., in preparation) examined the effects of engaging in a prior period of relaxation, worry/rumination, or neutral thinking on participants' ability to either generate multiple potential outcomes for a salient worry topic or generate multiple explanations for a topic about which they depressively ruminate. Contrary to our hypotheses, engaging in prior relaxation did not enhance participants' cognitive flexibility, as measured by the number of outcomes/explanations they generated regarding their topic of worry/rumination. Of note, the neutral thinking condition in this study (engaging in mental math) did not evidence the same effects as in the current study, but it might be that the mental math procedure we used was not

actually neutral in nature. Instead, participants in the ostensibly neutral mental math condition reported greater levels of anxious affect after engaging in the induction. In summary, although it would be premature to conclude from these two studies that relaxation is ineffective at enhancing cognitive flexibility, these investigations do raise the possibility that relaxation does not have the same facilitative effects on cognitive flexibility as it does on other clinically relevant indices.

4.2 **Speech Performance**

Despite evidence for stronger effects of CBM-I among participants in the NT condition, this facilitation of cognitive flexibility did not generalize to behavioral outcomes. There were no between-groups differences in behavioral avoidance (i.e., speech length) or anxiety (anticipatory, peak, habituation) during the speech task. All participants exhibited a quadratic pattern of self-reported anxiety in response to the task, as predicted by conceptualizations emphasizing fear activation followed by habituation of fear response (Foa & Kozak, 1986). In attempting to understand the lack of between-groups differences, it is first worth noting that the trend-level between-groups differences observed on the CBM-I test phase might have been too weak to differentially impact traditional measures of speech task performance.

Importantly, however, Hertel and Mathews (2011) suggested that a “transfer-appropriate processing” framework may be useful in understanding why performance on some tasks appears to improve as a result of engaging in CBM paradigms, but performance on others remains unchanged. According to this conceptualization, “near transfer” tasks are those that rely on processes or skills that have a substantial degree of overlap with the types of cognitive processes or learning involved in the training. For example, the test phase of Mathews and Mackintosh’s (2000) CBM-I is highly similar in structure and content to the training procedure, thus promoting

transfer. Performance on other tasks that require interpretation of ambiguity may also improve after CBM-I training.

There is also evidence that individuals' responses to and interpretations of emotion-inducing stimuli are more adaptive after undergoing CBM-I procedures. Some studies have demonstrated that participants evidence reductions in emotional responses to anxiety- or stress-provoking videos after engaging in benign/positive (versus threatening) CBM-I training (Amir, Beard, & Bower, 2005; Mackintosh et al., 2006; Wilson, Macleod, Mathews, & Rutherford, 2006). Mackintosh et al. (2013) found similar effects of a CBM-I paradigm for academic failure on emotional response to failure on a difficult task, but only when the CBM-I paradigm was similar in content to participants' fears *and* addressed coping with failure, further supporting the idea of "near transfer." Similarly, modification of interpretation bias using either the paradigm developed by Mathews and Mackintosh (2000; Mobini et al., 2014) and by Amir and colleagues (2009; Amir et al., 2010) may lead to reductions in other cognitive biases, such as attentional bias toward threatening stimuli. However, it is important to note that although Salemink, van den Hout, and Kindt (2010b) found that positive (versus negative) CBM-I training led to more adaptive interpretations of ambiguous academic performance and social situations, they failed to find evidence of CBM-I's transferability to other cognitive and emotional tasks related to social anxiety (e.g., interpreting an ambiguous social vignette, emotion ratings in response to a social feedback video clip).

In contrast, fewer studies support CBMI-I's efficacy in performance on tasks involving more complex emotional responses or *in vivo* behaviors (e.g., avoidance), potentially because these tasks may or may not constitute a "near transfer," depending upon the content of the training and the specific task demands. For example, at least five investigations have failed to

find effects of CBM-I training on behavioral outcomes, in spite of consistent evidence that the training positively impacted participants' ability to make positive interpretations in these investigations. First, Lange et al. (2010) found that CBM-I increased reflexive approach behavior when participants were subsequently confronted with pictures of feared situations, but were unable to replicate these findings in Study 2 of the investigation. Second, two studies of CBM-I among individuals who had a fear of spiders (Teachman & Addison, 2008) and individuals high in anxiety sensitivity (Steinman & Teachman, 2010) demonstrated that participants receiving positive CBM-I training reported reduced fear-consistent negative interpretations post-training, but did not exhibit significant differences in behavioral avoidance when subsequently confronted with feared stimuli. Third, Clerkin and Teachman (2010) found that in an analog sample of individuals high in obsessive-compulsive-related concerns, participants who received positive (versus neutral) CBM-I training reported lower negative affect and lower *desire* to perform neutralizing behaviors during a subsequent exposure, but the two groups did not differ in actual performance of neutralizing behaviors. Fourth, Steinman and Teachman (2014) found that height-fearful individuals who received either CBM-I or a combination of CBM-I plus exposure therapy (CBM-I+E) exhibited increased approach behaviors during behavioral avoidance tasks that were comparable to those exhibited by individuals who had received exposure therapy alone; however, at one-month follow-up (relative to baseline assessment), individuals who received CBM-I or CBM-I+E did not report decreased peak fear, whereas individuals who received exposure therapy alone reported significantly lower levels of peak fear). In summary, our results are consistent with those from other studies in which training did not impact behavioral outcomes, and this may be due to the fact that our behavioral speech task did not

qualify as a “near transfer” vis-à-vis the CBM-I procedures that constituted the training portion of our study.

If CBM-I procedures do not exert effects on behavioral outcomes, this represents a serious limitation of these training procedures. This is particularly true given evidence indicating that concordance between response systems (self-report, behavioral, physiological) predicts treatment outcome (Lang, Melamed, & Hart, 1970; Ning & Liddell, 1991; Pitman, Orr, Altman, & Longpre, 1996). Thus, evidence of treatment response in one domain of functioning in the absence of treatment response in additional domains of functioning may predict a lack of overall treatment outcome. This calls into question the overall clinical utility of CBM-I procedures. However, it is important to note that an analogue socially anxious population may require more than one session of an induction paired with CBM-I training to exact change at the behavioral level. Additionally, because all speeches were relatively short, it is possible that the abbreviated length restricted the variance in task performance, thereby diminishing potential differences. To address some of these concerns, we are currently coding verbal (e.g., hedge/filler words, passive language) and nonverbal (e.g., gaze, posture, vocal quality) anxiety-related behaviors via transcriptions and video recordings of the speeches, respectively. Analysis of these behaviors may yield a finer-grained analysis of avoidance behaviors and overall performance.

Compared to strictly behavioral outcomes, interpreting one’s own social performance (as on the MPSP) may represent a much nearer transfer. Consistent with Cody and Teachman (2011), our sample of socially anxious individuals were more likely to deny negative aspects of speech performance on the MPSP than they were to endorse positive aspects of performance, but this finding did not depend on induction condition. This likely relates to socially anxious individuals’ negative image of the self as a social interactant (Hambrick et al., 2003; Schultz &

Heimberg, 2008). More interesting is that although participants in the three induction conditions rated their performance on *specific* items of the MPSP comparably, individuals in the SAT condition rated their performance on *global* items higher relative to individuals in either the Relaxation or NT condition. Individuals with SAD have relatively unbiased perceptions of specific aspects of task performance relative to observer ratings, but they often have a negatively biased perception of their overall (global) performance in social situations (Rapee & Lim, 1992). A focus on more specific information can preclude perception and processing of information that might disconfirm socially anxious individuals' negative self-image and may lead to even more negative perceptions of performance. Evidence further suggests that global information becomes more negatively distorted over the course of several days relative to specific information (Cody & Teachman, 2011), possibly as a result of relative focus on specific aspects of performance (Cody & Teachman, 2010).

The fact that participants who engaged in SAT had more positive perception of global elements of social performance on the MPSP may indicate a more balanced and adaptive interpretation style. However, if the effects of CBM-I directly transferred to interpretation of social performance on the speech task, we would expect that the NT condition would endorse the most adaptive perceptions of their social performance, which we did not find. It is possible that the SAT induction was akin to imaginal exposure, which led to a less extreme perception of actual performance after being instructed to intensely visualize a feared social situation. Alternatively, it may be that although participants in the SAT condition did not derive as much benefit from the training compared to participants in the NT condition, priming anxiety-provoking situations and immediately modifying maladaptive cognitions related to that situation might have promoted more adaptive interpretation of actual performance in a subsequent,

similarly anxiety-provoking social situation. However, if this were the case, these individuals would likely endorse more adaptive interpretations of the ambiguous scenarios in the test phase of the CBM-I paradigm.

4.3 **Limitations**

In addition to the lack of baseline bias measurement and our single-session design, our study has several limitations. First, many of our effects were either statistically non-significant or of limited magnitude. Many of the analyses were statistically underpowered, which is due in part to the small effect sizes typically observed in CBM paradigms. It is also possible that effects would have been stronger if we had notified participants that they would be giving a speech later in the study prior to their completion of the test phase, since evidence suggests that between-groups differences are more prominent when bias is measured after stress-inducing tasks (Hallion & Ruscio, 2011). Unfortunately, the manipulations we conducted did not serve to amplify these effects, and may have in some cases actually diminished effects. It is also possible that because a substantial proportion of our participants (nearly 30%) primarily spoke a language other than English, the effects of CBM might have been dampened, further contributing to the small effects obtained in this study.

Second, although our inductions followed a standardized format and were idiographic in nature, they may not have worked in expected ways. Participants reported engaging in the inductions for relatively low percentages of time (about 60% on average, with values ranging from 12% to 94%), and the affective changes produced by the inductions did not align precisely with hypothesized strength and direction of changes. Specifically, although individuals in the SAT condition reported experiencing reduced PA following the induction, they did not report experiencing heightened anxiety, despite the fact that these participants reported the highest

levels engagement across the three inductions. Similarly, although individuals in the Relaxation condition reported reduced anxiety and reduced NA, they did not report increased subjective relaxation. Finally, although the NT induction was designed to minimize any changes in affect, individuals in this condition reported reduced negative affect, reduced anxiety, and reduced PA.

Finally, because our study was primarily interested in the augmentation of CBM-I via affective inductions, we did not include a negative or neutral control version of CBM-I. Combined with the fact that our neutral induction was not actually neutral, it becomes difficult to make any strong causal claims regarding the efficacy of any of our inductions in enhancing CBM-I. However, it is unlikely that including such CBM-I control conditions would have substantially altered the interpretation of our findings, given the evidence that neutral CBM-I training impacts interpretation bias to a lesser degree than does positive CBM-I training (Salemink et al., 2014).

4.4 **Future Directions**

Very few studies have considered potential moderators of CBM-I efficacy and/or behavioral outcomes. One potential moderator that has been explored in both CBM-A and CBM-I literatures is higher order executive control processes. Cognitive biases are thought to be automatic in nature, and may be negatively reinforced over time by their anxiety-reducing properties, or by avoidance behaviors that preclude acquisition of evidence that is contradictory to the bias. Individuals who have greater capacity or functionality of systems that can override those automatic tendencies in favor of a more adaptive locus of attention or interpretation of situations might exhibit reduced biases at baseline and/or stand to benefit less from modification of these processes. In the CBM-I literature, Salemink and Wiers (2012) examined whether socially anxious individuals' levels of "regulatory control" moderated performance on baseline

and post-training assessments of interpretation bias. In this study, regulatory control was assessed by the classic Stroop color-word paradigm, in which individuals are required to inhibit irrelevant information in order to respond correctly to presented words. Results of this study indicated that individuals with lower than average baseline regulatory control exhibited greater baseline negative interpretation bias relative to individuals with higher than average regulatory control, as well as greater post-training reductions in interpretive bias. Additionally, regulatory control was found to interact with levels of state anxiety: there was no effect of regulatory abilities on interpretation bias among individuals low in state anxiety, but among individuals high in state anxiety, those with lower regulatory control abilities had relatively greater negative interpretation bias scores. This study suggests that it may be valuable to additionally consider cognitive and neuropsychological factors in investigations of CBM-I, and raises the question of whether behavioral outcomes might also be moderated by differences in baseline executive or regulatory abilities. Future studies might also more carefully examine the relationship between CBM-I and aspects of cognitive and neuropsychological flexibility, and whether flexibility in interpretation of ambiguity translates to flexible strategies in other cognitive or problem-solving tasks.

5. CONCLUSION

This study sought to investigate the potential facilitative effects of relaxation on the efficacy of a CBM-I paradigm for SAD and behavioral indicators of anxiety and avoidance on a subsequent speech task. Contrary to our predictions, the NT group displayed the most adaptive interpretation biases post-CBM-I training. There were no differences observed on any behavioral measures, but there were marginally significant differences in perceptions of global (vs. specific) aspects of speech performance. Further investigation is needed to explore moderators of CBM-I efficacy as well as other factors that might contribute to enhancement of its effects in treating anxiety.

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CURRICULUM VITA
Elizabeth Sara Stevens

Education

- 2012-present **University of Illinois at Chicago**
M.A., Clinical Psychology, 2015
Ph.D., Clinical Psychology, expected completion 2017
- 2008-2012 **University of Virginia**
B.A. Psychology, Minor in Sociology

Fellowships and Academic Appointments

- 2014, June-August **Psychology Department Summer Research Assistantship**
One award per division
- 2012-2013 **UIC College of Liberal Arts and Sciences Graduate Fellowship**
(\$20,500)

Awards and Honors

- 2014, October College of Liberal Arts and Sciences at University of Illinois at Chicago
Travel Award (\$500)
- 2014, January Graduate Student Council Travel Award (\$275)
- 2013, October College of Liberal Arts and Sciences at University of Illinois at Chicago
Travel Award (\$500)
- 2012, October College of Liberal Arts and Sciences at University of Illinois at Chicago
Travel Award (\$250)
- 2010 Nominee for the Raven Society, University of Virginia
- 2010 Women's Leadership Development Program, University of Virginia
- 2009 Nominee for Golden Key National Honor Society
- 2008 - 2012 Echols Scholar, University of Virginia
- 2008 Howard Hughes Medical Institute Future Healthcare Professionals
Scholarship (\$7,500)

Research Experience/Appointments

- August 2012-present **Laboratory for Emotion and Anxiety Disorders, UIC**
Graduate Student Researcher
Conducted independent research projects related to cognitive
biases/cognitive flexibility and emotional experience in anxiety
disorders such as social anxiety and generalized anxiety disorders;

examined the nature of repetitive negative thought processes (e.g., worry, rumination); investigated the influence of relaxation on repetitive negative thought and the efficacy interventions.

Supervisor: Dr. Evelyn Behar

December 2013-present

Chicago Laboratory of Emotion and Physiology, UIC

Graduate Student Research Assistant

Conducted phone screenings for NRSA-funded research project examining emotion regulation in panic disorder compared to healthy control participants; administered cognitive and psychophysiological tasks.

Supervisors: Dr. Stewart Shankman, Casey Sarapas

August 2010-August 2012

Program for Anxiety, Cognition, and Treatment, University of Virginia

Undergraduate Research Assistant

Studied cognitive processes in anxiety disorders (e.g., social anxiety disorder), as well as the positivity effect in young and aging populations. Responsibilities included screening participants, running studies, data scoring and interpretation, reviewing articles for literature reviews, and creating posters and presentations. Trained in administration and scoring of the Rey Complex Figure Task, the Deese Roediger McDermott paradigm, other neuropsychological tasks, and structured clinical interviews. Gained experience using Eye Tracker camera and programs.

Supervisors: Dr. Bethany Teachman, and graduate students Dr. Meghan Cody, Dr. Jennifer Green, Eugenia Gorlin

June 2011-August 2012

Cognitive Aging Laboratory, University of Virginia

Assistant Lab Coordinator, Research Assistant (June 2011-August 2011)

Duties involved scheduling and running participants through a variety of cognitive and memory tasks, including 16 hours of Wechsler Adult Intelligence Scale and 12 hours of Wechsler Memory Scale administration, scoring the protocols, and supervising the logistics and administrative functioning of the lab such as scheduling RAs, working with the Procurement office, tracking supplies, and organizing the daily tasks of RAs.

Supervisors: Dr. Timothy Salthouse, Kelly Shaffer (Coordinator)

June 2010-August 2010

Early Childhood Lab, University of Virginia

Undergraduate Research Assistant

Studied Gravity Bias in toddlers. Recruited and scheduled participants, ran participants through the experiment, and gained experience in behavioral coding.

Supervisors: Dr. Rachel Keen, Dr. Carrie Palmquist

Publications

1. **Stevens, E. S.**, Jendrusina, A. A., Sarapas, C., & Behar, E. (2013). Generalized Anxiety Disorder. In T. Ehring & P. Emmelkamp (Ed.) *The Wiley Handbook of Anxiety Disorders: Theory, Research, and Practice* (pp. 378-423). Wiley-Blackwell.
2. Clerkin, E. M., Cody, M. W., **Stevens, E. S.**, Gasser, M. L., Pasciuti, M. L., & Teachman, B. A. (2014). Social anxiety disorder and global/local performance on a visuospatial processing task. *Journal of Experimental Psychopathology*, 5, 83-96.

Manuscripts in Preparation

1. **Stevens, E. S.**, & Behar, E. The effect of relaxation on cognitive bias modification training in social anxiety disorder.
2. **Stevens, E. S.**, Goldwin, M., Jendrusina, A. J., & Behar, E. The effect of a period of relaxation on qualities and flexibility of repetitive negative thought.
3. Jendrusina, A. J., **Stevens, E. S.**, & Behar, E. Concreteness of thought and imagery in worrisome and neutral thinking.
4. **Stevens, E. S.**, & Behar, E. Measurement of cognitive flexibility in anxiety disordered populations: A theoretical and integrative review.
5. **Stevens, E. S.**, Sarapas, C., & Shankman, S. A. The relationship between attentional and psychophysiological threat response.
6. **Stevens, E. S.**, Weinberg, A., Lieberman, L., Sarapas, C. S., Gorka, S. G., & Shankman, S. A. Respiratory sinus arrhythmia predicts habituation of emotional responding.

Academic Presentations and Symposia

1. **Stevens, E. S.**, Jendrusina, A. A., Tomchek, A., Kargol, J., Aldin, T., & Behar, E. (2015, submitted). The effect of relaxation on cognitive bias modification and behavioral indicators of social anxiety. In L. LaFreniere (Chair) *Enhancing cognitive behavioral treatments for anxiety disorders*. Symposium to be conducted at the annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.
2. **Stevens, E. S.**, Jendrusina, A. A., Fortune, M. R., Ranney, R. M., & Behar, E. (2015, submitted). *Trajectories of learning in cognitive bias modification: Comparison with typical bias assessment methods*. Poster to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.
3. Jendrusina, A. A., **Stevens, E. S.**, Ranney, R. M., Fortune, M. R., Bednarczyk, E., Reina, L., & Behar, E. (2015, submitted). Moderators of attentional threat bias using a probe discrimination task. Poster to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.
4. Jendrusina, A. A., **Stevens, E. S.**, Legrand, A., Nahin, E., & Behar, E. (2015, submitted). Abstractness and concreteness during thought- and imagery-based mentation

- about worrisome and neutral topics. Poster to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.
5. Fortune, M.R., **Stevens, E.S.**, Jendrusina, A.A., Ranney, R.M., & Behar, E. (2015, submitted). Evaluating emotional control as a moderator of the relationship between stressful life events and GAD symptom severity. Poster to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL
 6. Ranney, R. M., Bartoszek, G., Fortune, M. R., Jendrusina, A.A., **Stevens, E. S.**, & Behar, E. (2015, submitted). *Information-seeking in individuals intolerant of uncertainty: the maintenance of worry through attempts to limit uncertainty*. Poster to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.
 7. **Stevens, E. S.**, Jendrusina, A. A., Anemone, C., Dunn, N., Tahara-Eckl, L., and Behar, E. (2014, November). The effects of relaxation on cognitive bias modification training in social anxiety disorder. In A. Srivastav (Chair), *Assessing and modifying anxiety disorder-related attention and interpretive biases in adults*. Symposium conducted at the meeting of the Association for Behavioral and Cognitive Therapies, Philadelphia, PA.
 8. Jendrusina, A. A., **Stevens, E. S.**, Legrand, A., Skubic, D., & Behar, E. (November, 2014). *Investigating the relationship between intolerance of uncertainty and GAD using a probe detection task*. Symposium given at the 48th Annual Convention of Association for Behavioral and Cognitive Therapies, Philadelphia, PA.
 9. **Stevens, E. S.**, Goldwin, M., Jendrusina, A. A., Nahin, E., Legrand, A., & Behar, E. (2013, November). *The effect of a period of relaxation on the content of worry and ruminative thought*. Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Nashville, TN.
 10. Jendrusina, A. A., **Stevens, E. S.**, Legrand, A., Nahin, E., & Behar, E. (2013, November). Concreteness of thoughts and images about worrisome and neutral stimuli. Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Nashville, TN.
 11. Goldwin, M., Stevens, E. S., Conybeare, D., Bohacz, B., Wolff, J., & Behar, E (2012, November). *The Effects of Relaxation on Cognitive Flexibility in Individuals with Elevated Symptoms of Generalized Anxiety Disorder and/or Major Depressive Disorder*. Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Washington, D.C.
 12. Cody, M. W., Pasciuti, M. L., Gasser, M. L., **Stevens, E. S.**, & Teachman, B. A. (2011, November). *Moderators of true and false memories using the DRM paradigm in social phobia*. Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Toronto, Canada.

Peer Reviewer for Academic Journals

2012-present

Ad Hoc Reviewer, *Journal of Consulting and Clinical Psychology*
 2 manuscripts reviewed
Supervisor: Dr. Evelyn Behar

Clinical Experience

- 2012-present **Office of Applied Psychological Services, UIC**
Graduate Clinical Trainee
 Conducted individual and group therapy sessions and psychological assessments
- August 2010-May
 2012 **Madison House HELP Line, University of Virginia**
Crisis Hotline Volunteer
 Trained in crisis intervention; volunteered 2 hrs per week each semester

Supplemental Clinical Training and Workshops

- 2014, November **Acceptance and Commitment Therapy for Social Anxiety Disorder**
 Presented at the Association for Behavioral and Cognitive Therapies, Philadelphia
 Leader: Dr. James Herbert
- 2014, October **Conducting CBT in Group Formats**
 Leader: Dr. Amanda Lorenz
- 2014, June **Dialectical Behavior Therapy Workshop**
 Leader: Dr. Amanda Lorenz
- 2014, March-April **Motivational Interviewing**
 Leader: Dr. Kelly Walker Lowry, Motivational Interviewing Network of Trainers
- 2014, March **Treatment of Tic Disorders**
 Leader: Dr. Judy Tellerman

Teaching Experience

- Summer, Fall 2013,
 Fall 2014 **PSCH 270: Abnormal Psychology**
Teaching Assistant
Instructor: Dr. Karina Reyes
- Spring 2014 **PSCH 242: Research Methods**
Teaching Assistant
Guest Lecturer “Sampling and Descriptive Statistics”
Instructor: Dr. Eric Gobel

Memberships and Professional Affiliations

1. Association for Behavioral and Cognitive Therapies (October 2011-present)
2. National Network of Depression Centers (October 2014-present)
3. Psi Chi National Psychology Honor Society (April 2011)
4. Phi Eta Sigma National Honor Society (October 2009)

Other Community Involvement and Volunteer Experience

- July 2013-present **Pets are Worth Saving (PAWS) Chicago**
Kitty City Volunteer
 Cared for cats at the adoption center; work closely with potential adopters and families to find the right pet; educate adopters about the cats and adoption process
- October 2009-present **Nu Omega Iota Sorority, Inc., University of Virginia**
Recruitment Chair (2010), Social Chair (2011)
 Sorority built upon ideals of Scholarship, Philanthropy, Diversity, and Sisterhood. Planned and orchestrated several events, including two cycles of Recruitment.
- 2011-2012 **Psychological Society at University of Virginia**
Secretary
 Maintained listservs and helped organize events related to psychology and professional development for psychology majors
- 2010-2012 **Dance Marathon at University of Virginia**
University Relations Chair (2011-2012), Dancer
 Participated in and helped organize annual dance-a-ton event to raise money for the UVA Children's Hospital and the pediatric cancer research division
- 2008-2012 **University Programs Council**
Special Events Committee Chair (2009-2010), member
 Organized meetings and events, including the Girl Talk concert at John Paul Jones Arena attended by 5000 people.