EFFECTS OF INTERPRETATION TRAINING ON SUBJECTIVE, BEHAVIOURAL, AND PHYSIOLOGICAL MEASURES OF ANXIETY DURING A SELF-PRESENTATION TASK IN AN ANALOGUE SOCIAL ANXIETY SAMPLE

by

Matilda E. Nowakowski

Bachelor of Health Sciences (Honours), McMaster University, 2006

Doctor of Philosophy (Experimental Psychology), McMaster University, 2009

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Effects of Interpretation Training on Subjective, Behavioural, and Physiological Measures of Anxiety During a Self-Presentation Task in an Analogue Social Anxiety Sample

Matilda E. Nowakowski

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Ryerson University

Abstract

Negative interpretation biases, defined as a tendency to interpret ambiguous social situations negatively, have been theorized to play a role in the maintenance of social anxiety. Research has shown that computer-based interpretation training tasks can modify negative interpretation biases and that this modification is associated with decreases in subjective ratings of anxiety. Negative interpretation biases have also been shown to decrease following cognitive-behavioural therapy. This study investigated the effects of interpretation training and cognitive restructuring on symptomatology, cognitive processes, behaviour, and physiological reactivity in an analogue social anxiety sample. Seventy-two participants with elevated social anxiety scores were randomized to one of 3 conditions: interpretation training (n = 24), cognitive restructuring (n = 24), and control (n = 24). Although none of the conditions showed a decrease in social anxiety symptomatology, participants in the cognitive restructuring condition evidenced a significant decrease in anxiety-related cognitive processes at the 48-hour follow-up. There were no group differences on subjective distress and self-rated performance on the speech task. However, participants in the cognitive restructuring condition were rated as having higher quality speeches by an objective rater compared to participants in the interpretation training condition. Theoretical and clinical implications are discussed.

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Table of Contents

List of Tables

List of Figures

List of Appendices

Effects of Interpretation Training on Subjective, Behavioural, and Physiological Measures of Anxiety During a Self-Presentation Task in an Analogue Social Anxiety Sample

One in four Canadians will suffer from an anxiety disorder in his or her lifetime (Offord et al., 1996), making anxiety disorders the most prevalent type of psychiatric disorder (Kessler, Berglund, Demler, Jin, & Merikangas, 2005). When considering both direct (i.e., medications and psychosocial treatment) and indirect (i.e., lost productivity) costs, it has been estimated that anxiety disorders cost Canada $65 billion annually (Dupont, Dupont, & Rice, 2002), and these figures have likely increased over the past decade.

Social anxiety disorder, defined as a "marked fear or anxiety about one or more social situations in which the individual is exposed to possible scrutiny by others" (American Psychiatric Association, 2013), affects about 12% of the population (Kessler et al., 2005), making it the second most common anxiety disorder. Individuals with social anxiety disorder suffer significant impairment in a number of areas, including education, employment, family, and relationships (Antony, Roth, Swinson, Huta, & Devins, 1998; Lochner, Mogotsi, du Toit, Kaminer, Niehaus, & Stein, 2003). A unique aspect of social anxiety disorder is that it has a chronic course, despite the fact that individuals are regularly exposed to social situations. Cognitive theory postulates that information-processing biases play a significant role in the maintenance of anxiety disorders, including social anxiety disorder (Beck, Emery, & Greenberg, 1985; Rapee & Heimberg, 1997).

Research has shown that, compared to nonsocially anxious individuals, individuals with elevated social anxiety are significantly more likely to automatically orient toward negative social stimuli (attentional bias), interpret ambiguous social stimuli negatively (interpretation bias), and to view themselves negatively when imagining social situations (bias in self-image;

Hirsch & Clark, 2004). Interpretation biases are especially relevant to social anxiety given that all social interactions have a degree of ambiguity that requires interpretation. For instance, if one is talking with another individual who looks at his/her watch, there are a number of possible interpretations for this behaviour, including, for example: 1) the individual has to be somewhere at a designated time, or 2) the individual thinks the conversation is boring. The way in which one interprets the social situation will have a strong impact on one's views of social situations and one's willingness to engage in future social situations, thus playing a role in the maintenance of social anxiety.

Broadly, the proposed study focuses on the effects of modifying interpretation biases on subjective, behavioural and physiological measures of anxiety during a self-presentation task in an analogue social anxiety sample. This chapter consists of the following five sections: 1) cognitive-behavioural models of social anxiety; 2) interpretation biases in social anxiety; 3) cognitive-behavioural therapy; 4) single-session interventions; and 5) physiological reactivity in social anxiety.

Cognitive-Behavioural Models of Social Anxiety

Beck and colleagues (1985) first suggested the role of information processing biases in general psychopathology, including anxiety disorders. Based on this work, three prominent cognitive behavioural models of social anxiety disorder were developed in the 1990s (Clark & Wells, 1995; Leary & Kowalski, 1995; Rapee & Heimberg, 1997). Although these models emphasize the importance of cognitions in the generation and maintenance of anxiety during social situations, there are some differences in their conceptualizations. A summary of each of the models is presented in this section, followed by a discussion of the major differences between the three models.

Clark and Wells (1995). According to the model by Clark and Wells (1995) the anticipation or detection of a social situation activates a variety of negative assumptions that individuals with social anxiety hold. These negative assumptions include excessively high standards for social performance (e.g., "I must not show any signs of anxiety"), conditional beliefs about social situations (e.g., "If I shake others will think I am incompetent") and unconditional beliefs about social situations (e.g., "I am weak"). As a result of these negative assumptions, individuals come to believe that they are unlikely to succeed in social situations and that others will judge them negatively and/or reject them. In response to the belief that there is a high probability of negative evaluation or rejection, individuals with social anxiety focus their attention on their internal symptoms of anxiety, such as sweating, shaking, and blushing, and use this information to infer how others are perceiving them. Given that the internal information is largely based on physical sensations, this only further confirms to individuals that others notice their anxiety and further increases their concerns about negative consequences, such as rejection or negative evaluation.

In addition to increasing feelings of anxiety, the tendency to focus attention inwards also negatively influences performance in social situations. First, when individuals focus on their own internal experiences, they are less engaged in the social interaction as they divide their attention between two areas of focus. As a result, they may come across as less interested and more aloof. Consequently, others may be more likely to respond negatively to them, which only further reinforces their anxieties about social situations (Clark & Wells, 1995). Second, in an attempt to decrease the probability of negative evaluation, individuals with elevated social anxiety may engage in a variety of compensatory behaviours, also referred to as safety behaviours, in order to make their anxiety less visible (e.g., gripping their glass tightly to

decrease shaking, wearing a turtleneck to hide blushing, rehearsing what they will say next, etc.; Clark, 2001; Clark & Wells, 1995; Wells, Clark, Salkovskis, Ludgate, Hackmann, & Gelder, 1995). However, these compensatory behaviours often have a number of counterproductive consequences. First, if the social interaction goes well, then individuals are likely to attribute their success to the safety behaviours rather than their own abilities, thus not learning that the chance of being rejected or negatively evaluated by others is low. Second, in some cases, the safety behaviours may actually increase the feared consequences. For instance, wearing a turtleneck on a hot day due to a fear of blushing may actually increase a person's blushing and sweating due to feeling hot, and may attract attention from others. Thus, engagement in compensatory behaviours serves to maintain fears of rejection and negative evaluation.

Clark and Wells (1995) also discuss the processes that take place following social situations. They hypothesize that following a social situation, individuals with social anxiety engage in rumination, dissecting and analyzing every small aspect of the social interaction. Given the attentional focus on internal symptoms during the social interaction, individuals are likely to have an unrealistic negative memory of the social interaction, which only further enhances their fears of negative consequences.

In summary, the cognitive-behavioural model of social anxiety developed by Clark and Wells (1995) postulates that individuals with social anxiety focus their attention inward when they anticipate or perceive a social situation in an attempt to closely monitor and control their behaviour. This internal focus of attention contributes to a further increase in anxiety as it leads to the belief that their anxiety is visible to others and will bring rejection and negative evaluation. In addition, this internal focus of attention results in poorer social performance as well as

engagement in safety behaviours. Following social situations, individuals with social anxiety engage in postevent processing, which maintains their anxiety about future social situations.

Rapee & Heimberg (1997). Similar to Clark and Wells (1995), the model proposed by Rapee & Heimberg in 1997 also suggests that the detection of a social audience leads to fear in individuals with social anxiety due to the belief that others are inherently critical and that the probability of negative evaluation is high. As a result, individuals form a mental representation of themselves as seen by the audience (i.e., from the observer perspective rather than the field perspective). Similar to Clark and Wells (1995), this mental representation is influenced by turning one's attention inward and focusing on such factors as past experiences in social situations, internal physical symptoms (e.g., sweating, shaking, blushing, etc.), behavioural symptoms (e.g., lack of eye contact, rehearsing what one plans to say), and negative cognitions (e.g., thinking "I'm boring," "I'm stupid"). All of these factors feed back to the mental representation and contribute to the experience of anxiety. However, unlike Clark and Wells (1995), Rapee and Heimberg (1997) also include a role for information from the external environment (e.g., the social partner's responses) in the generation of the mental representation. They postulate that individuals with heightened social anxiety scan the external environment and are hypervigilant for signs of potential rejection and negative evaluation. This leads to a distorted perspective of the situation given that they are much more likely to notice behavioural signs of negative evaluation and rejection (e.g., someone checking a watch) than behavioural signs of approval (e.g., someone nodding and smiling). As well, given the ambiguous nature of social situations, individuals with elevated social anxiety are significantly more likely to interpret neutral information negatively.

Individuals assess the probability that their feared outcome will occur by comparing their performance to their perception of what the social audience expects. Given the vigilance toward internal and external cues for rejection and negative evaluation during the formation of the mental representation of self, socially anxious individuals typically conclude that their performance was below the audience's standard, thus contributing to the future maintenance of the disorder.

Thus, similar to the cognitive-behavioural model of social anxiety developed by Clark and Wells (1995), Rapee and Heimberg (1997) also postulate that individuals with social anxiety develop mental representations of how others perceive them, but they argue that these mental representations are influenced by both internal (i.e., physiological, cognitive, and behavioural) and external (e.g., the social partners behaviour) cues. However, the external cues are typically distorted due to the individual's vigilance for signs of rejection or negative evaluation. The comparison of the mental representation to the appraisal of the audience's standard maintains the social anxiety.

Leary & Kowalski (1995a, 1995b). The self-presentational theory of social anxiety (Leary & Kowalski, 1995a, 1995b; Schlenker & Leary, 1982) proposes that social anxiety symptoms are driven by a discrepancy between an individual's desire to make a positive impression and their belief in their ability to do so, especially if the interaction may lead to relationship devaluation (i.e., the social partner not valuing the relationship to the same extent as desired by the individual), rejection or avoidance. Given the evolutionary importance of social relationships, the self-presentational model suggests that all individuals have a sociometer which functions at an automatic, unconscious level in social situations constantly monitoring for any signs or potential of relational devaluation (Leary & Downs, 1995). If real or imaged relational

devaluation is detected, individuals experience symptoms of social anxiety and engage in various behaviours in order to decrease the consequences of relational devaluation, including closely monitoring their own performance in the social situation as well as how they are appearing to their social partner. Given that the sociometer functions as an early warning signal, it generates "false positives" and can lead to symptoms of social anxiety in situations where there is no real risk of relationship devaluation. Therefore, personality characteristics such as low confidence in one's social skills as well as extremely high expectations for one's and/or others' performance in social situations, can lead to the experience of social anxiety symptoms in social situations that do not pose any actual risks to one's social relationships.

Differences between the models of social anxiety. These models illustrate the significant role of cognitive processes in the onset and maintenance of anxiety in social situations. Specifically, all three models emphasize the role of fear of negative evaluation and rejection in social anxiety as well as engagement in self-focused attention in an attempt to reduce the consequences of social anxiety symptoms. However, both the Clark and Wells (1995) and Rapee and Heimberg (1997) models further describe the role of these behaviours in the maintenance and perpetuation of social anxiety. Both these models suggest that individuals with social anxiety focus their attention inward in order to create a mental representation of how they appear to others and that this mental representation further increases feelings of anxiety. However, these two models differ on the degree to which this mental representation is influenced by external information from the environment. While Clark and Wells (1995) do not view external cues as playing a role in the onset and maintenance of social anxiety, Rapee and Heimberg (1997) do incorporate external cues in their cognitive-behavioural model of social anxiety. Thus, as reviewed by Schultz & Heimberg (2008), the model proposed by Clark and

Wells (1995) suggests that the anxiety response in social situations is a closed automatic system that is not influenced by environmental factors. On the other hand, the model by Rapee and Heimberg (1997) is more flexible and variable in that it incorporates external environmental cues in the generation of the anxiety response. Overall, there is much overlap between the cognitive models of social anxiety and research support has been established for a variety of hypotheses stemming from these models. Given that these models stress the importance of cognitive processes in the development and maintenance of social anxiety, it is natural to expect that the modification of these processes will decrease social anxiety. Accordingly, the research on interpretation biases, one of the information processing biases present in social anxiety, is reviewed in the next section.

Interpretation Biases and Social Anxiety

Correlational studies. Studies investigating interpretation biases can be grouped into two broad types: 1) studies that investigate "offline" processing and 2) studies that investigate "online" processing. Studies focusing on "offline" processing ask participants to reflect on an ambiguous social situation and determine or rank order a set of possible outcomes. In general, offline studies have shown that social anxiety is associated with a tendency to interpret ambiguous social situations negatively, even when general distress and depression are controlled for (Amir, Beard, & Bower, 2005; Kanai, Sasagawa, Chen, Shimada, & Sakano, 2010; Standage, Ashwin, & Fox, 2010; Voncken, Bogels, & Peeters, 2007). On the other hand, "online" studies assess the processing of ambiguous social information in the moment. These studies have found that individuals with high social anxiety lack a benign interpretation bias, which is exhibited by individuals low in social anxiety (Constans, Penn, Ihen, & Hope, 1999; Hirsch & Mathews, 1997, 2000). Thus, depending on the point at which interpretation biases are assessed,

individuals with social anxiety lack a benign interpretation bias and are more likely to interpret ambiguous social information as threatening.

Amir and colleagues (1998) conducted one of the first studies to investigate the association between social anxiety and negative interpretation biases. In this study, interpretation biases were assessed using a questionnaire that included vignettes of ambiguous social and nonsocial scenarios followed by three possible interpretations: positive, negative, and neutral. Treatment-seeking participants with a DSM-IV diagnosis of generalized social phobia were asked to rank order the possible interpretations from most likely to least likely for each social and nonsocial situation. The results showed that individuals with social anxiety disorder rated the negative interpretations of ambiguous social situations as significantly more likely compared to individuals with obsessive-compulsive disorder and nonanxious controls. These findings were specific to the social situations, as there were no group differences for the nonsocial situations, thus supporting the presence of content-specificity in interpretation biases in social anxiety disorder (Amir, Foa, & Coles, 1998). A number of studies using the same questionnaire have replicated this pattern of findings (Alden, Taylor, Mellings, & Laposa, 2008; Beard & Amir, 2010; Constans et al., 1999; Hirsch & Mathews, 1997; Huppert, Foa, Furr, Filip, & Mathews, 2003; Stopa & Clark, 2000; Voncken et al., 2007).

In addition, studies using a variety of other tasks, including, speech tasks with confederates (Kanai et al., 2010), videos (Amir et al., 2005), sentence completion tasks (Huppert, Pasupuleti, Foa, & Mathews, 2007), and lexical relations tasks (Beard & Amir, 2009; Huppert et al., 2003) have also shown a relation between social anxiety and interpretation biases. For instance, Kanai and colleagues (2010) compared nonclinical participants who were high and low on social anxiety on their reactions to an opposite-sex confederate's ambiguous behaviours

during a speech task. Participants were instructed to complete a 4-minute speech in front of a confederate who engaged in a variety of ambiguous behaviours, including throat clearing, head scratching, and propping chin in hands. Participants were then asked open-ended questions regarding their interpretations of the confederate's behaviour during the speech. Individuals high on social anxiety were significantly more likely to interpret the confederate's behaviour as threatening and negative compared to individuals low on social anxiety.

Extending these findings, researchers have also developed computer-based tasks to examine not only the frequency of endorsing interpretation biases but also the speed with which the endorsements are made. One example of a computer-based task to assess interpretation biases is the *Word Sentence Association Paradigm* (WSAP) developed by Beard and Amir (2009). During this task, participants are presented with one of two words (e.g., funny or embarrassed) followed by a sentence depicting a social or nonsocial situation (e.g., People laugh after something you said). In the development of the task, each sentence was linked with two words – one that would lead to a benign interpretation of the situation (e.g., funny) and one that would lead to a threatening interpretation (e.g., embarrassed). After reading the sentence, participants had to indicate whether the word and sentence were related. Using an undergraduate sample selected for high and low levels of social anxiety based on scores on the *Social Phobia and Anxiety Inventory* (SPAI; Turner et al., 1989), Beard and Amir (2009) found that individuals high in social anxiety were significantly faster at endorsing the threatening interpretations for social situations and significantly slower at endorsing the benign interpretations for social situations, compared to the control condition. Furthermore, in terms of frequencies of endorsement, individuals high on social anxiety were significantly more likely to endorse a relationship between the negative word and the sentence and significantly less likely to endorse a

relationship between the neutral word and the sentence compared to individuals low on social anxiety.

In summary, these studies provide support for the presence of a negative interpretation bias that is specific to social situations in individuals with social anxiety. It is important to note, however, that the quasi-experimental nature of these studies limits the ability to determine whether interpretation biases play a causal role in the maintenance of social anxiety disorder. It is possible, for example, that interpretation biases are a secondary outcome driven by some other factor. Accordingly, researchers have begun to investigate the effects of modifying interpretation biases on social anxiety symptoms, both in nonanxious and anxious populations.

Experimental studies using nonanxious populations. Grey and Mathews (2000) conducted the first study to experimentally manipulate interpretation biases in nonanxious populations. Interpretation training was completed using a task that included homographs (i.e., words that have two meanings) during which participants were presented with a homograph (e.g., batter) followed by a word fragment that was related either to the threat meaning of the homograph (i.e., assault) or to the neutral meaning of the homograph (i.e., pancake). Participants had to use the homograph to solve the word fragment as quickly as possible. In the threat training condition the word fragment was always related to the threat meaning of the homograph while in the neutral training condition the word fragment was always related to the neutral meaning of the homograph. The interpretation assessment task involved a lexical decision task during which threatening or neutral homographs were presented followed by a word or nonword target that was presented for 750 ms. Fifty percent of the time the word targets were associated with the threatening interpretation of the homograph and 50% of the time they were associated with the neutral interpretation of the homograph. Participants had to decide as quickly as possible whether

the target was a word or nonword. Grey and Mathews (2000) found that following training participants in the threat training condition were significantly faster in making lexical decisions that involved target words that were associated with a threatening interpretation of the homograph while participants in the neutral training condition were significantly faster in making lexical decisions that involved target words that were associated with a neutral interpretation of the homograph. This was the first study to illustrate the successful use of computer-based training tasks for the modification of interpretation biases in a nonanxious sample.

Following the homograph task, Mathews and Mackintosh (2000) developed an interpretation training task using ambiguous scenarios that has become the most frequently used task for the modification of interpretation biases (Beard, 2011). During the training, participants read 95 short ambiguous social scenarios that ended with a word fragment that had to be solved by the participant in order for the social scenario to be disambiguated in either a positive or negative direction. After the social scenario was disambiguated, participants were asked a comprehension question that further reinforced the direction in which the social scenario had been disambiguated and were then given feedback about their answer (i.e., "correct answer" or "wrong answer"). For participants in the negative interpretation training condition, 85 of the social scenarios had a negative resolution while for participants in the positive interpretation training condition, 85 of the social scenarios had a positive resolution. In both conditions, 10 neutral social scenarios were presented followed by a neutral comprehension question to decrease the chance that participants would guess the purpose of the training. A control interpretation training condition was also developed at a later time during which half the ambiguous social scenarios were disambiguated in a positive direction and the other half were

disambiguated in a negative direction (Murphy, Hirsch, Mathews, Smith, & Clark, 2007). The effects of interpretation training were assessed in two ways. First, reaction times for solving the word fragments that resolved the ambiguous social scenarios in a positive or negative direction were assessed. Second, participants were presented with 10 new ambiguous social scenarios that remained ambiguous to the end and were asked to read them while imagining themselves as the primary character in the situations. Each ambiguous social scenario had a title. After each social scenario, participants were presented with a comprehension question that required a neutral response (i.e., it did not require participants to make any interpretations about the emotionality of the situation). During the recognition phase, participants were presented with the title of the ambiguous social scenario followed by four sentences, presented one at a time, and were asked to rate the sentences for the similarity of their meaning to the original ambiguous social situation using a rating scale ranging from 1 (very different in meaning) to 4 (very similar in meaning). The 4 sentences consisted of 2 possible interpretations of the ambiguous social situation (one positive and one negative) and 2 foil items (i.e., one negative and one positive interpretation that was not possible based on the information presented in the ambiguous social scenario).

Using a sample of undergraduates, Mathews and Mackintosh (2000) found that participants who were trained in the negative interpretation training condition endorsed significantly more negative interpretations for the ambiguous social situations and were also significantly faster at solving the negative word fragments compared to participants in the positive interpretation training condition (Cohen's d = 1.96 and .95, respectively). These results have been replicated by a number of researchers (Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Salemink, van den Hout, & Kindt, 2007a, 2007b; Salemink, van den Hout, & Kindt, 2009a; Yiend, Mackintosh, & Mathews, 2005).

Experimental studies using anxious populations. To date, two studies focusing on trait anxiety have provided support for the training of neutral or positive interpretation biases in high trait anxious participants. Mathews and colleagues (2007) used a modified version of the procedure developed by Mathews and Mackintosh (2000) to train a positive interpretation bias in trait anxious individuals, as defined by high scores on the *State-Trait Anxiety Inventory* (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Participants completed four interpretation training sessions during a 2-week period. During these sessions, participants were presented with 100 ambiguous social situations followed by a question that required them to resolve the emotional ambiguity by selecting one of two words. Over the sessions, the words were gradually increased in their degree of positivity, such that initially the interpretations were neutral. Following the fourth session of training, participants completed two assessments of interpretation biases. During the first assessment, participants were presented with ambiguous social situations followed by 3 possible interpretations (negative, neutral, and positive) and were asked to rank order the interpretations according to how likely they would come to mind. During the second assessment, participants were asked to imagine themselves in the presented ambiguous social situations and were then presented with four possible interpretations (2 positive and 2 negative) and asked to indicate the degree to which each interpretation matched the ambiguous situations. Participants in the control condition only completed the pre and posttraining assessment of interpretation biases. Results showed that, compared to individuals in the control group, individuals who received the interpretation training were significantly more likely to endorse the positive interpretations for ambiguous social situations (Cohen's $d = .68$) and significantly less likely to endorse the negative interpretations (Cohen's $d = .97$). Furthermore, during a 1-week follow-up, participants in the interpretation training condition

reported significantly lower trait anxiety scores compared to participants in the control condition (Cohen's *d* = .63).

Salemink and colleagues (2009a) conducted another study investigating the effects of positive interpretation training on trait anxiety. Undergraduate participants rated high on trait anxiety completed either 8 consecutive sessions of the Mathews and Mackintosh (2000) positive interpretation training or the Mathews and Mackintosh (2000) control condition. Ratings of state and trait anxiety, general psychopathology, social phobia, and distress following a stressful task (i.e., an unsolvable anagram task) were collected pre and posttraining. While there were no differences between the conditions on reaction times for solving the positive word fragments (Cohen's *d* = .01), participants in the positive interpretation training condition were significantly slower at solving the negative word fragments compared to participants in the control condition (Cohen's *d* = .39). Moreover, participants in the interpretation training condition endorsed the positive interpretations for novel ambiguous scenarios significantly more frequently compared to participants in the control condition (Cohen's *d* = .73). Participants in the positive interpretation training condition reported significantly lower levels of state (Cohen's *d* = .47) and trait anxiety (Cohen's *d* = .21) after the interpretation training compared to participants in the control condition. However, there were no differences between the control and interpretation training groups on symptoms of social phobia (effect size information not provided) or distress following the anagram task (Cohen's *d* = .12). It is important to note, however, that participants in this study were not selected for high levels of social anxiety, thus potentially explaining the lack of findings with respect to the effects of interpretation training on social anxiety symptomatology.

As mentioned earlier, interpretation biases are especially salient in social anxiety given the high degree of ambiguity in every day social situations. Consequently, researchers have

investigated the training of interpretation biases specifically in samples involving individuals rated high on social anxiety. Using a modified version of the procedure developed by Mathews and Mackintosh (2000), Murphy and colleagues (2007) were the first to show that interpretation biases could be modified in a sample of undergraduate students rated high on social anxiety, as determined by the *Brief Fear of Negative Evaluation* (BFNE) scale (Leary, 1983). Participants in both the positive and nonnegative interpretation training conditions were significantly more likely to endorse positive interpretations for novel ambiguous social situations (Cohen's d = 1.42 and 1.03, respectively) and significantly less likely to endorse negative interpretations (Cohen's d = 1.23 and 1.04, respectively) compared to participants in the control condition. Moreover, those individuals in the positive and nonnegative interpretation training conditions rated their anticipatory anxiety about a future social situation involving a conversation with an unknown group of individuals significantly lower compared to individuals in the control condition (Cohen's d = .62 and .58, respectively).

Beard and Amir (2008) also developed an interpretation training procedure based on the WSAP described earlier. Participants received positive feedback ("You are correct!") when they indicated a relation between the neutral word and ambiguous social situation or no relation between the threatening word and ambiguous social situation and negative feedback ("You are incorrect.") when they indicated no relation between the neutral word and ambiguous social situation or a relation between the threatening word and ambiguous social situation. Participants in the control condition completed the same task except that the feedback they received was random and not related to their responses. Socially anxious undergraduate students, as determined by scores on the SPAI (Turner et al., 1989), were randomly assigned to the interpretation training or control condition and completed 8 sessions of interpretation training or

the control condition in the laboratory over a 4-week period. As expected, participants in the interpretation training condition were significantly more likely to endorse non-threat interpretations of ambiguous statements and significantly less likely to endorse threat interpretations compared to participants in the control condition (Cohen's *d* = 1.69 and 2.08, respectively). Furthermore, participants in the interpretation training condition reported significantly lower levels of social anxiety symptoms compared to the control group (Cohen's *d* = .86). Interestingly, all participants (i.e., interpretation training and control group) reported significantly lower levels of trait anxiety and depression following training (effect size information not available). Mediator analyses showed that the change in the benign interpretation bias from pre to posttraining was a significant predictor of change in social anxiety symptoms from pre to posttraining.

Most recently, Amir and Taylor (2012) conducted the first randomized controlled-trial investigating the effects of interpretation training on self-report and clinician-rated social anxiety. Treatment-seeking individuals with a DSM-IV diagnosis of generalized social anxiety disorder completed either 12 sessions of the WSAP (Beard & Amir, 2009; two sessions per week) or 12 sessions of the control task where endorsement of positive interpretations was reinforced 50% of the time. Although both groups showed a decrease in endorsement of threatening interpretations (Cohen's *d* = 1.91 for interpretation training condition and .79 for control condition) and an increase in endorsement of benign interpretations (Cohen's *d* = 1.76 for interpretation training condition and .35 for control condition), the interpretation training group endorsed benign interpretations significantly more frequently at posttreatment compared to the control group (Cohen's *d* = 1.30). Both groups self-reported significant decreases in trait anxiety (Cohen's *d* = 1.35 for the interpretation training condition and .72 for the control condition) as

well as social anxiety (Cohen's *d* = 1.95 for the interpretation training condition and .61 for the control condition) and depression (Cohen's *d* = 1.62 for the interpretation training condition and .48 for the control condition) over time, with the interpretation training group reporting significantly lower levels of trait anxiety (Cohen's *d* = .66) as well as depression (Cohen's *d* = .83) and social anxiety (Cohen's *d* = 1.05) at posttreatment compared to the control group. Clinician assessments revealed that diagnostic criteria for social anxiety disorder were no longer met at posttreatment for 65% of participants in the interpretation training condition versus 13% of participants in the control condition. Furthermore, although participants' reports of functional impairment decreased significantly over time for both groups (Cohen's *d* = 1.52 for the interpretation training condition and .99 for the control condition), at posttreatment participants in the interpretation training condition reported significantly lower levels of functional impairment compared to participants in the control condition (Cohen's *d* = .80).

Thus, based on the research reviewed, it is clear that benign and positive interpretation biases can be trained in nonclinical socially anxious populations. In a recent meta-analysis conducted by Hallion & Ruscio, (2011), it was found that interpretation training has a medium effect size for the modification of interpretation biases. Furthermore, studies have shown that the training of these biases leads to lower levels of self-reported anxiety as well as an increased willingness to partake in future social situations.

Generalizability of trained interpretation biases. In the majority of studies conducted to date, the tasks used to train and assess interpretation biases are very similar. For instance, the procedure developed by Mathews and Mackintosh (2000) uses lexically presented ambiguous social stories to both train and assess interpretation biases. Similarly, the tasks developed by Beard and Amir (2009) to assess and test interpretation biases use ambiguous social sentences

and require participants to indicate the relations between a word and the sentences. Thus, one question that remains is whether the trained interpretation biases reflect a simple task-specific priming process or whether they reflect true modification of interpretation biases.

Initial research suggests that, although the extent to which participants are required to actively seek and select responses has no effect on task-congruent assessments of interpretation biases (Grey & Mathews, 2000; Mathews & Mackintosh, 2000), it does affect whether the training effect influences emotionality. For instance, Hoppitt and colleagues (2010a) used two versions of the Mathews and Mackintosh (2000) task with a nonanxious population: 1) active condition (participants had to actively solve the word fragment to disambiguate the scenario); and 2) passive condition (the solved word fragment was presented to participants). Participants were presented with ambiguous scenarios at pre and posttraining and were asked to imagine the outcome of the scenarios and to rate the emotionality of their images. Results showed that only participants in the active negative interpretation training condition reported their images as being more negative in emotionality at posttraining (Cohen's $d = 2.21$). Furthermore, although not statistically significant, participants in the active positive interpretation training condition reported their images as being more positive in emotionality at posttraining. In another study with nonanxious participants, Hoppitt and colleagues (2010b) modified the interpretation training task developed by Grey and Mathews (2000) such that participants in the active training condition completed the original task while participants in the passive training condition were presented with an unambiguous cue rather than a homograph for solving the word fragment. While participants in both the active and passive threat training conditions were faster to identify threatening words than participants in the active (Cohen's $d = .34$ compared to both the active threat training and passive threat training conditions) and passive (Cohen's $d = .61$ compared to

the active threat training condition and .59 for the passive threat training condition) neutral training conditions, only participants in the active threat training condition showed higher levels of state anxiety after watching a video of accidents (Cohen's *d* = .43 compared to passive threat training condition, .20 compared to the active neutral training condition, and .29 compared to the passive neutral training condition). As discussed by the authors and by Mackintosh (2013), these studies suggest that for interpretation training to influence emotionality, participants must engage in active seeking and selection of interpretations during training. This active process then leads to the development of a rule or method for dealing with ambiguous information (e.g., interpret ambiguous information in a threatening manner) that is transferred to a new task. On the other hand, passive interpretation training leads to task-specific priming effects such that the effects of the training are dependent on a set of task-specific stimuli and are not a true indication of modified interpretation biases.

Although the process of actively searching and selecting an interpretation for an ambiguous scenario appears to be important in modifying emotionality in response to a stressor, not all studies with active training procedures have found that the effects of interpretation training generalize to emotional reactions toward stressors. While a number of studies have found training-congruent effects in response to videos depicting accidents that have lasted up to 24 hours after training and have been robust to environmental changes such as changes in experimenters, rooms, and forms of testing (Hoppit et al., 2010b; Mackintosh et al., 2006; Wilson, Macleod, Mathews, & Rutherford, 2006), other studies have failed to find any effects of interpretation training on emotional reactions toward videotaped comments about one's appearance or belongings, (Salemink, van de Hout, & Kindt, 2009b), an unsolvable anagram

task, (Salemink, van den Hout, & Kindt, 2009a), and an impromptu speech task (Standage, Ashwin, & Fox, 2009).

As reviewed by Mathews (2012), the degree to which training effects generalize to stressors may also be influenced by whether there is consistency in the domain of emotional concern between the training materials and the later stressor. This is consistent with the fact that most of the studies that have found training-congruent changes in emotionality in response to stressors have training materials that were of the same domain of emotional concern as the stressor. For instance, in the study by Mackintosh and colleagues (2006), the training scenarios focused on physical threat and the stressor that participants were exposed to posttraining was videos of accidents. Similarly, most homographs focus on physical threat and the studies that have found generalizability to stressors have focused on videos of accidents (Hoppitt et al., 2010b; Wilson et al., 2006). Most recently, Mackintosh and colleagues (2013) conducted a series of experiments in which they modified the similarity of the domain of emotional concern between the training stimuli and the stressors. They found that when the training was focused on positive social outcomes, participants reported higher levels of negative emotionality in response to failing a difficult cognitive task. In contrast, when the training was focused on benign interpretations of failure, participants in the benign condition reported significantly lower levels of negative emotionality in response to failing the cognitive task compared to participants in the control condition. Thus, in order to show generalizability of training effects, the training may need to actively involve participants in selecting the interpretation of ambiguous situations and may also need to involve stimuli that specifically target the domain of emotional concern.

There is also some question as to the degree to which the effects of interpretation training generalize to other measures of interpretation biases. Using a sample of participants with high

trait anxiety who completed 4 sessions of the Mathews and Mackintosh (2000) interpretation training or control tasks, Mathews and colleagues (2007) found that when participants were provided with descriptions of ambiguous social situations followed by three possible outcomes (positive, negative, and neutral), participants in the positive interpretation training condition rank ordered the positive outcomes as significantly more likely to occur (Cohen's d = .95) and the negative outcomes as significantly less likely to occur (Cohen's d = .97) compared to participants in the control condition. In contrast, also using a sample of participants with high trait anxiety, Salemink and colleagues (2009a) found that after completing 8 sessions of the interpretation training procedure or control procedure developed by Mathews and Mackintosh (2000), there were no significant differences between groups in how participants rank ordered positive, neutral, and negative interpretations of ambiguous social situations (Cohen's d = 0). In a follow-up study using undergraduate students with high trait anxiety, Salemink, van de Hout, and Kindt (2010) found that after completing a single session of the Mathews and Mackintosh (2000) interpretation training procedure or the control procedure, there were no differences between the interpretation training and control groups in reactions to videos involving actors approaching the camera and making ambiguous comments about some aspect of the participant's appearance or belongings (Cohen's d = 0) or to a written vignette depicting various ambiguous occurrences during a date (Cohen's d = .21), despite the presence of a positive interpretation bias in the interpretation training group.

Salemink and colleagues (2007) have also assessed the generalizability of interpretation biases using a combination of implicit and explicit measures in a sample of participants with high trait anxiety. Interpretation biases were first trained and assessed using the cognitive bias modification procedure developed by Mathews and Mackintosh (2000). Participants then

completed the *Extrinsic Affective Simon Task* (EAST; De Houwer, 2003). In this task, participants were first trained to press one key (e.g., "p") when a positive word was presented and another key (e.g., "q") when a negative word was presented. Participants were then trained to press one of the keys (e.g., "p") when a word of a particular colour appeared (e.g., green) and the other key (e.g., "q") when a word of a different colour (e.g., blue) appeared. Participants were then presented homographs (i.e., words that have multiple meanings, one being negative and one positive) written in either blue or green and were instructed to classify the homographs based on colour as quickly as possible. It was hypothesized that participants with negative interpretation biases would be faster at classifying homographs that appeared in blue (congruency between colour and emotional valence) and slower at classifying homographs that appeared in the colour green (incongruency between colour and emotional valence). In addition, participants also completed a second questionnaire during which they were presented with ambiguous social scenarios and asked to indicate what they thought would happen. Although participants who were in the positive interpretation training condition exhibited positive interpretation biases as assessed by the reaction time and response selection tasks in the Mathews and Mackintosh (2000) procedure, they did not show the corresponding interpretation training effects in either the EAST or the open-ended questionnaire tasks.

In summary, the research to date regarding the generalizability of interpretation biases is mixed. Although studies have found little support for generalizability across different interpretation biases tasks, there is some evidence of generalizability to emotional stressors, with the suggestion that active training procedures and consistency in the focus of emotional concern between the training stimuli and the stressor may be essential for generalization of interpretation

training. Further research in this area is needed and has theoretical and clinical implications, as it is important to understand what is being changed and modified during interpretation training.

Combination Training. As discussed previously, in addition to interpretation biases, attention biases and imagery biases have also been implicated in social anxiety (Hirsch & Clark, 2004). Computer-based cognitive bias modification procedures have also been developed for the modification of attention biases. These attention training tasks involve a modified dot-probe task during which participants are shown two stimuli (one threatening and one neutral) simultaneously for 500 ms followed by a probe that appears in the same location as one of the stimuli. Participants have to indicate the location of the probe as quickly as possible by pressing one of two keys. In the attention training condition, the probe always replaces the neutral stimulus in order to train individuals to disengage from threatening stimuli, while in the control condition the probe replaces the neutral and threatening stimuli with equal frequency (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). Studies have shown that participants with high levels of social anxiety report lower levels of anxiety following attention training (e.g., Amir, Beard, Taylor, Klumpp, Elias, Burns, & Chen, 2009; Amir, Weber, Beard, Bomyea, & Taylor, 2008; Li, Tan, Qian, & Liu, 2008; Schmidt, Richey, Buckner, & Timpano, 2009).

Two recent studies have investigated the effect of combining attention and interpretation training on self-reported anxiety in participants with high levels of social anxiety. In a pilot study, Brosan and colleagues (2011) investigated the effect of combined interpretation and attention training on self-reported anxiety levels in a sample of 13 treatment-seeking patients at an outpatient cognitive therapy clinic who met diagnostic criteria for either social anxiety disorder or generalized anxiety disorder. After completing four sessions (one session per week) of combined interpretation and attention training, participants showed both interpretation training

and attention training effects (effect size information not provided) as well as reductions in state (Cohen's *d* = .81) and trait (Cohen's *d* = 1.12) anxiety at posttreatment. The study conducted by Brosan and colleagues (2011) has some obvious limitations, including the lack of a control group as well as the small sample size. It does, however, provide preliminary evidence for the utility of combining interpretation and attention training.

More recently, Beard and colleagues (2011) have expanded on the work of Brosan and colleagues (2011) by conducting a randomized controlled trial investigating the effects of combined interpretation and attention training using a modified dot-probe task and the WSAP (Beard & Amir, 2009) in a sample of treatment-seeking participants with social anxiety disorder. Participants completed eight sessions (two times per week) of combined interpretation and attention training (treatment condition) or the control tasks (i.e., 50% of the time positive interpretations and 50% of the time negative interpretations of a statement were reinforced; and the probe replaced the threatening and non-threatening faces with equal frequency; control condition). Self-reported social anxiety levels were assessed weekly using the *Liebowitz Social Anxiety Scale* (Liebowitz, 1987) and a behavioural assessment of social anxiety was conducted through an impromptu speech at posttreatment. Participants in the treatment condition had significantly lower levels of self-reported social anxiety at each time point compared to participants in the control condition (Cohen's *d* = .70). As well, the speeches of participants in the training condition were rated as significantly higher in quality and as showing lower levels of anxiety compared to the speeches of participants in the control condition (Cohen's *d* = .85). Moreover, most participants in the training condition viewed the computer tasks as acceptable, with the interpretation training task being rated as more useful compared to the attention training task. Although these studies are preliminary and need to be replicated with larger sample sizes,

they do provide initial evidence for the effectiveness of combined treatments for reducing subjective and behavioural symptoms of social anxiety. It remains to be determined whether these combined training approaches lead to greater reductions in subjective and behavioural measures of anxiety compared to the individual training approaches (i.e., interpretation training alone or attention training alone).

Cognitive-Behavioural Therapy

Cognitive-behavioural therapy (CBT) is one of the most widely researched psychosocial treatments. There is an abundance of research that has illustrated the effectiveness of CBT for a variety of psychiatric disorders, including social anxiety disorder (Butler, Chapman, Forman, & Beck, 2006). Furthermore, Franklin and colleagues (2005) found that patients who received 14 sessions of group CBT for social anxiety disorder reported significantly lower levels of interpretation biases compared to participants in the waitlist control group.

CBT for social anxiety consists of 3 main treatment components: 1) psychoeducation; 2) identification and modification of maladaptive cognitions; and 3) exposure. In some cases, it can also include social skills training, relaxation training, or other strategies. The rationale for the modification of maladaptive cognitions is based on the theoretical conceptualization that individuals with social anxiety are hypervigilant towards signs of negative evaluation or criticism, thus leading to distorted perspectives of social situations (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997). These distorted perspectives result in individuals with social anxiety viewing social situations as threatening and expecting the worst possible outcome. Consequently, it is believed that by identifying and modifying these distorted cognitions, one can modify the emotions individuals experience toward the event. The rationale for exposure is based on learning theory; by repeatedly facing anxiety-provoking situations without the feared

outcomes occurring, individuals experience a decrease in their anxiety levels through the process of extinction.

Although it is well established that CBT is an effective psychosocial treatment for social anxiety disorder, the role that each of the components of CBT plays in decreasing social anxiety symptomatology is less clear. Therefore, researchers have begun to investigate the relative contributions of the different components of CBT. To date, four meta-analyses have compared the effects of: 1) exposure only, 2) cognitive restructuring only, 3) combined exposure and cognitive restructuring, 4) social skills training, and 5) applied relaxation (Fedoroff & Taylor, 2001; Feske & Chambless, 1995; Gould, Buckminster, Pollack, Otto, & Yap, 1996; Taylor, 1996).

In a meta-analysis conducted by Taylor (1996) cognitive restructuring, exposure, combined cognitive restructuring and exposure, placebo control (i.e., pill placebo or attention placebo), and waitlist control were compared on social anxiety measures following treatment. It was found that all the treatment conditions as well as the placebo control condition had significantly greater decreases in self-reported ratings of social anxiety from pretreatment to posttreatment compared to the waitlist control (Cohen's d = .63 for cognitive restructuring, .82 for exposure, 1.06 for combined cognitive restructuring and exposure, .48 for placebo control, and -.13 for waitlist control). Only the combined cognitive restructuring and exposure condition resulted in significantly lower ratings of social anxiety at posttreatment compared to the placebo control condition. There were no other differences between the treatment conditions at posttreatment. The direction and pattern of results remained the same at the 3-month follow-up with the exception that the effect sizes were larger, suggesting continued improvement in symptomatology following treatment. Thus, this meta-analysis suggests that all treatments were

equally effective in improving symptomatology and that there may be some advantage in combined cognitive restructuring and exposure treatments. A similar pattern of results has been found in a number of follow-up meta-analyses (e.g., Federoff & Taylor, 2001; Gould et al., 1997). For instance, Gould and colleagues (1997) found that although all components of CBT lead to significant decreases in social anxiety symptomatology, the exposure alone and combined cognitive restructuring and exposure conditions evidenced larger effect sizes (Cohen's *d* = .89 and .80, respectively) compared to the cognitive restructuring alone condition (Cohen's *d* = .60). Similarly, Feske and Chambless (1995) found that in a comparison of 12 studies that involved combined cognitive-behavioural treatments and 9 studies that involved only exposure, there were no significant differences between combined cognitive-behavioural treatments and exposure on changes in self-report measures of social anxiety (Cohen's *d* = .90 and .99, respectively), cognitive symptoms (Cohen's *d* = 1.02 and .72, respectively), or depressed/anxious mood (Cohen's *d* = .58 and .56, respectively) from pretreatment to posttreatment. Similarly, Fedoroff and Taylor (2001) found no significant differences in changes in self-reported and clinician-assessed social anxiety symptoms from pretreatment to posttreatment following exposure only (Cohen's *d* = 1.08 for self-report and 3.47 for clinician-assessed), cognitive restructuring only (Cohen's *d* = .72 for self-report, no information provided for clinician-assessed), or combined cognitive restructuring and exposure (Cohen's *d* = .84 for self-report and 1.8 for clinician-assessed). Furthermore, treatment gains were maintained at follow-up assessments. Therefore, there is a robust body of evidence illustrating the effectiveness of the individual and combined components of CBT in the treatment of social anxiety, although there is some suggestion that exposure only and combined cognitive restructuring and exposure may be superior than cognitive restructuring only.

In addition to specific symptomatology and interpretation biases, a number of other biased cognitive processes have also been associated with social anxiety, including a fear of negative evaluation (Leary, 1983; Stopa & Clark, 1993: Weeks et al., 2005), a tendency to overestimate the probability and cost of negative social situations (Foa et al., 1996; Hofmann, 2007) as well as negative beliefs about one's own abilities in social situations (Hofmann, 2007). Research has shown that CBT as a whole is also effective in reducing biased cognitive processes associated with social anxiety. For instance, Hofmann (2004) found that patients who completed group CBT for social anxiety evidenced statistically significant decreases in cognitions about the cost of negative social situations compared to patients in the waitlist control group at posttreatment (Cohen's d = .92) and these decreases were positively associated with treatment outcome. In a follow-up study, Moscovitch and colleagues (2012) found that patients who made significant improvements during group CBT for social anxiety showed significant decreases in cognitions about the probability and cost of negative social situations from pretreatment to midtreatment (Cohen's d = 1.39 and 1.74, respectively) and from midtreatment to posttreatment (Cohen's d = 1.10 and 1.09, respectively). Decreases in cost of negative social situations was a significant predictor of treatment response. As well, CBT has been shown to result in significant decreases in fear of negative evaluation (Cohen's d = 1.69) as well as negative evaluation of one's own performance in social situations (Cohen's d = 1.13; Collins et al., 2005; Koerner et al., 2013). Thus, there is a robust body of empirical evidence illustrating the effectiveness of CBT as a whole in not only reducing symptoms of social anxiety but also successfully reducing the cognitive processes associated with social anxiety.

There is a necessity for continued research on the components of CBT, including cognitive restructuring, to better elucidate their role in the treatment of social anxiety disorder.

This has both theoretical and clinical implications. Theoretically, one of the main postulates in cognitive-behavioural models explaining the maintenance of social anxiety is that individuals who are socially anxious believe that social situations will result in catastrophic outcomes and that others will judge them negatively (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997). Therefore, it is hypothesized that the modification of these cognitive distortions will result in decreases in anxiety. Thus, a better understanding of the mechanisms of change in CBT will enable the development of more effective and efficient treatments and the identification of those components that are most important in the treatment of social anxiety.

Single-Session Interventions

Related to the idea of increasing the effectiveness and efficiency of interventions, a number of studies have investigated the effects of single-session interventions involving cognitive restructuring in the treatment of various conditions, including specific phobias, public speaking anxiety, obsessive-compulsive symptoms, and depression. These brief one-session interventions have shown to be effective in a number of studies.

One-session interventions have been shown to be effective for specific phobias, including dental (De Jongh, Muris, Ter Horst, Van Zuuren, Schoenmakers, & Makkes, 1995), animal (Koch, Spates, & Himle, 2004), and flying phobias (Öst, Brandberg, & Alm, 1997). De Jongh and colleagues (1995) investigated the effects of a 1-hour cognitive restructuring intervention in individuals with dental phobias. They found that, compared to a psychoeducation condition focused on oral health and dental procedures and a wait-list control condition, patients in the cognitive restructuring condition reported significantly lower dental anxiety as well as decreased frequency and believability of negative cognitions at posttreatment (effect size information not provided). Interestingly, at the 1-year follow-up, although the change from pretreatment to

posttreatment was even greater, there were no significant differences between the two treatment conditions. It should be noted that this study was conducted in a dental fear clinic and that the participants had avoided dental treatments for a number of years (M = 6 years). Consequently, the participants had undergone a number of dental procedures during the follow-up year. As suggested by de Jong and colleagues (1995), the repeated exposures to the dental procedures may have resulted in the decrease in dental anxiety for both treatment conditions. Thus, this study may be seen as consisting of 2 conditions: 1) cognitive restructuring followed by in vivo exposure; and 2) psychoeducation followed by in vivo exposure. The results suggest that, although cognitive restructuring may aid in reducing patients' fears before the dental procedures, the inclusion of in vivo exposures during the follow-up year is sufficient to decrease dental anxiety in both conditions.

In another study focused on specific phobias, Koch and colleagues (2004) compared a single session of CBT (i.e., cognitive restructuring and exposure) to a singe session of in vivo exposure in a sample of patients with small animal phobias (i.e., snakes, spiders, etc.). Participants in both treatment conditions evidenced significant decreases in fears from pretreatment to posttreatment as measured through self-report and behavioural approach tests and these effects were maintained at 1-year follow-up (effect size information not provided). Although the treatment effects were the same across the two treatment conditions, participants in the in vivo exposure condition reported that they felt that the treatment was more intrusive compared to participants in the CBT condition. Thus, although treatment outcome may be the same, it appears that patients may prefer CBT for the treatment of small animal phobias.

In a sample of college students with subclinical levels of obsessive-compulsive symptoms, Zucker and colleagues (2006) found that participants who attended a 3-hour CBT

workshop endorsed significantly lower levels of thought-action fusion at 1-month and 5-month follow-up assessments, as well as fewer obsessive-compulsive symptoms at 5-month follow-up, compared to individuals who only underwent the assessment (effect size information not provided). However, there were no differences between the conditions in the severity of the symptoms endorsed.

More recently, McManus and colleagues (2012) investigated the effects of a 30-minute single session intervention during which participants either completed a thought record (i.e., cognitive restructuring) or a behavioural experiment (i.e., exposure) in reducing beliefs, anxiety and behaviours associated with concerns about contamination from not washing one's hands after using the washroom. Participants in the control condition were asked to read a neutral text and answer questions about what they had read as well as solve mathematical problems. Although within-group analyses revealed that participants in the cognitive restructuring and behavioural experiment conditions both experienced reductions in beliefs, anxiety, and behaviours around the target thought, between-group analyses revealed that, although there were no between group differences for the two intervention conditions at posttreatment or 1-week follow-up, comparisons of the two intervention conditions with the control condition revealed some statistically significant differences. For instance, compared to the control condition, the behavioural experiment condition showed a significant decrease in belief ratings at post-treatment (Cohen's $d = .75$) and 1-week follow-up (Cohen's $d = .92$) while the cognitive restructuring group showed a significant decrease at the 1-week follow-up (Cohen's $d = .76$) but not at posttreatment (Cohen's $d = .52$). Moreover, while there were no significant differences between the interventions and the control condition on generalizability of beliefs at postintervention (Cohen's $d = .34$ for cognitive restructuring versus control and .50 for

behavioural experiment versus control), participants in the behavioural experiment condition showed a significant increase in generalizability of beliefs at the 1-week follow-up compared to participants in the control condition (Cohen's *d* = .70) while the cognitive restructuring group did not (Cohen's *d* = .51). As well, while there were no differences between the interventions and control conditions on likelihood of engaging in washing behaviours at postintervention (Cohen's *d* = .52 for cognitive restructuring versus control and .50 for behavioural experiment versus control), at the 1-week follow-up, participants in the behavioural experiment condition reported a significantly lower likelihood of engaging in washing behaviours in the future compared to the control group (Cohen's *d* = .59) while participants in the cognitive restructuring group did not (Cohen's *d* = .43). Thus, there is preliminary evidence that both cognitive restructuring and exposure play an important role in treatment outcome but that exposure may lead to changes in symptomatology being detected earlier during treatment as well as greater generalizability of effects.

Teasdale and Fennell (1982) investigated the immediate effects on depressed mood of 30 minutes of cognitive restructuring versus 30 minutes of thought exploration in a sample of patients with chronic depression. Patients in the cognitive restructuring condition reported significantly lower levels of depressed mood and indicated lower levels of believability in their depressogenic thoughts immediately following the intervention compared to individuals in the thought exploration condition (effect size information not provided).

Steil and colleagues (2011) investigated the effects of a two-session program involving cognitive restructuring and imagery modification in a sample of 9 women suffering from posttraumatic stress disorder as a result of a history of childhood sexual abuse and who were experiencing the feeling of being contaminated. The results showed that the two-session

program was effective in reducing the vividness (Cohen's *d* = 1.83), uncontrollability (Cohen's *d* = 2.79) and distress (Cohen's *d* = 2.45) related to the feeling of being contaminated as well as symptoms of posttraumatic stress disorder immediately after treatment. The effects were maintained when patients were reassessed 6 weeks after treatment.

In summary, a number of studies have shown that brief 1 to 2 session interventions can be effective in the treatment of various conditions, including specific phobias, depression, subclinical levels of obsessive-compulsive disorder, and posttraumatic stress disorder symptoms. In addition, these effects were maintained at follow-up in a number of studies. These findings are clinically significant as in today's fiscal environment there is increasing pressure to develop more efficient treatments.

Interpretation Training versus CBT

Whereas interpretation training utilizes implicit and unconscious processes to modify interpretation biases, CBT employs deliberate and conscious efforts to change automatic negative thoughts. To date, only one study has compared computerized CBT to interpretation training in individuals with social anxiety. Using a community sample of participants who scored 17 or higher on the FNE scale, Bowler and colleagues (2012) found that participants who received four sessions (two sessions per week) of interpretation training or computerized CBT reported significantly greater reductions in self-reported social anxiety (Cohen's *d* = .46 for interpretation training versus control and .71 for computerized CBT versus control), depression (Cohen's *d* = .58 for interpretation training versus control and .98 for computerized CBT versus control), and trait anxiety levels (Cohen's *d* = .43 for interpretation training versus control and .91 for computerized CBT versus control) compared to the no intervention waitlist control condition. As well, when presented with a questionnaire that involved rating the likelihood of

positive or negative interpretations of ambiguous social situations, participants in both intervention conditions endorsed the positive interpretations as significantly more likely to come to mind compared to participants in the waitlist control condition (effect size information not provided). However, when asked to self-generate possible interpretations of ambiguous social situations and to rate the believability of the generated interpretations, participants in the interpretation training condition generated significantly more positive interpretations and rated their belief in the interpretations as significantly higher compared to participants in the computerized CBT (Cohen's $d = .62$) and waitlist control conditions (Cohen's $d = 1.10$). Participants were also asked to complete a scrambled sentence task in which they were presented with a set of scrambled words and asked to create a sentence from the words. Participants did not have to use all of the presented words to create the sentence and the words that were presented could be used to create either a positive or a negative sentence. Participants completed this task under two conditions: no cognitive load (i.e., they just had to complete the task) and cognitive load (i.e., they had to remember a string of numbers while completing the task). In the no cognitive load condition, both intervention conditions generated significantly more positive sentences compared to the waitlist control condition and there were no differences between the intervention conditions in the number of positive sentences generated. However, in the cognitive load condition, the interpretation training condition generated significantly more positive sentences and fewer negative sentences compared to the computerized CBT and waitlist control conditions (effect size information not provided). These preliminary findings suggest that, although both computerized CBT and interpretation training may be effective in reducing symptoms of social anxiety and depression and enhancing positive interpretations of ambiguous social situations, the interpretation training condition may lead to an advantage in generating

positive interpretations of social situations under cognitive load due to the focus on implicit and automatic processes during training. It should also be noted, however, that although both the interpretation training task and computerized CBT had statistically significant effects on self-reported social anxiety, state anxiety, and depression compared to the control condition, an examination of the effect sizes revealed that the differences between the interpretation training and control conditions generated medium effect sizes while the differences between the computerized CBT and control conditions generated large effect sizes.

Physiological Reactivity

As can be seen from the studies reviewed earlier, the majority of studies focusing on interpretation training in social anxiety utilize self-report as the sole measure of anxiety, with some studies also including a behavioural component (e.g., a speech task or a social interaction with a confederate). However, the anxiety response is theorized to be composed of three inter-related components: subjective, behavioural, and physiological (Bernstein, Borkovec & Coles, 1986; Lang, 1978). Many emotion theories propose that these three components show high levels of coherence, thus producing a coordinated response (e.g., Ekman, 1992; Lazarus, 1991; Levenson, 1994; Scherer, 1984). However, the empirical research to date is mixed, with many studies failing to find high levels of coherence between the three components of the anxiety response (Reisenzein, 2000). More specifically, there is consistent research evidence for coherence between subjective and behavioural measures of social anxiety (e.g., Beidel, Turner, & Dancu, 1985; Borkovec, Stone, O'Brien, & Kaloupek, 1974; Bruch Gorsky, Collins, & Berger, 1989; Grossman, Wilhelm, Kawachi, & Sparrow, 2001; Levin et al., 1993; Twentyman & McFall, 1975). However, research on coherence between subjective and physiological as well as behavioural and physiological measures in social anxiety is mixed (see Mauss, Wilhelm, &

Gross, 2004 for a review). While some studies have found evidence for coherence between subjective and physiological reactivity during social and nonsocial stressors (e.g., Beidel et al., 1985; Bruch et al., 1989; Davidson, Marshall, Tomarken, & Herniques, 2000; Hofmann, Newman, Ehlers, & Roth, 1995; Levin et al., 1993; Moscovitch, Suvak, & Hofmann, 2010; Stein, Asumundsdon, Chartier, 1994; Turner & Beidel, 1985) other studies have failed to find such relations (Baggett, Saab, & Carver, 1996; Beatty & Behnke, 1991; Eckman & Shean, 1997; Edelmann & Baker, 2002; Grossman et al., 2001; Lang & McTeague, 2009; Mauss et al., 2004; Mulken, de Jong, Dobbelaar, & Bogels, 1999; Panayiotous & Vrana, 1998).

Edelmann and Baker (2002) compared individuals with a DSM-III-R diagnosis for social anxiety with individuals with a different anxiety disorder (i.e., panic disorder, generalized anxiety disorder, and specific phobia), and a community control condition, on self-report and objective measures of physiological reactivity during a social conversation with a female confederate. Heart rate and skin conductance were measured continuously during baseline, conversation and recovery. Participants also rated their levels of anxiety and physiological reactivity immediately prior to and following the social interaction. Participants in the social anxiety condition reported significantly higher heart rate compared to participants in the other two conditions and participants in both the social anxiety and other anxiety disorder groups reported significantly higher levels of sweating compared to the community control group. Contrary to the self-report measures, however, there were no significant differences between the three groups on measured heart rate and skin conductance.

Mauss and colleagues (2004) built on the study conducted by Edelmann and Baker (2002) by incorporating all three components of the anxiety response. Female undergraduate participants who reported either high levels of social and speech anxiety or low levels of social

and speech anxiety completed a speech task in the laboratory. Physiological measures of heart rate, skin conductance, facial blushing, and respiratory rate were collected at baseline (3 minutes), preparation (3 minutes), speech completion (3 minutes), and recovery (2 minutes). Prior to and following the speech, participants reported their levels of distress as well as their perceptions of their autonomic arousal (e.g., heart rate, sweating, shortness of breath, and blushing). Participants' videotaped speeches were also coded for the presence of anxious behaviours, including fearful or rigid facial expression and rigid posture. Mauss and colleagues (2004) found that, although there were no differences between groups in self-reported anxiety levels and self-reported physiological reactivity at baseline, individuals in the high social anxiety group reported significantly higher levels of anxiety as well as physiological reactivity during the preparation, speech completion and recovery phases of the speech task compared to individuals in the low social anxiety group. Furthermore, individuals in the high social anxiety group showed significantly more anxious behaviours during the speech task compared to individuals in the low social anxiety group. Despite these significant findings, there were no significant differences between groups on measured physiological reactivity. That is, measured physiological reactivity, including heart rate and skin conductance, increased in response to the speech task for both groups and there were no significant differences in the magnitude of the increase between groups. Moreover, self-reported anxiety levels were significantly correlated with both self-reported physiological and behavioural measures but not objective physiological measures.

A number of potential explanations have been suggested for these discrepant patterns of findings (see Mauss et al., 2005 for a review). First, methodology is a potentially significant confounding factor. Studies have varied on the tasks utilized to measure the anxiety response

(e.g., speech tasks, social interactions with confederates, eye gaze tasks, imagery tasks), the specific populations utilized (e.g., clinical populations versus community populations rated high and low on self-reported measures of social anxiety), the type of autonomic reactivity assessed (e.g., heart rate, skin conductance, facial blushing, or respiratory rate), the statistical methods used (i.e., within versus between group comparisons) and the timing of measures of self-report and objective physiological reactivity. Timing is important as, while most studies utilize online, moment-by-moment monitoring of objective physiological reactivity during the social stressor tasks, the measurement of subjective physiological reactivity is typically done retrospectively following the completion of the social stressor task. This retrospective assessment creates the potential for biased responses and error due to cognitive processes such as memory biases (Feldman-Barrett, 1997; Rosenberg & Ekman, 1994).

There is also variability across studies in the relevance of the social stressor tasks. In some cases, studies using a speech task have screened participants for both social anxiety and speech anxiety and have only selected those individuals who endorsed both high levels of social anxiety as well as a specific fear of giving speeches in front of others. In contrast, other studies using a speech task have only selected participants based on social anxiety ratings, thus not assessing their fears of public speaking and the relevance of the speech task. This is an important issue as research has shown that coherence is more likely to be found when intense levels of an emotion are experienced (Davidson, 1992; Gramer & Saria, 2007; Rosenberg & Ekman, 1994). Thus, for individuals who have a specific fear of giving speeches in front of others, completion of a speech task will potentially be associated with a greater anxiety response compared to individuals who do not have a specific fear of giving speeches, thus potentially explaining some of the variability across studies.

It has also been suggested that the anxiety response may exhibit less coherence due to the significant role of cognitions in the experience of anxiety (e.g., Mauss et al., 2004; Reisenzein, 2000). Contemporary theories of social anxiety postulate that one contributing factor to the experience and maintenance of social anxiety is the tendency to misattribute the likelihood and social costs of displaying physiological arousal publicly (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). This theoretical view has received empirical support with a number of studies finding that one factor that contributes to socially anxious individuals' fears of social situations is the fear of exhibiting observable symptoms of physiological arousal, such as blushing, sweating, or shaking (e.g., Bogels, Mulken, & de Jong, 1997; Moscovitch, 2009). Furthermore, socially anxious individuals tend to overestimate the degree to which internal physiological sensations are visible to others (Wild, Clark, Ehlers, & McManus, 2008) as well as the degree to which others will judge them negatively for displaying symptoms of physiological arousal (Roth, Antony, & Swinson, 2001; Voncken et al., 2007). Thus, cognitions, specifically the interpretations and meanings that individuals attribute to their physiological reactivity, may play a more central role in the experience of anxiety, thus decreasing the coherence between physiological measures and behavioural and subjective measures.

In addition to the discrepancies in coherence, Gramer and Sprintschnik (2008) have also proposed a possible explanation for the lack of differences in measured physiological reactivity between high and low social anxiety groups, despite significant differences in self-reported physiological reactivity. Gramer and Sprintschnik (2008) point out that all studies investigating physiological reactivity have used active performance tasks as social stressors. It has been suggested that one's perception of success in such a situation is related to physiological reactivity. That is, as long as one perceives the potential for success in the situation, there will

be a positive relation between exerted effort and physiological reactivity, such that a higher amount of exerted effort is associated with greater physiological reactivity. However, when the task becomes too overwhelming for the individual and he/she no longer perceives the potential for success, one may abandon the task thus inhibiting physiological reactivity.

Gramer and Sarai (2007) found that when individuals with social anxiety completed a social stressor task under conditions of low evaluative threat, individuals with high social anxiety exhibited higher blood pressure compared to individuals with low social anxiety, suggesting that the task required more effort and coping resources from individuals with high levels of social anxiety. In contrast, when the task was completed under high evaluative threat, there were no significant group differences in blood pressure, suggesting that the task may have overwhelmed the coping resources of individuals who reported high levels of anxiety, thus inhibiting group differences in physiological reactivity. In a follow-up study, Gramer and Sprintschnik (2008) found that individuals with high social anxiety exhibited higher heart rate and blood pressure compared to individuals with low social anxiety during a speech task and this difference was mediated by the presence of coping resources as well as an anticipatory period.

In summary, although one of the central tenets of many theories of emotion is coherence amongst subjective, behavioural, and physiological components, the empirical research to date has been mixed, especially with regard to the issue of coherence between physiological and behavioural and subjective components. As suggested by Moscovitch and colleagues (2010), at this point, the question of coherence may need to be modified from whether there is coherence amongst the three components of the anxiety response to the specific situations and components that exhibit coherence. It is clear from the literature that the answer is much more complex than originally theorized and there is a need to further elucidate the factors involved in coherence.

This body of literature also highlights the importance of multimethod studies in understanding social anxiety. While many studies rely solely on self-report measures of anxiety, it is clear that self-report does not provide a complete picture of the anxiety response and a thorough assessment of anxiety should include both behavioural and physiological measures in addition to self-report measures.

No studies to date have investigated the effects of interpretation training on physiological reactivity in response to a stressor. However, two studies have investigated the effects of attention training on physiological reactivity in individuals with a spider phobia (Van Bockstaele et al., 2011) and social anxiety (Heeren, Reese, McNally, & Philippot, 2012). While the study by Van Bockstaele and colleagues (2011) failed to show any differences between the attention training and control groups on heart rate and skin conductance levels in response to pictures of spiders, Heeren and colleagues (2012) found that participants in the attention training condition showed significantly lower heart rate and skin conductance levels in response to the impromptu speech task compared to participants in the control condition.

The Current Study

Broadly, the current study aimed to compare the effects of interpretation training, cognitive restructuring, and a computer-control task on interpretation biases, social anxiety symptomatology, cognitive processes associated with social anxiety, and self-report, behavioural, and physiological measures of anxiety during a self-presentation task in an analogue social anxiety sample. As reviewed earlier, cognitive theories postulate that information processing biases, including interpretation biases, play a significant role in the maintenance of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). There is a robust body of literature that supports the role of interpretation biases in social anxiety and more recent studies

have begun to investigate the potential role of computer-based tasks for the modification of interpretation biases. This study aimed to contribute to this body of literature in a number of ways.

First, to date, the interpretation training literature has relied for the most part on self-report measures of symptomatology as outcome variables. However, the anxiety response is conceptualized as consisting of three interrelated components: subjective, behavioural, and physiological (Bernstein et al., 1986; Lang, 1978). Thus, the present study extends current literature by including behavioural and physiological measures of anxiety, thus aiming to provide a more comprehensive assessment of the effects of interpretation training on the anxiety response.

Second, most of the research on interpretation training has used social anxiety symptomatology as an outcome measure. However, there are a number of cognitive processes that have been associated with social anxiety and that have been shown to decrease following multisession CBT for social anxiety (Collins et al., 2005; Hofmann, 2004; Koerner et al., 2013; Moscovitch et al., 2012). These cognitive processes include fear of negative evaluation, negative thoughts about one's performance in social situations, and probability and cost of negative social situations. Therefore, the present study extended previous research by examining the effects of a single-session interpretation training task and a single-session cognitive restructuring task on these cognitive processes.

Third, the majority of studies to date have used similar tasks to modify and measure interpretation biases, thus bringing into question the generalizability of the effects of interpretation training. For instance, the procedure developed by Mathews and Mackintosh (2000), requires participants to solve word fragments and answer comprehension questions

during both the training and testing phases. The few studies that have investigated the generalizability of the effects of interpretation training to other measures of interpretation biases have resulted in mixed findings. Thus, another goal of the present study was to investigate whether the effects of interpretation training generalize to a self-report measure of interpretation biases as well as a behavioural measure of social anxiety (i.e., a speech task).

Fourth, there is a lack of dismantling studies investigating the effects of cognitive restructuring on social anxiety, as much of the research to date has focused on the effects of in vivo exposure. Theoretically and clinically, this is an important area of research as dismantling studies provide insight into the mechanisms of action for effective treatments, which helps to enhance the efficiency and effectiveness of available treatments. Accordingly, the present study aimed to investigate the effects of a single-session cognitive restructuring task, a specific component of CBT, on social anxiety symptomatology, cognitive processes, interpretation biases, and self-report, behavioural, and physiological measures of anxiety during a self-presentation task in a social anxiety analogue sample.

Lastly, with the exception of one study comparing interpretation training to computerized CBT, no studies have compared the effects of interpretation training to face-to-face therapeutic interventions in individuals with social anxiety. This is an important area of exploration because research has shown that CBT strategies do challenge interpretation biases, although the processes through which these strategies modify interpretation biases may be indirect. Therefore, there is the question of whether a separate intervention targeting interpretation biases (i.e., interpretation training) is really necessary or whether interpretation biases are already being targeted and addressed through CBT. Although some researchers have suggested that CBT does not directly target interpretation biases while interpretation training does (e.g., Beard, 2011; Mathews, 2012;

Mobini, 2013) there is a paucity of dismantling studies that have examined the components of CBT, including cognitive restructuring, in order to increase understanding of the role that each component plays in addressing social anxiety symptoms. This is an important area of research before suggestions are made about the addition of new treatment components. Accordingly, the present study compared the effects of single-session interpretation training and a single-session cognitive restructuring task on symptomatology, cognitive processes, interpretation biases, and self-report, behavioural, and physiological measures of anxiety in a social anxiety analogue sample.

In summary, the following questions were addressed in the current study:

1) Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task report significant decreases in state anxiety and state negative affect at posttask and postspeech? Are there between-group differences on state anxiety and state negative affect at posttask and postspeech?

2) Do the effects of a single-session interpretation training task or a single-session cognitive restructuring task generalize to self-report measures of interpretation biases in individuals with high levels of social anxiety? If so, are these changes maintained at a 48-hour follow-up assessment? Are there between-group differences on self-reported measures of interpretation biases at posttask and 48-hour follow-up?

3) Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task report a decrease in social anxiety symptomatology? If so, are these changes maintained

at a 48-hour follow-up assessment? Are there between-group differences on social anxiety symptomatology at posttask and 48-hour follow?

4) Do the effects of a single-session interpretation training task or a single-session cognitive restructuring task generalize to changes in cognitive processes associated with social anxiety, including fear of negative evaluation, negative thoughts about one's abilities in social situations, and the overestimation of the probability and cost of negative social situations, in a sample of individuals with high levels of social anxiety? If so, are these changes maintained at a 48-hour follow-up assessment? Are there between-group differences on self-reported measures of cognitive processes at posttask and 48-hour follow-up?

5) Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task report less distress during the speech task and rate their performance on the speech as better compared to individuals in the control condition?

6) Are individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task rated by an objective observer as performing better on a speech compared to individuals in the control condition?

7) Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task show lower levels of skin conductance and lower heart rate during a speech task compared to individuals in the control condition?

Based on: 1) the theoretical model of social anxiety, emphasizing the role of interpretation biases in the maintenance of social anxiety; 2) previous research showing that individuals who received interpretation training endorsed lower levels of state anxiety as well as lower levels of anxiety when anticipating a future social situation compared to individuals in the control condition (Murphy et al., 2007); 3) the research illustrating the effectiveness of CBT in decreasing social anxiety symptomatology as well as interpretation biases and related cognitive processes (Butler et al., 2006; Collins, 2005; Franklin et al., 2005; Koerner et al., 2013; Moscovitch et al., 2012); and 4) the interrelated components of the anxiety response, the following hypotheses were proposed:

H1a: Participants in the interpretation training and cognitive restructuring conditions will report a statistically significant decrease in state anxiety and state negative affect following the group-specific task compared to participants in the control condition.

H1b: Participants in all three conditions will report a statistically significant increase in state anxiety and state negative affect from posttask to postspeech but the increase will be significantly lower in the interpretation training and cognitive restructuring conditions compared to the control condition.

H1c: State anxiety and state negative affect scores will be significantly lower in the interpretation training and cognitive restructuring conditions at posttask and postspeech compared to the control condition. The interpretation training and cognitive restructuring conditions will not differ significantly on state anxiety and state negative affect at posttask and postspeech.

H2a: Only participants in the interpretation training and cognitive restructuring conditions will report a statistically significant decrease in self-reported negative

interpretations of novel social situations from baseline to posttask. This decrease in negative interpretations of social situations will be maintained at the 48-hour follow-up. Participants in the control condition will not report any significant changes in negative interpretations of social situations from baseline to posttask or at the 48-hour follow-up.

H2b: Participants in the interpretation training and cognitive restructuring conditions will be significantly less likely to select negative interpretations of novel social situations compared to participants in the control condition at posttask and at 48-hour follow-up. The interpretation training and cognitive restructuring conditions will not differ significantly on endorsement of negative interpretations of novel social situations at posttask or 48-hour follow-up.

H3a: Only participants in the interpretation training and cognitive restructuring conditions will report a statistically significant decrease in social anxiety symptomatology and anticipatory anxiety and avoidance of future social situations from baseline to posttask. This decrease in social anxiety symptomatology and anticipatory anxiety and avoidance scores will be maintained at the 48-hour follow-up. Participants in the control condition will not report any significant changes in social anxiety symptomatology and anticipatory anxiety and avoidance of future social situations from baseline to posttask or at the 48-hour follow-up.

H3b: Scores on social anxiety symptomatology and anticipatory anxiety and avoidance will be significantly lower in the interpretation training and cognitive restructuring conditions at posttask and 48-hour follow-up compared to the control condition. The interpretation training and cognitive restructuring conditions will not differ significantly

on social anxiety symptomatology or anticipatory anxiety and avoidance scores at posttask and 48-hour follow-up.

H4a: Only participants in the interpretation training and cognitive restructuring conditions will report statistically significant decreases on cognitive processes associated with social anxiety, including the BFNE (Leary, 1983), *Social Thoughts and Behaviors Scale* (STABS; Turner et al., 2003) and *Social Probability and Cost Questionnaire* (SPCQ; McManus et al., 2000) subscales from baseline to posttask. This decrease in scores will be maintained at the 48-hour follow-up. Participants in the control condition will not report any significant changes on these scales from baseline to posttask or at the 48-hour follow-up.

H4b: Participants in the interpretation training and cognitive restructuring conditions will have significantly lower scores on the BFNE (Leary, 1983), STABS (Turner et al., 2003), and SPCQ Probability and Cost (McManus et al., 2000) subscales compared to participants in the control condition at posttask and at the 48-hour follow-up. The interpretation training and cognitive restructuring conditions will not differ significantly on BFNE, SPIN, STABS, and SPCQ Probability and Cost subscale scores at posttask or at 48-hour follow-up.

H5a: Participants in the interpretation training and cognitive restructuring conditions will report significantly lower levels of subjective distress during the speech task compared to participants in the control condition. The interpretation training and cognitive restructuring conditions will not differ significantly on subjective units of distress during the speech task.

H5b: Participants in the interpretation training and cognitive restructuring conditions will rate their performance on the speech as being higher compared to participants in the control condition. The interpretation training and cognitive restructuring conditions will not differ significantly on their self-ratings of observable anxiety and performance during the speech task.

H6a: An objective rater blind to the hypotheses of the present study and to group status will rate the speech performance of participants in the interpretation training and cognitive restructuring conditions as being higher in quality compared to the speech performance of individuals in the control condition. There will be no differences between the interpretation training and cognitive restructuring conditions on objective ratings of speech performance.

H7a: Given the mixed findings with regard to physiological reactivity during self-presentation tasks in individuals with social anxiety, no specific hypotheses as to how the interpretation training and cognitive restructuring will influence physiological reactivity, as measured through heart rate and skin conductance, during the speech task were outlined.

Given that, to date, no studies have compared single-session interpretation training with single-session cognitive restructuring, no specific hypotheses were outlined for the comparison between the interpretation training and cognitive restructuring conditions. The analyses comparing the interpretation training and cognitive restructuring conditions were considered exploratory.

Method

Participants

Participants were recruited from the community through flyers and online postings describing a research study for adults with social anxiety. All interested individuals who contacted the researcher were provided with a link to an online screener questionnaire that included the *Social Phobia Inventory* (SPIN; Connor et al., 2000), the *Personal Report and Confidence as Speaker* (PRCS; Paul, 1966), a self-report assessment of English language ability (i.e., reading, writing, and speaking), and a question about previous experiences with CBT. Participants between the ages of 17 and 65 years old who scored 19 or higher on the SPIN (Connor et al., 2000) and 16 or higher on the PRCS (Paul, 1966); indicated their English language ability as good or higher for reading, writing, and speaking; and did not endorse ever receiving CBT were invited to participate in the study. Previous research has shown that 79% of participants who score 19 or higher on the SPIN (Connor et al., 2000) meet the diagnostic criteria for social anxiety (Connor, Kobak, Churchill, Katzelnick, & Davidson, 2001) and that scores ranging from 16 to 20 on the PRCS (Paul, 1966) are a valid indicator of speech anxiety (Jones, Phillips, & Rieger, 1995; Phillips, Jones, Rieger, & Snell, 1997).

The recruitment for this study was combined with recruitment for another study being conducted in the lab at the same time. Both studies included the same inclusion criteria and participants who completed one of the studies were not eligible to participate in the other study due to overlapping methodologies (i.e., cognitive restructuring). Therefore, in order to ensure that participants did not participate in both studies recruitment for the two studies was combined and eligible participants were randomized to one of the two studies. In total, 662 individuals contacted the researcher and expressed an interest in participating in the research studies. Of

these individuals, 602 (90.9%) completed the screener questionnaire with 379 (63%) being eligible to participate in one of the two studies. Of the 223 (37%) individuals who were not eligible to participate in the study, 18 (8.1%) had scores below 19 on the SPIN (Connor et al., 2000), 73 (32.7%) had scores below 16 on the PRCS (Paul, 1966), 102 (45.7%) reported a history of CBT, and 30 (13.5%) rated their English language skills as fair or less. Of the 379 participants who were eligible to participate in one of the two studies, 213 were invited to participate in the current study and were given more information about the study. In total, 112 individuals signed up for the current study. Of these individuals, 23 (20.5%) cancelled or failed to show up for their scheduled laboratory visit and 17 (15.2%) generated unusable data. The following reasons accounted for the 17 participants whose data were not usable: language difficulties that made it difficult to complete the laboratory procedures (10 individuals), refusal to complete the speech task or to have the speech videotaped (3 individuals), difficulties understanding and completing the computer tasks (2 individuals), difficulties understanding cognitive restructuring (1 individual), and occurrence of a fire alarm that disrupted the speech task (1 individual). In total, 72 individuals completed the laboratory visit and generated usable data.

Participants were randomized to one of three conditions: interpretation training (n = 24), cognitive restructuring (n = 24) and control (n = 24). Demographic information for the participants is presented in Table 1. There were no significant differences between the three conditions on any of the demographic variables. At baseline, there were no significant differences between conditions on scores on the SPIN (Connor et al., 2000) or the PRCS (Paul, 1966). During the laboratory visit, the Social Phobia section of the *Structured Clinical Interview for DSM-IV* (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996) was also administered (please

see the interview measures section for more information). The difference between conditions on the percentage of participants who met criteria for social anxiety on the SCID-IV approached statistical significance, $X^2(2) = 5.88$, $p = .053$. Fewer participants in the cognitive restructuring condition reported symptoms meeting the criteria for social anxiety disorder on the social phobia section of the SCID-IV compared to participants in the interpretation training and control conditions. However, given the relative small number of participants in the present study who did not meet criteria for social anxiety on the social anxiety section of the SCID-IV (i.e., 11 out of 72), it did not make sense to include SCID-IV diagnosis as a separate predictor variable in the analyses as the small sample size in the no-diagnosis group as well as the unequal sample sizes would have prevented any meaningful conclusions being drawn from any significant findings.

Table 1

Demographic Information and Inclusion Criteria Separated by Condition

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
Sex	19 (79%) female, 5 (21%) male	18 (75%) female, 6 (25%) male	17 (71%) female, 7 (29%) male
Age	24.00 (4.00)	24.00 (6.00)	28 (10.00)
Ethnicity[1]			
White/European	16 (67%)	14 (58%)	18 (75%)
Asian	6 (25%)	7 (29%)	2 (8%)
Aboriginal	0	0	1 (4%)
Black	1 (4%)	0	1 (4%)
Hispanic	0	1 (4%)	0
Biracial	1 (4%)	1 (4%)	1 (4%)
Education Level			
High School	11 (46%)	16 (67%)	12 (50%)
College/University	9 (38%)	7 (29%)	9 (38%)
Graduate Level	4 (17%)	1 (4%)	3 (13%)
Enrolled in Educational Program[2]			
Yes	14 (58%)	18 (75%)	12 (50%)
No	9 (38%)	6 (25%)	12 (50%)

Table continued on next page

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
Employment[2]			
Not working	8 (33%)	15 (63%)	11 (46%)
Part-Time Job	11 (46%)	9 (38%)	8 (33%)
Full-Time Job	4 (17%)	0	5 (21%)
Relationship Status[1]			
Single	15 (63%)	8 (33%)	8 (33%)
Long-term	7 (29%)	10 (42%)	8 (33%)
Married	0	4 (17%)	3 (13%)
Cohabiting	2 (8%)	1 (4%)	3 (13%)
Divorced	2 (8%)	1 (4%)	3 (13%)
Social Phobia on SCID-IV			
Yes	23 (96%)	17 (71%)	20 (83%)
No	1 (4%)	7 (29%)	3 (13%)
Baseline SPIN Score	41.92 (8.46)	38.50 (8.27)	43.63 (11.88)
Baseline PRCS Score	24.42 (3.01)	24.54 (3.96)	23.38 (5.42)

SCID-IV = *Structured Clinical Interview for DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996), SPIN = *Social Phobia Inventory* (Connor et al., 2000), PRCS = *Personal Report and Confidence as Speaker* (Paul, 1966)

[1]One participant in the cognitive restructuring condition and 1 participant in the control condition chose not to answer this question.

[2]One participant in the interpretation training condition chose not to answer this question.

Self-Report and Interview Measures

***Ambiguous Social Situations Interpretation Questionnaire* (ASSIQ; Stopa & Clark, 2000).** The ASSIQ is a 24-item self-report questionnaire that assesses interpretation biases. Participants are presented with short descriptions of ambiguous social (n = 14) and nonsocial (n = 10) scenarios followed by three possible interpretations (1 positive, 1 negative, and 1 neutral). Participants are asked to rank order the interpretations in terms of how quickly they would come to mind. Scoring for the questionnaire is based on the rank ordering of the negative interpretation for each scenario. If the negative interpretation is ranked first then the scenario is given a score of 3, if it is ranked second then it is given a scores of 2 and if it is ranked third then it is given a score of 1. Separate subscales are calculated for the Social and Nonsocial items and higher scores on the subscales indicate a negative interpretation bias. In the present study, the internal consistency for the ASSIQ Social and Nonsocial subscales ranged from .86 (prelaboratory) to .92 (48-hour follow-up) and .68 (prelaboratory) to .80 (48-hour follow-up), respectively.

***Brief Fear of Negative Evaluation Questionnaire* (BFNE; Leary, 1983).** The BFNE is a 12-item questionnaire that assesses fears of negative evaluation. Individuals are asked to rate each statement on a 5-point Likert scale that ranges from 1 (not at all characteristic of me) to 5 (very characteristic of me). Past studies have shown that the BFNE has excellent internal consistency and test-retest reliability in undergraduate and clinical samples as well as good discriminant and convergent validity (Duke, Krishnan, Faith, & Storch, 2006; Rodebaugh et al., 2004; Weeks et al., 2005). In the present study, the internal consistency of the BFNE ranged from questionable to acceptable with Cronbach alpha values ranging from .65 (prelaboratory) to .75 (48-hour follow-up).

***Demographic Questionnaire* (See Appendix A).** A standard demographic questionnaire was administered that asked participants about their age, relationship status, ethnicity, education background, current employment, and income.

***Perception of Speech Performance* (PSP; Rapee & Lim, 1992).** The PSP is a 17-item questionnaire that asks individuals to rate their speech performance on 12 specific and five global aspects on a scale from 0 ("not at all") to 4 ("very much"). Participants were asked to complete the PSP following their speech. In addition, one undergraduate volunteer who was blind to group assignment and to the hypotheses of the study coded the videotaped speeches on the same specific and global dimensions. Past research has shown that the PSP has good internal consistency (Rodebaugh et al., 2004). In the present study the internal consistency of the PSP was .88.

***Personal Report and Confidence as Speaker* (PRCS; Paul, 1966).** The PRCS (Paul, 1966) is a 30-item scale that assesses the cognitive and affective components of fear of public speaking using a true/false format. The PRCS was originally developed by Gilkinson (1942) and consisted of 104 questions. Paul (1966) then modified it to a 30-item scale. The 30-item version of the PRCS has shown good convergent validity (Daly, 1978) and internal consistency (Daly, 1978; Fredrikson, 1983; Klorman, Weerts, Hastings, Melamed, & Lang, 1974) and is sensitive to changes in public speaking symptomatology following treatment (Leary, 1991). In the present study the internal consistency of the PRCS was .87.

***Positive and Negative Affect Scale* (PANAS; Watson, Clark, & Tellegen, 1988).** The PANAS is a measure of state positive and negative affect. Participants are asked to rate 20 adjectives on a 5-point scale ranging from 1 ("very slightly or not at all") to 5 ("extremely"). Ten adjectives are used to describe positive affect (e.g., excited, enthusiastic, proud) and 10

adjectives are used to describe negative affect (e.g., distressed, guilty, scared). Both the positive and negative affect scales have shown high internal consistency (Watson et al., 1988). In the present study the internal consistency for the positive and negative affect scales ranged from .87 (baseline) to .90 (posttask) and .84 (baseline) to .91 (postspeech), respectively.

Social Phobia Inventory **(SPIN; Connor et al., 2000).** The SPIN (Connor et al., 2000) is a 17-item self-report measure that assesses social anxiety during the previous week across a number of different situations, including social interactions, displaying physical symptoms of social anxiety, and fear of criticism. Participants are asked to rate the extent to which each item applies to them on a 5-point Likert scale that ranges from 0 (not at all) to 4 (extremely). The SPIN had been shown to possess good validity and reliability (Antony, Coons, McCabe, Ashbaugh, & Swinson, 2006; Connor et al., 2000). The internal consistency for the SPIN in the present study ranged from .85 (baseline) to .91 (48-hour follow-up).

Social Probability and Cost Questionnaire **(SPCQ; McManus et al., 2000)**. The SPCQ (McManus et al., 2000) is a 33-item questionnaire based on the work of Foa and colleagues (1996). The SPCQ consists of 33 potentially negative social situations and asks individuals to first rate the probability of the event occurring to them using a scale ranging from 0 ("not at all likely to happen) to 100 ("almost sure to happen") followed by the estimated cost of the event occurring (i.e., how distressing it would be if the event occurred) using a scale from 0 ("not at all distressing/bad") to 100 ("really bad/distressing"). Factor analyses have confirmed the 2 factors for the SPCQ: 1) probability of negative event occurring; and 2) costs of negative event occurring (McManus et al., 2000). The SPCQ has shown good internal consistency and test-retest reliability in clinical samples and has also been shown to be sensitive to change in social anxiety symptoms (McManus et al., 2000; Moscovitch et al., 2012). In the present study, the

internal consistencies for the SPCQ Probability and Cost subscales ranged from .95 (pre-laboratory) to .98 (48-hour follow-up) and .97 (pre-laboratory, pos-task) to .98 (48-hour follow-up), respectively.

Social Thoughts and Beliefs Scale **(STABS; Turner et al., 2003).** The STABS is a 21-item questionnaire that assesses individual's cognitions regarding social situations. Participants are asked to indicate the degree to which each statement is characteristic of their thoughts or beliefs when anticipating or participating in a social situation using a 5-point Likert scale ranging from 1 (never characteristic) to 5 (always characteristic). The STABS has shown good internal and external validity (Fergus, Valentiner, Kim, & Stephenson, 2009; Turner, Johnson, Beidel, Heiser, & Lydiard, 2003). In the present study, the internal consistency of the STABS ranged from .90 (pre-laboratory) to .95 (48-hour follow-up).

State-Trait Anxiety Inventory for Cognitive and Somatic Anxiety **(STICSA; Ree, MacLeod, French, & Locke, 2008).** The STICSA is a recently developed measure of state and trait anxiety meant to address some of the limitations of the *State-Trait Anxiety Inventory* (Spielberger, 1983), including separating anxiety into its cognitive and somatic components as well as better discriminating between depression and anxiety symptoms (Gros, Antony, Simms, & McCabe, 2007). Participants are asked to rate 21-items on a 4-point scale ranging from 1 ("not at all") to 4 ("very much so"). The questionnaire consists of two subscales: cognitive symptoms of anxiety (10 items) and somatic symptoms of anxiety (11 items). Both the trait and state versions of the STICSA have shown good construct, convergent, discriminant, and predictive validity in clinical (Gross et al., 2007) and nonclinical samples (Ree et al., 2008; Gros, Simms, Antony, 2010). In the present study, only the state version of the STICSA was used to assess levels of anxiety following the group-specific task and the speech task. In the present

study, the internal consistencies for the STICSA Cognitive and Somatic subscales ranged from .91 (baseline) to .94 (postspeech) and .87 (posttask) to .90 (postspeech), respectively.

***Structured Clinical Interview for DSM-IV* (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996; See Appendix B).** The SCID-IV is a semistructured interview that assesses whether DSM-IV-TR (American Psychiatric Association, 2000) diagnostic criteria are met for a number of psychological disorders, including social anxiety disorder. In the present study, only the social anxiety disorder section of the SCID-IV was administered to determine whether DSM-IV criteria for social phobia were met (See Appendix B). The reliability of the SCID-IV for the diagnosis of social phobia has been established as acceptable (Del-Ben et al., 2005; Lyneham & Rapee, 2005). As part of the social anxiety disorder section of the SCID-IV interview, participants were presented with a list of social situations and were asked to rate their anxiety and avoidance of each of the situations on a scale where 0 = "not at all" and 4 = "extremely." Participants were then presented the same social situations in written format at posttask and at the 48-hour and 1-week follow-ups and were asked to used the same scale to rate their level of anxiety and avoidance if they were to face the situation in the upcoming week. The internal consistency for the anticipatory anxiety and avoidance subscales for the situations ranged from .78 (baseline) to .87 (48-hour follow-up) and .80 (baseline) to .88 (48-hour follow-up), respectively. Since the completion of the study, the DSM-5 (American Psychiatric Association, 2013) has been published and the following four changes have been applied to the social anxiety disorder criteria: 1) the name of the disorder has been formally changed from social phobia to social anxiety disorder; 2) individuals no longer have to recognize their anxiety in social situations as excessive or unreasonable; 3) the anxiety must be disproportionate to the actual threat posed by the situation; and 4) the social anxiety symptoms must be present for a minimum

of 6 months. Given that all participants did endorse viewing their anxiety and fear as excessive or unreasonable and reported the social anxiety symptoms as being present for a number of years, the changes regarding viewing one's symptoms as excessive and the length of time symptoms are present would not have influenced diagnoses in the present study. Furthermore, when the interviewer asked participants to rate their anxiety and avoidance for various social situations, follow-up questions were asked regarding the nature of the fear. Based on the answers provided by participants, it appears that for all individuals the fear was disproportionate to the actual threat posed by the situation. Therefore, it is likely that most, if not all, participants in the present study who met DSM-IV-TR criteria for social phobia would also meet DSM-5 criteria for social anxiety disorder.

***Subjective Units of Distress Scale* (SUDS; Wolpe, 1982).** The SUDS is a 100-point scale that asks individuals to rate their current level of anxiety from 0 (not at all anxious) to 100 (extremely anxious). Participants were prompted to provide SUDS ratings prior to, during, and following the speech task.

***Thoughts Questionnaire* (TQ; Edwards et al., 2003).** A modified version of the TQ was used to measure rumination following the speech task. The TQ is a 29-item questionnaire that measures level of rumination. It includes 11 positive rumination items, 16 negative rumination items, and 2 general items. Participants were asked to rate each question on a scale ranging from 0 ("never") to 4 ("very often). The positive, negative, and total rumination subscales have shown acceptable to excellent internal consistencies (i.e., Cronbach alphas: .79, .94, 90, respectively; Edwards et al., 2003). However, the internal consistencies for the positive and negative rumination subscales in the present study were low (.66 and .44, respectively).

For all questionnaires that were repeatedly administered during the study, the original instructions for the questionnaires were presented to participants when they completed the questionnaire for the first time. For all follow-up assessments, participants were asked to answer the questions based on their experiences during the past 2 days or the previous week (depending on whether it was the 48-hour or 1-week follow-up) in order to provide information about changes during the course of participating in the study.

Laboratory Tasks

Interpretation bias assessment and training. The stimuli developed by Mathews and Mackintosh (2000) were used for interpretation training and assessment. This method was chosen over the interpretation training modification program (ITMP) developed by Beard and Amir (2008) for a number of reasons. First, to date, the only study that has used the ITMP as a single-session intervention did not assess the effects of interpretation training on anxiety levels (Amir, Bomyea, & Beard, 2010), whereas the task by Mathews and Mackintosh (2000) has been found to be effective as a single-session procedure in training positive interpretation biases in individuals with social anxiety (Murphy et al., 2007). Furthermore, there is unpublished evidence that the ITMP initially results in an increase in participants' anxiety as they figure out the task (personal communication, C. Beard). In a qualitative study, participants reported feeling negatively judged when they provided the wrong answers during the training task (Beard, Weisberg, & Primack, 2012). Consequently, individuals' anxiety appears to increase during the first session but then decreases as participants continue working on the task during later sessions. Given that the present study utilized a single-session interpretation training task, this temporary increase in anxiety had the potential of negatively influencing the results.

During the training phase, short paragraphs consisting of 3 lines depicting various ambiguous social scenarios were presented on a computer screen. Participants were asked to imagine themselves as the main character in the social scenarios while reading them. The paragraphs were presented one line at a time and participants pressed the spacebar to see the next line. The social scenarios remained ambiguous until the end when a word fragment was presented. Participants were required to solve the word fragment by typing in the missing letters. Depending on the condition, solving the word fragment disambiguated the social scenario in a positive or negative direction. After the social scenario was disambiguated, participants were presented with a yes/no comprehension question that emphasized the direction in which the social scenario was disambiguated. After participants answered the comprehension question, they were given feedback (i.e., "correct answer" or "incorrect answer").

Below is an example of an ambiguous social scenario and associated comprehension question (the correct answer to the word fragment is present in parentheses for the reader):

> You asked a lot of questions during lecture because you didn't understand the subject and tried to grasp it. The other students seemed to find it difficult too. They listened with … to all your questions. App---tion (appreciation)/ir--tation (irritation)
>
> Did the other students find you annoying?

During the training, participants were presented 8 blocks with optional rests between each block. Each block consisted of eight ambiguous social scenarios that ended with a word fragment and three filler stories (i.e., scenarios that have set positive or negative outcomes). In the positive training condition, all ambiguous social scenarios were disambiguated in a positive direction while in the control condition half of the ambiguous social scenarios were disambiguated in a positive direction while the other half were disambiguated in a negative

direction. Interpretation biases were assessed by the speed with which participants solved the word fragments. That is, if participants were faster at solving the positive word fragments and slower at solving the negative word fragments, this was viewed as evidence of a positive interpretation bias.

Following the interpretation training phase, participants completed a 2-minute filler task during which they were presented with a list of words and were asked to circle the nouns in the list. This filler task was meant to eliminate any group differences in state emotions as a result of the training procedure. Participants were also presented with a recognition test to assess trained interpretation biases. The recognition test consisted of 10 ambiguous social scenarios that remained ambiguous even after the word fragment was solved. Each scenario had a title and participants were asked a neutral comprehension question following each scenario that did not require them to make interpretations about the valence of the social scenario to ensure that they read the social scenario. After being presented with the 10 ambiguous social scenarios, participants were presented with the title of each scenario followed by 4 sentences, presented one at a time. The four sentences included: 1) a positive interpretation; 2) a negative interpretation; 3) a positive foil; and 4) a negative foil. For each sentence, participants rated its similarity to the meaning of the ambiguous social scenario on a 4-point scale ranging from 1 (very different in meaning) to 4 (very similar in meaning).

Below is an example of a recognition test stimulus followed by the corresponding comprehension question as well as the 4 corresponding sentences:

The job interview

You see a job advertised that you'd really like. You apply and are invited to an interview, where you answer the questions as well as you can. Reflecting later, you think that the quality of your answers decided the ou--om- (outcome).

Comprehension question:

Did you think about your answers later?

Four corresponding sentences:

a) You think it must have been your clear answers that got you the job.

b) Reflecting later, you realize that your poor answers lost you the job.

c) Reflecting later, you think it was a good thing you did not take the job.

d) You think that your appearance must have made a bad impression.

Cognitive restructuring task. The cognitive-restructuring task involved a 45-minute task that was completed with the experimenter (See Appendix C). The task consisted of the following elements: 1) psychoeducation about the relation between thoughts, behaviours, and physical sensations; 2) discussion of cognitive distortions, including catastrophization, and probability overestimation; 3) description of a thought record; and 4) completion of a thought record.

Speech task. The behavioural assessment of anxiety involved the delivery of a speech in front of an unfamiliar research assistant. The speech was videotaped and coded by a trained volunteer who was blind to group assignment and to the hypotheses of the present study. Participants were told that they were to complete a 3-minute speech in front of a research assistant that would come in to the room and that the speech was going to be videotaped and evaluated for its quality at a later date. They were provided with a list of controversial topics to choose from based on the work of Hofmann and colleagues (1995), including, abortion, corporal

punishment, and the legalization of marijuana (See Appendix D). Participants were given 3 minutes to prepare for the speech and, if they wished, were allowed to make notes during their preparation. However, they were informed that they would not be able to use their notes during the speech. After the 3-minute preparation period, all notes were removed and the unfamiliar research assistant entered the room. Participants were told that the research assistant would inform them when 3 minutes had passed but that they could put up their hand if they wished to terminate the task early. Ten (42%) individuals in the interpretation training condition, 8 (33%) individuals in the cognitive restructuring condition, and 10 (42%) individuals in the control condition terminated the speech early (i.e., before 3 minutes). The experimenter then set up the camera and left the room. Participants remained seated while giving their speech in front of the unfamiliar research assistant in order to minimize movement for the psychophysiological data collection. The unfamiliar research assistant was instructed to maintain a neutral facial expression during the speech task. Following the completion of the speech, the unfamiliar research assistant left the room and the experimenter returned.

Physiological Measures of Anxiety

Heart rate and skin conductance. Heart rate and skin conductance level data were collected using a Biopac MP100 system and analyzed using AcqKnowledge 3.9.1 software connected to a Windows PC. Heart rate data were collected by placing two pregelled 35 mm disposable electrodes near the collar bones. Skin conductance level data were collected by placing two pregelled Biopac disposable electrodes on the palmar region of the first and second fingers of the nondominant hand. Both heart rate and skin conductance level were recorded continuously at a rate of 200 Hz. Heart rate recordings were converted to beats per minute (bpm) by the AcqKnowledge software through the detection of cardiac R-waves. Heart rate values

below 40 bpm and above 180 bpm occurred infrequently as a result of participants moving excessively and were extremely brief (e.g., a fraction of a second). After visually screening data for these instances and removing them, mean heart rate and skin conductance level values for the 3-minute baseline, preparation, speech, and recovery periods were calculated using AcqKnowledge software.

Procedure

Potential participants between the ages of 17 and 65 years completed a set of online screening questionnaires during which the SPIN (Connor et al., 2000) and the PRCS (Paul, 1966) were administered. Based on previous studies on clinical cutoff scores, participants who scored 19 or higher on the SPIN (Connor et al., 2000) and 16 or higher on the PRCS (Paul, 1966), did not report any previous CBT, and rated their English language skills (i.e., reading, writing, and speaking) as good or higher were invited to participate in the current study. These selection criteria ensured that participants experienced both high levels of social anxiety as well as fear of public speaking. Two days prior to their laboratory visit, participants were sent an e-mail that provided a link to the online questionnaires (demographic questionnaire, SPIN, STABS, BFNE, PRCS, ASSIQ and SPCQ), to be completed using Qualtrics, a secure online survey program. Prior to completing the questionnaires, participants were presented with an online informed consent agreement that highlighted the components of the study, compensation, and the investigator's contact information. By clicking on the accept button, they provided their consent to complete the prelaboratory online questionnaires (see Appendix E).

A second consent procedure for the remaining components of the study was completed at the beginning of the laboratory visit (see Appendix F). The Social Anxiety Disorder section of the SCID-IV (First et al., 1996) was administered by the researcher. Participants then completed

the PANAS and STICSA-State on the computer to assess for state positive and negative affect as well as anxiety. Depending on group assignment, participants then completed one of the following three tasks: 1) the cognitive restructuring task with the experimenter, 2) the computer-based interpretation training task, or 3) the computer-based control task. All participants then completed the interpretation bias assessment portion of the Mathews and Mackintosh (2000) task to assess for interpretation biases. Following the interpretation bias assessment, participants completed the ASSIQ to assess for changes in interpretation biases as well as the PANAS and STICSA-State to assess for changes in state positive and negative affect as well as state anxiety. Participants were also presented with a number of different social situations and were asked to indicate the degree to which they would feel anxious if faced with the social situation in the coming week as well as how likely they would be to avoid the social situation in the coming week.

Participants were then provided an alcohol swab and were asked to clean the area under their left and right collarbone as well as the middle and index fingers of their nondominant hand prior to being hooked up to the electrophysiological equipment to ensure consistent recording. When the electrophysiological equipment was set up, participants were asked to complete the deep breath test and the wave forms for skin conductance and heart rate were examined to ensure that the equipment was working correctly. Participants were then asked to sit back and relax, and baseline recordings of heart rate and skin conductance were collected for 3 minutes. Participants were asked to indicate their SUDS level at the beginning and end of the 3-minute baseline period. Participants were then informed that they would be asked to complete a 3-minute speech in front of an unfamiliar research assistant that would be videotaped and later coded for its quality. They were presented with a list of controversial topics to choose from and

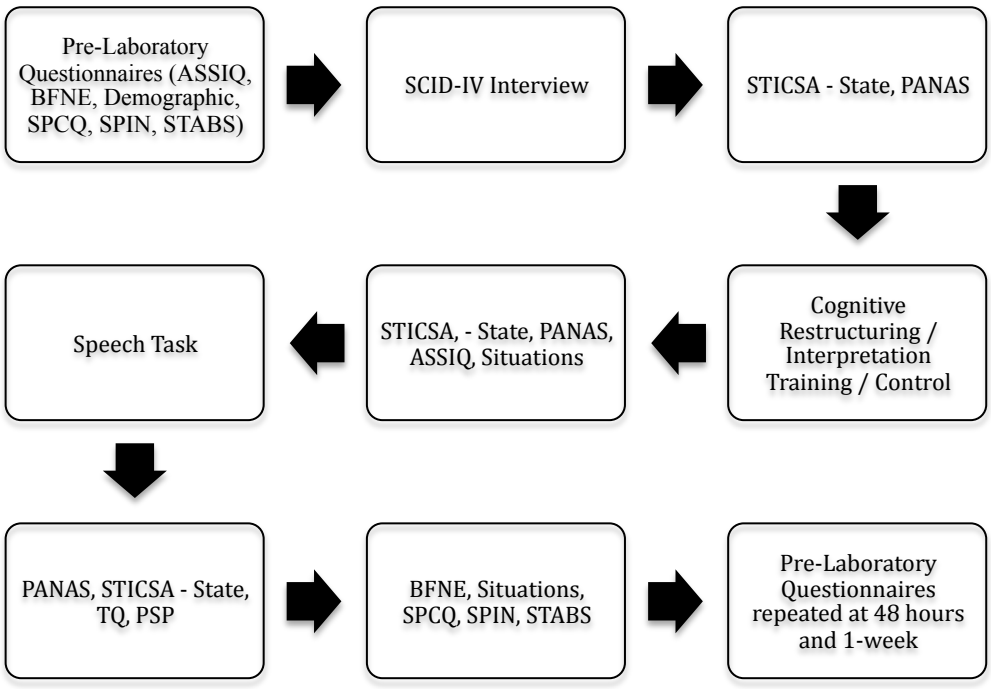
were given 3 minutes to prepare for the speech. Participants were asked to rate their SUDS level, using a scale ranging from 0 to 100 (Wolpe, 1982) at the beginning of the preparation period as well as at the end of the preparation period. Following the 3-minutes, all notes were removed and the unfamiliar research assistant entered the room. The experimenter set up the camera and left the room and the participants completed their speech in front of the camera and the unfamiliar research assistant while sitting in their chair. Following the speech, the unfamiliar research assistant left the room and the experimenter returned. Participants were asked to rate their highest SUDS level (Wolpe, 1992) during the speech as well as their current SUDS level. Participants were then asked to complete the PSP (Rapee & Lim, 1992), TQ (Edwards et al., 2003), PANAS (Watson et al., 1988), and STICSA-State (Ree et al., 2008) to provide measures of speech perception, postspeech rumination, state affect, and state anxiety, respectively. Participants were again asked to sit back and relax for 3 minutes during which heart rate and skin conductance data were collected and they were asked to rate their SUDS level (Wolpe, 1992) at the beginning and end of the 3-minute period. Heart rate and skin conductance data were recorded continuously during this period at a rate of 200 Hz. After the 3-minute postspeech recovery period, the recording of heart rate and skin conductance was terminated and participants removed the electrodes from their fingers and collarbones.

Lastly, participants were asked to complete the SPIN (Connor et al., 2000), STABS (Turner et al., 2003), PRCS (Paul, 1966), BFNE (Leary, 1983), and SPCQ (McManus et al., 2000) on Qualtrics. Participants were briefly debriefed at the end of the laboratory visit (i.e., the experimenter checked that they were okay with everything that occurred during the visit) and were given the opportunity to ask questions. Participants were also provided with information for community resources specializing in anxiety-related problems.

Fourty-eight hours after the laboratory visit, participants were sent an e-mail with an online secure link that asked them to complete the same set of questionnaires completed prior to the laboratory visit. This was repeated again 1 week after the laboratory visit. After completing the final questionnaires, participants were presented with an electronic debriefing form that outlined the purpose of the study (see Appendix G). Participants were also given the contact information for the principal investigator in case they had any questions regarding the information on the debriefing form. If participants did not complete the online follow-up questionnaires, the debriefing form was sent to them electronically. Please see Figure 1 for a summary of the procedure.

Figure 1

Summary of the study procedure



ASSIQ = *Ambiguous Social Situations Interpretation Questionnaire* (Stopa & Clark, 2000), BFNE = *Brief Fear of Negative Evaluation* (Leary, 1983), SPCQ = *Social Probability and Cost Questionnaire* (McManus et al., 2000), SPIN = *Social Phobia Inventory* (Connor et al., 2000), STABS = *Social Thoughts and Beliefs Scale* (Turner et al., 2003), SCID-IV = *Structured Clinical Interview for DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996), STICSA = *State-Trait Anxiety Inventory for Cognitive and Somatic Anxiety* (Ree, MacLeod, French, & Locke, 2008), PANAS = *Positive and Negative Affect Scale* (Watson, Clark, & Tellegen, 1988), TQ = *Thoughts Questionnaire* (Edwards et al., 2003), PSP = *Perception of Speech Performance* (Rapee & Lim, 1992)

Behavioural Coding

The videotaped speeches were coded by a volunteer who was blind to the research questions and hypotheses of the current study using the criteria from the *Perception of Speech Performance* (Rapee & Lim, 1992) questionnaire. Four criteria were not included in the behavioural coding as they were difficult to detect from the videotaped speeches. These four criteria included: seemed to tremble or shake, sweated, blushed, and face twitched. The rater coded each criterion on a 5-point scale ranging from 0 ("not at all") to 4 ("very much") and the criteria were summed together to create one total score, with reverse coding of positive items (e.g., content was understandable). Higher scores indicated lower quality speeches. Training was conducted by the doctoral student and consisted of an overview of the PSP criteria and the completion of six videos that were coded together. Interrater reliability was established through 12 (17%) videotapes that were coded by both the volunteer and the doctoral student independently. The videotapes included four participants from each condition (i.e., interpretation training, cognitive restructuring, and control) and were coded in random order. Intraclass correlation coefficients for each criterion that was coded ranged from acceptable (.6 for the voice quivered criterion) to excellent (.98 for the fidgeted criterion), with all criteria except for voice quivered having intraclass correlation coefficients of .71 or higher.

Results

Data Screening

The data were initially screened for outliers and missing data points. Outliers were defined as *z*-score values that were greater than the absolute value of 3.29 (Tabachnick & Fidell, 2007). An examination of the data revealed that outliers were rare. One participant had a score on the STICSA Somatic subscale completed at posttask that was deemed an outlier. Two participants had scores on the TQ Positive subscale that were deemed outliers and one participant had a score on the SPCQ Distress subscale completed at 48-hours that was deemed an outlier. Values that were identified as outliers were replaced by the second most extreme value in the distribution of the measure. With the exception of the ASSIQ measures (Stopa & Clark, 2000), missing data were relatively rare in the present study, although all completed questionnaires had some missing data. Missing values were replaced with the mean score for the measure. Although replacement by the mean is considered an older and more conservative approach for dealing with missing data, Tabachnick and Fidell (2007) have suggested that it is appropriate for datasets with a small number of missing data.

For the ASSIQ measure, 6 participants were missing 20% or more data points for the ASSIQ Social subscale at baseline, 1 participant was missing 20% or more data points for the ASSIQ Social subscale at posttask, 1 was missing 20% or more data points for the ASSIQ Nonsocial subscale at posttask, 1 participant was missing 20% or more data points for the ASSIQ Social subscale at 48-hour follow-up, and 2 participants were missing 20% or more data points for the ASSIQ Nonsocial subscale at the 48-hour follow-up. In the majority of cases, the higher rate of missing data for the ASSIQ, especially at baseline, was due to participants incorrectly

completing the questionnaire. Therefore, for these cases, the participants' data for the relevant ASSIQ subscales only was deleted.

All data were also examined for deviations from normal distribution. Skewness and kurtosis were identified through a combination of examining histograms as well as skewness and kurtosis values. Consistent with West, Finch, and Curran (1995), skewness and kurtosis scores with absolute values less than 2 and 7, respectively, were viewed as approximating normal distributions. According to these criteria, all the data were found to approximate normal distributions.

Posttask Data Analyses

Between-Group Differences on Outcome Measures at Baseline. One-way analyses of variance (ANOVAs) were conducted to assess between-group differences on outcome variables. Statistical significance was set at $p < .05$ and Bonferroni corrections were applied to all follow-up tests of main effects. The interpretation training, cognitive restructuring, and control conditions differed significantly on baseline scores of the STICSA Cognitive subscale, $F(2,69) = 3.91$, $p = .03$. Bonferroni posthoc analyses revealed that participants in the interpretation training condition ($M = 26.79$, $SD = 7.82$) had significantly higher baseline STICSA Cognitive scores compared to participants in the cognitive restructuring condition ($M = 20.92$, $SD = 6.40$), $p = .02$, Cohen's $d = .82$. Pearson-product moment correlations between the baseline STICSA Cognitive scores and the outcome measures revealed a number of statistically significant positive correlations. The analyses were conducted while both controlling for and not controlling for baseline STICSA Cognitive scores. Given that the results for both sets of analyses were identical, the analyses presented below do not control for baseline STICSA Cognitive scores. No

other significant between-group differences on baseline scores of the outcome variables were identified.

Interpretation Training. The effects of interpretation training were assessed in two ways. First, the interpretation training and control conditions were compared on latencies to complete the word fragments during training. In order to minimize the effects of outliers, for each participant the median was calculated for latency to solve positive word fragments separately for the first and second half of the training task as well as for latency to solve negative word fragments. Based on previous studies, it was predicted that participants in the interpretation training condition would be faster at solving the positive word fragments and slower at solving the negative word fragments while the reaction times for participants in the control condition would not differ for the positive and negative word fragments (Salemink, van den Hout, & Kindt, 2009, 2010). Mean scores and standard deviations for the reaction times for positive and negative word fragments for the first half and second half of the training task are presented in Table 2. A 2 (Condition: interpretation training, control) by 2 (Word Fragment: positive or negative) by 2 (Time: first half of training task, second half of training task) mixed analysis of variance was conducted. Statistical significance was set at $p < .05$. Given that the present study had specific a priori hypotheses, planned contrasts were conducted regardless of whether the mixed analysis of variance revealed a significant interaction or significant main effects. To be conservative in the evaluation, SPSS was used to generate Bonferroni-corrected *p*-values for all planned contrasts.

Table 2

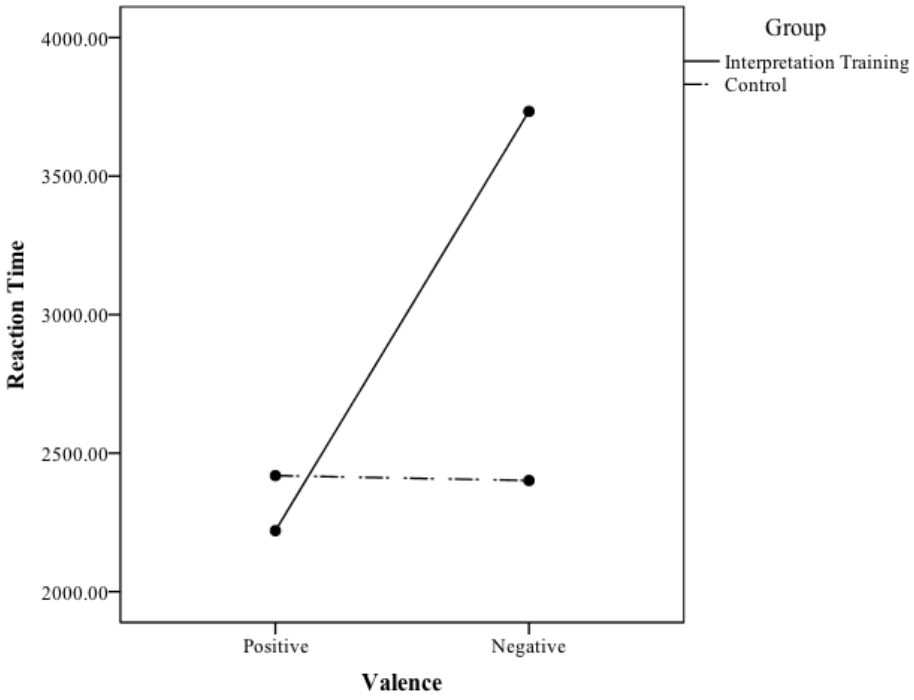
Means and Standard Deviations of Reaction Times for Solving the Word Fragments Separated by Condition

	Interpretation Training (n = 24)	Control (n = 24)
First Half		
Positive Word Fragment	2247.71 (661.54)	2416.92 (762.17)
Negative Word Fragment	3553.63 (2949.81)	2347.75 (553.83)
Second Half		
Positive Word Fragment	2192.63 (720.59)	2420.79 (1000.41)
Negative Word Fragment	3913.50 (3110.13)	2454.75 (969.74)

There was a statistically significant main effect of valence, $F(1,46) = 12.35$, $p < .01$, $\eta_p^2 = .21$, such that regardless of condition participants were faster at solving the positive word fragments compared to the negative word fragments. The main effect of valence was qualified by a statistically significant interaction between condition and valence, $F(1,46) = 12.94$, $p < .01$, $\eta_p^2 = .22$. There was no significant three-way interaction between condition, valence, and time. Planned contrasts revealed that participants in the interpretation training condition were slower to solve negative word fragments ($M = 7467$, $SD = 5001.72$) compared to positive word fragments ($M = 4440.33$, $SD = 1299.14$), $p < .01$, Cohen's $d = 1.54$, while there were no differences in the reaction times for solving positive ($M = 4837.71$, $SD = 1601.19$) and negative ($M = 4802.50$, $SD = 1439.14$) word fragments in the control condition, $p = .87$, Cohen's $d = .03$, see Figure 2. Between-group analyses also revealed that participants in the interpretation training condition were significantly slower at solving the negative word fragments compared to participants in the control condition, $p = .02$, Cohen's $d = .72$. There were no significant group differences in reaction times for solving positive word fragments ($p = .35$, Cohen's $d = .27$).

Figure 2

Mean Reaction Times for Solving Positive and Negative Word Fragments Separated by Condition



The second way in which interpretation biases were assessed was by investigating group differences on interpretations of new ambiguous social situations. It was predicted that participants in the interpretation training and cognitive restructuring conditions would be more likely to endorse positive interpretations for new ambiguous social situations compared to participants in the control condition. Furthermore, given previous evidence for the specificity of interpretation biases, group differences on endorsement of positive and negative foils for the ambiguous social situations were not expected. Mean scores and standard deviations for endorsement of positive interpretations, negative interpretations, positive foils, and negative foils are presented in Table 3. A 3 (Condition: interpretation training, cognitive restructuring, control) by 2 (Valence: positive or negative) by 2 (Target: possible interpretation or foil sentence) mixed model analysis of variance was conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analysis of variance revealed a significant interaction or significant main effects.

Table 3

Means and Standard Deviations of Frequency of Endorsement of Positive and Negative Interpretations and Positive and Negative Foils Separated by Condition

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)[1]	Control (n = 24)
Negative Interpretation	2.55 (.44)	2.84 (.46)	2.65 (.50)
Positive Interpretation	2.95 (.39)	2.57 (.51)	2.55 (.38)
Negative Foil	1.58 (.51)	1.59 (.39)	1.71 (.44)
Positive Foil	1.72 (.37)	1.53 (.38)	1.73 (.52)

[1]Data for one participant in the cognitive restructuring condition was not recorded properly, therefore, n = 23 in the cognitive restructuring condition.

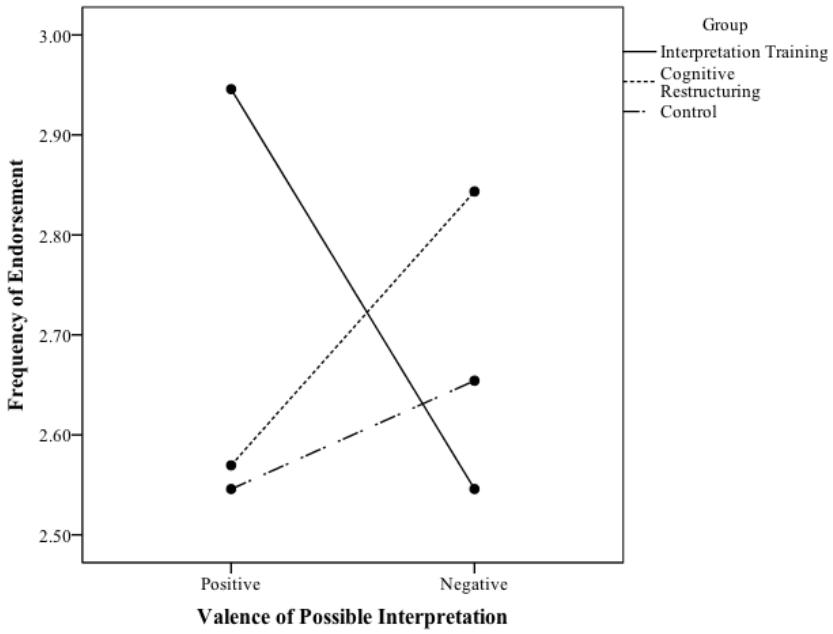
There was a statistically significant main effect of target, $F(1,68) = 340.33$, $p < .01$, $\eta_p^2 = .83$, such that regardless of condition participants were more likely to endorse the possible interpretations than the foils, as well as a statistically significant interaction between valence and condition, $F(2,68) = 4.97$, $p = .01$, $\eta_p^2 = .13$. However, both of these findings were qualified by a statistically significant 3-way interaction between condition, valence, and target, $F(2,68) = 5.08$, $p < .01$, $\eta_p^2 = .13$. Separate mixed analyses of variance for possible interpretations (i.e., possible negative interpretation, possible positive interpretation) and foils (i.e., positive foil, negative foil) were conducted to deconstruct the three-way interaction. Statistical significance was set at $p < .05$ and Bonferroni corrections were applied to all follow-up tests. For the possible interpretations analyses, there was no main effect of valence and no main effect of condition. There was a statistically significant condition by valence interaction, $F(2,68) = 7.49$, $p < .01$, $\eta_p^2 = .18$. Planned contrasts revealed that participants in the interpretation training condition endorsed the positive possible interpretations ($M = 2.95$, $SD = .39$) significantly more frequently compared to the negative possible interpretations ($M = 2.55$, $SD = .44$), $p < .01$, Cohen's $d = 1.13$. In contrast, participants in the cognitive restructuring condition endorsed the negative possible interpretations ($M = 2.84$, $SD = .46$) significantly more frequently compared to the positive possible interpretations ($M = 2.57$, $SD = .51$), $p = .04$, Cohen's $d = .56$. In the control condition, there were no significant differences in the frequency with which participants endorsed negative possible interpretations ($M = 2.55$, $SD = .38$) or positive possible interpretations ($M = 2.65$, $SD = .50$) for the ambiguous social scenarios, $p = .40$, Cohen's $d = .23$, see Figure 3. Between group analyses also revealed that participants in the interpretation training condition were significantly more likely to endorse positive possible interpretations compared to participants in the cognitive restructuring condition and participants in the control

condition, $p = .01$, Cohen's $d = .84$ and $p < .01$, Cohen's $d = 1.04$, respectively. There were no between-group differences for endorsement of negative possible interpretations. For the foil analyses, there were no significant main effects of condition or valence and no significant condition by valence interaction.

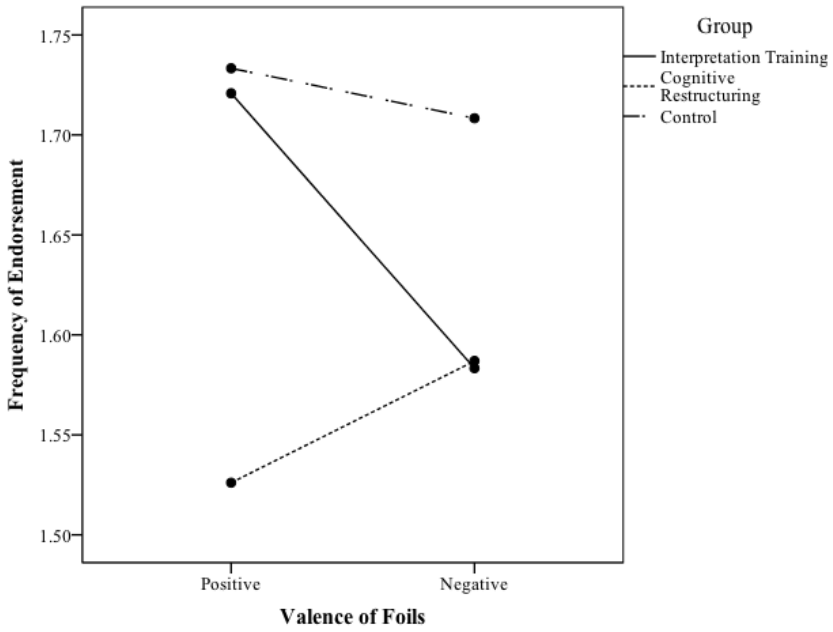
Figure 3

Mean Endorsement of Positive and Negative Possible Interpretations (A) and Positive and Negative Foils (B) Separated by Condition

(A)



(B)



Therefore, the present study's hypotheses regarding the effects of interpretation training and cognitive restructuring on interpretation biases were partially supported. Specifically, consistent with previous research, participants in the interpretation training condition evidenced a positive interpretation bias such that they were more likely to endorse positive interpretations of novel ambiguous social scenarios compared to negative interpretations. This positive interpretation bias was specific to possible interpretations and did not generalize to foils. However, contrary to the present study's hypotheses, participants in the cognitive restructuring condition did not evidence a positive interpretation bias and were actually more likely to negatively interpret the ambiguous social scenarios compared to participants in the interpretation training condition.

Question 1: Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task report significant decreases in state anxiety and state negative affect at posttask and postspeech? It was predicted that state anxiety scores would decrease significantly from baseline to posttask in the interpretation training and cognitive restructuring conditions but not in the control condition. As well, it was hypothesized that state anxiety scores would increase for all three conditions following the speech but that the increase would be significantly higher in the control condition compared to the interpretation training and cognitive restructuring conditions. Lastly, it was predicted that participants in the interpretation training and cognitive restructuring conditions would report significantly lower levels of state anxiety after the group-specific task as well as after the speech compared to participants in the control condition. Mean scores and standard deviations for the PANAS Positive, PANAS Negative, STICSA Cognitive, and STICSA Somatic subscales are presented in Table 4. Four 3 (Condition: interpretation training,

cognitive restructuring, control) by 3 (Time: baseline, posttask, and postspeech) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 4

Means and Standard Deviations of PANAS and STICSA Scores Separated by Condition

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
PANAS Negative			
Baseline	21.88 (6.11)	19.92 (6.27)	19.38 (5.82)
Posttask	17.04 (5.30)	15.46 (5.17)	16.75 (5.53)
Postspeech	23.63 (9.60)	20.83 (8.82)	20.21 (6.60)
PANAS Positive			
Baseline	22.83 (7.00)	25.08 (6.16)	24.83 (6.58)
Posttask	20.13 (6.66)	22.21 (6.59)	21.17 (7.77)
Postspeech	19.54 (6.66)	20.67 (6.07)	21.83 (5.83)
STICSA Cognitive			
Baseline	26.79 (7.82)	20.92 (6.40)	24.54 (7.74)
Posttask	22.96 (8.15)	19.42 (6.51)	22.50 (7.47)
Postspeech	25.96 (8.62)	21.46 (7.59)	24.46 (7.85)
STICSA Somatic			
Baseline	22.13 (6.48)	21.13 (6.34)	23.17 (7.94)
Posttask	17.50 (4.45)	17.08 (5.05)	19.71 (6.31)
Postspeech	23.83 (6.06)	23.79 (8.49)	25.71 (8.58)

PANAS = *Positive and Negative Affect Schedule* (Watson et al., 1988), STICSA = *State-Trait Inventory for Cognitive and Somatic Anxiety* (Ree et al., 2008)

Mauchly's test indicated that the assumption of sphericity was violated for the PANAS Positive subscale, $X^2(2) = 7.07$, $p = .03$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .91$). There was a significant main effect of time for scores on the PANAS Positive subscale $F(1.82,125.6) = 15.75$, $p < .01$, $\eta_p^2 = .19$. Planned contrasts revealed that, regardless of condition, PANAS Positive scores were significantly higher at baseline ($M = 24.25$, $SE = .78$) compared to at posttask ($M = 21.17$, $SE = .83$) and postspeech ($M = 20.68$, $SE = .73$), $p < .01$ for all analyses. There was no significant main effect of condition and no significant condition by time interaction. Planned contrasts revealed a statistically significant decrease in PANAS Positive scores from baseline to posttask and from baseline to postspeech for all three conditions (see Figure 4A). Specifically, in the interpretation training condition, PANAS Positive scores decreased from baseline ($M = 22.83$, $SE = 1.34$) to posttask ($M = 20.13$, $SE = 1.44$, $p = .05$, Cohen's $d = .69$) and from baseline to postspeech ($M = 19.54$, $SE = 1.27$, $p = .01$, Cohen's $d = .75$). In the cognitive restructuring condition, PANAS Positive scores also decreased from baseline ($M = 25.08$, $SE = 1.34$) to posttask ($M = 22.21$, $SE = 1.44$, $p < .01$, Cohen's $d = .50$) and from baseline to postspeech ($M = 20.67$, $SE = 1.27$, $p < .01$, Cohen's $d = .71$). Lastly, planned contrasts revealed a statistically significant decrease in PANAS Positive scores from baseline ($M = 24.83$, $SE = 1.34$) to posttask ($M = 21.17$, $SE = 1.44$, $p < .01$, Cohen's $d = .58$) and from baseline to postspeech ($M = 21.83$, $SE = 1.27$, $p = .02$, Cohen's $d = .59$) in the control condition. Between-group analyses did not reveal any significant group differences on the PANAS Positive subscale at posttask or postspeech.

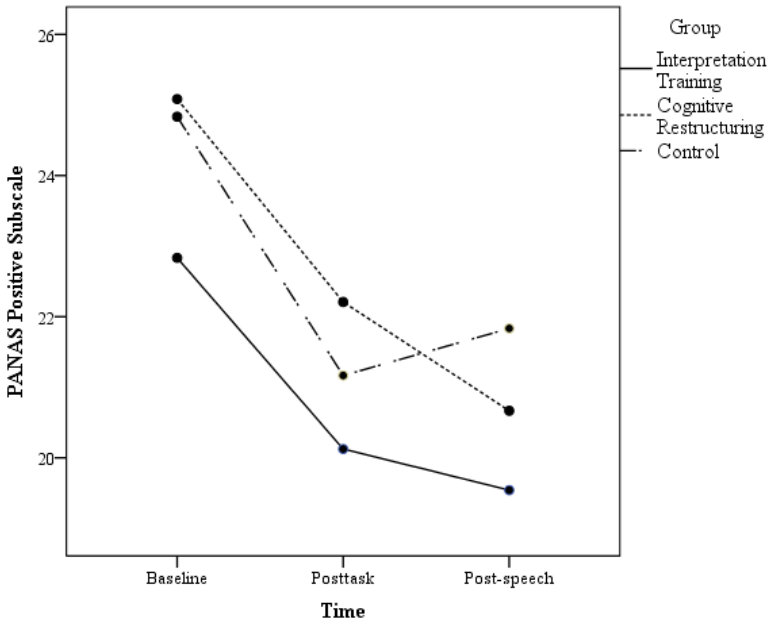
Mauchly's test indicated that the assumption of sphericity was violated for the PANAS Negative subscale, $X^2(2) = 11.30$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .87$). There was a statistically significant

main effect of time for scores on the PANAS Negative subscale, $F(1.73,119.68) = 30.01$, $p < .01$, $\eta_p^2 = .30$. Planned contrasts revealed that PANAS Negative scores were significantly lower at posttask ($M = 16.42$, $SE = .63$) compared to at baseline ($M = 20.39$, $SE = .72$) and at postspeech ($M = 21.56$, $SE = .99$), $p < .01$ for all analyses. There was no significant main effect of condition and no significant condition by time interaction. Planned contrasts revealed that for all three conditions, there was a significant decrease in PANAS Negative scores from baseline to posttask and a significant increase in PANAS Negative scores from posttask to postspeech. There were no significant differences between baseline and postspeech PANAS Negative scores for any of the conditions (see Figure 4B). Specifically, for the interpretation training condition, PANAS Negative scores significantly decreased from baseline ($M = 21.88$, $SD = 6.11$) to posttask ($M = 17.04$, $SD = 5.30$, $p < .01$, Cohen's $d = .93$) and significantly increased from posttask to postspeech ($M = 23.63$, $SD = 9.59$, $p < .01$, Cohen's $d = 1.09$). Similarly, in the cognitive restructuring condition PANAS Negative scores decreased significantly from baseline ($M = 19.92$, $SD = 6.27$) to posttask ($M = 15.46$, $SD = 5.17$, $p < .01$, Cohen's $d = 1.15$) and increased significantly from posttask to postspeech ($M = 20.83$, $SD = 8.82$, $p < .01$, Cohen's $d = .83$). Lastly, in the control condition, PANAS Negative scores decreased significantly from baseline ($M = 19.38$, $SD = 5.82$) to posttask ($M = 16.75$, $SD = 5.53$, $p = .02$, Cohen's $d = .58$) and increased significantly from posttask to postspeech ($M = 20.21$, $SD = 6.60$, $p = .04$, Cohen's $d = .71$). Between-group analyses did not reveal any significant group differences on the PANAS Negative subscale at posttask or postspeech.

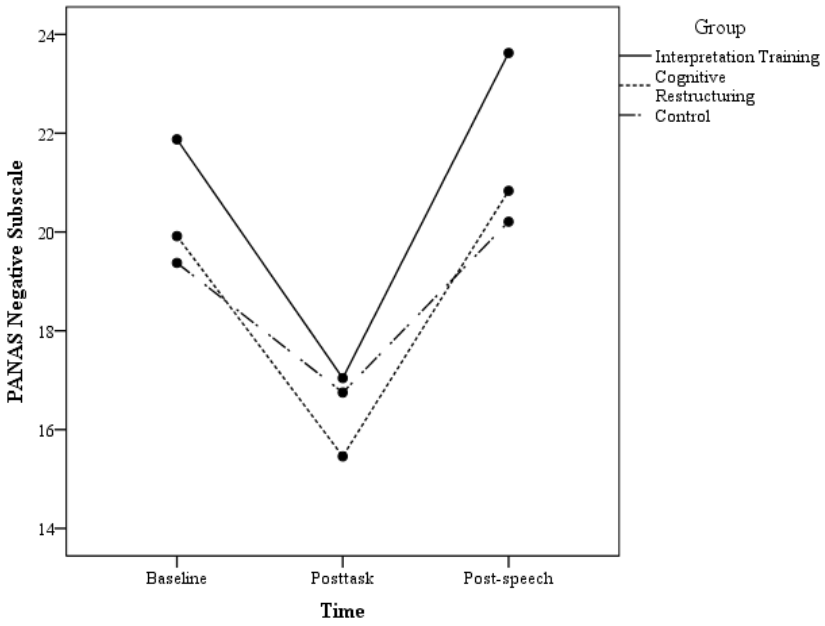
Figure 4

Mean Positive and Negative Affect Schedule (PANAS) Positive (A) and Negative (B) Scores from Baseline to Posttask to Postspeech Separated by Condition

(A)



(B)



Mauchly's test indicated that the assumption of sphericity was violated for the STICSA Cognitive subscale, $X^2(2) = 15.02$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .84$). The main effect of time for STICSA Cognitive scores was statistically significant, $F(1.67,115.18) = 7.58$, $p < .01$, $\eta_p^2 = .10$. Planned contrasts revealed that, regardless of condition, STICSA Cognitive scores were significantly higher at baseline ($M = 24.08$, $SE = .87$) and postspeech ($M = 23.96$, $SE = .95$) compared to at posttask ($M = 21.63$, $SE = .87$), $p < .01$ for both comparisons. There were no significant differences between STICSA Cognitive scores at baseline and postspeech. The main effect of Condition approached statistical significance, $F(2,69) = 2.98$, $p = .06$, $\eta_p^2 = .08$. Planned contrasts revealed that, regardless of time, the interpretation training condition ($M = 25.24$, $SE = 1.38$) had higher STICSA Cognitive scores compared to the cognitive restructuring condition ($M = 20.60$, $SE = 1.38$), $p = .06$. The Condition by Time interaction was not statistically significant. However, planned contrasts revealed a statistically significant decrease in STICSA Cognitive scores from baseline ($M = 26.79$, $SD = 7.82$) to posttask ($M = 22.96$, $SD = 8.15$, $p < .01$, Cohen's $d = .059$) and a statistically significant increase in STICSA Cognitive scores from posttask to postspeech ($M = 25.96$, $SD = 8.62$, $p < .01$, Cohen's $d = -.57$) in the interpretation training condition only (see Figure 5A). The change in STICSA Cognitive scores from baseline to postspeech in the interpretation training condition was not statistically significant, $p = 1$, Cohen's $d = .11$. There were no statistically significant changes in STICSA Cognitive score from baseline ($M = 20.92$, $SD = 6.40$) to posttask ($M = 19.42$, $SD = 6.51$) and from posttask to postspeech ($M = 21.46$, $SD = 7.59$) in the cognitive restructuring condition, $p = 68$, Cohen's $d = .42$, and $p = .12$, Cohen's $d = .41$, respectively. In the control condition, although the decrease from baseline ($M = 24.54$, $SD = 7.74$) to posttask ($M = 22.50$, $SD = 7.47$) and the increase from

posttask to postspeech (M = 24.46, SD = 7.85) were not statistically significant (p = .30, Cohen's d = .28, and p = .14, Cohen's d = .53), the increase from posttask to postspeech was associated with a medium effect size. Given that there were significant group differences at baseline on STICSA Cognitive scores, two analyses of covariance with baseline STICSA Cognitive scores as the covariate, condition as the independent variable and posttask and postspeech STICSA Cognitive scores as the dependent variables were conducted to examine between-group differences on the STICSA Cognitive subscale at posttask and postspeech. The analyses did not reveal any significant group differences on the STICSA Cognitive subscale at posttask or postspeech.

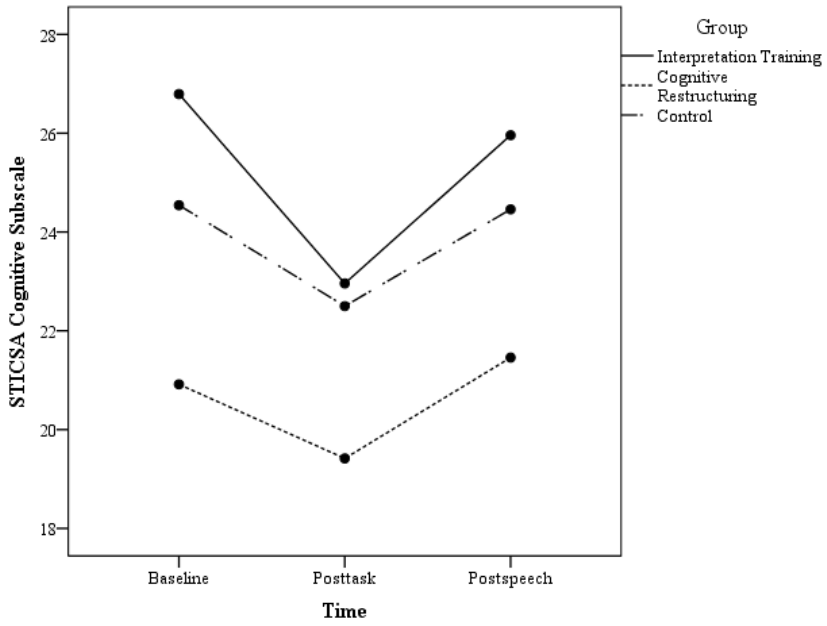
There was a statistically significant main effect of time for STICSA Somatic scores, $F(2,138) = 46.63$, $p < .01$, $\eta_p^2 = .40$. Planned contrasts revealed that, regardless of condition, STICSA Somatic scores were significantly higher at postspeech (M = 24.44, SE = .92) compared to baseline (M = 22.14, SE = .82) and posttask (M = 18.10, SE = .63), $p < .01$ for both analyses. There was no statistically significant main effect of Condition and no significant Condition by Time interaction. Planned contrasts revealed that there was a statistically significant decrease in STICSA Somatic scores from baseline to posttask and a statistically significant increase in STICSA Somatic scores from posttask to postspeech in all three conditions. None of the conditions had statistically significant differences in STICSA Somatic scores from baseline to postspeech (see Figure 5B). Specifically, in the interpretation training condition STICSA Somatic scores decreased from baseline (M = 22.13, SD = 6.48) to posttask (M = 17.50, SD = 4.45, $p < .01$, Cohen's d = .91) and increased from posttask to postspeech (M = 23.83, SD = 6.06, $p < .01$, Cohen's d = 1.25). Similarly, in the cognitive restructuring condition STICSA Somatic scores decreased from baseline (M = 21.12, SD = 6.34) to posttask (M = 17.08, SD = 5.05, $p <$

.01, Cohen's $d = 1.39$) and increased from posttask to postspeech ($M = 23.79$, $SD = 8.49$), $p < .01$, Cohen's $d = 1.23$). Lastly, STICSA Somatic scores decreased from baseline ($M = 23.17$, $SD = 7.94$) to posttask ($M = 19.71$, $SD = 6.31$, $p < .01$, Cohen's $d = .55$) and increased from posttask to postspeech ($M = 25.71$, $SD = 8.58$, $p < .01$, Cohen's $d = 1.31$) in the control condition. Between-group analyses did not reveal any significant group differences on the STICSA Somatic subscale at posttask or postspeech.

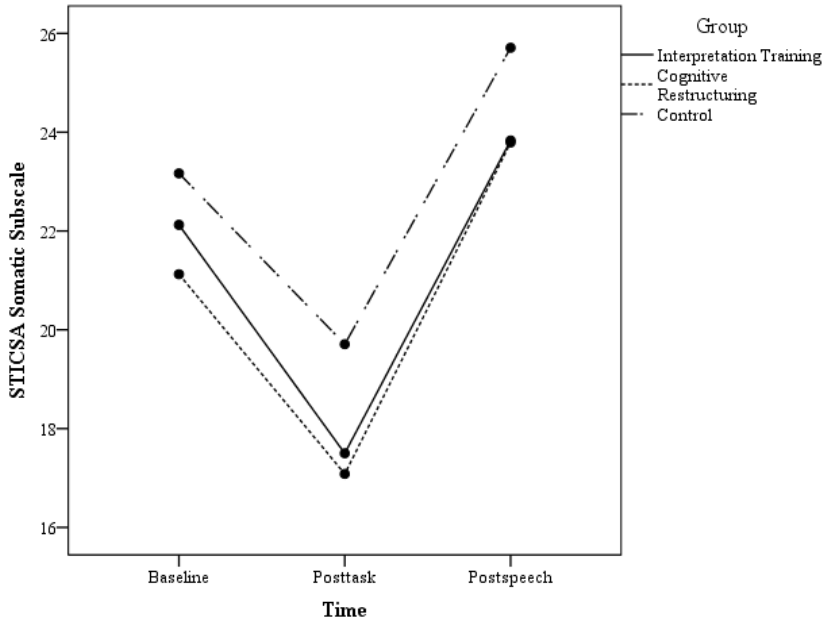
Figure 5

Mean State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) Cognitive (A) and Somatic (B) Scores from Baseline to Posttask to Postspeech Separated by Condition

(A)



(B)



Question 2: Do the effects of a single-session interpretation training task or a single-session cognitive restructuring task generalize to self-report measures of interpretation biases in individuals with high levels of social anxiety? It was hypothesized that only the interpretation training and cognitive restructuring conditions would show a significant decrease in ASSIQ Social subscale scores from baseline to posttask and that the interpretation training and cognitive restructuring conditions would score significantly lower on the ASSIQ Social subscale at posttask compared to the control condition. It was also predicted that these group differences would be specific to the Social subscale of the ASSIQ and that there would be no group differences for the ASSIQ Nonsocial subscale. Mean scores and standard deviations for the ASSIQ Social and Nonsocial subscales are presented in Table 5. A series of two 3 (Condition: interpretation training, cognitive restructuring, control) by 2 (Time: baseline, posttask) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 5

Means and Standard Deviations of ASSIQ Scores Separated by Condition

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
ASSIQ Social[1]			
Baseline	30.48 (7.73)	31.00 (5.78)	31.25 (7.16)
Posttask	29.87 (7.92)	28.71 (7.73)	30.67 (7.93)
ASSIQ Nonsocial[2]			
Baseline	12.68 (2.61)	12.55 (2.70)	13.36 (3.22)
Posttask	11.91 (3.05)	11.86 (2.87)	13.14 (2.78)

ASSIQ = *Assumptions of Social Situations Interpretation Questionnaire* (Stopa & Clark, 2000)

[1]The ASSIQ Social subscale analyses are based on a sample size of 23 participants in the Interpretation Training Condition.

[2]The ASSIQ Nonsocial subscale analyses are based on the following sample sizes: Interpretation Training Condition (n = 22), Cognitive Restructuring (n = 22), and Control (n = 22).

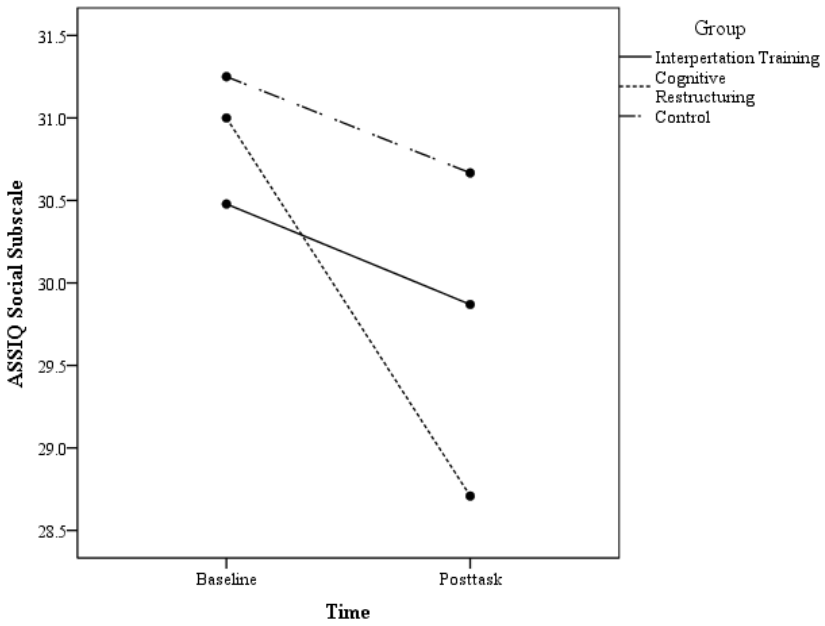
The main effect of time for the ASSIQ Social score approached statistical significance, $F(1,68) = 3.17$, $p = .08$, $\eta_p^2 = .04$. Planned contrasts revealed that, regardless of condition, the difference between ASSIQ Social scores at baseline and posttask approached statistical significance, such that ASSIQ Social scores at posttask ($M = 29.75$, $SE = .93$) were lower compared to baseline ASSIQ Social scores ($M = 30.91$, $SE = .82$), $p = .08$. There was neither a significant main effect of condition nor a significant Condition by Time interaction. However, planned contrasts revealed a statistically significant decrease in ASSIQ Social subscale scores from baseline ($M = 31.00$, $SD = 5.78$) to posttask ($M = 28.71$, $SD = 7.73$, $p = .05$, Cohen's $d = .45$) in the cognitive restructuring condition only (see Figure 6A). There were no significant changes in ASSIQ Social subscale scores from baseline to posttask in the interpretation training ($p = .6$, Cohen's $d = .09$) or control conditions ($p = .6$, Cohen's $d = .15$; see Figure 6A). Between-group analyses did not reveal any significant group differences on the ASSIQ Social subscale at posttask.

The main effect of time for the ASSIQ Nonsocial subscale approached statistical significance, $F(1.63) = 3.82$, $p = .06$, $\eta_p^2 = .06$. Planned contrasts revealed that, regardless of condition, the difference in ASSIQ Nonsocial scores from baseline to posttask approached statistical significance, such that ASSIQ Nonsocial scores were lower at posttask ($M = 12.30$, $SE = .36$) compared to at baseline ($M = 12.86$, $SE = .35$), $p = .06$. There was neither a significant main effect of condition nor a significant Condition by Time interaction. Planned contrasts did not reveal any significant changes on the ASSIQ Nonsocial subscale across time for any of the conditions (Cohen's d ranged from .14 for the control condition to .36 for the cognitive restructuring condition; see Figure 6B). Between-group analyses did not reveal any significant group differences on the ASSIQ Nonsocial subscale at posttask.

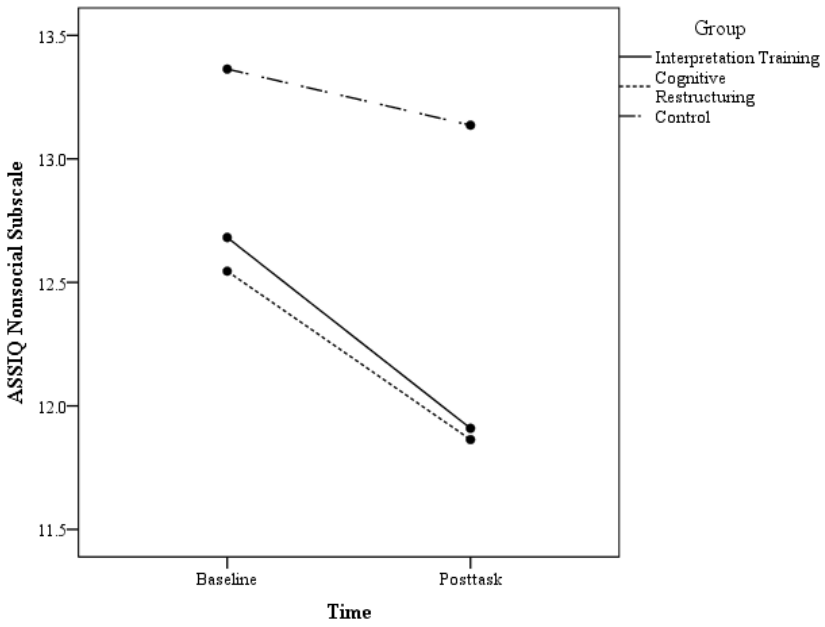
Figure 6

Mean Assumptions of Social Situations Interpretation Questionnaire (ASSIQ) Social (A) and Nonsocial (B) Subscale Scores from Baseline to Postspeech Separated by Condition

(A)



(B)



Question 3: Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task report a decrease in social anxiety symptomatology at posttask? Social anxiety symptomatology was assessed using the SPIN (Connor, 2000) and by having participants rate their anticipatory anxiety and avoidance of future social situations. It was predicted that there would be a significant decrease in SPIN scores and in anticipatory anxiety and avoidance of future social situations from baseline to posttask in the interpretation training and cognitive restructuring conditions but not in the control condition. It was also predicted that at posttask, the interpretation training and cognitive restructuring conditions would have lower scores on the SPIN and on anticipatory anxiety and avoidance of future social situations compared to the control condition. Mean scores and standard deviations for the SPIN and Anticipatory Anxiety and Avoidance scores are presented in Table 6. Three 3 (Condition: interpretation training, cognitive restructuring, control) by 2 (Time: baseline, posttask) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 6

Means and Standard Deviations for Social Anxiety Symptomatology Separated by Condition

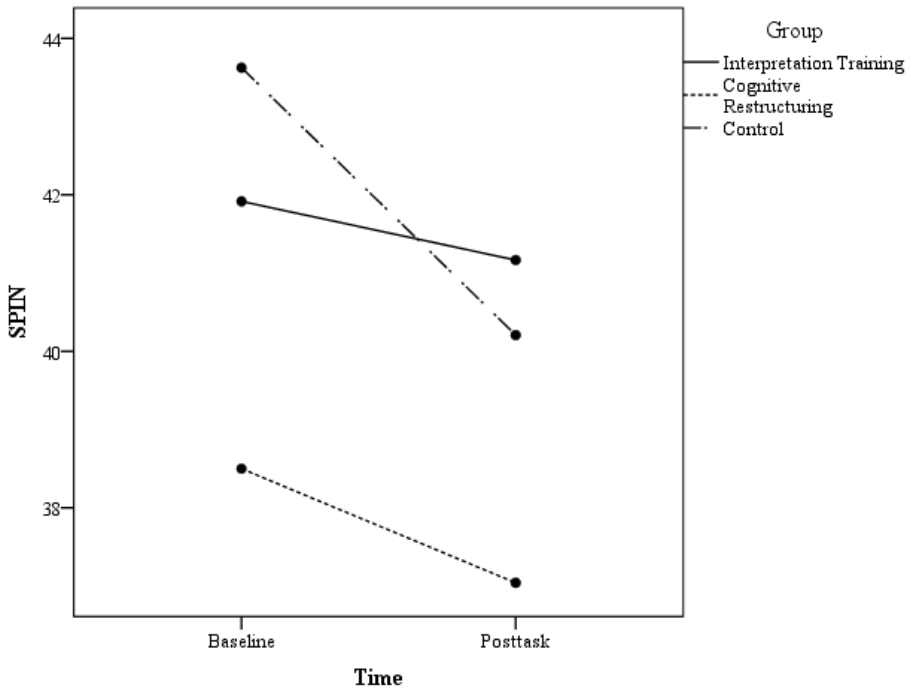
	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
SPIN			
Baseline	41.92 (8.46)	38.50 (8.27)	43.63 (11.88)
Posttask	41.17 (9.81)	37.04 (8.65)	40.21 (12.54)
Anxiety			
Baseline	19.54 (4.49)	18.25 (4.74)	19.83 (5.48)
Posttask	20.50 (4.72)	18.38 (5.32)	20.96 (6.14)
Avoidance			
Baseline	18.17 (5.41)	16.37 (4.99)	17.96 (6.08)
Posttask	19.88 (4.93)	17.5 (6.79)	20.29 (7.58)

SPIN = *Social Phobia Inventory* (Connor et al., 2000)

The main effect of time for scores on the SPIN approached statistical significance, $F(1,69) = 3.46$, $p = .07$, $\eta_p^2 = .05$. Planned contrasts revealed that, regardless of condition, SPIN scores were lower at posttask ($M = 39.47$, $SE = 1.23$) compared to at baseline ($M = 41.35$, $SE = 1.14$) and this difference approached statistical significance, $p = .07$. There was no significant main effect of condition and no significant interaction of condition by time. However, planned contrasts revealed a significant decrease in SPIN scores from baseline ($M = 43.63$, $SD = 11.88$) to posttask ($M = 40.21$, $SD = 12.54$) only in the control condition, $p = .05$, Cohen's $d = .37$. There were no significant changes in SPIN scores from baseline to posttask in the cognitive restructuring ($p = .31$, Cohen's $d = .22$) or interpretation training conditions ($p = .67$, Cohen's $d = .10$; see Figure 7). Between-group analyses did not reveal any significant group differences on SPIN scores at posttask.

Figure 7

Mean Social Phobia Inventory (SPIN) Scores from Baseline to Posttask Separated by Condition



There was a significant main effect of time for anticipatory anxiety about future social situations, $F(1,69) = 4.64$, $p = .04$, $\eta_p^2 = .06$. Planned contrasts revealed that, regardless of condition, anticipatory anxiety scores were significantly higher at posttask ($M = 19.94$, $SE = .64$) compared to at baseline ($M = 19.21$, $SE = .58$), $p = .04$. There was no significant effect of condition and no significant condition by time interaction. However, planned contrasts revealed that the change in anticipatory anxiety about future social situations approached statistical significance in the control condition, $p = .06$, Cohen's $d = .53$, see Figure 8A. Participants in the control condition reported a medium sized increase in their anticipatory anxiety about future social situations from baseline ($M = 19.83$, $SD = 4.48$) to posttask ($M = 20.96$, $SD = 6.14$). As well, although the change in anticipatory anxiety about future social situations was not statistically significant for the interpretation training condition, the direction of change was not in the predicted direction such that anticipatory anxiety about future social situations increased from baseline ($M = 19.83$, $SD = 5.48$) to posttask ($M = 20.5$, $SD = 4.72$), $p = .11$, Cohen's $d = .33$. The change in anticipatory anxiety about future social situations from baseline ($M = 18.25$, $SD = 4.74$) to posttask ($M = 18.38$, $SD = 5.32$) was negligible in the cognitive restructuring condition, $p = .83$, Cohen's $d = .04$. Between-group analyses did not reveal any significant group differences on anticipatory anxiety at posttask.

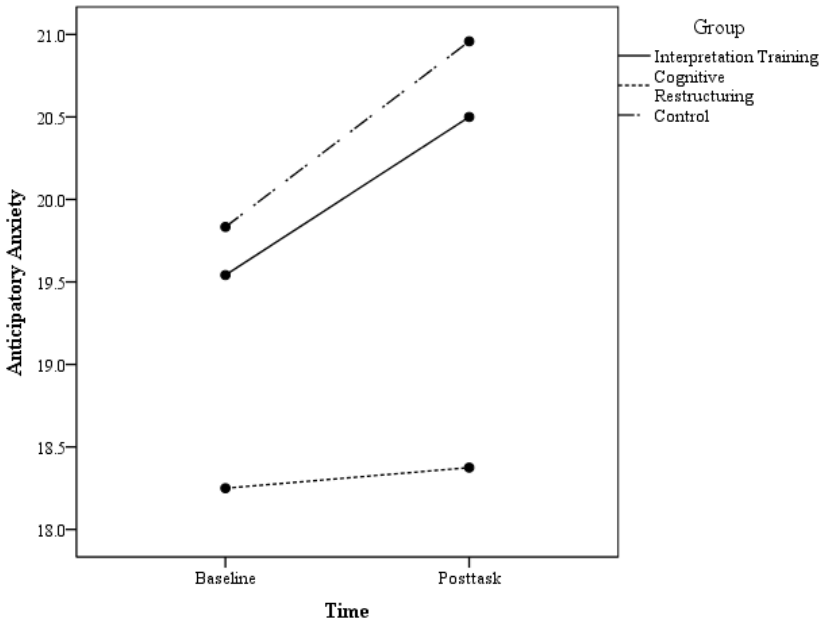
There was a statistically significant main effect of time for self-reported avoidance of future social situations, $F(1,69) = 17.32$, $p < .01$, $\eta_p^2 = .20$. Planned contrasts revealed that, regardless of condition, avoidance was significantly higher at posttask ($M = 19.22$, $SE = .77$) compared to at baseline ($M = 17.50$, $SE = .77$), $p < .01$. There was no significant main effect of condition and no significant condition by time interaction. However, planned contrasts revealed a statistically significant increase in avoidance from baseline (Interpretation training: $M = 18.17$,

SD = 5.41, Control: *M* = 17.96, *SD* = 6.08) to posttask (Interpretation training: *M* = 19.88, *SD* = 4.93, Control: *M* = 20.29, *SD* = 7.58) for both the interpretation training and control conditions, *p* = .02, Cohen's *d* = .48, and *p* < .01, Cohen's *d* = .53, respectively, but not for the cognitive restructuring condition, *p* = .12, Cohen's *d* = .29, see Figure 8B. Between-group analyses did not reveal any significant group differences on avoidance of future social situations at posttask.

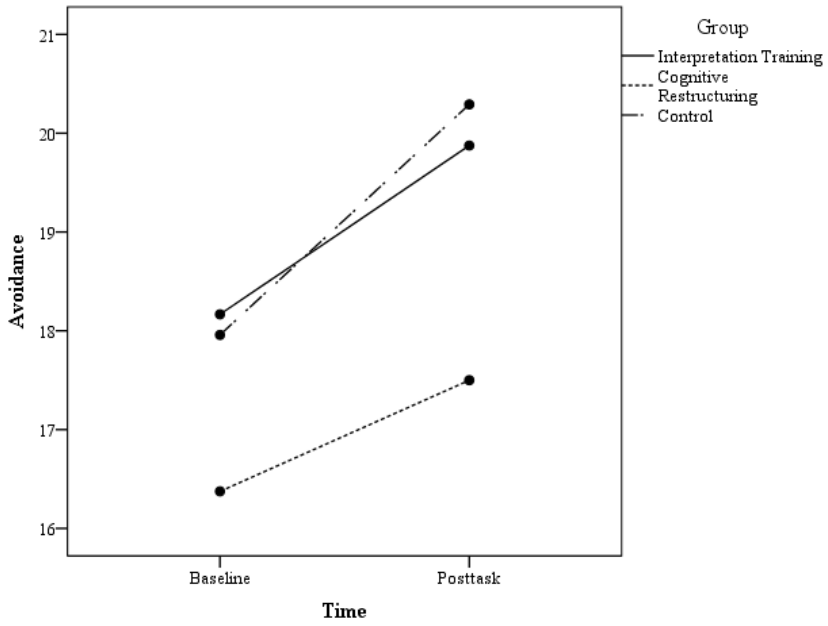
Figure 8

Mean Anticipatory Anxiety (A) and Avoidance (B) Scores from Baseline to Posttask Separated by Condition

(A)



(B)



Question 4: Do the effects of interpretation training and cognitive restructuring generalize to changes in other cognitive factors related to social anxiety, including fear of negative evaluation, thoughts about one's performance in social situations, and the probability and cost of negative social situations, in a sample of individuals with high levels of social anxiety? It was hypothesized that scores on the BFNE (Leary, 1983), STABS (Turner et al., 2003) and SPCQ (McManus et al., 2000) questionnaires would decrease significantly from baseline to posttask in the interpretation training and cognitive restructuring conditions but not in the control condition. It was also predicted that at posttask, the interpretation training and cognitive restructuring conditions would have significantly lower scores on the BFNE, STABS and SPCQ questionnaires compared to the control condition. Mean scores and standard deviations for the BFNE, STABS, SPCQ Probability, and SPCQ Cost subscales are presented in Table 7. A series of four 3 (Condition: interpretation training, cognitive restructuring, control) by 2 (Time: baseline, posttask) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 7

Means and Standard Deviations for BFNE, STABS, and SPCQ Sores Separated by Condition

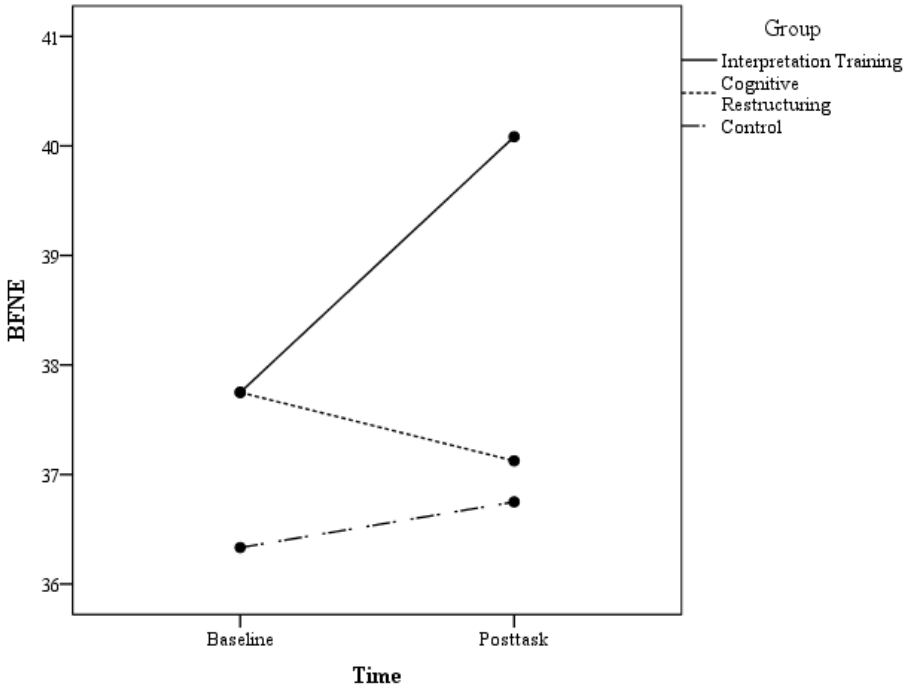
	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
BFNE			
Baseline	37.75 (4.09)	37.75 (3.31)	36.33 (7.04)
Posttask	40.08 (4.81)	37.13 (4.65)	36.75 (6.80)
STABS			
Baseline	78 (9.30)	75.04 (12.24)	78.17 (13.36)
Posttask	78.96 (10.44)	74.21 (12.93)	77.38 (13.90)
SPCQ Probability			
Baseline	1928.08 (475.50)	1885.63 (524.01)	2003.67 (668.63)
Posttask	2103.92 (490.42)	1795.50 (560.47)	1963.46 (700.29)
SPCQ Cost			
Baseline	2088.58 (486.27)	2140.37 (488.09)	2080.87 (728.50)
Posttask	2159.83 (443.10)	1996.50 (486.94)	1993.17 (735.37)

BFNE = *Brief Fear of Negative Evaluation* (Leary, 1983), STABS = *Social Thoughts and Behaviors Scale* (Turner et al., 2003); SPCQ = *Social Probability and Cost Questionnaire* (McManus et al., 2000)

Levene's test of equality of error variances was statistically significant for the baseline BFNE (Leary, 1983) scores, $F(2,69) = 6.95$, $p < .01$. However, when sample sizes are equal and large (i.e., 20 or more participants in each condition) and the ratio of the largest variance to the smallest variance is less than 4, mixed analyses of variance are robust to heterogeneity of error variances (Tabachnick & Fidell, 2007). Given that the current analyses met all of these criteria, the results with untransformed data were deemed valid. There was no significant main effect of time or condition for BFNE scores. The condition by time interaction approached statistical significance, $F(2,69) = 2.61$, $p = .08$, $\eta_p^2 = .07$. Contrary to prediction, planned contrasts revealed that BFNE scores increased significantly from baseline ($M = 37.75$, $SD = 4.09$) to posttask ($M = 40.08$, $SD = 4.81$) in the interpretation training condition only, $p = .01$, Cohen's $d = .5$. There were no statistically significant changes in BFNE scores for the cognitive restructuring ($p = .50$, Cohen's $d = .16$) and control conditions ($p = .66$, Cohen's $d = .09$, see Figure 9). Between-group analyses did not reveal any significant group differences on BFNE scores at posttask.

Figure 9

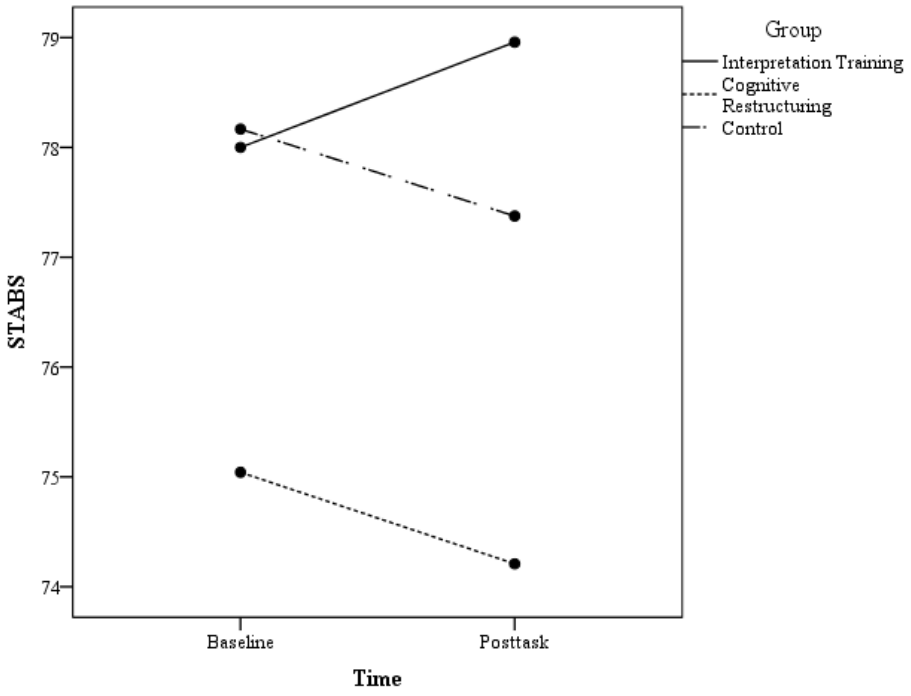
Mean Brief Fear of Negative Evaluation (BFNE) Scores from Baseline to Posttask Separated by Condition



There were no significant main effects of time or condition and no significant interaction of condition and time for STABS (Turner et al., 2003) scores. Planned contrasts did not reveal any significant changes in STABS scores from baseline to posttask for any of the conditions (Cohen's *d* ranged from .08 for the control condition to .19 for the interpretation training condition; see Figure 10). Between-group analyses did not reveal any significant group differences on STABS scores at posttask.

Figure 10

Mean Social Thoughts and Behaviors Scale (STABS) Scores from Baseline to Posttask Separated by Condition



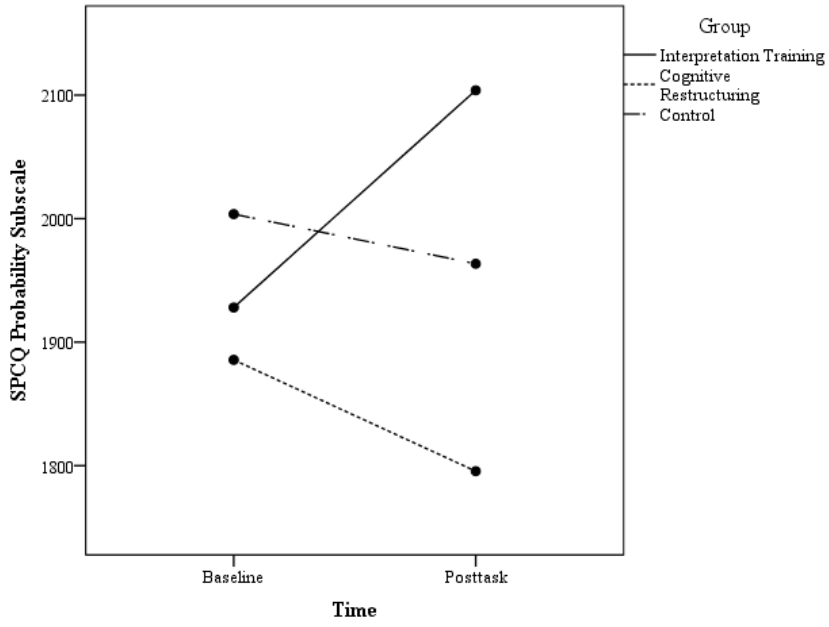
There was a significant condition by time interaction for the SPCQ Probability subscale, $F(2,68) = 4.15$, $p = .02$, $\eta_p^2 = .11$. There were no significant main effects of condition or time. Contrary to hypotheses, planned contrasts revealed that scores on the SPCQ Probability subscale increased significantly from baseline ($M = 1928.08$, $SD = 475.50$) to posttask ($M = 2103.92$, $SD = 490.42$) in the interpretation training condition only, $p = .02$, Cohen's $d = .51$. There were no statistically significant changes in SPCQ Probability subscale scores from baseline to posttask in the cognitive restructuring ($p = .21$, Cohen's $d = .24$) and control ($p = .42$, Cohen's $d = .18$) conditions (see Figure 11A). Between-group analyses did not reveal any significant group differences on the SPCQ Probability subscale at posttask.

Levene's test of equality of error variances was statistically significant for the baseline and posttask SPCQ Cost scores, $F(2,69) = 3.68$, $p = .03$, and $F(2,69) = 4.04$, p .02, respectively. However, when sample sizes are equal and large (i.e., 20 or more participants in each condition) and the ratio of the largest variance to the smallest variance is less than 4, mixed analyses of variance are robust to heterogeneity of error variances (Tabachnick & Fidell, 2007). Given that the current analyses met all of these criteria, the results with untransformed data were deemed valid. There were no significant main effects of Condition or Time and no significant Condition by Time interaction for scores on the SPCQ Cost subscale. Planned contrasts did not reveal any significant within-group changes on the SPCQ Cost subscale scores for any of the conditions (Cohen's d ranged from .15 for the interpretation training and control conditions and .42 for the cognitive restructuring condition; see Figure 11B). Between-group analyses did not reveal any significant group differences on the SPCQ Cost subscale at posttask.

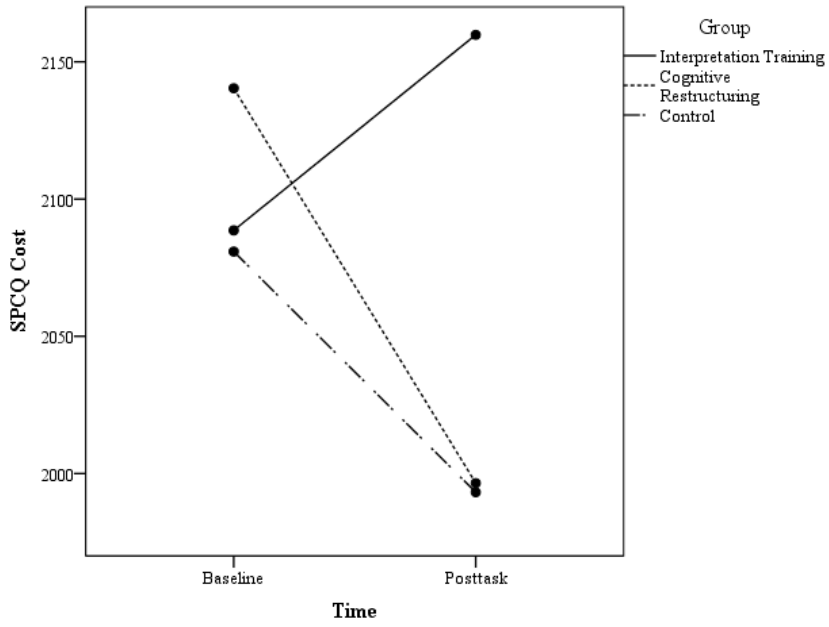
Figure 11

Mean Social Probability and Cost Questionnaire (SPCQ) Probability (A) and Cost (B) Subscale Scores by Condition from Baseline to Posttask

(A)



(B)



Question 5: Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task report less distress during a speech task and rate themselves as performing better during the speech compared to individuals in the control condition? It was hypothesized that participants in the interpretation training condition and cognitive restructuring condition would report lower levels of distress at baseline, preparation, speech, and recovery compared to participants in the control condition. Mean scores and standard deviations for SUDS levels at baseline, preparation, speech, and recovery are presented in Table 8. Hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) was used to determine whether there were significant condition by time interactions as well as whether there were any main effects of condition and time on self-reported distress levels, controlling for baseline self-reported distress levels. The covariance structure model that was found to be most appropriate for the data was the random intercept and random slope uncorrelated model. Hierarchical linear model analyses indicated that, controlling for baseline self-reported distress levels, the interaction between condition and time was not significant (i.e., there was no significant difference on the rate of change of self-reported distress between conditions). There was no significant main effect of condition on self-reported distress levels controlling for baseline self-reported distress levels. The main effect of time was significant $F(1,410.95) = 72.37$, $p < .01$. Analyses revealed that regardless of group, distress ratings increased significantly from baseline to preparation to speech and then decreased from speech to recovery.

Table 8

Means and Standard Deviations for Subjective Units of Distress During the Speech Task Separated by Condition

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
Baseline			
Start	40 (20)	33 (23)	37 (23)
End	37 (20)	28 (21)	35 (22)
Preparation			
Start	54 (19)	52 (22)	50 (25)
End	62 (19)	61 (22)	55 (25)
Speech			
Start	69 (20)	70 (21)	62 (24)
End	65 (22)	65 (26)	61 (24)
Highest	80 (16)	81 (17)	78 (23)
Recovery			
Start	46 (20)	39 (24)	44 (20)
End	36 (19)	26 (20)	35 (21)

It was also hypothesized that the interpretation training and cognitive restructuring conditions would report experiencing less visible anxiety during the speech and would evaluate their performance on the speech as higher compared to participants in the control condition. Mean scores and standard deviations for the PSP, TQ Negative, and TQ Positive subscales are presented in Table 9. The conditions did not differ significantly on the length of their speeches. A one-way analysis of variance with condition (interpretation training, cognitive restructuring, and control) as the independent measure and PSP score as the dependent variable was conducted to examine group differences on the PSP measure. A multivariate analysis of variance with condition (interpretation training, cognitive restructuring and control) as the independent measure and TQ Negative and TQ Positive as the dependent measures was conducted to examine between-group differences on the TQ Negative and TQ Positive subscales. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the analyses of variance revealed significant main effects.

Table 9

Means and Standard Deviations for self-reported PSP and TQ Sores by Condition

	Interpretation Training (n = 24)	Cognitive Restructuring (n = 24)	Control (n = 24)
PSP	42.50 (8.68)	41.75 (12.75)	40.38 (11.14)
TQ Negative	45.33 (12.70)	41.46 (13.73)	45.00 (10.06)
TQ Positive	16.42 (4.50)	17.54 (4.19)	17.04 (4.41)

PSP = *Perception of Speech Performance* (Rapee & Lim, 1992), TQ = *Thoughts Questionnaire* (Edwards et al., 2003)

There was no main effect of condition on the PSP score, $F(2,69) = .23$, $p = .79$. Planned contrasts did not reveal any significant group differences on the PSP (Cohen's *d* ranged from .07 to .21). There were no main effects of condition on the TQ Positive or the TQ Negative scores, $F(4,138) = .44$, $p = .78$. Planned contrasts did not reveal any significant group differences on the TQ Positive (Cohen's *d* ranged from .11 to .26) or TQ Negative scores (Cohen's *d* ranged from .14 to .39).

Question 7: Are individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task rated by an objective observer as showing lower levels of anxiety and better performance on a speech compared to individuals in the control condition? It was hypothesized that the objective rater would rate the participants in the interpretation training and cognitive restructuring conditions as showing less signs of anxiety and performing better quality speeches compared to participants in the control condition. A one-way analysis of variance with condition (interpretation training, cognitive restructuring, and control) as the independent variable and PSP Observer score as the dependent variable was conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analysis of variance revealed a significant main effect.

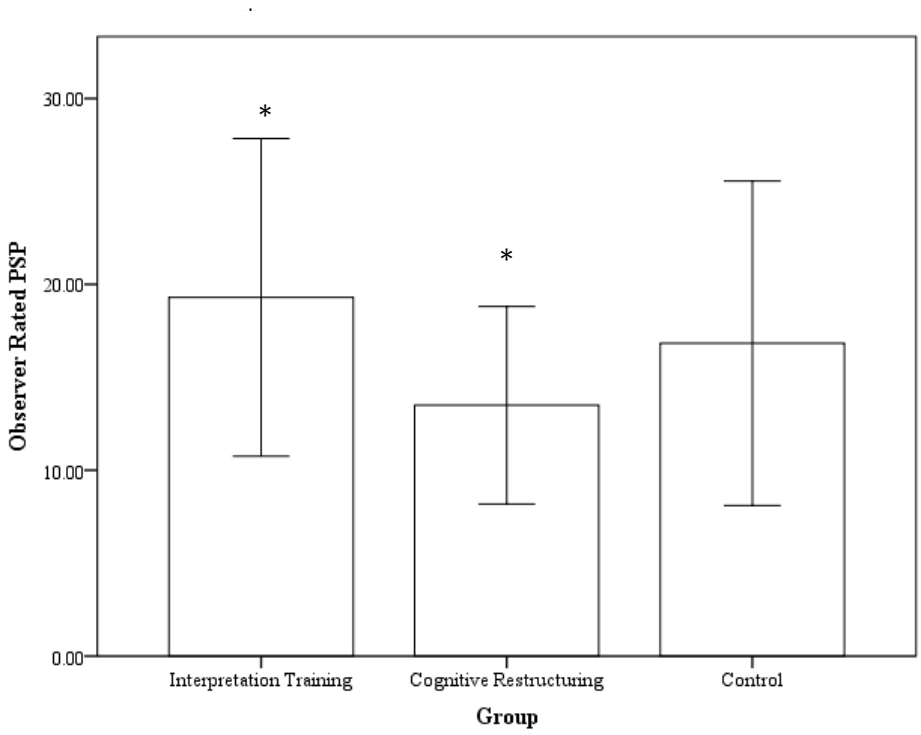
Given that the homogeneity of variance assumption was violated, the Welch F-ratio was used to evaluate the significance of the analysis and the Games-Howell pairwise comparison procedure was used to test the significance of planned contrasts. Both of these approaches have been found to be robust to violations of the homogeneity of variance assumption in analysis of variance. There was a statistically significant main effect of Condition, $F(2,42.63) = 4.04$, $p = .03$. Games-Howell pairwise comparisons revealed that participants in the cognitive

restructuring condition (M = 13.57, SD = 5.57) received significantly lower scores on the PSP compared to participants in the interpretation training condition (M = 19.30, SD = 8.55), p = .03, Cohen's d = .79, suggesting that the observer rated them as showing fewer symptoms of anxiety during the speech and rated their speeches as higher in quality. There were no statistically significant differences on PSP scores between the cognitive restructuring condition and the control condition (M = 17.29, SD = 9.01, p = .21, Cohen's d = .50) or between the interpretation training and control conditions (p = .71, Cohen's d = .23, see Figure 12).

Figure 12

Mean Observer Rated Perception of Speech Performance (PSP) Separated by Condition.

*Statistically significant group differences at $p < .05$ are indicated by *.*



Question 8: Do individuals with high levels of social anxiety who complete a single-session interpretation training task or a single-session cognitive restructuring task show lower levels of skin conductance and heart rate during a speech task? There was some missing psychophysiological data due to technical difficulties with the MP100 Biopac system. Specifically, the MP100 Biopac system was broken for 2 months during data collection. Although the newer MP150 Biopac system was used to continue collecting psychophysiological data, the unit in which the skin conductance data was collected differed from the old system and was not transferable. As well, recordings of skin conductance that were less than 1 mV were deemed unusable data because meaningful measures of skin conductance must be greater than 1 mV. Fourteen participants in the interpretation training condition, 19 in the cognitive restructuring condition, and 11 in the control condition had usable skin conductance data. Of the 9 participants in the interpretation training condition who had unusable skin conductance data, 1 had unclear markers on the recording such that it was not possible to identify the start and end times for the various tasks, 5 had no psychophysiological data due to malfunctioning of the MP100 Biopac system during testing, 1 had skin conductance data in different units, and 2 had skin conductance data that was less than 1 mV. Of the 6 participants in the cognitive restructuring condition who had unusable skin conductance data, 1 had unclear markers on the recording such that it was not possible to identify the start and end time for the various tasks, 3 had skin conductance data in different units, and 2 had skin conductance data that was less than 1 mV. Of the 13 participants in the control condition who had unusable skin conductance data, 1 had unclear markers on the recording such that it was not possible to identify the start and end time for the various tasks, 9 had skin conductance data in different units, and 3 had skin conductance data that was less than 1 mV. For the heart rate data, 18 participants in the

interpretation training condition, 23 in the cognitive restructuring condition and 23 in the control condition had usable data. Of the 6 participants in the interpretation training condition who had unusable data, 1 had unclear markers such that it was not possible to identify the start and end time for the various tasks, and 5 had no psychophysiological data due to malfunctioning of the MP100 Biopac unit during testing. The participants who had unusable data for the control and interpretation training conditions (one in each condition) had unclear markers such that it was not possible to identify the start and end times for the various tasks.

Given the lack of clear findings regarding synchrony between self-reported anxiety levels and heart rate and skin conductance levels and the lack of previous studies investigating the effects of interpretation training on physiological measures during a social stressor, no specific hypotheses regarding physiological reactivity during the speech task were generated. Mean scores and standard deviations for skin conductance level at baseline, preparation, speech, and recovery are presented in Table 10. A 3 (Condition: interpretation training, cognitive restructuring, control) by 4 (Time: baseline, preparation, speech, recovery) mixed analysis of variance was conducted for the skin conductance level data. Statistical significance was set at $p < .05$ and Bonferroni corrections were applied to all follow-up tests of main effects and interactions. Posthoc tests were used to follow-up on both significant and nonsignificant omnibus hypotheses.

Table 10

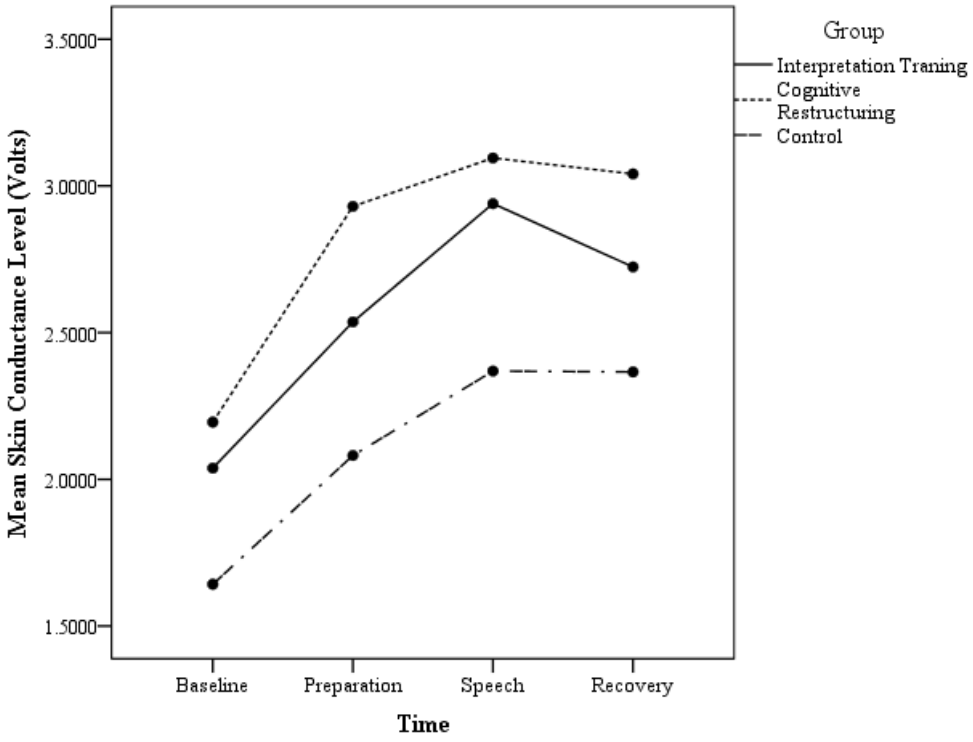
Means and Standard Deviations for Skin Conductance Level at Baseline, Preparation, Speech, and Recovery Separated by Condition

	Interpretation Training (n = 14)	Cognitive Restructuring (n = 19)	Control (n = 11)
Baseline	2.04 (.94)	2.22 (.80)	1.64 (.54)
Preparation	2.54 (.97)	2.88 (1.12)	2.08 (.67)
Speech	2.94 (1.00)	3.06 (1.07)	2.37 (.90)
Recovery	2.72 (1.21)	3.01 (1.17)	2.37 (.85)

Mauchly's test indicated that the assumption of sphericity was violated for skin conductance, $X^2(5) = 31.14$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .73$). There was a significant main effect of time for skin conductance level, $F(2.18,87.09) = 48.86$, $p < .01$, $\eta_p^2 = .55$. Bonferroni posthoc analyses revealed that, regardless of condition, skin conductance levels were significantly lower at baseline ($M = 1.97$, $SE = .12$) compared to preparation ($M = 2.50$, $SE = .15$), speech ($M = 2.79$, $SE = .16$), and recovery ($M = 2.70$, $SE = .17$), $p < .01$ for all analyses. As well, skin conductance levels at preparation were significantly lower compared to skin conductance levels at speech, and recovery, $p < .01$ and $p = .05$, respectively. There was no significant main effect of condition and no significant condition by time interaction. Bonferroni posthoc analyses revealed that for all three conditions, skin conductance level increased significantly from baseline to preparation and from preparation to speech. There was no significant change in skin conductance level from speech to recovery but skin conductance level was significantly higher at recovery than at baseline for all 3 conditions (see Figure 13). In the interpretation training condition, skin conductance levels increased significantly from baseline ($M = 2.04$, $SD = .94$) to preparation ($M = 2.54$, $SD = .97$, $p < .01$, Cohen's $d = 1.60$) and from preparation to speech ($M = 2.94$, $SD = 1.00$, $p < .01$, Cohen's $d = 1.11$). Similarly, in the cognitive restructuring condition, skin conductance levels increased significantly from baseline ($M = 2.22$, $SD = .80$) to preparation ($M = 2.88$, $SD = 1.12$, $p < .01$, Cohen's $d = 1.07$) and from preparation to speech ($M = 3.06$, $SD = 1.07$, $p = .04$, Cohen's $d = 1.09$). Lastly, in the control condition, skin conductance levels increased significantly from baseline ($M = 1.64$, $SD = .54$) to preparation ($M = 2.08$, $SD = .67$, $p = .05$, Cohen's $d = 1.20$) and from preparation to speech ($M = 2.37$, $SD = .90$), $p < .01$, Cohen's $d = 1.67$.

Figure 13

Mean Skin Conductance Level from Baseline to Preparation to Speech Performance to Recovery Separated by Condition



Levene's test of homogeneity of variance was statistically significant for all measures of heart rate (i.e., baseline, preparation, speech, and recovery) indicating that the assumption of homogeneity of variance was violated. When sample sizes are unequal, mixed analysis of variance is less robust to violations of heterogeneity and may inflate type I error rates for between-group differences, especially if the smallest group has the largest variance. An examination of the heart rate data revealed that the interpretation training condition (which had the smallest sample size) had the second largest variance for heart rate at all time points. Furthermore, the heart rate data did reveal a significant main effect of condition. Consequently, a number of transformations were applied to the heart rate data. However, none of the transformations successfully transformed the data so that the assumption of homogeneity of variances was met. Therefore, nonparametric tests were used to assess the changes in heart rate during the speech task. A Kruskal-Wallis test revealed that the groups differed significantly on heart rate at baseline with participants in the cognitive restructuring condition (Mean Rank = 41.85) having higher heart rates at baseline compared to participants in the interpretation training (Mean Rank = 34.08) and control conditions (Mean Rank = 22.91), $X^2(2) = 11.87$, $p < .01$. Given these baseline differences and the constraint of having to use nonparametric tests, a greater emphasis was place on examining within-group changes over time in heart rate compared to between-group differences. Three Friedman's tests were conducted (one for each condition) to examine the change in heart rate across the speech task. Given that three separate Friedman's tests were conducted, significance was set at $p = .017$ to account for the multiple comparisons and to prevent inflation of the Type I error rate. For both the interpretation training and control conditions, there was a statistically significant change in heart rate across time during the speech task, $X^2(3) = 16.34$, $p < .01$, and $X^2(3) = 38.84$, $p < .01$, respectively. In contrast, there was no

change in heart rate over time for the cognitive restructuring condition. For both the interpretation training and control conditions, posthoc analyses were conducted using a series of three Wilcoxon signed-rank tests with a Bonferroni correction applied, resulting in a significance level of $p = .017$. For the interpretation training condition, only the decrease in heart rate from speech (Median = 91.90, Range = 81.76 to 104.71) to recovery (Median = 78.52, Range = 71.33 to 92.55) was statistically significant, $Z = 2.83$, $p < .01$ although the increase in heart rate from baseline (Median = 70.84, Range = 81.94 to 91.05) to preparation (Median = 74.18, Range = 84.84 to 106.89) approached statistical significance, $Z = 2.25$, $p = .03$. For the control condition, the increase in heart rate from baseline (Median = 71.41, Range = 62.05 to 77.27) to preparation (Median = 76.19, Range = 70.89 to 92.55), and from preparation to speech (Median = 88.62, Range = 78.34 to 97.86) as well as the decrease in heart rate from speech to recovery (Median = 69.18, Range = 58.84 to 84.33) were all statistically significant, $Z = 2.95$, $p < .01$; $Z = 3.16$, $p < .01$; and $Z = 3.56$, $p < .01$, respectively.

48-hour Follow-up Analyses

Eighteen (75%) participants in the interpretation training condition, 19 (79%) participants in the cognitive restructuring condition, and 9 (38%) participants in the control condition completed the online 48-hour follow up questionnaires. The low number of participants in the control condition is a reflection of the fact that the 48-hour follow-up questionnaires were added after data collection had begun and the first few participants in the study were randomized to the control condition. Consequently, throughout the study, fewer participants in the control condition had the opportunity to complete the 48-hour follow-up questionnaires. Given the low sample sizes, analyses including the 48-hour follow-up data were conducted separately from the laboratory data analyses. As well, a greater emphasis was placed on examining effect sizes

rather than *p*-values to determine meaningful differences as effect sizes are not dependent on sample sizes. Moreover, greater emphasis was placed on within-group analyses rather than between-group analyses as it was decided that the uneven sample sizes and the small sample size in the control condition ($n = 9$) would limit meaningful interpretations of any findings.

Table 11 presents the demographic data for the participants included in the 48-hour follow-up analyses. Chi-square and one-way analysis of variance tests were conducted to examine group differences on demographic and baseline symptomatology variables (i.e., SPIN, and PRCS). All three one-way analyses of variance (i.e., age, SPIN, and PRCS as dependent variables and condition as the independent variable) revealed that Levene's test of homogeneity of variances was statistically significant, indicating that the assumption of homogeneity of variances was not met. Therefore, the Welch F-ratio was used to evaluate the significance of the analysis and the Games-Howell pairwise comparison procedure was used to test the significance of posthoc analyses. There were no significant differences between conditions on any of the demographic variables assessed. Although there were no differences between conditions on SPIN and PRCS scores at baseline, the chi-square revealed that there was a significant difference between groups on the percentage of participants meeting the diagnostic criteria for social anxiety, with fewer participants in the cognitive restructuring condition meeting diagnostic criteria compared to the interpretation training and control conditions, $X^2(2) = 6.26$, $p = .04$. As discussed previously, the fact that SCID diagnosis was a categorical variable, as well as the relative small number of participants for whom diagnostic criteria were not met on the SCID, precluded the incorporation of the SCID as a covariate or separate predictor in the analyses.

Table 11

Demographic Information and Inclusion Criteria for the 48-hour Follow-up Sample

	Interpretation Training (n = 18)	Cognitive Restructuring (n = 19)	Control (n = 9)
Sex	13 (72%) female, 5 (28%) male	16 (84%) female, 3 (16%) male	7 (78%) female, 2 (22%) male
Age	25.00 (5.00)	25.00 (7.00)	33 (14.00)
Ethnicity[1]			
White/European	12 (67%)	11 (58%)	7 (75%)
Asian	4 (22%)	5 (26%)	0
Aboriginal	0	0	1 (11%)
Black	1 (6%)	0	1 (11%)
Hispanic	0	1 (5%)	0
Biracial	1 (6%)	1 (5%)	0
Education Level			
High School	8 (44%)	12 (63%)	3 (33%)
College/University	8 (44%)	6 (32%)	4 (44%)
Graduate Level	2 (11%)	1 (6%)	2 (22%)
Enrolled in Educational Program[2]			
Yes	11 (61%)	14 (74%)	3 (33%)
No	6 (33%)	5 (26%)	6 (67%)

Table continued on next page

	Interpretation Training (n = 18)	Cognitive Restructuring (n = 19)	Control (n = 9)
Employment[2]			
Not working	6 (33%)	12 (63%)	4 (44%)
Part-Time Job	8 (44%)	7 (37%)	4 (44%)
Full-Time Job	3 (17%)	0	1 (11%)
Relationship Status[1]			
Single	13 (72%)	7 (37%)	3 (33%)
Long-term	4 (22%)	9 (47%)	3 (33%)
Married	0	2 (11%)	1 (11%)
Cohabiting	1 (6%)	1 (5%)	1 (11%)
Divorced	0	0	1 (11%)
Social Phobia on SCID-IV			
Yes	17 (94%)	12 (63%)	8 (89%)
No	1 (6%)	7 (37%)	1 (11%)
Baseline SPIN Score	43.00 (8.35)	38.95 (8.05)	47.44 (12.28)
Baseline PRCS Score	24.67 (3.07)	24.05 (4.28)	23.78 (7.31)

SCID-IV = *Structured Clinical Interview for DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996), SPIN = *Social Phobia Inventory* (Connor et al., 2000), PRCS = *Personal Report and Confidence as Speaker* (Paul, 1966)

[1]One participant in the cognitive restructuring condition did not answer this question.

[2]One participant in the interpretation training condition did not answer this question.

Between-Group Differences at Baseline. A series of one-way ANOVAs were conducted to determine whether there were any between-group differences on outcome measures at baseline. The groups did not differ on any of the outcome measures at baseline.

Question 1: Do the effects of a single-session interpretation training task or a single-session cognitive restructuring task generalize to self-report measures of interpretation biases in individuals with high levels of social anxiety? If so, are these changes maintained at a 48-hour follow-up assessment? It was hypothesized that there would be a significant decrease in the ASSIQ Social subscale scores from baseline to posttask in the cognitive restructuring and interpretation training conditions and that this decrease would be maintained at the 48-hour follow-up. It was not expected that ASSIQ Social scores would decrease significantly from baseline to posttask or from posttask to 48-hour follow-up in the control condition. It was predicted that these changes would be specific to the Social subscale of the ASSIQ and that there would be no changes for the ASSIQ Nonsocial subscale. Mean scores and standard deviations for the ASSIQ Social and ASSIQ Nonsocial subscales at baseline, posttask, and at 48-hour follow-up are presented by condition in Table 12. A series of two 3 (Condition: interpretation training, cognitive restructuring, control) by 3 (Time: baseline, posttask, 48-hour follow-up) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 12

Means and Standard Deviations of ASSIQ Scores at Baseline, Posttask, and 48-hour Follow-up Separated by Condition

	Interpretation Training (n = 18)	Cognitive Restructuring (n = 19)	Control (n = 9)
ASSIQ Social			
Baseline	31.53 (8.06)	30.74 (5.89)	30.22 (6.24)
Posttask	30.82 (8.07)	29.21 (7.86)	29.44 (7.50)
48-hour follow-up	29.82 (8.71)	26.74 (8.07)	28.11 (6.83)
ASSIQ Nonsocial[1]			
Baseline	12.47 (2.79)	12.29 (2.69)	13.11 (3.33)
Posttask	12.29 (3.27)	12.12 (3.04)	12.78 (2.99)
48-hour follow-up	12.41 (3.45)	12.00 (3.08)	12.67 (3.39)

ASSIQ = *Assumptions of Social Situations Questionnaire* (Stopa & Clark, 2000)

[1]One participant in the cognitive restructuring group did not have data for the ASSIQ Nonsocial subscale.

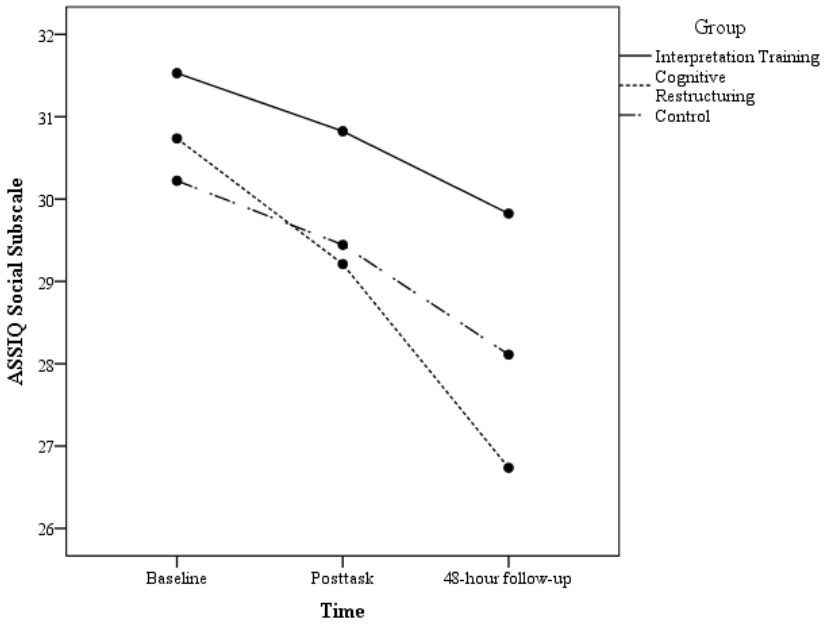
Mauchly's test indicated that the assumption of sphericity was violated for the ASSIQ Social subscale, $X^2(2) = 10.12$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .82$). There was a significant main effect of time for the ASSIQ Social subscale, $F(1.64,68.92) = 4,10$, $p = .03$, $\eta_p^2 = .09$. Planned contrasts revealed that, regardless of condition, ASSIQ Social scores at the 48-hour follow-up ($M = 28.22$, $SE = 1.28$) were significantly lower compared to ASSIQ Social scores at baseline ($M = 30.83$, $SE = 1.08$), $p = .05$ and that the difference in ASSIQ Social scores from posttask ($M = 29.83$, $SE = 1.24$) to 48-hour follow-up approached statistical significance with scores at the 48-hour follow-up being lower compared to scores at posttask, $p = .06$. There was neither a significant main effect of condition nor a significant condition by time interaction. However, planned contrasts revealed a statistically significant decrease in ASSIQ Social subscale scores from baseline ($M = 30.74$, $SD = 5.89$) to 48-hour follow-up ($M = 26.74$, $SD = 8.07$, $p = .04$, Cohen's $d = .78$) and from posttask ($M = 29.21$, $SD = 7.86$) to 48-hour follow-up ($p = .05$, Cohen's $d = .52$) in the cognitive restructuring condition only. There were no statistically significant changes in ASSIQ Social scores from baseline to posttask and from posttask to 48-hour follow-up in the interpretation training (Cohen's $d = .1$ and .26, respectively) or control conditions (Cohen's d = .16 and .36, respectively; see Figure 14A).

There were no significant main effects of Condition or Time and no significant Condition by Time interaction for the ASSIQ Nonsocial scores. Planned contrasts did not reveal any significant changes in ASSIQ Nonsocial scores from baseline to posttask or from posttask to the 48-hour follow-up for any of the groups (Cohen's d ranged from .02 to .06 for the interpretation training condition, .05 to .23 for the cognitive restructuring condition, and .11 to .24 for the control condition; see Figure 14B).

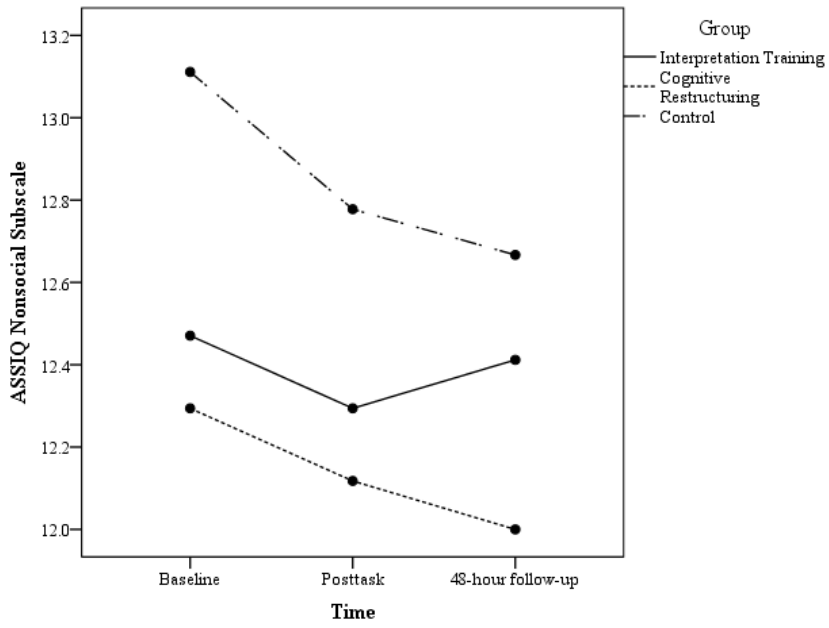
Figure 14

Mean Assumptions of Social Situations Interpretation Questionnaire (ASSIQ) Social (A) and Nonsocial (B) Subscale Scores from Baseline to Post-Speech to 48-hour Follow-up Separated by Condition

(A)



(B)



Question 2: Does a single-session interpretation training task or a single-session cognitive restructuring task lead to reductions in social anxiety symptoms in an analogue social anxiety sample? If so, are these changes maintained at a 48-hour follow-up assessment? It was predicted that there would be a significant decrease in SPIN (Connor et al., 2000) scores and in anticipatory anxiety and avoidance scores for future social situations from baseline to posttask in the interpretation training and cognitive restructuring conditions but not in the control condition and that this decrease would be maintained at the 48-hour follow-up. Mean scores and standard deviations for the SPIN and anticipatory anxiety and avoidance scores are presented in Table 13. Two 3 (Condition: interpretation training, cognitive restructuring, control) by 3 (Time: baseline, posttask, 48-hour follow-up) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 13

Means and Standard Deviations for Social Anxiety Symptomatology and Anticipatory Anxiety and Avoidance of Social Situations at Baseline, Posttask, and 48-hour Follow-up Separated by Condition

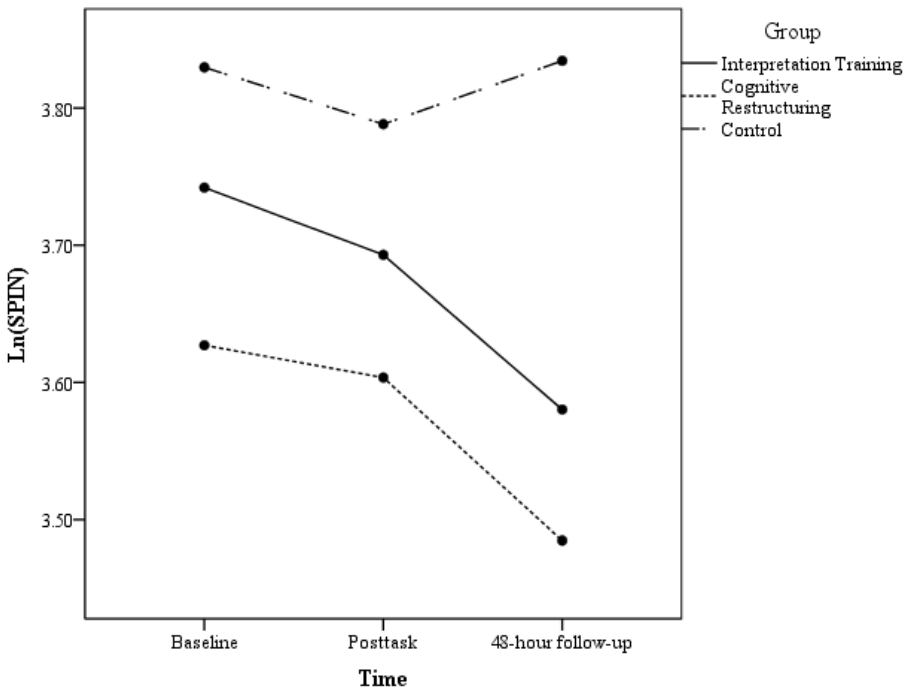
	Interpretation Training (n = 18)	Cognitive Restructuring (n = 19)	Control (n = 9)
SPIN			
Baseline	43 (8.35)	38.95 (8.05)	47.44 (12.28)
Posttask	41.50 (10.08)	37.37 (8.75)	45.44 (11.51)
48-hour follow-up	37.39 (10.58)	33.53 (11.48)	47.33 (10.97)
Anxiety			
Baseline	20.17 (4.41)	18.79 (4.20)	21.33 (5.72)
Posttask	20.44 (4.77)	18.58 (5.14)	23.44 (5.64)
48-hour follow-up	19.83 (4.85)	17.37 (7.17)	22.89 (6.31)
Avoidance			
Baseline	18.83 (4.84)	16.47 (5.04)	20.89 (6.17)
Posttask	20.28 (4.35)	17.84 (6.82)	24 (7.86)
48-hour follow-up	18.44 (5.07)	15.32 (7.62)	23.44 (6.54)

SPIN = *Social Phobia Inventory* (Connor et al., 2000)

Levene's test of equality of error variances was statistically significant for the baseline SPIN scores, $F(2,42) = 3.36$, $p = .05$. An examination of the variances revealed that the control condition had the largest variance as well as the smallest sample size. According to Tabachnick & Fidell (2007) when the Levene's test is statistically significant with unequal sample sizes and the smallest group has the highest error variance, Type I error rates for between-group analyses are inflated making any statistically significant findings too liberal. Given that the analyses did indicate a significant effect of condition, a natural log transformation was applied to the baseline, posttask, and 48-hour follow-up SPIN scores, which corrected the heterogenentiy of error variances. There was a significant main effect of condition for scores on the SPIN, $F(2,42) = 3.87$, $p = .03$, $\eta_p^2 = .16$. Planned contrasts revealed that, regardless of time, the cognitive restructuring condition ($M = 3.57$, $SE = .05$) had significantly lower SPIN scores compared to the control condition ($M = 3.82$, $SE = .07$), $p = .03$. The main effect of time was also statistically significant, $F(2,84) = 3.15$, $p = .05$, $\eta_p^2 = .07$. Planned contrasts revealed that, regardless of condition, the difference in SPIN scores at baseline ($M = 3.73$, $SE = .04$) and at the 48-hour follow-up ($M = 3.63$, $SE = .05$) approached statistical significance with scores at baseline being higher compared to scores at the 48-hour follow-up, $p = .07$. There was no significant interaction of condition by time. Planned contrasts revealed that the decrease in SPIN scores from baseline ($M = 3.74$, $SD = .21$) to 48-hour follow-up ($M = 3.58$, $SD = .30$) was statistically significant in the interpretation training condition only, $p = .04$, Cohen's $d = .56$. In the cognitive restructuring condition, the decrease in SPIN scores from baseline ($M = 3.63$, $SD = .23$) to 48-hour follow-up ($M = 3.48$, $SD = .32$) approached statistical significance, $p = .09$, Cohen's $d = .54$. There were no significant changes in SPIN scores across time in the control condition (Cohen's d ranged from .03 to .41; see Figure 15).

Figure 15

Mean Social Phobia Inventory (SPIN) Scores from Baseline to Posttask to 48-Hour Follow-up Separated by Condition

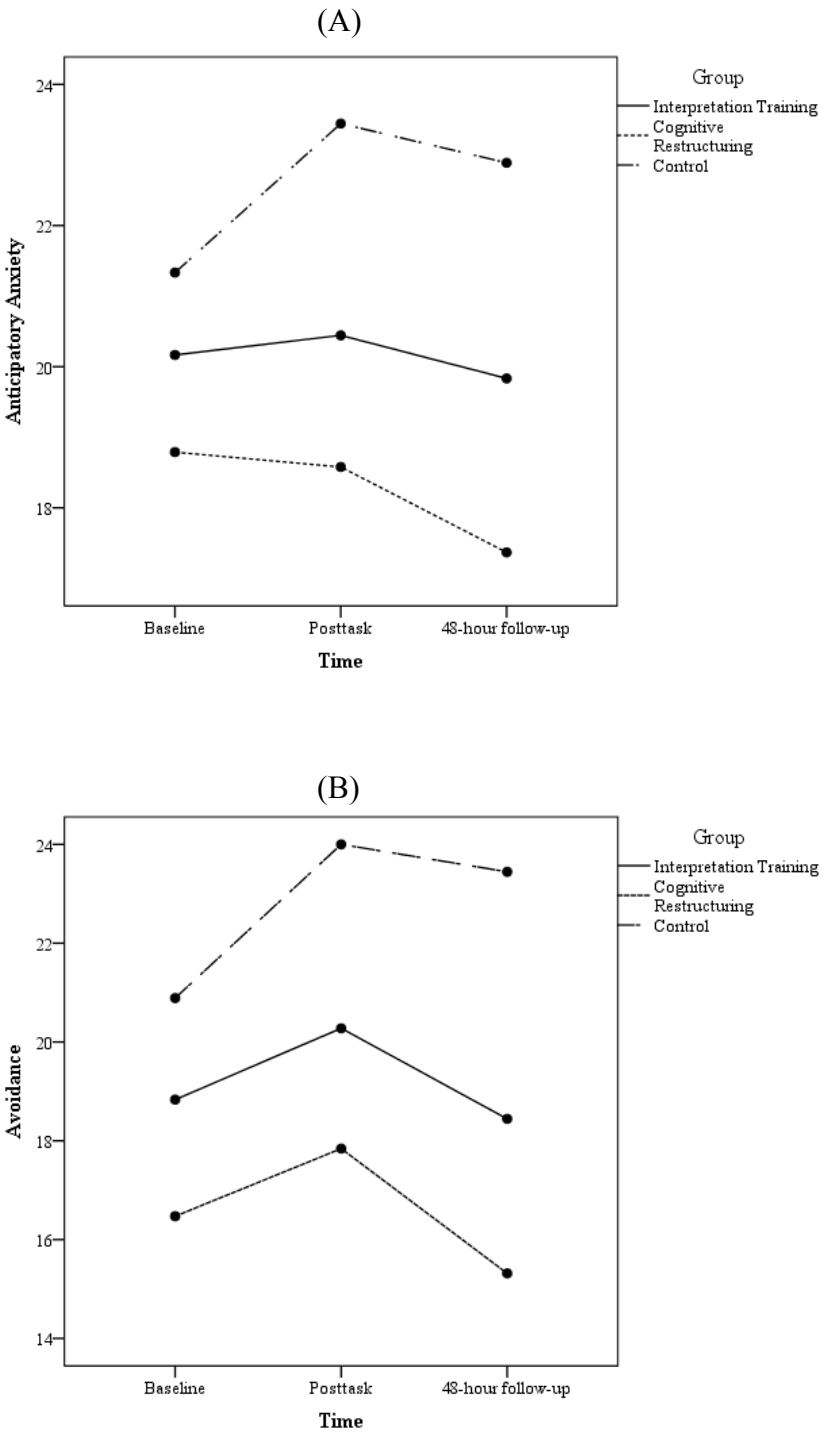


Mauchly's test indicated that the assumption of sphericity was violated for the anticipatory anxiety measure, $X^2(2) = 20.63$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .72$). The main effect of Condition approached statistical significance, $F(2,43) = 2.61$, $p = .09$, $\eta_p^2 = .11$. Planned contrasts revealed that, regardless of time, the difference in anticipatory anxiety scores between the cognitive restructuring ($M = 18.25$, $SE = 1.08$) and control conditions ($M = 22.56$, $SE = 1.57$) approached statistical significance, $p = .09$. There was no significant main effect of time and no significant condition by time interaction for anticipatory anxiety about future social situations. However, planned contrasts revealed that the change in anticipatory anxiety from baseline to posttask approached statistical significance in the control condition only, $p = .08$, Cohen's $d = .93$. Participants in the control condition reported a large increase in their anticipatory anxiety about future social situation from baseline ($M = 21.33$, $SD = 5.72$) to posttask ($M = 23.44$, $SD = 5.64$) and a small decrease in anticipatory anxiety from posttask to 48-hour follow-up ($M = 22.89$, $SD = 6.31$, $p = 1$, Cohen's $d = .12$). As well, although the changes in anticipatory anxiety were not statistically significant across time for the interpretation training condition, the direction of change from baseline to posttask was not in the predicted direction such that self-reported anticipatory anxiety increased from baseline ($M = 20.17$, $SD = 4.41$) to posttask ($M = 20.44$, $SD = 4.77$, $p = 1$, Cohen's $d = .12$) and decreased from posttask to 48-hour follow-up ($M = 19.83$, $SD = 4.85$) in the interpretation training condition, $p = 1$, Cohen's $d = .12$. The change in anticipatory anxiety about future social situations from baseline ($M = 18.79$, $SD = 4.20$) to posttask ($M = 18.58$, $SD = 5.13$) was negligible in the cognitive restructuring condition ($p = 1$, Cohen's $d = .04$) and the decrease from posttask to 48-hour follow-up ($M = 17.37$, $SD = 7.17$) had a small effect size, $p = .77$, Cohen's $d = .33$, see Figure 16A.

There were statistically significant main effects of time and condition for self-reported avoidance of future social situations, $F(2,86) = 4.52$, $p < .01$, $\eta_p^2 = .10$ and $F(2,43) = 4.14$, $p = .02$, $\eta_p^2 = .16$, respectively. Planned contrasts revealed that, regardless of condition, avoidance scores were significantly lower at the 48-hour follow-up ($M = 19.07$, $SE = 1.02$) compared to posttask ($M = 20.71$, $SE = .97$), $p < .01$. Planned contrasts also revealed that, regardless of time, avoidance scores were significantly lower in the interpretation training condition ($M = 16.54$, $SE = 1.24$) compared to the control condition ($M = 22.78$, $SE = 1.80$), $p = .02$. There was no significant condition by time interaction. However, planned contrasts revealed that for all three conditions, the avoidance scores increased from baseline to posttask. The increase in avoidance scores from baseline ($M = 18.83$, $SD = 4.84$) to posttask ($M = 20.28$, $SD = 4.35$) for the interpretation training condition had a small effect size, $p = .40$, Cohen's $d = .46$. Similarly, the increase in avoidance scores from baseline ($M = 16.47$, $SD = 5.04$) to posttask ($M = 17.84$, $SD = 6.82$) for the cognitive restructuring condition had a small effect size, $p = .43$, Cohen's $d = .35$. In contrast, the increase in avoidance scores from baseline ($M = 20.89$, $SD = 6.17$) to posttask ($M = 24.0$, $SD = 7.86$) in the control condition had a medium effect size that approached statistical significance, $p = .07$, Cohen's $d = .69$. Planned contrasts revealed that in all three conditions avoidance scores decreased from posttask to 48-hour follow-up. The decrease in avoidance scores from posttask to 48-hour follow-up ($M = 15.32$, $SD = 7.62$) approached statistical significance in the cognitive restructuring condition only, $p = .08$, Cohen's $d = .47$. The decrease in avoidance scores from posttask to 48-hour follow-up had a small effect size for both the interpretation training ($M = 18.44$, $SD = 5.07$, $p = .32$, Cohen's $d = .48$) and control ($M = 23.44$, $SD = 6.54$, $p = 1$, Cohen's $d = .12$) conditions (see Figure 16B).

Figure 16

Mean Anticipatory Anxiety (A) and Avoidance (B) Scores from Baseline to Posttask to 48-hour Follow-Up Separated by Condition



Question 3: Do the effects of a single-session interpretation training task and a single-session cognitive restructuring task generalize to changes in cognitive factors associated with social anxiety, including fear of negative evaluation, thoughts about one's performance in social situations, and the probability and cost of negative social situations, in a sample of individuals with high levels of social anxiety? If so, are these changes maintained at a 48-hour follow-up assessment? It was hypothesized that scores on the BFNE (Leary, 1983), STABS (Turner et al., 2003) and SPCQ (McManus et al., 2000) questionnaires would decrease significantly from baseline to posttask in the interpretation training and cognitive restructuring conditions but not in the control condition and that this decrease would be maintained at the 48-hour follow-up. Mean scores and standard deviations for the BFNE, STABS, SPCQ Probability, and SPCQ Cost subscales are presented in Table 14. A series of four 3 (Condition: interpretation training, cognitive restructuring, control) by 3 (Time: baseline, posttask, 48-hour follow-up) mixed analyses of variance were conducted. Statistical significance was set at $p < .05$. Again, Bonferroni-corrected planned contrasts were conducted regardless of whether the mixed analyses of variance revealed significant interactions or significant main effects.

Table 14

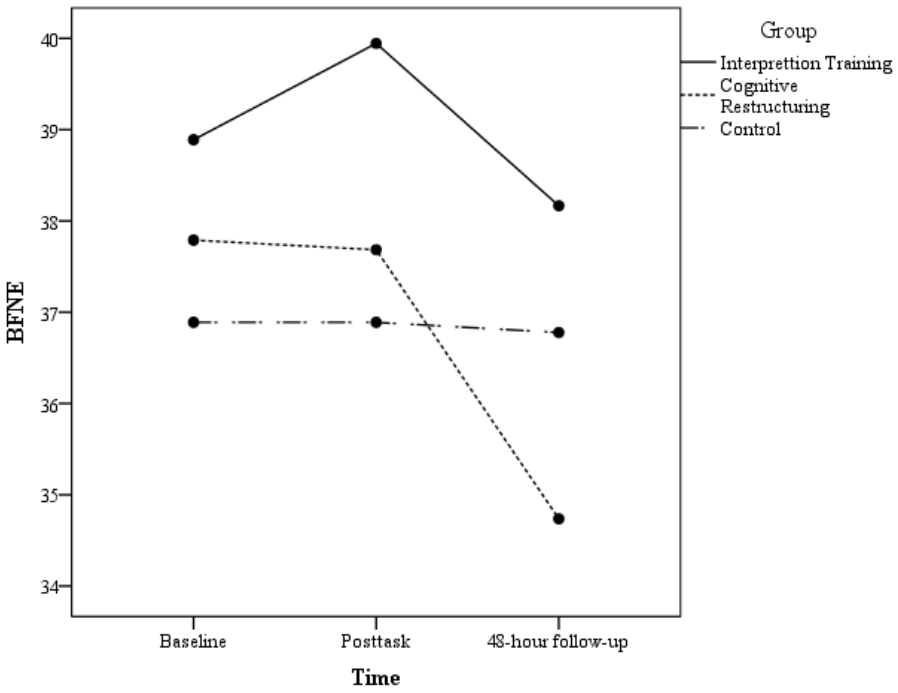
Means and Standard Deviations of BFNE, STABS, and SPCQ Scores at Baseline, Posttask, and 48-hour Follow-up Separated by Condition

	Interpretation Training (n = 18)	Cognitive Restructuring (n = 19)	Control (n = 9)
BFNE			
Baseline	38.89 (3.41)	37.79 (3.52)	36.89 (7.37)
Posttask	39.94 (4.62)	37.68 (4.64)	36.89 (7.79)
48-hour follow-up	38.17 (5.02)	34.74 (7.09)	36.78 (5.43)
STABS			
Baseline	80.00 (8.65)	74.21 (12.46)	81.56 (14.14)
Posttask	80.56 (10.26)	74.79 (13.94)	81.78 (15.02)
48-hour follow-up	74.17 (11.58)	65.32 (17.25)	79.56 (13.64)
SPCQ Probability			
Baseline	1976.26 (504.72)	1858.25 (557.74)	1943.60 (712.65)
Posttask	2102 (546.89)	1811.60 (580.81)	1848.10 (753.63)
48-hour follow-up	1784.79 (680.29)	1573.70 (823.87)	1725.70 (884.87)
SPCQ Cost			
Baseline	2176.44 (461.85)	2162.05 (513.07)	2203.78 (568.18)
Posttask	2190.56 (477.76)	2005.79 (505.63)	2122.78 (594.50)
48-hour follow-up	2024.40 (507.99)	1825.16 (680.55)	2178.89 (703.85)

Levene's test of equality of error variances was statistically significant for the baseline BFNE scores, $F(2,43) = 7.32$, $p < .01$. An examination of the variances revealed that the control group had the largest variance as well as the smallest sample size. According to Tabachnick & Fidell (2007) when the Levene's test is statistically significant with unequal sample sizes and the smallest group has the highest error variance, Type I error rates for between-group analyses are inflated making any statistically significant findings too liberal. However, under these conditions, null findings are valid. Given that the analyses did not reveal any significant effects of group, no transformations to reduce heterogeneity of variances were applied to the data as, under these conditions, the between-group analyses are valid. There was no significant main effect of time or condition for BFNE scores and no significant condition by time interaction. However, planned contrasts revealed that, although BFNE scores did not decrease significantly from baseline ($M = 37.79$, $SD = 3.52$) to posttask ($M = 37.68$, $SD = 4.64$, $p = 1$, Cohen's $d = .03$) in the cognitive restructuring condition, the change in BFNE scores from posttask to 48-hour follow-up ($M = 34.74$, $SD = 7.09$) in the cognitive restructuring condition approached statistical significance, $p = .06$, Cohen's $d = .72$, see Figure 17. Although there were no other significant changes in BFNE scores across time, the change in BFNE scores from baseline to posttask in the interpretation training condition was not in the expected direction. Participants in the interpretation training condition reported an increase in BFNE scores from baseline ($M = 38.89$, $SD = 3.41$) to posttask ($M = 39.94$, $SD = 4.62$) with a small effect size ($p = .98$, Cohen's $d = .22$) and a decrease in BFNE scores from posttask to 48-hour follow-up ($M = 38.17$, $SD = 5.02$), again with a small effect size, $p = .48$, Cohen's $d = .32$. The changes in BFNE scores in the control condition over time had negligible effect sizes (i.e., Cohen $d < .1$).

Figure 17

Mean Brief Fear of Negative Evaluation (BFNE) Scores from Baseline to Posttask to 48-hour Follow-up Separated by Condition

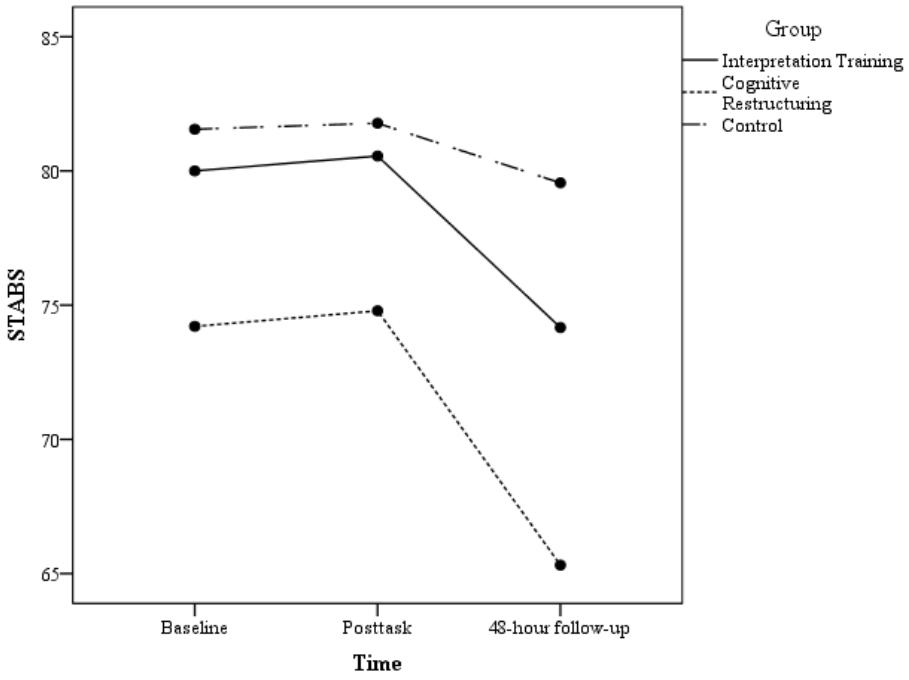


Mauchly's test indicated that the assumption of sphericity was violated for the STABS scores, $X^2(2) = 16.06$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .76$). There was a significant main effect of time for STABS scores, $F(1.52, 65.26) = 8.33$, $p < .01$, $\eta_p^2 = .16$. Planned contrasts revealed that, regardless of condition, STABS scores were significantly lower at the 48-hour follow-up (M = 73.01, SE = 2.27) compared to baseline (M = 78.59, SE = 1.79) and posttask (M = 79.04, SE = 2.01), $p = .01$ and $p < .01$, respectively. The main effect of Condition approached statistical significance, $F(2,43) = 2.67$, $p = .08$, $\eta_p^2 = .11$. Planned contrasts did not reveal any significant group differences regardless of time. There was no significant interaction of condition by time for STABS scores. However, planned contrasts revealed that, although there were no changes in STABS scores in the cognitive restructuring condition from baseline (M = 74.21, SD = 12.46) to posttask (M = 74.79, SD = 13.94, $p = 1$, Cohen's $d = .07$), there was a statistically significant decrease in STABS scores from posttask to 48-hour follow-up (M = 65.32, SD = 17.25) in the cognitive restructuring condition only, $p < .01$, Cohen's $d = .69$. There was also a statistically significant decrease in STABS scores from baseline (M = 74.21, SD = 12.46) to 48-hour follow-up in the cognitive restructuring condition, $p < .01$, Cohen's $d = .70$. In the interpretation training condition, the change in STABS scores from posttask (M = 80.56, SD = 10.26) to 48-hour follow-up (M = 74.17, SD = 11.58) approached statistical significance, $p = .09$, Cohen's d = .60. The changes in STABS scores from baseline (M = 80, SD = 8.65) to posttask ($p = 1$, Cohen's $d = .10$) and from baseline to 48-hour follow-up ($p = .13$, Cohen's $d = .48$) were not statistically significant and were associated with small effect sizes in the interpretation training condition. The change in STABS scores from baseline (M = 81.56, SD = 14.14) to posttask (M = 81.78, SD = 15.02) in the control condition had a negligible effect size (Cohen's $d = .04$) and the

change in STABS scores from posttask to 48-hour follow-up (M = 79.56, SD = 13.46) in the control condition was associated with a small effect size (Cohen's d = .25) and was not statistically significant (p = 1); see Figure 18.

Figure 18

Mean Social Thoughts and Behaviors Scale (STABS) Scores from Baseline to Posttask to 48-hour Follow-up Separated by Condition



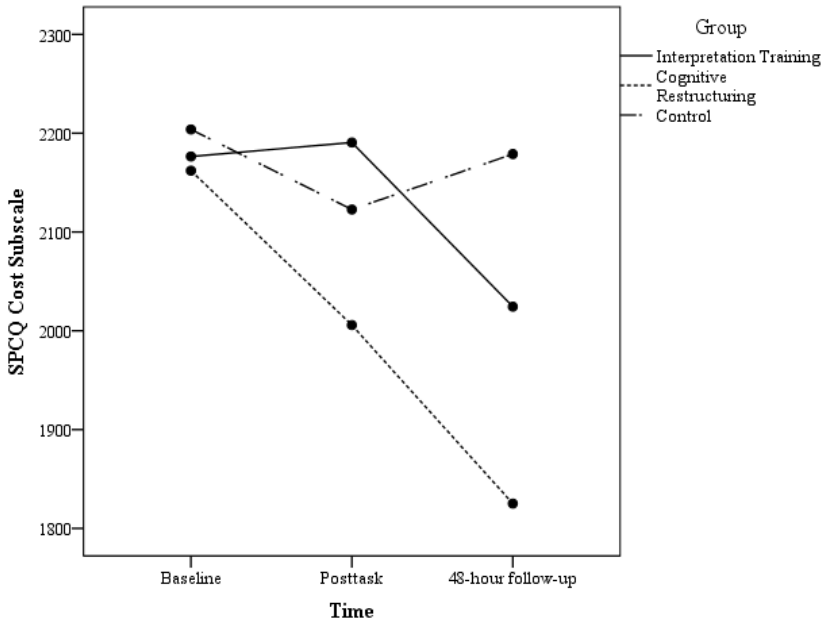
Mauchly's test indicated that the assumption of sphericity was violated for the SPCQ Probability subscale, $X^2(2) = 10.11$, $p < .01$. Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .83$). There was a significant main effect of time for the SPCQ Probability subscale, $F(1.67,76.59) = 7.99$, $p < .01$, $\eta_p^2 = .15$. Planned contrasts revealed that, regardless of condition, SPCQ Probability scores were significantly lower at the 48-hour follow-up ($M = 1694.73$, $SE = 117.64$) compared to baseline ($M = 1926.04$, $SE = 85.87$) and posttask ($M = 1920.57$, $SE = 90.96$), $p < .01$ for both analyses. There was no significant main effect of condition and no significant condition by time interaction. However, planned contrasts revealed a small effect size for the increase in SPCQ Probability scores from baseline ($M = 1976.26$, $SD = 504.72$) to posttask ($M = 2102$, $SD = 546.89$) in the interpretation training condition, $p = .30$, Cohen's $d = .42$. Analyses also revealed a statistically significant decrease in SPCQ Probability scores from posttask to 48-hour follow-up ($M = 1784.79$, $SD = 680.29$) in the interpretation training condition only, $p = .02$, Cohen's $d = .70$. The change in SPCQ Probability scores from posttask ($M = 1811.60$, $SD = 580.81$) to 48-hour follow-up ($M = 1573.7$, $SD = 823,87$) approached statistical significance in the cognitive restructuring condition, $p = .09$, Cohen's $d = .82$. As well, the difference between baseline and 48-hour follow-up scores was statistically significant only in the cognitive restructuring condition ($p = 04$, Cohen's $d = .75$) and not in the interpretation training condition, $p = .29$, Cohen's $d = .40$. There was a small decrease in SPCQ Probability scores from baseline ($M = 1943.60$, $SD = 712.65$) to posttask ($M = 1848.10$, $SD = 753.63$) and from posttask to 48-hour follow-up ($M = 1725.70$, $SD = 884.87$) in the control condition ($p = 1$ for both analyses, Cohen's $d = .28$ and .40, respectively). The change in SPCQ Probably scores from baseline to 48-hour follow-up in the control condition revealed a small to medium effect size ($p = 1$, Cohen's $d = .49$, see Figure 19A).

There was a significant main effect of Time for scores on the SPCQ Cost subscale, $F(2,86) = 5.50$, $p < .01$, Cohen's $d = .11$. Planned contrasts revealed that, regardless of condition, SPCQ Cost scores were significantly higher at baseline ($M = 2180.76$, $SE = 78.76$) compared to the 48-hour follow-up ($M = 2009.48$, $SE = 97.24$), $p = .01$. There was no significant main effect of Condition and no significant Condition by Time interaction for scores on the SPCQ Cost subscale. However, planned contrasts revealed that the decrease in SPCQ Cost scores from posttask ($M = 2005.79$, $SD = 505.63$) to 48-hour follow-up ($M = 1825.16$, $SD = 680.55$) was statistically significant in the cognitive restructuring condition only, $p = .05$, Cohen's $d = .60$. Moreover, the decrease in SPCQ Cost scores from baseline ($M = 2162.05$, $SD = 513.07$) to 48-hour follow-up was also statistically significant in the cognitive restructuring condition, $p < .01$, Cohen's $d = 1.32$. The decrease in SPCQ Cost scores from posttask ($M = 2190.56$, $SD = 477.76$) to 48-hour follow-up ($M = 2024.40$, $SD = 507.99$) approached statistical significance in the interpretation training condition, $p = .09$, Cohen's $d = .53$. However, the change in SPCQ Cost scores from baseline ($M = 2176.44$, $SD = 461.85$) to 48-hour follow-up was not statistically significant in the interpretation training condition, $p = .25$, Cohen's $d = .14$. There was a small decrease in SPCQ Cost scores from baseline ($M = 2203.78$, $SD = 568.18$) to posttask ($M = 2122.78$, $SD = 594.50$) followed by a small increase from posttask to the 48-hour follow-up ($M = 2178.89$, $SD = 703.85$) in the control condition, $p = 1$ for both comparisons, Cohen's $d = .31$ and .26, respectively. The change in SPCQ Cost scores from baseline to 48-hour follow-up in the control condition was negligible, $p = 1$, Cohen's $d = .09$, see Figure 19B.

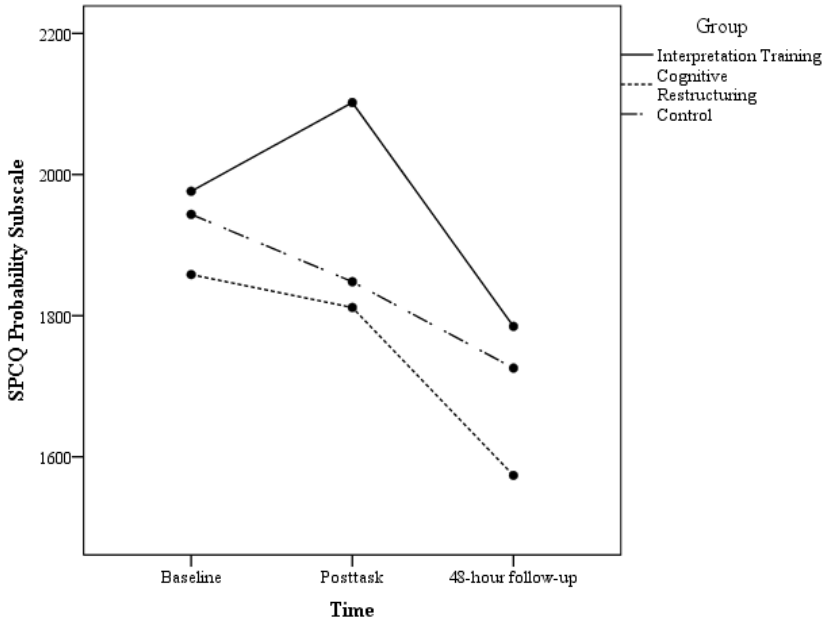
Figure 19

Mean Social Probability and Cost Questionnaires (SPCQ) Probability (A) and Cost (B) Subscale Scores from Baseline to Posttask to 48-hour Follow-up Separated by Condition

(A)



(B)



1-week Follow-up

Given the small number of participants who completed both the 48-hour and 1-week follow-up questionnaires (14 in the interpretation training condition, 12 in the cognitive restructuring condition, and 8 in the control condition), the 1-week follow-up data was not analyzed as the small sample size precluded the identification of any meaningful findings.

Discussion

Summary and Interpretation of Results

Given that interpretation biases have been theorized to play a role in the maintenance of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997), the purpose of the current study was to investigate the effects of modifying interpretation biases on self-reported, behavioural, and physiological measures of anxiety during a self-presentation task in an analogue social anxiety sample. Furthermore, the present study sought to evaluate the longevity of the effects of modifying interpretation biases through a 48-hour follow-up as well as to compare the effects of two different approaches for modifying interpretation biases: 1) computer-based interpretation training; and 2) cognitive restructuring.

The interpretation training procedure developed by Mathews and Mackintosh (2000) successfully trained a positive interpretation bias in the interpretation training condition. Specifically, participants in the interpretation training condition were slower at solving negative word fragments compared to positive word fragments. As well, training-congruent changes were observed on a posttraining recognition test during which participants were presented with new ambiguous social scenarios and were asked to endorse various positive and negative possible interpretations and foils for the scenarios. Participants in the interpretation training condition endorsed significantly more positive possible interpretations compared to negative possible interpretations while participants in the cognitive restructuring condition endorsed significantly more negative possible interpretations compared to positive possible interpretations. Participants in the control condition were equally likely to endorse the positive and negative possible interpretations. There were no within or between-group differences on the endorsement of positive and negative foils, which illustrates that the training effects were specific and did not

just result in a general tendency to interpret new information positively, regardless of the plausibility of the suggested interpretations.

Consistent with previous research, there were no reaction time differences for solving positive and negative word fragments in the control condition (Salemink et al., 2009, 2010). This pattern of results is contrary to what would be expected given that research has consistently shown that individuals with social anxiety evidence a negative interpretation bias. Salemink and colleagues (2008) have suggested that the lack of a clear negative interpretation bias in the control condition may be a reflection of the structure of the control task. Specifically, for participants in the control condition, the ambiguous social situations are disambiguated in a negative direction 50% of the time and in a positive direction the other 50% of the time. Consequently, participants in the control condition still gain exposure to positive interpretations of ambiguous social situations and this exposure most likely underlies the lack of reaction time differences between the positive and negative word fragments. However, this exposure is not sufficient to generalize to the recognition task during which individuals are asked to endorse positive or negative possible interpretations or foils for new ambiguous social situations.

Participants in the cognitive restructuring condition did not show any evidence of a positive interpretation bias as assessed through the recognition task developed by Mathews and Mackintosh (2000). In fact, participants in the cognitive restructuring condition showed a negative interpretation bias in that they were more likely to endorse negative possible interpretations for the social scenarios rather than positive possible interpretations. As discussed below, this pattern of findings may be a reflection of the different levels of interpretation biases that were targeted by the computer-based interpretation training procedure and the cognitive restructuring task. Specifically, the interpretation training procedure used an implicit approach

to modify interpretation biases while the cognitive restructuring task used an explicit approach and the recognition task assessed implicit interpretation biases.

The present study examined the effects of interpretation training and cognitive restructuring on: 1) changes in self-report measures of interpretation biases; 2) changes in social anxiety symptomatology; 3) changes in cognitive processes associated with social anxiety; 4) self-reported state anxiety and subjective distress during a speech task; 5) objective behavioural ratings of performance during a speech task; and 6) psychophysiological reactivity (i.e., heart rate and skin conductance) during a speech task. Although the analyses revealed a number of statistically significant main effects of time, the results failed to reveal the expected condition by time interactions that were hypothesized. However, given that the present study had a priori hypotheses, planned comparisons were also conducted regardless of whether the main effects of condition or condition by time interactions were statistically significant. A summary of the planned comparison results is presented in Table 15.

Table 15

Summary of study results

	Laboratory Visit	48-hour follow-up
PANAS		
Positive	All conditions: decrease from BS to PT and BS to PS	N/A
Negative	All conditions: decrease from BS to PT, increase from PT to PS	N/A
STICSA		
Cognitive	IT: decrease from BS to PT, increase from PT to PS	N/A
Somatic	All conditions: decrease from BS to PT, increase from PT to PS	N/A
ASSIQ		
Social	CR: decrease from BS to PT	CR: decrease from BS to FU, PT to FU
Nonsocial	No changes	No changes
SPIN	Control: decrease from BS to PT	IT: decrease from BS to FU
Situations		
Anxiety	Control: decrease from BS to PT	No changes
Avoidance	IT and Control: increase from BS to PT	No changes
BFNE	IT: increase from BS to PT	No changes
STABS	No changes	CR: decrease from PT to FU, BS to FU
SPCQ		
Probability	IT: increase from BS to PT	CR: decrease from BS to FU, IT: decrease from PT to FU
Costs	No changes	CR: decrease from PT to FU, BS to FU

Table continued on next page

	Laboratory Visit	48-hour follow-up
SUDS	All conditions: increase from baseline to preparation, baseline to speech, decrease from speech to recovery	N/A
TQ		
Negative	No group differences	N/A
Positive	No group differences	N/A
PSP Self Report	No group differences	N/A
PSP Observer	CR: lower than IT	N/A
Skin Conductance	All conditions: increase from baseline to preparation and from preparation to speech	N/A
Heart Rate	IT: decrease from speech to recovery; CR: no change; Control: increase from baseline to preparation, preparation to speech, decrease from speech to recovery	N/A

BS = Baseline, PT = Posttask, PS = Postspeech, IT = Interpretation Training Condition, CR = Cognitive Restructuring Condition

Participants in all three conditions (i.e., interpretation training, cognitive restructuring, and control) reported a significant decrease in state anxiety and in overall negative state affect from baseline to posttask. However, an examination of effect sizes revealed that the effect size for the decrease in state anxiety and state negative affect from baseline to posttask was large for both the interpretation training and cognitive restructuring conditions and medium for the control condition, although there were no significant differences between conditions at posttask on state anxiety or state negative affect. The general pattern that participants reported decreases in state anxiety and overall negative affect from baseline to posttask may reflect the fact that the baseline measure of state anxiety and state negative affect was completed at the beginning of the laboratory visit so it most likely captured the participants' anticipatory anxiety about the laboratory visit. However, as participants engaged in the laboratory visit and became more familiar with the experimenter, their state anxiety and state negative affect may have decreased. The fact that state negative affect and state anxiety for the control condition appears to have decreased less than that of the interpretation training and cognitive restructuring conditions may be due to the differences between the tasks that participants in the three conditions completed. The control task may have potentially been more challenging than the interpretation training task because 50% of the scenarios were disambiguated in a positive direction while the other 50% were disambiguated in a negative direction. Therefore, unlike in the interpretation training condition where participants learned over trials to generate positive interpretations for the scenarios to solve the word fragments, participants in the control condition may have had more difficulty correctly solving the word fragments as they switched between positive and negative interpretations, thus resulting in less of a decrease in state anxiety and state negative affect at posttask. Future qualitative research should aim to better understand the self-reported

experiences of participants completing the Mathews and Mackintosh (2000) interpretation training task.

One empirical question that has received minimal focus in the literature is the generalizability of the effects of computer-based interpretation training. Given that the tasks used to train and assess interpretation biases are very similar, there is the question of whether participants are merely learning a specific pattern of responding to the tasks rather than actually learning a new way of thinking about ambiguous social situations. In order to assess the generalizability of interpretation training, participants completed the ASSIQ (Stopa & Clark, 2000), a self-report measure that involved reading ambiguous social and nonsocial scenarios followed by three possible interpretations (i.e., negative, positive, neutral) and ranking the likelihood that each interpretation would come to mind.

Only participants in the cognitive restructuring condition exhibited a significant decrease in negative interpretations of new ambiguous social scenarios from baseline to posttask as well as from posttask to 48-hour follow-up, although there were no significant between-group differences at posttask or 48-hour follow-up on the questionnaire. Participants in the interpretation training condition did not evidence any changes in negative interpretations of new ambiguous social scenarios across time, despite showing training effects on the Mathews and Mackintosh (2000) recognition task. A number of previous studies using the ASSIQ (Stopa & Clark, 2000) and a single-session interpretation training procedure have found a similar pattern of results (Fu et al., 2013; Salemink et al., 2009), bringing into question what is actually being learned during interpretation training and the transferability of the interpretation training to other contexts. However, the present study adds to the literature by also including a single-session cognitive restructuring condition and assessing the generalizability of the effects of cognitive

restructuring to both the ASSIQ (Stopa & Clark, 2000) as well as the Mathews and Mackintosh (2000) recognition task.

Despite the fact that participants in the cognitive restructuring task evidenced a decrease in negative interpretation biases as assessed by the self-report questionnaire, there was no evidence of trained interpretation biases as assessed by the Mathews and Mackintosh (2000) recognition task. Therefore, it is possible that the apparent lack of generalizability may be a reflection of the way in which interpretation biases are assessed. A measure such as the ASSIQ (Stopa & Clark, 2000) provides an assessment of explicit interpretation biases. In contrast, a computer-based assessment of interpretation biases, such as the recognition task developed by Mathews and Mackintosh (2000) provides an implicit assessment of interpretation biases. Similarly, the computer interpretation training modifies interpretation biases at an implicit level while cognitive restructuring modifies interpretation biases at an explicit level. Therefore, it is possible that cognitive restructuring and interpretation training are modifying interpretation biases at different levels and that a single-session of interpretation training or cognitive restructuring is not sufficient to generalize to a different level of interpretation biases (i.e., implicit or explicit). This idea is consistent with recent studies using multiple-session interpretation training procedures that have found that the effects of interpretation training generalize to explicit self-report measures of interpretation biases after between 4 to 8 sessions of interpretation training (Bowler et al., 2012; Mathews et al., 2007). Therefore, it is possible that a higher "dosage" of interpretation training is necessary in order to generalize to explicit measures of interpretation biases. Given that this is the first study to compare the effects of interpretation training and cognitive restructuring on a computer-based implicit measure of interpretation biases, the present findings and interpretations need to be considered tentative and there is a need

for future studies to replicate the present findings as well as continue to better understand the necessary criteria for trained interpretation biases to generalize to different contexts.

The present study used two approaches to assess changes in social anxiety symptoms: 1) the *Social Phobia Inventory* (SPIN: Connor et al., 2000), a self-report measure of cognitive and behavioural symptoms of social anxiety; and 2) ratings of anticipatory anxiety and avoidance of various social situations. With regard to the SPIN (Connor et al., 2000), the present study found that while there were no significant changes from baseline to posttask in the interpretation training and cognition restructuring conditions on the SPIN (Connor et al., 2000), both the interpretation training and cognitive restructuring conditions showed a medium sized decrease on SPIN (Connor et al., 2000) scores from posttask to 48-hour follow-up with this decrease being statistically significant in the interpretation training condition and approaching statistical significant in the cognitive restructuring condition. Unexpectedly, scores on the SPIN (Connor et al., 2000) increased significantly from baseline to posttask in the control condition, although this increase had a small effect size and was not associated with significant group differences at posttask. With regard to ratings of anticipatory anxiety and avoidance, there were no significant changes in anticipatory anxiety over time in the interpretation training and cognitive restructuring conditions, with participants in these conditions showing small, nonsignificant increases in anticipatory anxiety from baseline to posttask followed by small, nonsignificant decreases from posttask to 48-hour follow-up. However, contrary to predictions, participants in the control condition showed an increase in anticipatory anxiety and avoidance scores from baseline to posttask that approached statistical significance and had medium effect sizes followed by small, nonsignificant decreases from posttask to 48-hour follow-up.

While the finding that interpretation training was not associated with a decrease in anticipatory anxiety and avoidance is contradictory to the results of previous studies (Amir & Taylor, 2012; Beard et al., 2011; Murphy et al., 2007), there are a number of methodological differences between the present study and these previous studies that may underlie the different patterns of results. First, only one study to date has assessed anticipatory anxiety and avoidance following a single session of interpretation training using the Mathews and Mackintosh (2000) interpretation training procedure. Using a sample of undergraduate students with elevated levels of fear of negative evaluation, Murphy and colleagues (2007) found that participants who completed a single session of interpretation training reported significantly lower anticipatory anxiety regarding a future social interaction with two unfamiliar individuals compared to participants in the control condition. The Murphy and colleagues (2007) study differed from the current study on participant selection and the way in which anticipatory anxiety was assessed. First, the study by Murphy and colleagues (2007) used an undergraduate sample of participants who had elevated scores on fear of negative evaluation, while the current study used participants from the community who had elevated scores on social phobia symptomatology, including a fear of public speaking. Second, in the Murphy and colleagues (2007) study, participants' anticipatory anxiety was assessed by asking about one specific future social situation which participants believed they would be asked to complete during the laboratory visit. In contrast, the present study's assessment of anticipatory anxiety and avoidance used a variety of different hypothetical social situations and participants knew that they would not be asked to participate in these situations. Consequently, the present study's assessment of multiple social situations and participants' knowledge that they would not be asked to participate in any of the situations may

underlie some of the differences between the results of the present study and those of Murphy and colleagues (2007).

Other studies that have found that participants who completed interpretation training reported significant decreases in anticipatory anxiety and avoidance of future social situations used high social anxiety samples and assessed anticipatory anxiety and avoidance using the *Liebowitz Social Anxiety Scale* (Liebowitz, 1987), which provides a list of social situations and asks participants to provide ratings of anxiety and avoidance for each situation (Amir & Taylor, 2012; Beard et al., 2011). Although the sample and manner in which anticipatory anxiety and avoidance were assessed in these studies is similar to the present study, these studies used different training procedures that were completed during multiple sessions. For instance, in the study by Amir and Taylor (2012) participants completed 12 sessions of the *Word Sentence Association Paradigm* procedure (Beard & Amir, 2009) to train interpretation biases while Beard and colleagues (2011) used 8 sessions of a combined interpretation training and attention training program. Therefore, it may be the case that in a high social anxiety population, the effects of interpretation training influence anticipatory anxiety and avoidance only when interpretation training involves multiple-sessions over time, thus providing participants a larger "dosage' of interpretation training,

In addition to symptoms of social anxiety, the present study also examined the effects of a single-session of interpretation training and a single-session of cognitive restructuring on a number of cognitive processes associated with social anxiety that have been previously shown to decrease following treatment with CBT for social anxiety (Collins et al., 2005; Hofmann et al., 2004; Koerner et al., 2013; Moscovitch et al., 2012). Specifically, participants completed self-report questionnaires assessing fear of negative evaluation, estimation of the probability and cost

of negative social events, and beliefs about one's own and others' abilities in social situations at baseline, posttask, and 48-hour follow-up. Although participants in the cognitive restructuring condition did not evidence any changes from baseline to posttask on the cognitive processes assessed, at the 48-hour follow-up, there was a medium sized decrease from posttask that was either statistically significant or that approached statistical significance for all cognitive processes. The present study's finding that cognitive processes only changed after a 48-hour delay, suggest that time and real-word experiences may be necessary for the modification of cognitive processes underlying social anxiety.

In contrast, the findings for the interpretation training condition were less clear. Contrary to predictions, participants in the interpretation training condition evidenced a statistically significant increase in fear of negative evaluation from baseline to posttask followed by a small, nonsignificant decrease at the 48-hour follow-up. With regard to the probability of negative social situations, individuals in the interpretation training condition showed a medium sized significant increase from baseline to posttask followed by a significant decrease from posttask to 48-hour follow-up that also had a medium effect size. For the cost of negative social situations, participants in the interpretation training condition showed no significant changes from baseline to posttask but evidenced a significant decrease from posttask to 48-hour follow-up that had a medium effect size. However, there were no differences on the probability and cost of negative social situations from baseline to 48-hour follow-up, suggesting that, overall, interpretation training did not decrease self-reported probability and cost of negative social situations. Similar to the cognitive restructuring condition, participants in the interpretation training condition showed a decrease in beliefs about one's own lack of abilities in social situations from posttask to 48-hour follow-up, despite no changes from baseline to posttask. This change had a medium

effect size and approached statistical significance. There were no changes over time in cognitive processes associated with anxiety in the control condition. It is important to remember, however, that the 48-hour follow-up analyses were limited by a small sample size (n = 9) in the control condition.

It is difficult to hypothesize possible reasons for the unexpected increases in some of the cognitive processes in the interpretation training condition. A recent qualitative study conducted by Beard and colleagues (2011) focused on the *Word Sentence Association Paradigm* (Beard & Amir, 2009) showed that participants with social anxiety show an increase in anxiety about social situations after the first session. Beard and colleagues (2011) explained this unexpected increase in anxiety as resulting from the fact that during the first session participants are just learning to associate ambiguous social statements with neutral or positive interpretations. Therefore, compared to later sessions, participants are given more negative feedback about their answers as they learn the task, leading to higher levels of anxiety. Although the present study did not find an increase in state anxiety after completion of the interpretation training or control tasks, it is possible that receiving direct negative feedback with regard to answering the comprehension questions related to the social scenarios as well as struggling to solve the word fragments may have lead to a temporary increase in cognitive processes associated with social anxiety.

It is important to note that, although a number of within-group changes were observed for measures of symptomatology and cognitive processes, there were no significant between-group differences at posttask. This suggests that the changes over time may not have been large enough to result in differences between conditions. Furthermore, as discussed previously,

between-group analyses were not conducted for the 48-hour follow-up due to uneven sample sizes and the small sample size in the control condition (n = 9).

The present study did not find any significant group differences for any of the self-reported measures of state anxiety and distress during the speech task or on self-reported speech performance. Interestingly, the current study did find that participants in the cognitive restructuring condition were rated as performing better on the speech task compared to participants in the interpretation training and control conditions by an observer who was blind to group status and to the hypotheses of the study.

The two studies to date that have examined behavioural outcomes following interpretation training have included multi-session training procedures and have generated mixed findings with one study finding no effects of 8 sessions of interpretation training on anxiety and distress following an unsolvable anagram task (Salemink et al., 2009) while the other study found that 4 sessions of combined interpretation and attention training significantly increased speech quality (Beard et al., 2011). The study by Beard and colleagues (2011) did not assess self-reported levels of distress during the speech task and the combined interpretation and attention training procedures makes it difficult to delineate whether one procedure had a greater impact on speech performance than the other, given that previous research has shown that a single session of attention training can increase self-reported and observed speech performance and decrease self-reported distress levels during the speech (Beard et al., 2008). The results of the present study suggest that a single session of interpretation training is not sufficient to influence a behavioural measure of social anxiety, such as performance on a speech task.
It is interesting that, while participants in the cognitive restructuring condition did not differ from participants in the interpretation training and control conditions on self-reported distress and

anxiety or self-rated performance during the speech task, they were rated as performing better on the speech by an observer who was blind to group status and to the hypotheses of the current study. This discrepancy between self-rated performance and observer-rated performance is consistent with previous findings that participants with social anxiety tend to rate their speech performance lower and more critically compared to observers (Clark & Wells, 1995; Rapee & Heimberg, 1997). It is also important to note that the current study did not include a baseline assessment of speech performance. Therefore, it is possible that participants in the cognitive restructuring condition were more skilled at giving speeches and/or had lower levels of anxiety about speeches compared to participants in the interpretation training and control conditions. Although the lack of between-group differences on baseline scores for the SPIN (Connor et al., 2000) and PRCS (Paul, 1966) suggest that it is unlikely that the groups differences on speech anxiety levels, it is not possible to fully rule out the possibility of differences between groups on public speaking ability.

The focus on explicit versus implicit approaches in the modification of interpretation biases may be one possible explanation for the differences between the interpretation training and cognitive restructuring conditions on observed speech performance. Specifically, the interpretation training task is an implicit procedure and the instructions given to participants did not in any way imply that the procedure would help participants shift their thinking about social situations or that the task could help to decrease feelings of anxiety in social situations. Rather, participants were told that they would be asked to solve word fragments and answer comprehension questions related to various social scenarios. In contrast, the cognitive restructuring task included a short section on the role of anxious thoughts in the maintenance of social anxiety and suggested that evaluating negative thinking patterns and developing more

balanced thoughts could be helpful in breaking the cycle of anxiety. Therefore, the explicit approach of the cognitive restructuring task may have increased its transferability to the self-presentation task. It is important to acknowledge that the explicit nature of the cognitive restructuring task may also have created a demand effect such that participants felt that their anxiety about social situations should decrease throughout the course of participating in the laboratory study. Previous research has shown that adding explicit information as to the potential effectiveness of a task in reducing symptoms of social anxiety enhances the magnitude of symptom reduction at posttask (Mobini et al., 2012). However, given that participants in the cognitive restructuring condition did not report decreased scores on all measures of anxiety assessed and that it was observed speech performance rather than self-reported speech performance that differed between the conditions on the speech task, it is unlikely that demand characteristics explain the pattern of the current study's results. As mentioned previously, given the lack of baseline assessments of speech performance, the current results need to be considered tentative and are in need of further replication.

There were also no significant differences between groups on skin conductance level during the speech task. For all three conditions, skin conductance level increased significantly from baseline to preparation and from preparation to speech. There were no significant changes from postspeech to recovery on skin conductance level, such that skin conductance level was higher at recovery than at baseline. This pattern of results is consistent with self-reported distress as measured during the speech task as all participants, regardless of condition, reported increased levels of distress and anxiety while preparing for and completing the speech. However, it appears that the effects of the single-session interpretation training and single-session cognitive restructuring tasks did not influence skin conductance levels, suggesting that a

single session task is not sufficient to influence skin conductance levels in response to a social stressor.

The heart rate data revealed a more complicated pattern of results. First, at baseline, the cognitive restructuring condition had a significantly higher heart rate than the interpretation training and control conditions and, unlike the other two conditions, participants in the cognitive restructuring condition did not evidence any significant changes in heart rate during the speech task. The higher baseline heart rate in the cognitive restructuring condition may be a reflection of the nature of the group-specific tasks. Unlike the interpretation training and control conditions, which were completed on the computer, the cognitive restructuring task was completed one-on-one with the experimenter and involved discussing situations in which individuals experienced anxiety as well as examining and evaluating the specific cognitions experienced in those situations. Although there were no significant group differences on state anxiety after the group-specific tasks, it is possible that the face-to-face interaction and the idiosyncratic nature of the task, which required participants to reveal personal information, may have increased arousal levels in the cognitive restructuring condition. The increased arousal may have then resulted in a ceiling effect such that heart rate was elevated at baseline during the speech task and there was little room for a further increase. In contrast, in the interpretation training condition, the increase in heart rate from baseline to preparation and from preparation to speech approached statistical significance while the decrease from speech to recovery was statistically significant. The control condition revealed significant increases in heart rate from baseline to preparation and preparation to speech as well as a significant decrease in heart rate from speech to recovery.

In summary, the results appear to suggest that a single session of interpretation training or cognitive restructuring is not sufficient to influence skin conductance levels and heart rate during a social stressor such as a speech task. Although the skin conductance level findings suggest synchrony between skin conductance and self-reported levels of distress and anxiety during the speech task, the heart rate findings suggest a lack of synchrony in the cognitive restructuring condition, possibly a reflection of the nature of the cognitive restructuring task as well as a ceiling effect.

Strengths and Limitations

The present study has a number of strengths. First, this is the first study to date to examine the effects of interpretation training and single-session cognitive restructuring on self-reported, behavioural, and physiological measures of anxiety during a self-presentation task in a social anxiety analogue sample. One of the limitations to date of both the interpretation training and CBT literature is the strong focus on self-report outcome measures with little consideration of the effects on behavioural and physiological measures of anxiety. Therefore, the present study provides more insight into the effects of cognitive restructuring and interpretation training on social anxiety symptoms and cognitive processes, as well as self-reported, behavioural, and physiological reactions to a speech task. Second, this is the first study to date to directly compare a single session of interpretation training with a single session of cognitive restructuring. Given that some researchers in the area of interpretation training have suggested that interpretation training may be used an adjunct to CBT for social anxiety or even as a standalone treatment for social anxiety (e.g., Beard, 2011; Hertel & Mathews, 2011; Mathews, 2012; Mobini et al., 2013), it is important to compare interpretation training to the components of CBT for social anxiety in order to make an informed decisions as to the potential role of

interpretation training in the treatment of social anxiety. Third, much of the research to date has only examined the immediate effects of interpretation training and has failed to consider the longevity of the changes due to a lack of follow-up. The current study included a 48-hour follow-up. Although this is still a very limited follow-up period, the current study's results from the 48-hour follow-up illustrate the importance of including follow-ups in order to more accurately and fully understand the symptomatology and cognitive changes that occur as a result of interpretation training and/or cognitive restructuring.

The current study also has a number of limitations that suggest directions for future research. First, due to time and financial constraints, the study included a single session of interpretation training and a single session of cognitive restructuring. Given that CBT for social anxiety typically consists of between 12 to 15 treatment sessions (e.g., Heimberg et al., 1990; Hope et al., 1995) and includes between-session homework exercises as well as the fact that recent studies have begun to investigate the effects of multiple sessions of interpretation training (e.g., Amir & Taylor, 2012; Beard & Amir, 2008; Bowler et al., 2012; Mathews et al., 2007), the "low dosage" of cognitive restructuring and interpretation training that participants in the present study received limited the power to find changes across time and between conditions on symptomatology, cognitive processes and self-reported, behavioural, and physiological measures of anxiety during the speech task. However, it is important to note that the present study was not designed as a treatment study but rather was meant as a theoretical investigation of the theory that interpretation biases underlie social anxiety symptoms.

Second, the percentage of participants who met diagnostic criteria for social anxiety on the social phobia section of the SCID approached statistical significance, with fewer participants in the cognitive restructuring condition meeting criteria for social anxiety compared to

participants in the interpretation training and control conditions. This raises the possibility that participants in the cognitive restructuring condition may have had less severe levels of social anxiety compared to participants in the other two conditions. Although the fact that there were no baseline differences between conditions on scores on the SPIN (Connor et al., 2000) or any other measures of symptomatology or cognitive processes assessed increases confidence in the present study's results, the differences on SCID-IV diagnoses is a limitation of the present study and future studies should consider including a diagnosis of social anxiety disorder on the SCID-IV as an inclusion criterion to help ensure equivalency in participant severity.

Third, there are a number of limitations in the present study's baseline assessments that must be acknowledged and that should be addressed in future research. Participants completed all baseline measures at home between 1 to 2 days before the laboratory visit. This was done in order to decrease participant burden so that participants did not have to attend two laboratory visits. Although participants were encouraged to complete the questionnaires in a quiet location it is impossible to know where participants completed the questionnaires and if there were any distractions that may have influenced their responses. As well, while the present study included a baseline measure of explicit interpretation biases, there was no baseline measure of implicit interpretation biases. This was due to the fact that the Mathews and Mackintosh (2000) recognition task for assessing interpretation biases involves a surprise memory task where participants are required to rate the similarity of negative and positive statements to scenarios that they have read previously. Given that this is a surprise memory task, it was not possible to obtain an implicit measure of interpretation biases both at baseline and posttask without sacrificing the surprise component of the recognition task. However, given the present study's findings that the implicit and explicit measures of interpretation biases lead to different results

regarding the generalizability of interpretation training and cognitive restructuring this is an important area for future research. Since there are currently two main approaches for modifying and assessing interpretation biases, the recognition task developed by Mathews and Mackintosh (2000) that was used in the current study and the *Word Sentence Association Paradigm* developed by Beard and Amir (2008), it would be interesting to assess whether trained interpretation biases from the Mathews and Mackintosh (2000) task generalize to the *Word Sentence Association Paradigm* (Beard & Amir, 2009). Given that both of these tasks provide implicit measures of interpretation biases, this would be one approach in which to assess the generalizability of implicit interpretation biases and to better understand what is being changed through the interpretation training procedure. Furthermore, as discussed previously, the present study did not include baseline speeches. Therefore, it is possible that the group differences on observer-rated speech performance may be a reflection of baseline differences on speech performance. Although the lack of between-group differences on baseline PRCS (Paul, 1966) provides some support for a lack of between-group differences on speech anxiety, future research should consider including both baseline and posttask speeches in order to obtain a more accurate perspective on the effects of interpretation training and cognitive restructuring on a social stressor task, such as a speech task.

Fourth, there are a number of limitations with the interpretation training procedure that should be investigated in future research. The degree of personal relevance of the social situations that were presented to participants during the interpretation training and cognitive restructuring tasks most likely differed. Specifically, during the cognitive restructuring task, there were two opportunities during which participants were asked to think about social situations in which they felt anxious and to discuss their thoughts, feelings, and behaviours in

those situations. Therefore, the situations discussed in the cognitive restructuring condition were idiosyncratic for each participant. In contrast, during the interpretation training task participants were presented with a standard set of ambiguous social situations. Although the development of these social situations considered typical situations in which individuals with social anxiety experience feelings of anxiety (Mathews and Mackintosh, 2000), no research to date has assessed the degree to which participants with social anxiety actually feel that they can relate to the situations. Therefore, it would be interesting to investigate: 1) the degree to which individuals actually report being able to relate to the situations as well as 2) to examine whether there are any differences in the effects of interpretation training when the scenarios are tailored to the specific concerns of individuals compared to when a standard set of scenarios is used for all participants, given that there is variability across individuals with social anxiety in the types and numbers of feared social situations (e.g., public speaking, talking with strangers, attending parties, etc.).

As discussed previously, the interpretation training and cognitive restructuring procedures differed on the focus on explicit versus implicit approaches in the modification of interpretation biases. Specifically, while the instructions in the interpretation training condition did not in any way imply that the procedure would help participants shift their thinking about social situations or that the task could help to decrease feelings of anxiety in social situations, the cognitive restructuring procedure did include a short section on the role of negative anxious thoughts in the maintenance of social anxiety and suggested that evaluating negative thinking patterns and developing more balanced thoughts could be helpful in breaking the cycle of anxiety. Therefore, it is possible that the explicit nature of the cognitive restructuring task may have created a demand effect such that participants felt that their anxiety about social situations

should decrease throughout the course of participating in the laboratory study. However, given that participants in the cognitive restructuring condition did not report decreased scores on all measures that were assessed, it is unlikely that demand characteristics fully account for the present study's findings.

Furthermore, the present study did not find that the effects of interpretation training or cognitive restructuring influenced self-reported anxiety or distress during the self-presentation task. Recently, Mackintosh and colleagues (2013) have suggested that for the effects of interpretation training to generalize to a behavioural task it is necessary for the scenarios included in the interpretation training to be focused on the specific fears that individuals experience in that situation. Although the scenarios that were used for the interpretation training did include some situations that described speech situations, they also included a wide variety of other situations, including meeting unfamiliar individuals, attending parties, and eating at restaurants with a group of individuals. Therefore, the effects of the interpretation training may have been diluted. It would be interesting to see whether the results of the present study would have differed had the interpretation training and cognitive restructuring tasks specifically and exclusively focused on fears of public speaking.

The structure of the interpretation training task is such that if participants have difficulties solving a word fragment the only way they can progress through the task is to try and guess the word. Although participants are not explicitly told that they can guess, they are told that if their initial answer is incorrect they should try and solve the word fragment again. In the end, this does result in some participants being more likely to start guessing if they experience difficulties with some of the word fragments. To date, no studies have discussed the issue of participants guessing on the interpretation training task. Given that participants are instructed to press the

space bar when they know what the word is and then press the first missing letter, reaction times of more than 1000 ms for pressing the first missing letter are a good indicator that participants were guessing on that trial. An examination of reaction time data in the current study revealed that in some cases, participants guessed on around 30% of the trials, thus suggesting that the dosage of interpretation training that they received may have been less than intended. Future studies may consider modifying the interpretation training task such that there is a maximum time limit that participants are given to solve the word fragment and if the word fragment is not solved then the task moves on to the next scenario. This would potentially decrease the temptation for participants to guess when they are struggling to solve a word fragment, thus increasing their active effort on those trials, and would also provide researchers a better estimation of the percentage of scenarios on which participants were unable to solve the word fragment. As well, during the laboratory visit, a number of participants commented about the length of the interpretation training task and its tediousness. In order to be consistent with previous single-session interpretation training studies and to ensure that the current study's results would be comparable, the same number of trials of interpretation training were included in the present study as in previous similar studies. However, as suggested by Mobini (2013), there is a need to determine the optimal number of trials that are needed to train interpretation biases.

Moreover, during the interpretation training procedure, participants were instructed to imagine themselves in the presented social scenario. It is possible that there may have been variability between participants in how vividly they imagined the situations, thus possibly influencing the effectiveness of the interpretation training.

Fifth, the 48-hour follow-up was added to the study after data recruitment had already begun and was completed by participants electronically. As a result, the current study had small sample sizes for the 48-hour follow-up data analyses, especially for the control condition, which limits confidence in the results for the 48-hour follow-up data. As well, although a 1-week follow-up was planned for the current study, the number of participants who completed both the 48-hour and 1-week follow-ups resulted in even smaller sample sizes. Therefore, it was decided that the 1-week data would not generate any useful or meaningful results.

Lastly, there are a number of limitations related to the self-report measures used in the present study to assess social anxiety symptomatology and cognitive processes. The current study used originally developed situations to assess anxiety and avoidance in social situations. Although the measures of anxiety and avoidance had good internal consistencies and were significantly related to scores on the SPIN (Connor et al., 2000) and the BFNE (Leary, 1983), it may have been better to use an empirically-established measure of anxiety and avoidance of social situations, such as the *Liebowitz Social Anxiety Scale* (Liebowitz, 1987), in order to ensure strong psychometric properties and enable a better comparison with previous studies. Furthermore, given that some of the measures used in the present study normally ask participants to reflect on the last week or last two weeks when answering the questions, the instructions were modified such that participants were asked to think about the last 48 hours. Although the internal consistencies of the measures were good overall, it is possible that this modification may have influenced the psychometric properties of the measures. Furthermore, the TQ Positive and Negative subscales (Edwards et al., 2003) had low internal consistencies, suggesting that the results from these scales should be interpreted cautiously. Moreover, participants completed the same questionnaires three times during the span of around 5 to 6 days. The act of simply

answering the same questions over a short period of time can modify responses. It is possible that as participants habituated to the questions their responses decreased over time. However, this is unlikely given that the control condition also repeatedly completed the same questionnaires over the same period of time and, in general, failed to show decreases in anxiety symptoms or cognitive processes over time. Lastly, the baseline assessment of participants' anxiety and avoidance of social situations was conducted within the context of the SCID-IV interview with the researcher. Therefore, participants provided ratings verbally and follow-up questions were posed to ascertain that the anxiety and avoidance of social situations was due to a fear of negative evaluation, a hallmark characteristic of social anxiety. In contrast, the posttask and 48-hour follow-up assessments of anxiety and avoidance of social situations were completed by participants on the computer. Therefore, the different modalities of completion and the fact that the baseline measure was done during a face-to-face interview with the researcher while the posttask and 48-hour assessments were done on the computer may have influenced the pattern of results. It is possible, for instance, that participants may have minimized their anxiety and avoidance of social situations at baseline due to concerns about being negatively evaluated by the researcher.

Clinical Implications

The findings of the current study question the recent enthusiasm about the effectiveness of interpretation training for social anxiety. As discussed previously, it remains unclear whether the effects of interpretation training generalize to measures of interpretation biases that are contextually different than the recognition task developed by Mathews and Mackintosh (2000). Second, the present study found a number of unexpected findings at posttask, with participants in the interpretation training condition reporting temporary increases in some of the cognitive

processes assessed. Lastly, in the present study, there was no evidence that interpretation training lead to a reduction in self-reported distress and anxiety during the speech task or that it contributed to better performance on the speech. As seen in more recent studies, this pattern of results may be different with multiple-sessions of interpretation training (Beard et al., 2011). Nevertheless, given the findings that interpretation training temporarily increased a number of cognitive processes, there is a need for more research that assesses these measures after each session in order to better understand the pattern of change that occurs during interpretation training. As well, the research on interpretation training is currently being done by a limited number of research groups. Therefore, there is a need for further replication of findings by independent research teams in order to better assess the robustness of the effects of interpretation training. It is crucial that a better understanding of the processes and mechanisms underlying interpretation training is established before it is proposed as a possible adjunct or stand alone treatment for social anxiety.

Conclusion

The present study provides further support that a computer-based single-session procedure can successfully train positive interpretation biases, although the extent to which the trained interpretation biases generalize to other measures of interpretation biases remains unclear. Although neither a single session of interpretation training nor a single session of cognitive restructuring produced immediate changes in social anxiety symptomatology, after 48-hours both conditions evidenced decreases in self-reported anxiety symptoms. Furthermore, while the cognitive restructuring condition showed a significant decrease in cognitive processes associated with social anxiety from posttask to 48-hour follow-up, the pattern of results for the interpretation training condition were more complicated such that there was a temporary increase

in some of the cognitive processes from baseline to posttask that decreased back to baseline levels at the 48-hour follow-up. Lastly, although there were no differences between groups on self-reported anxiety and distress or self-rated performance on the speech task, participants in the cognitive restructuring condition were rated as performing better on the speech task compared to participants in the interpretation training and control conditions.

Although the present study's findings are limited by single-session tasks as well as the small sample size in the control condition at the 48-hour follow-up, they do bring into question the recent enthusiasm about the effects of interpretation training on social anxiety symptomatology. The current study's findings highlight the need for further research to better understand what is being changed during interpretation training and the degree to which the effects of interpretation training generalize to other measures of interpretation biases as well as to self-report, behavioural, and physiological measures of anxiety.

Appendices

Appendix A

Demographics Questionnaire

Sex:

☐ Female

☐ Male

Age*:* _____

Relationship Status (please check one)*:*

☐ Single

☐ In a steady relationship

☐ Married

☐ Co-habiting

☐ Separated

☐ Divorced

☐ Widowed

Ethnicity/Cultural Background*:*

☐ Aboriginal (e.g., First Nations, Métis, Inuit)

☐ Black/Afro-Caribbean/African

☐ White/European

☐ Hispanic/Latin American

☐ Asian (e.g., South Asian, East Asian, Southeast Asian)

☐ Biracial/multiracial

☐ Other (specify _____)

Are you enrolled in an educational program? ☐ Yes ☐ No
If yes, please check one:

☐ Community College

☐ University

☐ Adult Education/Continuing Education

Field of Study: _____

Education Level (please check one):

☐ Did not attend High School

☐ Some High School

☐ Completed High School/High School Equivalency (GED)

☐ Some College/University

☐ Completed College/University

☐ Some Graduate School

☐ Completed Graduate School

Employment Status:

☐ Not Working

☐ Working Part-Time

☐ Working Full-Time

If working part-time or full-time, indicate occupation: _____

Annual Family Income (please check one):

☐ Less than $25,000

☐ $25,000 - $49,999

☐ $50,000 - $74,999

☐ $75,000 - $99,999

☐ $100,000 - $149,999

☐ $150,000 - $174,999

☐ $175,000 - $199,999

☐ More than $200,000

☐ Don't know

Number of people supported by the family income (including self): _____

Are you currently taking any medications?

☐ Yes

☐ No

If yes, please list all the medications that you are currently taking. _____

Appendix B

SCID Interview Script

Now I'm going to ask you some more questions about your experiences in social situations.

Was there anything that you have been afraid to do or felt uncomfortable doing in front of other people, like speaking, eating, or writing?

I'm now going to go through a list of social situations that individuals may fear or avoid. Please let me know whether you fear or avoid any of these situations.

Parties
Participating at meetings/classes
Talking in front of a group/public speaking
Eating or drinking in front of others
Using public rest rooms
Writing in public (signing name, filling our forms)
Dating situations (if applicable)
Talking to people in authority
Being assertive (e.g., refusing unreasonable requests, asking others to change their behaviours)
Initiating a conversation
Maintaining a conversation
Maintaining eye contact
Speaking with or meeting strangers
Other (e.g., aerobics, performing music, family gatherings, using the phone)

For each situation that the participant endorses ask:

Can you tell me some more about that?

What were you afraid would happen when _____?

Do you always feel anxious when you (CONFRONTED PHOBIC STIMULUS)?

Do you think that you were more afraid of (PHOBIC ACTIVITY) than you should have been (or than made sense)?
IF YES: Would you want to be less anxious?
Do you think you're more anxious than other people?

IF NOT OBVIOUS: Did you go out of your way to avoid _____?
IF NO: How hard is it for you to _____?

IF UNCLEAR WHETHER FEAR WAS CLINICALLY SIGNIFICANT: How much did _____ interfere with your life?

IF DOES NOT INTERFERE WITH LIFE: How much has the fact that you have this fear bothered you?

Based on these responses, the interviewer will rate each situation for fear and avoidance on the following scale: 0 = None, 1 = Mild, 2 = Moderate, 3 = Severe, 4 = Very Severe.

If participant does not endorse feeling fearful or avoiding any social situations or if fear is not clinically significant then end interview by saying: Thank-you very much for your participation in the interview.

If participant endorses feeling fearful and avoiding social situations and the fear and/or avoidance is clinically significant ask:

Just before you began having these fears, where you taking any drugs, caffeine, diet pills, or other medicines?

(How much coffee, tea, or caffeinated soda do you drink a day?)

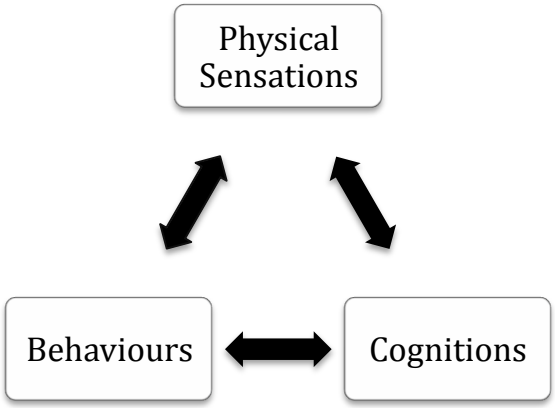
Just before the fears began were you physically ill?

IF YES: What did the doctor say?

Appendix C

Cognitive Restructuring Script

Now we are going to talk about strategies for coping with feelings of anxiety in social situations. The strategies we will be discussing are based on methods that have been tested in a large number of studies over the past 25 years or more.



To start, it can be useful to think about anxiety as being composed of three parts or components: our physical sensations, our thoughts, and our behaviours. Examples of physical sensations that are common in anxiety provoking social situations include: racing heart, sweating, trembling, and blushing. Examples of thoughts that can contribute to social anxiety include: "They're going to think I'm incompetent," and "I'm going to make a fool of myself." And anxious behaviours may include complete avoidance of a feared situation or more subtle "safety behaviours" meant to decrease anxiety or the likelihood of possible threats. Examples of such behaviours may include avoiding eye contact, wearing a turtleneck so others don't notice your blushing, and overpreparing for a presentation. All of 3 of these components interact with each other and increase the intensity and likelihood of experiencing anxiety.

Can you think of a time when you recently felt anxious in a social situation, like a presentation, a party, or meeting someone new? What physical sensations do you remember? Are there certain physical symptoms that are particularly bothersome to you in social situations? Do you recall what some of your thoughts, assumptions, or predictions were in the situation? If not, what types of thoughts do you typically experience when you feel anxious in social situations? Here is a list of thoughts that may accompany social anxiety (show list of examples to individual). Are any of these thoughts that have crossed your mind when feeling anxious? Finally, do you recall what you did in the situation to help reduce your anxiety or to protect yourself from possible negative consequences? Do you ever avoid social situations because of anxiety? Do you ever use safety behaviours to reduce your anxiety. Here is a list of anxious behaviours (show list of examples to individual). Are any of these examples of behaviours that you use from time to time when you feel anxious in social situations?

Examples of Social Anxiety Thoughts:

- It is important that everybody likes me
- If my boss doesn't like me, I will get fired
- If I am not liked by a particular person, I am unlikable
- If someone rejects me, I deserve it
- People find me unattractive
- I will look incompetent if I speak to my boss
- People will become angry with me if I make a mistake
- People are untrustworthy and nasty
- People should always be interested in what I say
- People should not look at me the wrong way
- I should be able to hide my anxiety symptoms
- If my hands shake at work, it will be a disaster
- Anxiety is a sign of weakness
- I should not appear anxious
- It is awful to blush, shake, or sweat in front of others
- People can tell when I am anxious
- I will not be able to speak if I am too anxious

Examples of Social Anxiety Behaviours

- Turning down an invitation to a party
- Making an excuse not to have dinner with a friend
- Never answering questions in class
- Always arriving late for meetings and leaving early in order to avoid making "small talk"
- Offering to help with the dishes at a party in order to avoid talking to the guests
- Making an excuse to get off the telephone with a friend or co-worker
- Distracting yourself from your anxious thoughts
- Having the room dark during your presentation in order to keep the audience focused on the slides rather than on you
- Filling out a check before arriving at a store, in order to avoid having to write in front of others
- Avoiding eye contact and talking very quietly during conversations with others
- Wearing make up and a turtleneck sweater to hide your blushing
- Always attending the office holiday party with a close friend, spouse, or other safe person, even though other guests tend to attend alone
- Always arriving for meetings early to ensure that it will not be necessary to enter the room after everyone else is already seated
- Having a couple of glasses of wine before meeting another person for a date

For today, I would like to focus a bit on the role of negative thinking and how it can trigger social anxiety and help to keep it alive. Lets say you're talking to someone at a party and he/she looks down at his/her watch. What are some different thoughts that you might have in this situation? (probe if participant doesn't come up with a range of both negative and neutral/positive thoughts; Can you think of some other possible interpretations that someone

might have in this situation?). Lets say that you interpret the person's looking at the watch as a sign that he or she has to be somewhere at a specific time (or some other neutral thought that the participant has come up with). How might that influence your feelings in the situation? What emotions would you experience? How would it influence your willingness to go to future parties? Now lets consider an opposite interpretation. Lets say that you interpret the person's looking at his/her watch as a sign that you're boring and he or she isn't interested in what you're talking about (or some other negative thought that the participant has come up with)? How would that make you feel in the situation? How would it influence your willingness to future parties?

So you can see, the thoughts that you have in a situation can influence how you feel in social situations. When we are anxious, we are more likely to automatically experience negative thoughts about the situation and to view our thoughts as being true. Many of the anxiety-provoking thoughts that we experience can be classified as being one of two main types: (1) probability overestimations and (2) catastrophic thinking.

Probability overestimation involves predicting that some sort of negative event is much more likely to occur than it really is. For example, someone who is fearful of going to parties might predict that she/he will make a fool of him/herself at the next party and no one will want to talk to him/her, even though he/she usually does well at parties and talks to a number of different individuals. Or, someone who fears dating may falsely assume that his or her partner is thinking all sorts of negative things (e.g., wow – is this person ever boring!").

Can you think of any examples of probability overestimations in your own life? Are there times when you assumed that something bad was going to happen, that ended up happening?

Catastrophic thinking (or catastrophizing) involves assuming that if a negative event does occur, the consequences will be terrible and unmanageable. For example, someone who is fearful of talking with others at parties might think "it would be a disaster if I blushed while speaking with others" or "it would be awful if some people thought what I was saying was boring."

Can you think of any examples of catastrophic thinking in your own life? Are there times when you assumed that a particular outcome would be unmanageable or that you would not be able to cope? Are there times when you have coped better with negative social events than you thought you would?

Now we are going to look at ways to challenge or change some of these anxious thoughts.

Often when we are anxious, we tend to automatically notice the negative or threatening aspects of a situation and fail to notice the neutral or positive aspects. For example, you might pay much more attention to the time your friend neglected to return your text message or phone call than all the times that he or she responded quickly, and assume that the lack of response is evidence that your friend is thinking bad things about you. Or, you might take the sleepy person in the front row during your presentation as evidence that your presentation is boring, even though many others in the audience are alert and paying attention.

One way to challenge your anxious thinking is to examine the evidence. The first step to learning to challenge your anxious thoughts is to recognize that your beliefs are not facts. Instead of assuming that your negative thoughts are true, it is helpful to treat your anxious thoughts as guesses or hypotheses. In the same way that a scientist gathers evidence for his or her hypotheses, you want to examine the evidence to assess the extent to which your beliefs are true. In order to examine the evidence for your beliefs, you can ask the following questions:

1. How do I know for sure that my prediction will come true?
2. What does my past experience tell me about the likelihood of my thoughts coming true?
3. Have there been times when I have experienced anxious thoughts that didn't come true?
4. Are there facts or statistics that can help me to decide whether my prediction is likely to come true?
5. Are there other possible interpretations for this situation?
6. How might another person (who isn't anxious in social situations) interpret the situation?

One other strategy that you can use is to view yourself as close others would, such as a close friend, family member, or partner. Alternatively, what if the tables were turned and a close friend came to you for advice and support after a party? What would you say if your friend said to you "I made a complete fool of myself at the party I went to last night. I couldn't think of anything to say and I'm sure I looked like a complete idiot." It is often much easier to challenge someone else's anxious thoughts than it is to challenge your own. Therefore, one way to cope with your anxious thoughts is by mentally "stepping out" of the situation for a moment. Here are some questions that you can use:

1. What might I say to a close friend or relative who was having the same thought as me?
2. What might a close friend or relative say to me if he or she knew what I was thinking?

A third way to challenge your anxious thinking it to challenge your catastrophic thinking. This involves shifting the focus of your thoughts from how terrible a particular outcome would be to how you might manage or cope with the situation if it were to occur. In many cases you will realize that even if your fear does come true, it won't be end of the world. You will cope with the situation, and your discomfort will pass. One of the most effective ways to overcome your catastrophic thinking is to ask yourself questions like the following:

1. So what?
2. What if my fears actually come true?
3. How can I cope with _____ if it were to occur?
4. Would _____ really be as terrible as I think?
5. Does this really matter in the big scheme of things?
6. Will I care about this a month from now? A year from now?

Looking at the list of strategies used to challenge you anxious thinking, which ones do you think might most apply to your experiences in social situations? Do any of them stand out to you as potentially being helpful?

Generally, the process of challenging anxiety-provoking thoughts involves four steps:

1. Identifying your anxious thought
2. Generating alternative thought
3. Examining the evidence
4. Coming to a balance conclusion

Here is an illustration of how to work through the four steps in the context of a fear of public speaking.

1. Identifying the Anxious Thought

   - During my presentation, people will notice my blushing and think that I am strange

2. Generating Alternative Thoughts

   - Nobody will notice my blushing
   - Only a small number of people will notice my blushing
   - People who notice my blushing will think I am feeling hot
   - People who notice my blushing will think I am feeling unwell
   - People who notice my blushing will think I am feeling a bit anxious
   - It is normal to blush sometimes, so people will think nothing of it if they notice me blush

3. Examining the Evidence

   Evidence Supporting my Anxious Belief

   - I believe that my blushing is very extreme
   - In high school people teased me for blushing on a few occasions
   - I tend to notice when other people blush

   Evidence Supporting my Alternative Beliefs

   - I know a lot of people who blush easily and people don't seem to think they are strange
   - When I notice other people blushing, I don't think they are strange
   - Often people do not seem to have noticed me blush when I ask them if it was noticeable
   - When people have noticed my blushing, they haven't tended to treat me differently
   - The people in the audience know me well. I can't imagine that their opinions of me would change dramatically based on whether I blush during a single presentation

4. Coming to a Balanced Conclusion

   - Some people may notice my blushing, but it's unlikely that they will think I'm strange

A Thought Record is a tool that can be used to facilitate the process of challenging anxious thoughts . This form can be used whenever you experience anxiety in a social situation. Here is a summary of how to complete a thought record.

How to Complete the *Anxiety Thought Record*

Column	*How to Complete*
1. Day and Time	▪ Record the date and time when your anxiety episode occurred
2. Situation	▪ Describe the situation that triggered your anxiety. This can be an object, activity, or experience (e.g., a thought, memory, image, or physical feeling)
3. Anxiety-Provoking Thoughts and Predictions	▪ Record any anxiety-provoking thoughts or predictions that were on your mind. What were you afraid might happen?
4. Anxiety Before (0 – 100)	▪ Using a scale ranging from 0 (completely calms) to 100 (completely terrified), rate your anxiety level before you started to challenge your anxious thoughts.
5. Alternative Thoughts and Predictions	▪ Record some alternative beliefs and predictions to counter the thoughts listed in column 3.
6. Evidence and Realistic Conclusions	▪ Using the strategies described in the remainder of this chapter, record any evidence you can think of to counter your anxiety provoking thoughts. Based on this evidence, write down a realistic conclusion or prediction.
7. Anxiety After (0 – 100)	▪ Using a scale ranging from 0 (completely calms) to 100 (completely terrified), rate your anxiety level after challenging your anxious thoughts.

Now let's go through a few examples of how you can use a Thought Record to challenge your own anxiety in social situations.

COMPLETE THOUGHT RECORDS WITH PARTICIPANTS.

Challenging your anxious thoughts takes practice. With time, this approach will become more automatic and you won't need to write out all of the steps.

Appendix D

Speech Task

Please select one of the following topics and prepare a 3-minute speech on it.

Topics:

1. Do you agree or disagree with the practice of euthanasia? Why or why not?

2. Do you agree or disagree with the death penalty? Why or why not?

3. Do you agree or disagree with the use of corporal punishment for children (i.e., should parents be able to spank their children)? Why or why not?

4. Do you agree or disagree with the practice of abortion? Why or why not?

5. Do you agree or disagree with the legalization of marijuana? Why or why not?

Appendix E

Informed Consent Agreement
Ryerson University

Title of Study: Reactions to Social Situations

You are being asked to participate in a research study. Before you give your consent to be a volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Investigators: Matilda E. Nowakowski, Graduate Student, Department of Psychology, Ryerson University
Dr. Martin M. Antony, Professor, Department of Psychology, Ryerson University
Dr. Naomi Koerner, Assistant Professor, Department of Psychology, Ryerson University

Purpose of the Study: The purpose of the study is to explore factors that play a role in how individuals experience social situations.

Description of the Study: The experiment will consist of 3 components: 1) completion of questionnaires online prior to the laboratory visit; 2) one visit to the Psychology Research and Training Centre at Ryerson University, located at 105 Bond Street on the second floor; and 3) completion of online questionnaires 1-week and 1-month following the laboratory visit. This consent agreement applies only to the prelaboratory online questionnaires. Another consent agreement will be provided during the laboratory visit.

For this portion of the study, you will complete a set of online questionnaires that will ask about your thoughts and emotions in a variety of situations. The total time commitment for the online questionnaires is 20 minutes.

Confidentiality: Everything you disclose in this study will remain completely confidential, with the following exceptions, for which we may be required by law to break confidentiality:

(1) if you intend to harm yourself;
(2) if you intend to harm someone else;
(3) if there is reasonable suspicion that a child up to the age of 16 years is at risk of neglect or abuse, we are required by law to report this to the Children's Aid Society right away;
(4) if our files are subpoenaed by the courts (records can be opened by a specific court order)
(5) if a regulated health professional has engaged in inappropriate sexual behaviour toward you or another person and you provide us with the name of this individual, we are obligated to report them to their regulatory body.

To ensure your privacy, an ID number, as opposed to your name, will be used on the questionnaires. Your personal information will be stored in a locked file cabinet in a locked room, separate from the data you generate while participating in the study. The questionnaire data will be stored on a password-protected computer. Only the experimenters involved in the study will have access to the data. Your confidentiality will be protected to the full extent allowed by law. Only group findings will be reported in publications and presentations arising from this research; neither your name nor any other identifying information about you will be shared. The data will be destroyed 7 years after publication of papers resulting from this study.

Potential Risks or Discomforts: There is minimal risk involved if you agree to take part in this study. By agreeing to participate in this portion of the study, you understand that you may experience some negative emotions when completing the questionnaires or other aspects of the study. You have the right to refuse or discontinue participation at any time.

Potential Benefits of the Study to You or Others: There may be no direct benefits to you for participating in the study. However, you may derive benefit from the self-assessment, as it may increase your awareness of your own emotions and behaviours in social situations. You may also develop a better understanding of research methodology and will be providing researchers with valuable insights.

Voluntary Nature of Participation: Participation in this study is completely voluntary. Your choice of whether to participate will not influence your future relations with Ryerson University. If you decide to participate, you are free to withdraw your consent and to stop your participation at any time. Your right to withdraw your consent also applies to our use of your data. If you decide that you do not want us to keep or analyze data that you have provided during the course of your participation in this study, please feel free to notify us. At any particular point in the study, you may refuse to answer any particular question or stop participation altogether.

Compensation for Participation in the Study: Upon completion of the online questionnaires, you will be entered into a draw for 1 of 2 $25 gift certificates to Chapters or Tim Hortons.

Questions about the Study: If you have any questions about the research now please contact Matilda Nowakowski, Graduate Student, Department of Psychology, Ryerson University, 416-979-5000 ext. 2184, mnowakowski@psych.ryerson.ca or Dr. Martin M. Antony, Professor, Department of Psychology, Ryerson University, 416-979-5000 ext. 2631, mantony@psych.ryerson.ca.

If you have questions regarding your rights as a human participant in this study, you may contact Toni Fletcher, at the Ryerson University Research Ethics Board for information.

Research Ethics Board
c/o Office of the Vice President, Research and Innovation
Ryerson University
350 Victoria Street
Toronto, ON M5B 2K3
416-979-5042

Agreement: By clicking below, you indicate that you have read the information in this agreement and you agree to complete the prelaboratory visit questionnaires for the Reactions to Social Situations study. You are aware you can change your mind at any time.

By clicking below you are not giving up any of your legal rights.

Appendix F

Informed Consent Agreement
Ryerson University

Title of Study: Reactions to Social Situations

You are being asked to participate in a research study. Before you give your consent to be a volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Investigators: Matilda Nowakowski, Graduate Student, Department of Psychology, Ryerson University
Dr. Martin M. Antony, Professor, Department of Psychology, Ryerson University
Dr. Naomi Koerner, Assistant Professor, Department of Psychology, Ryerson University

Purpose of the Study: The purpose of the study is to explore factors that play a role in how individuals experience social situations.

Description of the Study: The experiment will involve 3 components: 1) online questionnaires completed prior to the laboratory visit; 2) one visit to the Psychology Research and Training Centre at Ryerson University, located at 105 Bond Street, on the second floor; and 3) follow-up online questionnaires 1-week and 1-month following the laboratory visit. You have already completed the first component of the study. Therefore, the total time commitment for the remaining 2 components will be approximately 3.5 hours. The study consists of eight (8) parts (6 of which will be completed in the laboratory and 2 of which consist of online follow-up questionnaires):

1. You will complete a 15-minute interview that will ask about your thoughts, emotions, and behaviours in social situations.
2. You will complete a computer task that will ask you to determine whether words and sentences are related or unrelated to each other.
3. You will then complete one of two tasks: 1) a computer task during which you will again be asked to decide whether words and sentences are related or unrelated to each other and will be given feedback on your responses; or 2) a short interaction with the experimenter during which you will examine the various types of thoughts you have in social situations.
4. You will again complete the computer task from the beginning of the study.
5. Your heart rate and skin conductance (a measure of sweating) will be measured. Your heart rate will be measured using two sensors that you will place on the inside of your wrists and one sensor that you will place on the inside of your left forearm. Your skin

conductance will be measured using two sensors that will be placed over your left index finger. You will not experience any pain from the measurement of your heart rate and skin conductance and the methods used are safe and nonintrusive. You will be asked to take a few deep breaths for 1 minute and then to relax for 5 minutes while your heart rate and skin conductance are being measured. You will then be asked to select 1 of 5 topics and to give a speech on your selected topic in front of a video camera. The speech will be videotaped and later rated for its quality. Please note that being videotaped is a mandatory part of the speech task. After the speech, you will be asked to complete a questionnaire about your thoughts and emotions related to the speech. You will then be asked to sit back and relax for 5 minutes while your heart rate and skin conductance is measured

6. You will be asked to complete three questionnaires focusing on your thoughts, feelings, and experiences in social situations.
7. One week after your laboratory visit, you will be sent an e-mail that will provide you with a secure link to a set of online questionnaires about your experiences in social situations.
8. One month after your laboratory visit you will again be sent an e-mail that will provide you with a secure link to a set of online questionnaires about your experience in social situations.

Following the laboratory portion of the study, you will be asked a few questions about your experiences in the study and will be given an opportunity to ask questions. Following the last online questionnaire, you will be given more detailed written information about the study and its purposes and will again be given contact information for the experimenter if you have any further questions about the study.

Confidentiality: Everything you disclose in this study will remain completely confidential; however, as part of this study, I am obligated to inform everyone that there are five cases in which I might need to break confidentiality:

(1) if you intend to harm yourself;
(2) if you intend to harm someone else;
(3) if there is reasonable suspicion that a child up to the age of 16 years is at risk of neglect or abuse, we are required by law to report this to the Children's Aid Society right away;
(4) if our files are subpoenaed by the courts (records can be opened by a specific court order)
(5) if a regulated health professional has engaged in inappropriate sexual behavior toward you or another person and you provide us with the name of this individual, we are obligated to report them to their regulatory body.

This informed consent agreement and all information that you provide will be stored in locked file cabinets at the Psychology Research and Training Centre at Ryerson University. An ID number, as opposed to your name, will be used on all forms you complete, in all videotapes and audio-recordings and in all computer files that contain the data you provide during the study. The data you generate while participating in this study will be kept in a locked file cabinet, separate from this consent agreement and any data that identify you. Only the experimenters involved in the study will have access to the data. Your confidentiality will be protected to the

full extent allowed by law. Only group findings will be reported in publications and presentations arising from this research. The data will be destroyed 7 years after publication.

Potential Risks or Discomforts: There is minimal risk involved if you agree to take part in this study. By signing this form, you understand that you may experience some negative emotions when completing the tasks. You have the right to refuse or discontinue participation at any time. If you decide to stop participating, you will still be entitled to compensation for your time. However, we ask that you try to complete the study in its entirety, for the benefit of psychological research.

Potential Benefits of the Study to You or Others: There may be no direct benefits to you for participating in the study. However, you may derive benefit from the self-assessment, as it may increase your awareness of your own emotions and behaviours in social situations. You may also develop a better understanding of research methodology and will be providing researchers with valuable insights.

Voluntary Nature of Participation: Participation in this study is completely voluntary. Your choice of whether to participate will not influence your future relations with Ryerson University. If you decide to participate, you are free to withdraw your consent and to stop your participation at any time without penalty or loss of benefits to which you are allowed. Your right to withdraw your consent also applies to our use of your data. If you decide that you do not want us to keep or analyze data that you have provided during the course of your participation in this study, please feel free to notify us. At any particular point in the study, you may refuse to answer any particular question or stop participation altogether.

Compensation for Participation in the Study: Compensation for participation in the laboratory visit will be $30 (i.e., $10/hour). If you complete both online follow-up questionnaires (i.e., 1-week and 1-month) you will be entered into a draw for one of two $50 gift certificates to either Chapters or Tim Hortons.

Questions about the Study: If you have any questions about the research now, please ask. If you have questions about the research later, you may contact Matilda Nowakowski, Graduate Student, Department of Psychology, Ryerson University, 416-979-5000 ext. 2184, mnowakowski@psych.ryerson.ca, or Dr. Naomi Koerner, Assistant Professor, Department of Psychology, 416-979-5000 ext. 2151, naomi.koerner@psych.ryerson.ca, or Dr. Martin M. Antony, Ph.D., Professor, Department of Psychology, Ryerson University, 416-979-5000 ext. 2631, mantony@psych.ryerson.ca.

If you have questions regarding your rights as a human participant in this study, you may contact Toni Fletcher, at the Ryerson University Research Ethics Board for information.

Research Ethics Board
c/o Office of the Vice President, Research and Innovation
Ryerson University
350 Victoria Street
Toronto, ON M5B 2K3

416-979-5042

Obtaining the Study Results: If you would like any information about the results of the study once it is completed, please contact Matilda Nowakowski at mnowakowski@psych.ryerson.ca

Agreement: Your signature below means that you have read the information in this agreement and have had a chance to ask any questions you have about the Reactions to Social Situations study. Your signature also means that you agree to participate in the Reactions to Social Situations study and have been told that you can change your mind at any time.
You have been given a copy of this agreement, if requested.

You have been told that by signing this consent agreement you are not giving up any of your legal rights.

_____
Name of Participant (please print)

_____ _____
Signature of Participant Date

_____ _____
Signature of Investigator Date

Appendix G

Reactions to Social Situations

Background of the Study: People who experience anxiety in social situations tend to interpret ambiguous social situations as more negative and threatening. Studies have shown that it is possible to change these thought patterns by completing activities that challenge them. This was the goal of the current study.

Contact Information: If you have any questions or concerns about this experiment or your participation in this study you may contact:

Matilda Nowakowski, PhD
Main Study Investigator
Department of Psychology
Ryerson University
105 Bond Street
Toronto, ON M5B 2K3
(416) 979-5000 x. 2184
anxietylab@ryerson.ca

Martin Antony, PhD
Supervisor
Department of Psychology
Ryerson University
350 Victoria Street
Toronto, ON M5B 2K3
(416) 979-5000 x. 2631
mantony@psych.ryerson.ca

Nancy Walton, Ph.D.
Chair, Research Ethics Board
Ryerson University
350 Victoria Street, POD470B
Toronto, ON M5B 2K3
(416) 979-5000 x. 6300
rebchair@ryerson.ca

If you would like any information about the results of the study once it is completed, please contact Matilda Nowakowski.

Resources: We provide everyone who completes this study with the same list of resources, in case they are interested in learning more about anxiety or methods of changing patterns of thinking. Our list of resources has titles of books on anxiety management, as well as referral sources (please turn over this page for the list).

In order to maintain the integrity of this research, please do not disclose the purpose of this experiment to others who may be interested in taking part in this study. When participants have too much prior knowledge about the purpose of an experiment, this can affect how they behave in the experiment and the data for that person may not be usable.

Thank you very much for participating in this study!

Self-Help Books

Antony, M.M., & Swinson, R.P. (2008). *The shyness and social anxiety workbook: Proven, step-by-step techniques for overcoming your fear, 2nd ed*. Oakland, CA: New Harbinger Publications.

Butler, G. (2008). *Overcoming social anxiety and shyness: A self-help guide using cognitive behavioral techniques*. New York, NY: Basic Books.

Hope, D.A., Heimberg, R.G., & Turk, C.L. (2010). *Managing social anxiety: A cognitive behavioral therapy approach (workbook),* 2nd ed. New York, NY: Oxford University Press.

Monarth, H., & Kase, L. (2007). *The confident speaker: Beat your nerves and communicate at your best in any situation*. New York, NY: McGraw-Hill.

Other anxiety resources are available at:
http://www.martinantony.com/anxiety-referrals

Referrals in Toronto Area

OHIP-Covered and Sliding Scale Referral

Adult Mental Health Program
Humber River Regional Hospital, Toronto
Contact: Heather Wheeler, PhD
Tel: 416-658-2003

Anxiety Disorders Clinic
Centre for Addiction and Mental Health
250 College St., Toronto
Tel: 416-979-6819

Ryerson University Centre for Student Development and Counseling
(Available to Ryerson University Students Only)
350 Victoria St., Room JOR-07C, Lower Ground Floor, Jorgenson Hall, Toronto
Tel: 416-979-5195

Private Psychology Referrals

CBT Associates of Toronto
100 Adelaide St. West, Suite 805, Toronto
Tel: 416-363-4228
Web: http://www.cbtassociates.net/
E-Mail: eilenna.denisoff@cbtassociates.net or
peter.farvolden@cbtassociates.net

Hank Frazer, PhD, C.Psych.
3852 Finch Ave., Unit 309, Scarborough
Tel: 416-298-9143 or 416-298-1102

Tae Hart, PhD, C.Psych.
Tel: 416-473-7132
Email: stacey.hart@psych.ryerson.ca

David Moscovitch, PhD, C.Psych.
Randy Katz, PhD, C.Psych.
101 Dupont Street, Toronto, ON
Tel: 416-966-1692

Neil Pilkington, PhD, C.Psych.
2 Carlton Street, Suite 1718, Toronto
Tel: 416-977-5666
E-Mail: dr.neil.pilkington@gmail.com

Heather Wheeler, PhD, C.Psych.
1333 Sheppard Ave. East, Suite 225
Tel: 416-788-3038
E-Mail: hwheeler@rogers.cs

References

Alden, L.E., Taylor, C.T., Mellings, M.J.B., & Laposa, J.M. (2008). Social anxiety and the interpretation of positive social events. *Journal of Anxiety Disorders, 22,* 577-590.

American Psychiatric Association (2013). *Diagnostic statistical manual of mental disorders, Fifth Edition (5th ed.)*. Washington, DC: Author.

American Psychiatric Association (2000). *Diagnostic statistical manual of mental disorders, Fourth Edition – Text Revision (4th ed.)*. Washington, DC: Author.

Amir, N., Beard, C., & Bower, E. (2005). Interpretation bias and social anxiety. *Cognitive Therapy and Research, 29,* 433-443.

Amir, N., Beard, C., Taylor, C.T., Klumpp, H., Elias, J., Burns, M., & Chen, X. (2009). Attention training in individuals with generalized social phobia: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 77*, 961-973.

Amir, N., Bomyea, J., & Beard, C. (2010). The effect of single-session interpretation modification on attention bias in socially anxious individuals. *Journal of Anxiety Disorders, 24*, 178-182.

Amir, N., Foa, E.B., & Coles, M.E. (1998). Negative interpretation bias in social phobia. *Behaviour Research and Therapy, 36,* 945-957.

Amir, N., & Taylor, C.T. (2012). Interpretation training in individuals with generalized social anxiety disorder: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 80*, 497-511.

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

Antony, M.M., Coons, M.J., McCabe, R.E., Ashbaugh, A., & Swinson, R.P. (2006). Psychometric properties of the Social Phobia Inventory: Further evaluation. *Behaviour Research and Therapy, 44*, 1177-1185.

Antony, M.M., Roth, D., Swinson, R.P., Huta, V., & Devins, G.M. (1998). Illness intrusiveness in individuals with panic disorder, obsessive-compulsive disorder, or social phobia. *Journal of Nervous and Mental Disease, 5,* 311-315.

Baggett, H.L., Saab, P.G., & Carver, C.S. (1996). Appraisal, coping, task performance, and cardiovascular responses during the evaluated speaking task. *Personality and Social Psychology Bulletin, 22,* 483-494.

Beard, C. (2011). Cognitive bias modification for anxiety: Current evidence and future directions. *Expert Review of Neurotherapeutics, 11*, 299-311.

Beard, C., & Amir, N. (2008). A multi-session interpretation modification program: Changes in interpretation and social anxiety symptoms. *Behaviour Research and Therapy, 46*, 1135-1141.

Beard, C., & Amir, N. (2009). Interpretation in social anxiety: When meaning precedes ambiguity. *Cognitive Therapy and Research, 33,* 406-415.

Beard, C., & Amir, N. (2010). Negative interpretation bias mediates the effects of social anxiety on state anxiety. *Cognitive Therapy and Research, 34,* 292-296.

Beard, C., Weisberg, R.B., & Amir, N. (2011). Combined cognitive bias modification treatment for social anxiety disorder: A pilot trial. *Depression and Anxiety, 28*, 981-988.

Beard, C., Weisberg, R.B., & Primack, J. (in press). Socially anxious primary care patients' attitudes toward cognitive bias modification (CBM): A qualitative study. *Behavioural and Cognitive Psychotherapy*.

Beatty, M.J., & Behnke, R.R. (1991). Effects of public speaking trait anxiety and intensity of speaking task on heart rate during performance. *Human Communication Research, 18,* 147-176.

Beck, A.T., Emery, G., & Greenberg, R.L. (1985). *Anxiety disorders and phobias: A cognitive perspective.* New York, NY: Basic Books.

Beidel, D.C., Turner, S.M., & Dancu, C.V. (1985). Physiological, cognitive, and behavioral aspects of social anxiety. *Behaviour Research and Therapy, 23,* 109-117.

Bernstein, D.A., Borkovec, T.D., & Coles, M.G.H. (1986). Assessment of anxiety. In A.R. Ciminero, K.S. Calhoun, & H.E. Adams (Eds.), *Handbook of behavioral assessment* (pp. 353-403). New York, NY: John Wiley and Sons.

Bogels, S.M., Mulkens, S., & de Jong, P.J. (1997). Task concentration training and fear or blushing. *Clinical Psychology and Psychotherapy, 4,* 251-258.

Borkovec, T.D., Stone, N.M., O'Brien, G.T., & Kaloupek, D.G. (1974). Evaluation of a clinically relevant target behavior for analog outcome research. *Behavior Therapy, 5,* 503-513.

Bowler, J.O., Mackintosh, B., Dunn, B.D., Mathews, A., Dalgleish, T., & Hoppitt, L. (2012). A comparison of cognitive bias modification for interpretation and computerized cognitive behavior therapy: Effects on anxiety, depression, attentional control, and interpretive bias. *Journal of Consulting and Clinical Psychology, 80*, 1021-1033.

Brosan, L., Hoppitt, L., Shelfer, L., Sillence, A., & Mackintosh, B. (2011). Cognitive bias modification for attention and interpretation reduces trait and state anxiety in anxious patients referred to an out-patient service: Results from a pilot study. *Journal of Behavior Therapy and Experimental Psychiatry, 42*, 258-264.

Bruch, M.A., Gorsky, J.M., Collins, T.M., & Berger, P.A. (1989). Shyness and sociability reexamined: A multicomponent analysis. *Journal of Personality and Social Psychology, 57,* 904-915.

Butler, A.C., Chapman, J.E., Forman, E.M., & Beck, A.T. (2006). The empirical status of cognitive-behavioral therapy: A review of meta-analysis. *Clinical Psychology Review, 26,* 17-31.

Clark, D.M. (2001). A cognitive perspective on social phobia. In W.R. Crozier & L.E. Alden (Eds.), *International handbook of social anxiety: Concepts, research and interventions relating to the self and shyness* (pp. 405-430). New York, NY: John Wiley and Sons.

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

Collins, K.A., Westra, H.A., Dozois, D.J.A., & Stewart, S.H. (2005). The validity of the brief version of the Fear of Negative Evaluation Scale. *Journal of Anxiety Disorders, 19*, 345-359.

Connor, K.M., Davidson, J.R.T., Churchill, E.L., Sherwood, A., Sherwood, A., Weisler, R.H., & Foa, E. (2000). Psychometric properties of the Social Phobia Inventory: New self-rating scale. *British Journal of Psychiatry, 176*, 379-386.

Constans, J.I., Penn, D.L., Ihen, G.H., & Hope, D.A. (1999). Interpretive biases for ambiguous stimuli in social anxiety. *Behaviour Research and Therapy, 37,* 643-651.

Daly, J. A. (1978). The assessment of social-communicative anxiety via self-reports: A comparison of measures. *Communication Monographs, 45,* 204-218.

Davidson, R.J. (1992). Prolegomenon to the structure of emotion: Gleaning from neuropsychology. *Cognition and Emotion, 6,* 245-268.

Davidson, R.J., Marshall, J.R., Tomarken, A.J., Henriques, J.B. (2000). While a phobic waits: Regional brain electrical and autonomic activity in social phobics during anticipation of public speaking. *Biological Psychiatry, 47,* 85-95.

De Houwer, J. (2003). The extrinsic affective Simon task. *Experimental Psychology, 50*, 77-85.

De Jongh, A., Muris, P., Ter Horst, G., Van Zuuren, F., Schoenmakers, N., & Makkes, P. (1995). One-session cognitive restructuring of dental phobia: Preparing dental phobics for treatment by restricting negative cognitions. *Behaviour Research and Therapy, 33,* 947-954.

Del-Ben, C.M., Hallak, J.E., Sponholz, A. Jr., Marques, J.M., Labate, C.M., Contel, J.O., & Zuardi, A.W. (2005). Accuracy of psychiatric diagnosis performed under indirect supervision. *Revista Brasileira de Psiquiatria, 27*, 58-62.

Duke, D., Krishnan, M., Faith, M., & Storch, E.A. (2006). The psychometric properties of the Brief Fear of Negative Evaluation Scale. *Journal of Anxiety Disorders, 20*, 807-817.

Dupont, R.L., Dupont, C.M., & Rice, D.P. (2002). Economic costs of anxiety disorders. In D.J. Stein & E. Hollander (Eds.). *Textbook of anxiety disorders.* Washington, DC: American Psychiatric Publishing.

Eckman, P.S., & Shean, G.D. (1997). Habituation of cognitive and physiological arousal and social anxiety. *Behaviour Research and Therapy, 35,* 1113-1121.

Edelmann, R.J., & Baker, S.R. (2002). Self-reported and actual physiological responses in social phobia. *British Journal of Clinical Psychology, 41,* 1-14.

Edwards, S.L., Rapee, R.M., & Franklin, J. (2003). Postevent rumination and recall bias for a social performance event in high and low socially anxious individuals. *Cognitive Therapy and Research, 27*, 603-617.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion, 6*, 169-200.

Fedoroff, I.C., & Taylor, S. (2001). Psychological and pharmacological treatments for social anxiety disorder: A meta-analysis. *Journal of Clinical Psychopharmacology, 32*, 311-324.

Feldmann-Barrett, L. (1997). The relationships among momentary emotion experiences, personality descriptions, and retrospective ratings of emotion. *Personality and Social Psychology Bulletin, 23,* 1100-1110.

Fergus, T.A., Valentiner, D.P., Kim, H.S., & Stephenson, K. (2009). The Social Thoughts and Beliefs Scale: Psychometric properties and its relation with interpersonal functioning in a non-clinical sample. *Cognitive Therapy and Research, 33*, 425-431.

Feske, U., & Chambless, D.L. (1995). Cognitive behavioral versus exposure only treatment for social phobia: A meta-analysis. *Behavior Therapy, 26,* 695-720.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). *Structured clinical interview for DSM-IV Axis I disorders – Patient edition (SCID-I/P, version 2.0).* New York: Biometrics Research Department, New York State Psychiatric Institute.

Foa, E.B., Franklin, M.R., Perry, K.J., & Herbert, J.D. (1996). Cognitive biases in generalized social phobia. *Journal of Abnormal Psychology, 105*, 433-439.

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

Fredrikson, M. (1983). Reliability and validity of some specific fear questionnaires. *Scandinavian Journal of Psychology, 24*, 331–334.

Fu, X., Du, Y., Au, S., & Lau, J.Y.F. (2013). Reducing negative interpretations in adolescents with anxiety disorders: A preliminary study investigating the effects of a single session of cognitive bias modification training. *Developmental Cognitive Neuroscience, 4*, 29-37.

Gilkinson, H. (1942). Social fears reported by students in college speech classes. *Speech Monographs, 9,* 131–160.

Gould, R.A., Buckminster, S., Pollack, M.H., Otto, M.W., & Yap, L. (1997). Cognitive-behavior and pharmacological treatment for social phobia: A meta-analysis. *Clinical Psychology: Science and Practice, 4*, 291-306.

Gramer, M., & Saria, K. (2007). Effects of social anxiety and evaluative threat on cardiovascular responses to active performance situations. *Biological Psychology, 74,* 67-74.

Gramer, M., & Sprintschnik, E. (2008). Social anxiety and cardiovascular responses to an evaluative speaking task: The role of stressor anticipation. *Personality and Individual Differences, 44,* 371-381.

Grey, S., & Mathews, A. (2000). Effects of training on interpretation of emotional ambiguity. *Quarterly Journal of Experimental Psychology, 53*, 1143-1162.

Gros, D.F., Antony, M.M., Simms, L.J., & McCabe, R.E. (2007). Psychometric properties of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA): Comparison to the State-Trait Anxiety Inventory (STAI). *Psychological Assessment, 19*, 369-381.

Gros, D.F., Simms, L.J., & Antony, M.M. (2010). Psychometric properties of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) in friendship dyads. *Behavior Therapy, 41*, 277-284.

Grossman, P., Wilhelm, F.H., Kawachi, L., & Sparrow, D. (2001). Gender differences in psychophysiological responses to speech stress among older social phobics: Congruence and incongruence between self-evaluative and cardiovascular reactions. *Psychosomatic Medicine, 63,* 765-777.

Hallion, L.S., & Ruscio, A.M. (2011). A meta-analysis of the effect of cognitive bias modification on anxiety and depression. *Psychological Bulletin, 137*, 940-958.

Heeren, A., Reese, H.E., McNally, R.J., Philippot, P. (2012). Attention training toward and away from threat in social phobia: Effects on subjective, behavioral, and physiological measures of anxiety. *Behaviour Research and Therapy, 50*, 30-39.

Heimberg, R.G., Dodge, C.S., Hope, D.A., Kennedy, C.R., Zollo, L.J., & Becker, R.E. (1990). Cognitive behavioral group treatment for social phobia: Comparison with a credible placebo control group. *Cognitive Therapy and Research, 14*, 1-23.

Hertel, P.T., & Mathews, A. (2011). Cognitive bias modification: Past perspectives, current findings, and future applications. *Perspective on Psychological Science, 6*, 521-536.

Hirsch, C.R., & Clark, D.M. (2004). Information-processing bias in social phobia. *Clinical Psychology Review, 24,* 799-825.

Hirsch, C., & Mathews, A. (1997). Interpretative inferences when reading about emotional events. *Behaviour Research and Therapy, 35,* 1123-1132.

Hirsch, C.R., & Mathews, A. (2000). Impaired positive inferential bias in social phobia. *Journal of Abnormal Psychology, 109*, 705-712.

Hofmann, S.G. (2004). Cognitive mediation of treatment change in social phobia. *Journal of Consulting and Clinical Psychology, 72*, 392.399.

Hofmann, S.G. (2007). Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cognitive Behaviour Therapy, 36*, 195-209.

Hofmann, S.G., Newman, M.G., Ehlers, A., & Roth, W.T. (1995). Psychophysiological differences between subgroups of social phobia. *Journal of Abnormal Psychology, 104,* 224-231.

Hofmann, S.G., & Smits, J.A.J. (2008). Cognitive-behavioral therapy for adult anxiety disorders: A meta-analysis of randomized placebo-controlled trials. *Journal of Clinical Psychiatry, 69*, 621-632.

Hope, D.A., Heimberg, R.G., Bruch, M.A. (1995). Dismantling cognitive-behavioral group therapy for social phobia. *Behaviour Research and Therapy, 33*, 637-650.

Hoppitt, L., Mathews, A., Yiend, J., & Mackintosh, B. (2010a). Cognitive bias modification: The critical role of active training in modifying emotional response. *Behavior Therapy, 41*, 73-81.

Hoppitt, L., Mathews, A., Yiend, J., & Mackintosh, B. (2010b). Cognitive mechanisms underlying the emotional effects of bias modification. *Applied Cognitive Psychology, 24*, 312-325.

Huppert, J.D., Foa, E.B., Furr, J.M., Filip, J.C., & Mathews, A. (2003). Interpretation bias in social anxiety: A dimensional perspective. *Cognitive Therapy and Research, 27,* 569-577.

Huppert, J.D., Pasupuleti, R., Foa, E.B., & Mathews, A. (2007). Interpretation biases in social anxiety: Response generation, response selection, and self-appraisals. *Behaviour Research and Therapy, 45,* 1505-1515.

Jones, G., Phillips, G., & Rieger, E. (1995). Effects of cardiac awareness, public speaking anxiety, and physiological "priming" on state-trait anxiety (state) and feelings of apprehension. *Psychophysiology, 32*, S43.

Kanai, Y., Sasagawa, S., Chen, J., Shimada, H., & Sakano, Y. (2010). Interpretation bias for ambiguous social behavior among individuals with high and low levels of social anxiety. *Cognitive Therapy and Research, 34,* 229-240.

Kessler, R.C., Berglund, P.B., Demler, O., Jin, R., Merikangas, K.R., & Walters, E.E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62,* 593-602.

Klorman, R., Weerts, T. C., Hastings, J. E., Melamed, B. G., & Lang, P. J. (1974). Psychometric description of some specific-fear questionnaires. *Behavior Therapy, 5*, 401–409.

Koch, E.I., Spates, R.C., & Himle, J.A. (2004). Comparison of behavioral and cognitive-behavioral one-session exposure treatments for small animal phobias. *Behaviour Research and Therapy, 42,* 1483-1504.

Koerner, N., Antony, M.M., Young, L., & McCabe, R.E. (2013). Changes in beliefs about the social competence of self and others following group cognitive-behavioral treatment. *Cognitive Therapy and Research, 37*, 256-265.

Lang, P.J. (1978). Anxiety: Toward a psychophysiology definition. In H.S. Akistal & W.L. Webb (Eds.), *Psychiatric diagnosis: Exploration of biological predictors* (pp. 365-389). New York, NY: Spectrum.

Lang, P.J., & McTeague, L.M. (2009). The anxiety disorder spectrum: Fear imagery, physiological reactivity, and differential diagnosis. *Anxiety, Stress and Coping: An International Journal, 22*, 5-25.

Lazarus, R.S. (1991). Emotion and adaptation. New York, NY: Oxford University Press.

Leary, M.R. (1983). A brief version of the fear of negative evaluation scale. *Personality and Social Psychology Bulletin, 9*, 371-375.

Leary, M. R. (1991). Social anxiety, shyness, and related constructs. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes* (pp. 161–194). New York City: Academic Press.

Leary, M. R., & Downs, D. L. (1995). Interpersonal functions of the self-esteem motive: The self-esteem system as a sociometer. In M. Kernis (Ed.), *Efficacy, agency, and self-esteem*. New York: Plenum.

Leary, M. R., & Kowalski, R. M. (1995a). *Social anxiety*. New York: Guilford Press.

Leary, M. R., & Kowalski, R. M. (1995b). The self-presentational model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment*. New York: Guilford Press.

Levenson, R.W. (1994). Human emotion: A functional view. In P. Ekman & R.J. Davidson (Eds.), *The nature of emotions: Fundamental questions* (pp. 123-126). New York, NY: Oxford University Press.

Levin, A.P., Saoud, J.B., Strauman, T., Gorman, J.M., Fyer, A.J., Crawford, R., & Liebowitz, M.R. (1993). Responses of "generalized" and "discrete" social phobics public speaking. *Journal of Anxiety Disorders, 7,* 207-221.

Li, S., Tan, J., Qian, M., Liu, X. (2008). Continual training of attentional bias in social anxiety. *Behaviour Research and Therapy, 46*, 905-912.

Liebowitz, M.R. (1987). Social phobia. *Modern Problems in Pharmacopsychiatry, 22*, 141-173.

Lochner, C., Mogotsi, M., du Toit, P.L., Kaminer, D., Niehaus, D.J., & Stein, D.J. (2003). Quality of life in anxiety disorders: A comparison of obsessive-compulsive disorder, social anxiety disorder, and panic disorder. *Psychopathology, 36,* 255-262.

Lyneham, H.J., & Rapee, R.M. (2005). Agreement between telephone and in-person delivery of a structured interview for anxiety disorders in children. *Journal of the American Academy of Child and Adolescent Psychiatry, 44*, 274-282.

Mackintosh, B., Mathews, A., Eckstein, D., & Hoppitt, L. (2013). Specificity effects in the modification of interpretation biases and stress reactivity. *Journal of Experimental Psychopathology, 4*, 133-147.

Mackintosh, B., Mathews, A., Yiend, J., Ridgeway, V., & Cook, E. (2006). Induced biases in emotional interpretation influence stress vulnerability and endure despite changes in context. *Behavior Therapy, 37,* 209-222.

MacLeod, C., Rutherford, E., Campbell, L., Ebsworth, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology, 111*, 107-123.

Mathews, A. (2012). Effects of modifying the interpretation of emotional ambiguity. *Journal of Cognitive Psychology, 24*, 92-105.

Mathews, A., & Mackintosh, B. (2000). Induced emotional interpretation bias and anxiety. *Journal of Abnormal Psychology, 109,* 602-615.

Mathews, A., Ridgeway, V., Cook, E., & Yiend, J. (2007). Inducing a benign interpretation bias reduces trait anxiety. *Journal of Behavior Therapy and Experimental Psychiatry, 38,* 225-236.

Mauss, I.B., Levenson, R.W., McCarter, L., Wilhelm, F.H., & Gross, J.J. (2005). The tie that binds? Coherence among emotion experience, behavior and physiology. *Emotion, 5,* 175-190.

Mauss, I.B., Wilhelm, F.H., & Gross, J.J. (2004). Is there less to social anxiety than meets the eye? Emotion experience, expression, and bodily responding. *Cognition and Emotion, 18,* 631-662.

McManus, F., Clark, D.M., & Hackmann, A. (2000). Specificity of cognitive biases in social phobia and their role in recovery. *Behavioural and Cognitive Psychotherapy, 28*, 201-209.

Mobini, S., Reynolds, S., & Mackintosh, B. (2013). Clinical implications of cognitive bias modification for interpretation biases in social anxiety: An integrative literature review. *Cognitive Therapy and Research, 37*, 173-182.

Moscovitch, D.A. (2009). What is the core fear in social phobia?: A new model to facilitate individualized case conceptualization and treatment. *Cognitive and Behavioral Practice, 16,* 123-134.

Moscovitch, D.A., Gavric, D.L., Senn, J.M., Santesso, D.L., Miskovic, V., Schmidt, L.A., McCabe, R.E., & Antony, M.M. (2012). Changes in judgment biases and use of emotion regulation strategies during cognitive-behavioral therapy for social anxiety disorder: Distinguishing treatment responders from nonresponders. *Cognitive Therapy and Research, 36*, 261-271.

Moscovitch, D.A., Suvak, M.K., & Hofmann, S.G. (2010). Emotional response patterns during social threat in individuals with generalized social anxiety disorder and non-anxious controls. *Journal of Anxiety Disorders, 24,* 785-791.

Mulken, S., de Jong, P.J., Dobbelaar, A., & Bogels, S.M. (1999). Fear of blushing: Fearful preoccupation irrespective of coloration. *Behavior Research and Therapy, 37,* 1119-1128.

Murphy, R., Hirsch, C.R., Mathews, A., Smith, K., & Clark, D.M. (2007). Facilitating a benign interpretation bias in a high socially anxious population. *Behaviour Research and Therapy, 45,* 1517-1529.

Offord, D.R., Boyle, M.H., Campbell, D., Goering, P., Lin, E., Wong, M., & Racine, Y.A. (1996). One-year prevalence of psychiatric disorder in Ontarians 15 to 64 years of age. *Canadian Journal of Psychiatry, 41,* 559-563.

Öst, L.G., Brandberg, M., & Alm, (1997). One versus five sessions of exposure in the treatment of flying phobia. *Behaviour Research and Therapy, 35,* 987-996.

Panayiotou, G., & Vrana, S.R. (1998). Effects of self-focused attention on the startle reflex, heart rate, and memory performance among socially anxious and nonanxious individuals. *Psychophysiology, 35,* 328-336.

Paul, G. L. (1966). *Insight vs desensitization in psychotherapy.* Stanford, CA: Stanford University Press.

Phillips, G.C., Jones, G.E., Rieger, E.J., & Snell, J.B. (1997). Normative data for the personal report of confidence as a speaker. *Journal of Anxiety Disorders, 11*, 215-220.

Rapee, R.M., & Heimberg, R.G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35,* 741-756.

Rapee, R.M., & Lim, L. (1992). Discrepancy between self- and observer ratings of performance in social phobics. *Journal of Abnormal Psychology, 101*, 728-731.

Raudenbush, S., & Bryk, A.S. (2002). *Hierarchical linear models: Applications and data analysis methods (2nd ed.)*. Newbury Park, CA: Sage Publications.

Ree, M.J., French, D., MacLeod, C., & Locke, V. (2008). Distinguishing cognitive and somatic dimensions of state and trait anxiety: Development and validation of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA). *Behavioural and Cognitive Psychotherapy, 36*, 313-332.

Reisenzein, R. (2000). Exploring the strength of association between the components of emotion syndromes: The case of surprise. *Cognition and Emotion, 14,* 1-38.

Rodebaugh, T.L., Woods, C.M., Thissen, D.M., Heimberg, R.G., Chambless, D.L., & Rapee, R.M. (2004). More information from fewer questions: The factor structure and item properties of the original and brief fear of negative evaluation scale. *Psychological Assessment, 16*, 169-181.

Rosenberg, E.L., & Ekman, P. (1994). Coherence between expressive and experiential systems in emotion. *Cognition and Emotion, 8,* 201-229.

Roth, D., Antony, M.M., & Swinson, R.P. (2001). Interpretations for anxiety symptoms in social phobia. *Behaviour Research and Therapy, 39,* 129-138.

Salemink, E., & van den Hout, M. (2010). Trained interpretive bias survives mood change. *Journal of Behavior Therapy and Experimental Psychiatry, 41,* 310-315.

Salemink, E., van den Hourt, M., & Kindt, M. (2010). Generalisation of modified interpretive bias across tasks and domains. *Cognitive and Emotion, 24*, 453-464.

Salemink, E., van den Hout, M., & Kindt, M. (2009a). Effects of positive interpretive bias modification in highly anxious individuals. *Journal of Anxiety Disorders, 23,* 676-683.

Salemink, E., van den Hout, M., & Kindt, M. (2009b). Generalisation of modified interpretive bias across tasks and domains. *Cognition and Emotion, 24,* 453-464.

Salemink, E., van den Hout, M., & Kindt, M. (2007a). Trained interpretive bias: Validity and effects on anxiety. *Journal of Behavior Therapy and Experimental Psychiatry, 38*, 212-224.

Salemink, E., van den Hout, M., & Kindt, M. (2007b). Trained interpretive bias and anxiety. *Behaviour Research and Therapy, 45*, 329-340.

Salemink, E., van den Hout, M., & Kindt, M., & Rienties, H. (2008). Cognitive bias modification of interpretations: Effects in patients with anxiety disorders. In E. Salemink (Ed.), *Believing is seeing: The causal role of interpretive bias in social anxiety* (pp. 119-140). Wageningen: Netherlands: Ponsen and Looijen.

Scherer, K.R. (1984). On the nature and function of emotion: A component process approach. In K.R. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 293-317). Hillsdale, NJ: Lawrence Erlbaum Associates.

Schlenker, B. R., & Leary, M. R. (1982). Social anxiety and self-presentation: A conceptualization and model. *Psychological Bulletin*, *92*, 641-669.

Schmidt, N.B., Richey, A., Buckner, J.D., Timpano, K.R. (2009). Attention training for generalized social anxiety disorder. *Journal of Abnormal Psychology, 118*, 5-14.

Schultz, L.T., & Heimberg, R.G. (2008). Attentional focus in social anxiety disorder: Potential for interactive processes. *Clinical Psychology Review, 28,* 1206-1221.

Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Mind Garden.

Standage, H., Ashwin, C., & Fox, E. (2010). Is manipulation of mood a critical component of cognitive bias modification procedures? *Behaviour Research and Therapy, 48,* 4-10.

Standage, H., Ashwin, C., & Fox, E. (2009). Comparing visual and auditory presentation for the modification of interpretation bias. *Journal of Behavior Therapy and Experimental Psychiatry, 40*, 558-570.

Steil, R., Jung, K., & Stangier, U. (2011). Efficacy of a two-session program of cognitive restructuring and imagery modification to reduce the feeling of being contaminated in adult survivors of childhood sexual abuse: A pilot study. *Journal of Behavior Therapy and Experimental Psychiatry, 42,* 325-329.

Stein, M.B., Asmundson, G.J., & Chartier, M. (1994). Autonomic responsivity in generalized social phobia. *Journal of Affective Disorders, 31,* 211-221.

Stewart, R.E., & Chambless, D.L. (2009). Cognitive-behavioral therapy for adult anxiety disorders in clinical practice: A meta-analysis of effectiveness studies. *Journal of Consulting and Clinical Psychology, 77*, 595-606.

Stopa, L., & Clark, D.M. (2000). Social phobia and interpretation of social events. *Behaviour Research and Therapy, 38,* 273-283.

Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics (5th ed.)*. Boston, MA: Allyn and Bacon.

Taylor, S. (1996). Meta-analysis of cognitive-behavioral treatments for social phobia. *Journal of Behavior Therapy and Experimental Psychiatry, 27,* 1-9.

Teasdale, J.D., & Fennell, M.J.V. (1982). Immediate effects on depression of cognitive therapy interventions. *Cognitive Therapy and Research, 6,* 343-352.

Turner, S.M., & Beidel, D.C. (1985). Empirically derived subtypes of social anxiety. *Behavior Therapy, 16,* 384-392.

Turner, S.M., Beidel, D.C., Dancu, C.V., & Stanley, M.A. (1989). An empirically derived inventory to measure social fears and anxiety: The Social Phobia and Anxiety Inventory. *Psychological Assessment, 1*, 35-40.

Turner, S.M., Johnson, M.R., Beidel, D.C., Heiser, N.A., & Lydiard, R.B. (2003). The Social Thoughts and Beliefs Scale: A new inventory for assessing cognitions in social phobia. *Psychological Assessment, 15*, 384-391.

Twentyman, C.T., & McFall, R.M. (1975). Behavioral training of social skills in shy males. *Journal of Consulting and Clinical Psychology, 43,* 384-395.

Van Bockstaele, B., Verschuere, B., Koster, E.H.W., Tibboel, H., De Houwer, J., & Crombez, G. (2011). Effects of attention training on self-reported, implicit, physiological and behavioural measures of spider fear. *Journal of Behavior Therapy and Experimental Psychiatry, 42*, 211-218.

Voncken, M.J., Bogels, S.M., & Peeters, F. (2007). Specificity of interpretation and judgmental biases in social phobia versus depression. *Psychology and Psychotherapy: Theory, Research and Practice, 80,* 443-453.

Watson, D., Clark, L.A., & Tellegan, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070.

Weeks, J.W., Heimberg, R.G., Fresco, D.M., Hart, T.A., Turk, C.L., Schneier, F.R., & Liebowitz, M.R. (2005). Empirical validation and psychometric evaluation of the Brief

Fear of Negative Evaluation Scale in patients with social anxiety disorder. *Psychological Assessment, 17*, 179-190.

Wells, A., Clark, D.M., Salkovskis, P., Ludgate, J., Hackmann, A., & Gelder, M. (1995). Social phobia: The role of in-situation safety behaviors in maintaining anxiety and negative beliefs. *Behaviour Research and Therapy, 37,* 653-658.

West, S.G., Finch, J.F., & Curran, P.J. (1995). Structural equation models with nonormal variables: Problems and remedies. In Rich H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 56-75). Thousand Oaks, CA: Sage Publications, Inc.

Wild, J., Clark, D.M., Ehlers, A., & McManus, F. (2008). Perception of arousal in social anxiety: Effects of false feedback during a social interaction. *Journal of Behavior Therapy and Experimental Psychiatry, 39,* 102-116.

Wilson, E.J., MacLeod, C., Mathews, A., & Rutherford, E.M. (2006). The causal role of interpretive bias in anxiety reactivity. *Journal of Abnormal Psychology, 115*, 103-111.

Wolpe, J. (1982). *The practice of behavior therapy*. New York, NY: Pergamon Press.

Yiend, J., Mackintosh, B., & Mathews, A. (2005). Enduring consequences of experimentally induced biases in interpretation. *Behaviour Research and Therapy, 43*, 779-797.

Zucker, B.G., Craske, M.G., Blackmore, M.A., & Nitz, A. (2006). A cognitive behavioral workshop for subclinical obsession and compulsions. *Behaviour Research and Therapy, 44,* 289-304.