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The Effect of Post Event Processing on Response to Exposure Therapy among those with Social Anxiety Disorder

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THE EFFECT OF POST EVENT PROCESSING ON RESPONSE TO EXPOSURE THERAPY

AMONG THOSE WITH SOCIAL ANXIETY DISORDER

by

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Under the Direction of Page Anderson

ABSTRACT

Exposure therapy has received a great deal of support as an effective treatment for social anxiety. However, not all those who undergo exposure therapy improve, and some of those who do respond continue to report significant levels of symptoms. A theorized mechanism of change for exposure therapy is extinction learning. Extinction learning is believed to occur across exposure sessions during which new associations are formed and stored in memory. Individuals with social anxiety are prone to engage in post event processing (PEP), or rumination, after social experiences, which may interfere with extinction learning, and thus attenuate response to treatment. The current study examined whether PEP limits treatment response to two different exposure based treatments, a group based cognitive behavioral intervention and an individually based virtual reality exposure therapy among participants (n = 75) diagnosed with social anxiety disorder. The findings suggested that PEP decreased as a result of treatment and that social

anxiety symptoms for those with greater amounts of PEP improved at a slower rate of change than those with lower levels of PEP. Implications for the role of PEP on treatment response are discussed.

INDEX WORDS: Social anxiety, Post event processing, Cognitive behavioral therapy, Hierarchical linear modeling

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DEDICATION

To my adoring wife, Peggy A. Price, who has provided much needed love and support during my dissertation and throughout my entire graduate career. Without you, this would have never been accomplished.

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1. INTRODUCTION

Exposure therapy is considered the gold standard for treating a variety of anxiety disorders, including social anxiety (Barlow, 2002). The treatment is theorized to reduce fear through the development of nonfearful associations with a target stimulus and the integration of these new associations into memory (Moscovitch, Antony, Swinson, & Stein, 2009). Processes that interfere with this integration may reduce treatment response (Telch, et al., 2004). Within social anxiety disorder, one such interfering process may be *post event processing* (PEP; Clark & Wells, 1995). PEP has just begun to receive attention in the clinical literature and the extent that it interferes with treatment response remains to be tested. The current study sought to examine if PEP reduced treatment outcome to exposure therapy for social anxiety disorder. The following literature review will present the method by which exposure therapy is theorized to reduce fear, discuss models of social anxiety disorder, the function of PEP within these models, and present a rationale for how PEP may interfere with extinction learning during exposure therapy.

1.1 Social Anxiety

Social anxiety has received a great deal of empirical attention since its addition to the Diagnostic and Statistical Manual (Ponniah & Hollon, 2008). The disorder is categorized by an elevated and sustained fear of social situations. Social anxiety has been associated with lower levels of education, occupational achievement, and fewer personal relationships (APA, 2000). It also can increase the risk for developing comorbid depression and substance abuse (Kushner, Sher, & Beitman, 1990; Stein & Kean, 2000). Recent epidemiological data suggest that approximately 4%-13% of the American population meet criteria for social anxiety with many more suffering from subthreshold symptoms (Fehm, Schneider, & Hoyer, 2007; Kessler, McGonagle, Zhao, & Nelson, 1994).

The intervention that has received the most empirical support as a treatment for social anxiety disorder is exposure therapy (Barlow, 2002). Exposure is conducted by repeatedly presenting the feared stimulus for an extended period of time in a controlled setting. The feared stimulus can be presented in a variety of forms to effectively treat the disorder (for a review see Norton & Price, 2007). Clients can be asked to confront the actual stimulus (as in *in vivo* exposure), to imagine the feared stimulus (as in imaginal exposure), or to encounter a virtual presentation of the stimulus (as in virtual reality exposure, VRE).

Exposure therapy for social anxiety can be effectively delivered in a group or individual format (Herbert, Rheingold, Gaudiano, & Myers, 2004). The first randomized clinical trial to demonstrate the effectiveness of a group based intervention compared a cognitive behavioral group (CBGT) intervention to a credible placebo treatment (Heimberg, Dodge, Hope, & Kennedy, 1990). The CBGT arm contained several empirically based elements including cognitive restructuring and exposure. The placebo arm was designed to provide a supportive environment but not use evidence based techniques. Participants in both arms improved with regard to social fear, but the CBGT arm showed greater declines in symptomology at posttreatment and follow up. Although these results were the first to demonstrate that exposure based treatments can effectively reduce symptoms of social anxiety, they were criticized for including cognitive interventions that may have obscured the unique effect of exposure.

A subsequent dismantling study examined the unique contributions of exposure and cognitive interventions in the treatment of social anxiety symptoms (Hope, Heimberg, & Bruch, 1995). Participants were randomly assigned to one of three arms: 1) a CBGT treatment that included exposure and cognitive interventions, 2) an exposure group that followed the same protocol as the CBGT but removed the cognitive interventions, and 3) a wait list control

condition. Participants in both active treatments improved more than the waitlist group at posttreatment, but those in the exposure alone group showed a greater improvement on behavioral and cognitive measures than the CBGT group. However, this difference disappeared at 6 month follow up. The findings from these two studies suggest that exposure therapy, alone or in combination with cognitive techniques, are effective for treating social anxiety.

Since this initial work, several empirical studies have supported exposure therapy as being more successful at reducing social anxiety symptoms than other interventions. A meta analysis compared the effect of CBT treatments, which included exposure therapies, to pharmacological treatments for social anxiety across 24 controlled outcome studies (Gould, Buckminster, Pollack, Otto, & Yap, 1997). CBT had a larger effect size (ES = .74) as compared to pharmacological treatments (ES = .62). Within the cognitive behavioral treatments, exposure alone (ES = .89) and combined with cognitive treatments (ES = .80) were found to be most effective.

Although exposure appears to be a necessary component to reduce fear, a recent study suggested that including cognitive interventions that facilitate exposure may further improve treatment response (Rapee, Gaston, & Abbott, 2009). In this study participants were randomized across 1) a "basic" CBT intervention that included in vivo exposure, 2) an "enhanced" CBT intervention that used the same treatment as the basic approach with the addition of cognitive interventions designed to enhance exposure (e.g. attention retraining, evaluating performance appraisals, and feedback), and 3) stress management. Declines in social anxiety symptoms were greater for the basic and enhanced treatments as compared to stress management. As compared to those in the basic treatment, those in the enhanced treatment had significantly higher clinician's ratings of improvement and had a greater proportion of participants with scores below

a clinical cutoff for two outcome measures. Overall, the findings of this work validate exposure as an effective method for treating social anxiety disorder and suggest cognitive interventions may improve response.

The model that has been most influential in guiding the development of exposure therapy is the emotion processing theory (EPT; Foa & Kozak, 1986). EPT states that fear consists of a network of cognitions called the phobic fear structure. Phobic fear structures consist of three elements: 1) a description of the feared stimulus, 2) a response for when it is encountered, and 3) its meaning, which is theorized to be a set of negative associations that trigger fear, panic, and maladaptive cognitions (Foa & Kozak; Lang, 1977; Taylor, Koch, & McNally, 1992; Telch, Valentiner, Ilai, Petruzzi, & Hehmsoth, 2000). Maladaptive cognitions may include an overestimation of the probability that a negative outcome will occur and an exaggeration of the cost of the outcome. For example, socially anxious individuals estimate that during social interactions their sweating is readily apparent (increased probability) and that they will be publically ridiculed for it (exaggerated cost). In a social situation, their beliefs lead to a surge of anxiety that causes physical sensations, such as feeling hotter (response), and viewing the social situation as threatening (meaning). These situations are then avoided to minimize or prevent anxiety.

Using EPT as a theoretical framework, exposure therapy is presumed to reduce fear by activating and integrating contradictory information into the fear structure (Foa & Kozak, 1986; Foa & McNally, 1996). This contradictory information, referred to as extinction learning, may include new learning about the intensity of the fear reaction, its duration, the probability of a negative outcome, and the intensity of the costs associated with these outcomes. These new associations are promoted via prolonged contact with the feared stimulus which may lead to

learning about the fear reaction's finite duration and the limited intensity. The absence or limited occurrence of negative outcomes reduces estimations about the probability of such events and promotes learning about their actual cost and aversiveness. That is, during exposure therapy individuals learn that the likelihood of a negative outcome is lower than originally anticipated and the actual consequences are not as high.

Although exposure therapy has strong theoretical and empirical support, not all individuals with social anxiety disorder benefit from the treatment (Dalrymple & Herbert, 2007). Of those that do benefit, many remain with anxiety levels that are significantly higher than those without the disorder (Heimberg, et al., 1998; Herbert, et al., 2005). Data from long term follow up of individuals that received treatment suggested that those with higher levels of social anxiety and depression after treatment reported a poorer quality of life as compared to those with lower levels of the disorder (Eng, Coles, Heimberg, & Safren, 2001). There is some evidence to suggest that even after treatment, socially anxious individuals continue to view their social performance as a factor that limits their overall functioning (Eng, Coles, Heimberg, & Safren, 2005).

There is a lack of research examining causes for partial or nonresponse to exposure. A potential cause for a partial response is processes that interfere with the consolidation of new learning. For example, distraction during the presentation of the feared stimulus has been identified as one such process (Foa & Kozak, 1986). Experimental research with in vivo exposure therapy for claustrophobia has supported this claim. Changes in claustrophobic symptoms were compared across four conditions: 1) exposure therapy while focusing on threat words, 2) exposure therapy while focusing on neutral words, 3) exposure therapy while participating in a demanding auditory cue task, which was considered the "distraction" condition,

or 4) exposure without distraction (Telch, et al., 2004). Participants in the auditory cue condition had fewer between session changes in fear and poorer overall treatment response than those in the other conditions. The authors concluded that the heavy cognitive load imposed by the distraction task limited between session reductions in fear, an indicator of the consolidation of new learning, and contributed to an overall reduced treatment response.

Further evidence for the importance of the consolidation of new learning comes from research examining the potential for a drug that enhances this process to improve the effectiveness of exposure (for a review see Norberg, Krystal, & Tolin, 2008). D-cycloserine (DCS) is a partial agonist of the N-Methyl-D-aspartate (NMDA) receptor, originally used in the treatment of tuberculosis. Work with low dosages of DCS in laboratories, and more recently in human samples, suggests that it may work at the neurochemical level to enhance the consolidation of nonfearful learning into memory. Two studies have evaluated the extent that exposure therapies for social anxiety were enhanced by DCS (Guastella, et al., 2008; Hofmann, et al., 2006). Both randomized participants across two arms, one arm receiving exposure therapy and the medication and one arm receiving exposure therapy and a placebo. The Guastella, et al. sample used an individualized exposure based treatment whereas the Hofmann, et al. sample used both individual and group based exposure therapies. Guastella, et al. reported that the DCS arm reported fewer social anxiety symptoms at posttreatment as compared to the placebo arm. Hofmann, et al. had similar findings in that both group and individual treatments that received DCS had greater symptom reduction as compared to placebo. Both studies suggest that DCS facilitated extinction learning during exposure therapy.

Thus, there is evidence to suggest that the success of exposure therapy depends on extinction learning. Interestingly, the research suggesting that DCS facilitates exposure

(Norberg, et al., 2008) and that distraction (Telch, et al., 2004) attenuates exposure support the claim that extinction learning occurs between exposure sessions (Berry, Rosenfield, & Smits, 2009; van Minnen & Hagenaars, 2002). These studies demonstrated that a decrease in the level of peak fear across sessions was associated with greater treatment outcome. In other words, learning that occurred between exposure sessions was utilized during the following session to reduce the experience of fear during the subsequent exposure. Further support comes from research showing that treatment response is greater when exposures are spaced across several intervals as opposed to a single extended session (Rowe & Craske, 1998; Tsao & Craske, 2000). By spacing the exposures, new learning has a greater opportunity to be integrated into the fear structure, which results in greater overall fear reduction. Thus, empirical evidence suggests that the consolidation of new learning across sessions leads to better treatment response.

In summary, exposure therapy is effective in the treatment of social anxiety disorder, although not everyone benefits from treatment and a proportion of those who do benefit continue to experience symptoms. EPT provides a framework for understanding why exposure therapy works - by activating and modifying the fear structure. Recent evidence highlights the importance of memory consolidation for effective extinction learning via exposure therapy. Experimental studies show that distraction may interfere with between session fear reduction and animal and human studies show that drugs known to facilitate extinction learning enhance the effects of exposure therapy. Thus, there is converging evidence from different lines of research to suggest that memory consolidation is important for extinction learning. The current study proposes that post event processing is another mechanism by which memory consolidation is disrupted.

1.2   Post Event Processing

PEP is a review of the negative elements of a social situation in which inadequacies, mistakes, imperfections, and negative perceptions of the situation are exaggerated (Rachman, Grater-Andrew, & Shafran, 2000).   This process is hypothesized to perpetuate intrusive maladaptive cognitions about social interactions, disrupt concentration, trigger the recall of other negative memories, and lower anticipation for success in future social situations (Abbott & Rapee, 2004; Rachman, Grater-Andrew, et al., 2000). The following section describes how PEP fits within the extant models of social anxiety, reviews the empirical literature on PEP, including studies examining PEP and treatment response.

Two theoretical models (Clark & Wells, 1995; Rapee & Heimberg, 1997) have heavily influenced the empirical work on social anxiety disorder. The models propose similar mechanisms to explain the onset and maintenance of the disorder, including perceiving social situations as threatening, attention biases towards threats, negative self appraisals of performance, and rumination for past for social events.

The Clark and Wells (1995) model posits that social anxiety occurs when normal social cues are perceived as threatening (Figure 1.1). The detection of a threat triggers a series of somatic sensations. The outward appearance of these sensations (e.g. increased body temperature, heart rate, and sweating) is greatly overestimated, which further enhances the perception of threat. In an attempt to manage these sensations and cognitions, the individual engages in compensatory or safety behaviors. Safety behaviors are actions that make the person feel more comfortable, yet often have the paradoxical effect of leading to socially awkward behavior (e.g. repeatedly wiping one's forehead to minimize anxiety associated with sweating). Safety behaviors also orient the person towards their internal sensations of anxiety, which
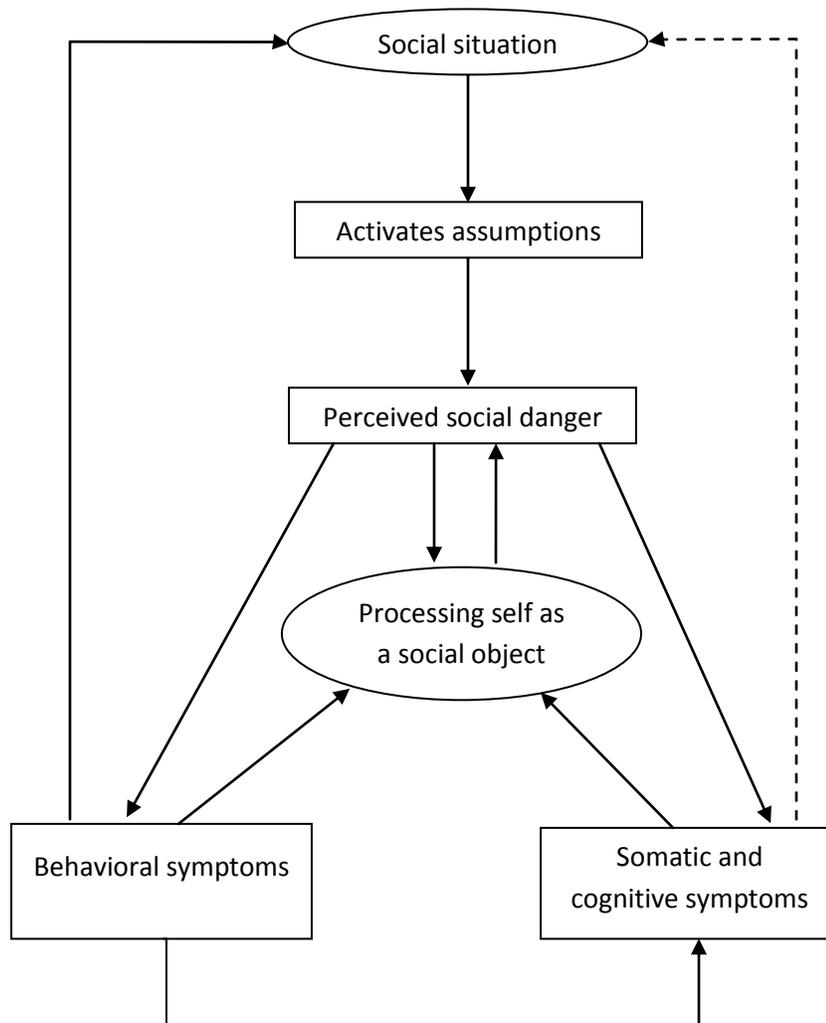
Figure 1.1 Clark and Wells Mode l of Social Phobia

reduces the likelihood that the socially anxious individual will attend to positive feedback in the environment. These processes reinforce the belief that the current social situation is threatening. Afterward, the negative portions of the social interaction are further reviewed (PEP), which magnifies these aspects and integrates them into a larger history of poor social performance. Thus, PEP is theorized to contribute to the maintenance of the disorder.

The Rapee & Heimberg model (1997) proposes that social anxiety stems from an individual having two core beliefs: 1) people, in general, are highly critical and 2) being positively received by others is immensely important. This framework leads to several processes during a social situation that generate and maintain anxiety (Figure 1.2). The first is the formation of a mental representation of the self, a picture of how one appears in the social situation. This is based upon personal attributes, environmental cues, learning history, somatic sensations, and beliefs about the self. Relevant to the current study, this mental representation occurs from an "observer" or third person perspective. Attention is then directed towards the situational "social threats", which are used to determine the expectations of the audience. The increasing difference between the representation of self and audience expectations causes an increase in anxiety and warps estimations about the probability and cost of a negative outcome. A later review of the situation (PEP) occurs from an observer perspective and leads the person to recall the negative aspects of the event in an exaggerated fashion that promotes anxiety about previous and future encounters with similar threats (Wells, Clark, & Ahmad, 1998; Wells & Papageorgiou, 1999).

1.3   Empirical Literature on Post Event Processing

The majority of research on PEP has focused on examining the relation between PEP and social anxiety. One of the first studies to examine PEP used self report data from a large sample
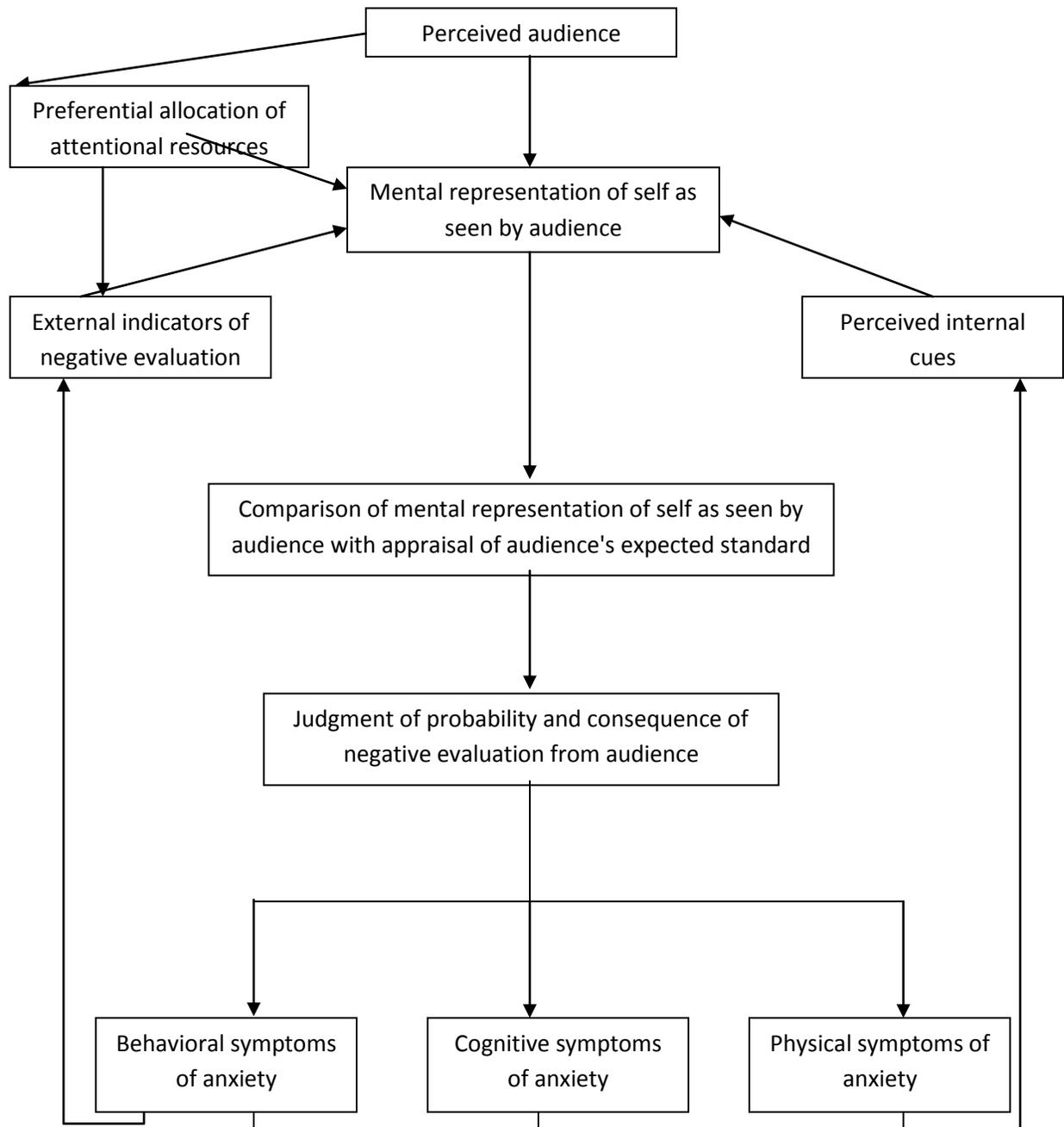
Figure 1.2 Rapee and Heimberg Model of Social Phobia

of undergraduates (Rachman, Gruter-Andrew, & Shafran, 2000). PEP was assessed using a self report measure created specifically for the study called the rumination questionnaire (RQ). A series of bivariate correlations between the RQ, measures of social anxiety, and measures of other cognitive processes demonstrated that PEP was positively related to social anxiety, poor concentration, and thought intrusions. Additional studies with nonclinical samples consistently have supported these relations (e.g. Dannahy & Stopa, 2007; Edwards, Rapee, & Franklin, 2003). Research with clinical samples also have been largely supportive of the association between PEP and social anxiety (Abbott & Rapee, 2004; Coles, Turk, & Heimberg, 2002; Kocovski & Rector, 2008; Perini, Abbott, & Rapee, 2006). Mellings & Alden (2000) evaluated differences in PEP between a clinical and non-clinical sample. Participants completed a social interaction task and returned a day later to complete a self report measure of PEP called the post event processing questionnaire (PEPQ). The findings indicated that socially anxious individuals reported greater levels of PEP as compared to the nonclinical sample. Furthermore, among the clinical sample, higher levels of PEP were related to an increased recall of negative information about the self. There was one study that did not support a bivariate relation between self reported PEP and social anxiety measures (McEvoy & Kingsep, 2006). However, a significant relation between PEP and state anxiety emerged after controlling for other variables.

Many of these studies have also demonstrated that PEP is associated with depression, which also has a ruminative component. However, the relation between PEP and social anxiety was consistently stronger than it was between PEP and depression. A reason for this difference is the content of depressive rumination and PEP (Kashdan & Roberts, 2007). Depressive rumination is a focused review of internal depressive symptoms, such as feelings of worthlessness (Nolen-Hoeksema, 1991). In contrast, PEP is focused on prior experiences about

external threats, such as the evaluations of audience members. This difference has been demonstrated in empirical work showing that the relation between social anxiety and PEP is maintained after controlling for depression (Edwards, et al., 2003; Perini, et al., 2006; Rachman, Grater-Andrew, et al., 2000). There is also some evidence to suggest that the relation between depression and PEP is weakened or no longer significant when controlling for social anxiety (Fehm, et al., 2007). However, experimental work that would better explain the direction of the relation between PEP and depression has not yet been conducted. It may be the case that PEP contributes to depression in that greater rumination after a poor social experience may lead to an increase in depressive symptoms.

Work on recall biases has been considered relevant to the study of PEP, as memory is an inherent part of the review of past social events. During recall of social situations, socially anxious individuals tended to use an observer perspective and over emphasize negative feedback. Coles et al. (2002) found that socially anxious individuals were more likely to recall their performance on speech and conversation tasks from an observer perspective three weeks after the event. In comparison, control participants did not utilize an observer perspective. Furthermore, for the socially anxious group, the observer perspective became more dominant during the three week period. Edwards, et al. (2003) examined recall for positive and negative feedback received after a speech. Feedback was provided by a confederate such that half was positive and half was negative. Relative to participants that were low in social anxiety, those with high social anxiety recalled more negative than positive feedback. Another study asked participants to complete a free recall task after a brief conversation with a confederate. Those with higher levels of social anxiety recalled more past negative experiences than those with lower anxiety (Field, Psychol, & Morgan, 2004). Taken together, these findings suggest that

those with elevated social anxiety recall social events from an observer perspective and remember more negative than positive feedback. It is possible that these processes occur when an event is recalled during PEP.

Other work on PEP has examined coping strategies for negative processes that occur during recall of a negative event. Kocovski and colleagues (2005) asked a nonclincal sample to record their thoughts after reviewing vignettes of mistakes made during public speaking. PEP was assessed with a self report questionnaire about rumination. The findings of this study were twofold. First, those with higher levels of social anxiety were more likely to cope with their anxiety after the situation by ruminating whereas those with lower levels of social anxiety were more likely to use distraction. Second, the high socially anxious participants reported the use of upward counterfactuals. Examples of an upward counterfactuals are "if only" statements (i.e. "if only I had not been sweating then it would have gone better"), which are associated with perceived failure and an increase in negative affect (Roese & Olson, 1995). These statements were used in lieu of downward counterfactuals, which are "at least" statements (i.e. "At least I did not say anything inappropriate") which are considered more adaptive. These findings and the work on recall indicate that PEP may exacerbates the negative aspects of past social experiences. leading to increased discomfort. The coping strategies that are employed to address the discomfort may include upward counterfactuals and ruminative thought, which perpetuate anxiety for the event.

Research also has examined other characteristics of PEP, including its duration after a social experience. Two studies using nonclinical samples found that participants with higher ratings of social anxiety symptoms negatively reviewed aspects of a social situation for the week following the social event (Dannahy & Stopa, 2007; Edwards, et al., 2003). Dannahy & Stopa

evaluated the course of PEP during the week after a conversation with a confederate by monitoring daily reports of ruminative thinking. The findings suggest that PEP is strongest after the first day, declined on the second and third days, and persisted without additional changes for the remainder of the week. Similar findings have been obtained with clinical samples (Abbott & Rapee, 2004; Coles, et al., 2002; Kocovski & Rector, 2008).

The research reviewed thus far has discussed the characteristics of PEP. There also has been some research to examine factors that contribute to PEP after a social event. Several studies have examined self appraisals as a potential intervening variable for the relation between social anxiety and PEP. Self-appraisals are personal thoughts about one's performance during a social situation. For socially anxious individuals, the appraisals often focus on a negative aspect of the situation (e.g. an instance in which they stuttered). Support for a positive relation between PEP and negative self appraisals were found in three studies using clinical samples. The first demonstrated that negative self appraisals obtained immediately after performing a speech were related to PEP over the course of the following week (Abbott & Rapee, 2004). A follow up study using a similar methodology with a different sample supported self appraisals as a mediator of the relation between social anxiety and PEP (Perini, et al., 2006). A third study showed that negative self appraisals, social anxiety symptoms, and beliefs about the negative consequences of the situation were related to PEP in a large ($n = 214$) clinical sample (Rapee & Abbott, 2007). Dannahy & Stopa (2007) obtained similar findings with a nonclinical sample (Dannahy & Stopa, 2007). However, results from Kashdan & Roberts (2007) did not support negative self appraisals as a mediator of the relation between social anxiety symptoms and PEP. However, there were several methodological differences between this study and those that were previously reviewed. First, Kashdan & Roberts used a nonclinical sample, which may have

impacted the extent that the participants engaged in PEP or the negativity of their self appraisals. Second, self appraisals were measured with a three item self report measure that was created specifically for the study. In contrast, self appraisals were measured with an empirically validated measure in the other studies. It is possible that these differences accounted for the contrasting findings.

A second factor that has been associated with increased PEP is the level of state anxiety during a social experience. McEvoy & Kingsep (2006) examined the relation between self reported PEP, social anxiety, and depression in a clinical sample. Bivariate relations between the variables suggest that PEP was related to depression, general stress, general anxiety, and state anxiety. When these variables were all regressed on PEP, the only significant predictor was state anxiety. From this, the authors conclude that greater fear during a social experience is associated with increased rumination about that experience.

In summary, PEP has been shown to be related to the use of an observer perspective, recall for negative aspects of social events, and the use of maladaptive coping strategies. PEP can last for up to a week after the social experience. Factors that contribute to PEP include greater state anxiety during a social situation and negative self appraisals following an event.

1.4   PEP and Treatment Outcome

There have been only two studies that have examined the relation between PEP and treatment outcome. Kocovski & Rector (2008) evaluated PEP after the initial sessions of a group exposure based intervention. Although this study did not evaluate the effects of PEP on treatment, it offers two important findings. First, it demonstrated that PEP occurred after exposures conducted in the context of treatment as evidenced by elevated PEP scores for the first and second sessions. Second, PEP for the first session was related to elevated anxiety during the

next session. This finding is suggestive of how PEP may attenuate extinction learning. After the first session, participants may have ruminated about their experiences, which prevented the consolidation of nonfearful learning, as indicated by increased ratings of anxiety for exposure during subsequent session. The second study examined changes in PEP after 12 weeks of CBT for social anxiety (Abbott & Rapee, 2004). The treatment included exposure and several additional elements such as attention training, assertiveness training, and realistic thinking. A pretest/posttest comparison suggested that PEP symptoms declined during the course of therapy, which provides preliminary evidence that PEP is impacted by treatments for social anxiety. However, this study had several shortcomings. First, it did not examine the influence PEP has on changes in social anxiety symptoms. Second, it failed to include a control group, which makes it difficult to determine if PEP declined as a direct result of treatment or other effects. Third, the analytical approach used only two waves of data for 12 treatment sessions. The small ratio of sessions to data may fail to capture important fluctuations of PEP during the course of treatment. Fourth, the study used an exposure based CBT, but did not specify whether the treatment was administered in a group or individual format. Although both formats are effective at treating social anxiety, they may have different effects on PEP. As such, further research on the influence of PEP and response to exposure is necessary.

1.5   Current Study

The thesis of the current study is that PEP may interfere with the consolidation of new learning, which is presumed to be critical to achieve benefit from exposure therapy. Based on EPT, the goal of exposure therapy is to activate and modify the fear structure. The modification of the fear structure is theorized to occur via the consolidation of new learning, which is presumed to happen, in part, between sessions. The reviewed literature suggests that state

anxiety experienced during exposure may subsequently lead to increased PEP between sessions. Given the evidence that new learning occurs between exposure sessions and PEP occurs between exposure sessions, PEP may potentially interfere with the consolidation of non-fearful learning.

The present study evaluated whether or not PEP attenuates response to exposure therapy for social anxiety disorder. Based on theoretical models of social anxiety and the empirical literature on PEP the following primary hypotheses were examined:

1) PEP will decrease during the course of exposure therapy and follow up period as compared to a wait list control,

2) PEP will negatively impact the rate of change in social anxiety over the course of treatment.

The current study also examined the relation of PEP with other variables theorized to be mechanisms of action for exposure therapy. Prior literature suggests that PEP after a session of exposure therapy is positively related to ratings of anxiety during the subsequent session, suggesting that PEP may attenuate extinction learning as measured by self-ratings of anxiety during exposure. While it would be ideal to examine the relation between PEP and self ratings of anxiety in the current study, this data was not available. Instead, the relation between self-reported PEP after a session of exposure therapy and self-reported estimates of the probability and cost of a negative outcome at the next exposure therapy session were examined. The cognitive constructs of overestimating the probability of a negative outcome and cost of a negative outcome have been identified as important variables for successful exposure therapy (Hofmann, 2000). The current study examined whether PEP is related to these constructs. The specific hypothesis were as follows:

3) PEP after a session of exposure therapy will be positively related to self-reported

estimates of the probability and cost of a negative outcome at the next session of

exposure therapy.

Finally, given the lack of literature on PEP and treatment outcome, the following

exploratory hypotheses will be tested, though there is little empirical literature to guide these

hypotheses. The current study compared the impact of group and individual therapy on PEP.

Given that the individual (VR) treatment is the experimental treatment the following hypothesis

was offered:

4) PEP will decrease more for the group treatment than the experimental VR treatment.

Finally, most clinical outcome research implies that symptoms decline in a linear fashion.

This is largely attributed to the use of only pretreatment and posttreatment measurements as the

means to test change during treatment. However, clinical work suggests that symptoms rarely

decline in a linear fashion with therapy often being described as a series of "hills and valleys."

As such, the current study used intersession measurements of PEP to assess how this symptom

fluctuates during the course of treatment. As such, the final hypothesis is as follows:

5) PEP will not decrease in a linear fashion during the course of treatment.

The data for the proposed study came from a larger NIMH funded randomly controlled

trial evaluating the effectiveness of an experimental virtual reality exposure treatment to a

cognitive behavioral group treatment and a waitlist control.

2. Methods

2.1   Participants

Participants were 75 individuals diagnosed with social anxiety. Nearly half of the sample

met criteria for the generalized subtype of social phobia ($n = 38$) and the remainder reported that

social anxiety was predominately limited to public speaking ($n = 37$). Most participants did not

have a comorbid diagnosis ($n = 59$, 78%). The comorbidity information for the rest of the

sample can be found in Table 2.1. The sample was predominately female (62%, $n = 46$) with an

average age of $M = 40.31$, $SD = 11.55$. The ethnic demographics of the current sample were

representative of the setting from which it was recruited, the metro Atlanta area. The

participants self identified as a European American ($n = 39$), African American ($n = 23$), Latino

($n = 3$), Asian American ($n = 2$). The remaining ($n = 8$) participants reported their ethnicity as

"Other." The sample was well educated with 44% completing college and 34% reporting their

relationship status as married. Most were middle class, with 47% having an annual income of

$50,000 or more.

Table 2.1 Frequency of Comorbidity in Sample

Diagnosis	Primary Diagnosis	2nd Diagnosis	3rd Diagnosis	4th Diagnosis
Social Phobia: Generalized	38			
Social Phobia: Public Speaking	37			
Specific Phobia		4	3	
Major Depression		3	1	
Generalized Anxiety		3	2	
Dysthmia		2		
Panic Disorder W/O Agoraphobia		2		
Obsessive Compulsive Disorder		1		
PTSD				1
Hypomania				1

2.2   Measures

The following measures were used to assess social anxiety, PEP, outcome cost, and outcome probability.

Fear of Negative Evaluation - Brief Form (FNE-B; Watson & Friend, 1969; Appendix A): The FNE-B is a 12 item self report questionnaire that assesses cognitions about negative evaluation for a variety of situations. Responses are measured on a 5-point Likert scale (1 = not at all, 5 = extremely) with overall scores ranging from 5 to 60. The FNE-B has demonstrated excellent internal consistency (Cronbach's α = .94-.98) and 1 month test-retest reliability (r = .78 - .94). Work with a normative sample of individuals diagnosed with social phobia (n = 165) has reported a mean of 46.91 (SD = 9.27) (Weeks, et al., 2005). The internal consistency for the current study were as follows: good for pretreatment (α = 0.89), good for midtreatment (α = 0.90), good for posttreatment (α = 0.87), good for 3-month follow up (α = 0.91), and good for 12-month follow up (α = 0.89).

Personal Report of Communication Apprehension (PRCA; McCroskey, 1978; Appendix B): The PRCA is a 10-item self report questionnaire that assesses anxiety for public speaking. Responses are scored on a 5-point Likert (1 = Strongly Agree, 5 = Strongly Disagree) with scores ranging from 0 to 46. Test-retest reliability over a five week period was r = .74. A scoring algorithm is used to determine the summary score for the PRCA that prevents a valid measure of internal consistency from being obtained.

Personal Report of Confidence as a Speaker (PRCS; Paul, 1966; Appendix C): The PRCS is a 30 item self report questionnaire that assesses behavioral and cognitive responses to public speaking. Answers are recording in a True False format and a specific scoring algorithm is used to determine the summary score. Summary scores range from 0-30 with higher scores

indicating less confidence with public speaking. The internal consistency for the current study were as follows: poor for pretreatment ($\alpha = 0.42$), good for midtreatment ($\alpha = 0.83$), good for posttreatment ($\alpha = 0.87$), good for 3-month follow up ($\alpha = 0.88$), and good for 12-month follow up ($\alpha = 0.87$).

Outcome Probability Questionnaire (OPQ; Uren, Szabó, & Lovibond, 2004; Appendix D): The OPQ is a 12 item self report questionnaire that assesses an individual's estimate of the probability that negative socially threatening events will occur. Items are scored on a 9-point Likert scale ($0 = $ not at all, $8 = $ extremely) with summary scores ranging from 0 to 96. Internal consistency for the measure has been be found to range from good to excellent (Cronbach's $\alpha = $ .89 - .90). The internal consistency for the current study were as follows: good for pretreatment ($\alpha = 0.86$), good for midtreatment ($\alpha = 0.92$), good for posttreatment ($\alpha = 0.92$), good for 3-month follow up ($\alpha = 0.94$), and good for 12-month follow up ($\alpha = 0.93$).

Outcome Cost Questionnaire (OCQ; Uren, et al., 2004; Appendix E): The OCQ is a 12 item self report questionnaire that assesses an individual's estimate of the cost of negative social events. Items are scored on a 9-point Likert scale ($0 = $ not at all, $8 = $ extremely) with summary scores ranging from 0 to 96. Internal consistency for the measure has been be found to be consistently in the excellent range (Cronbach's $\alpha = $ .92 - .94). The internal consistency for the current study were as follows: good for pretreatment ($\alpha = 0.84$), good for midtreatment ($\alpha = 0.91$), good for posttreatment ($\alpha = 0.94$), good for 3-month follow up ($\alpha = 0.91$), and good for 12-month follow up ($\alpha = 0.93$).

Rumination Questionnaire (RQ; Mellings & Alden, 2000; Appendix F). The RQ is a 5-item self report questionnaire that assesses PEP for a recent public speaking opportunity. This measure was chosen for the current study was because of its focus on rumination during public

speaking. Questions assess the frequency that a person has thought about their most recent speech and the negativity of these thoughts. Items are scored on a 7-point Likert scale (1 = not at all, 7 = very much) with summary scores ranging from 5 to 35. The authors of the original scale reported adequate internal consistency (Cronbach's α = .70). For the current study, the internal consistency were as follows: adequate for pretreatment (α = 0.73), good for midtreatment (α = 0.81), adequate for posttreatment (α = 0.76), good for 3-month follow up (α = 0.81), and good for 12-month follow up (α = 0.83).

A factor analysis was conducted to more fully assess the psychometric properties of the RQ. Exploratory factor analyses using a principle components analysis with varimax rotation were conducted for the RQ at pretreatment, midtreatment, posttreatment, 3-month follow up, and 12-month follow up. The number of extracted factors in the optimal solution was inconsistent across these measurement points. For pretreatment and posttreatment, a two-factor solution obtained. In contrast, a single factor solution was found for midtreatment, 3-month follow up, and 12-month follow up. Thus, the PEP was used as originally intended – a one factor scale - because the use of a two-factor solution did not improve the internal consistency across all time points and because factor analysis did not indicate the use of a two factor across all time points.

Structured Clinical Interview for the DSM-IV (SCID: First, Gibbon, Spitzer, & Williams, 2002): The SCID is a diagnostic interview that is used to assess psychological disorders based upon the criteria of the DSM-IV. For the current project, the SCID was used to obtain clinical diagnoses for participants.

2. 3   Procedure

Participants were recruited through radio and newspaper advertisements. A total of *n* = 182 people expressed interest in the study. After making initial contact, potential participants

completed a brief phone interview to determine if they met any of the exclusion criteria. The

exclusion criteria for the study were having active suicidal ideation, active substance abuse,

current enrollment in therapy for social anxiety, a history of mania, and having started or having

changed dosage of a psychotropic medication within the past three months. Those that qualified

completed an in person assessment during which the SCID was used to determine if the

participant met inclusion criteria for a primary diagnosis of social phobia. Those that met criteria

($n = 97$) were then randomly assigned to one of the three treatment conditions. Approximately

25% of the participants dropped out after being assigned to a treatment group ($n_{VR} = 4$, $n_{group} =$

9, $n_{WL} = 4$). The remaining $n = 75$ participants completed posttreatment measures ($n_{VR} = 25$, n

$_{Group} = 25$, $n_{WL} = 25$). After completing the wait period, WL participants were randomized to

one of the active treatment conditions. Five declined treatment and three dropped out after

beginning treatment. The remaining participants were evenly divided across the two treatments

such that the active treatment samples were $n_{VR} = 32$, $n_{Group} = 33$. The flow of participants

through the study is provided in Figure 2.1.

Assessments. Participants were given a full battery of measures prior to being randomized to a

condition (pretreatment), at the end of the fourth session (midtreatment), at the end of the eight

session (posttreatment), three months after completing treatment (3 month follow up), and 12

months after completing treatment (12-month follow up) (Table 2.2). A smaller battery of

measures that included the RQ, OPQ, and OCQ were administered at the end of each session (S1

- S8). During the pretreatment assessment, participants met with a trained research assistant who

used the SCID to determine if the participant met criteria for social anxiety disorder and other

comorbid disorders. Participants completed a behavioral avoidance test (BAT) that consisted of

giving an impromptu speech on three topics that were chosen at random. Finally, participants
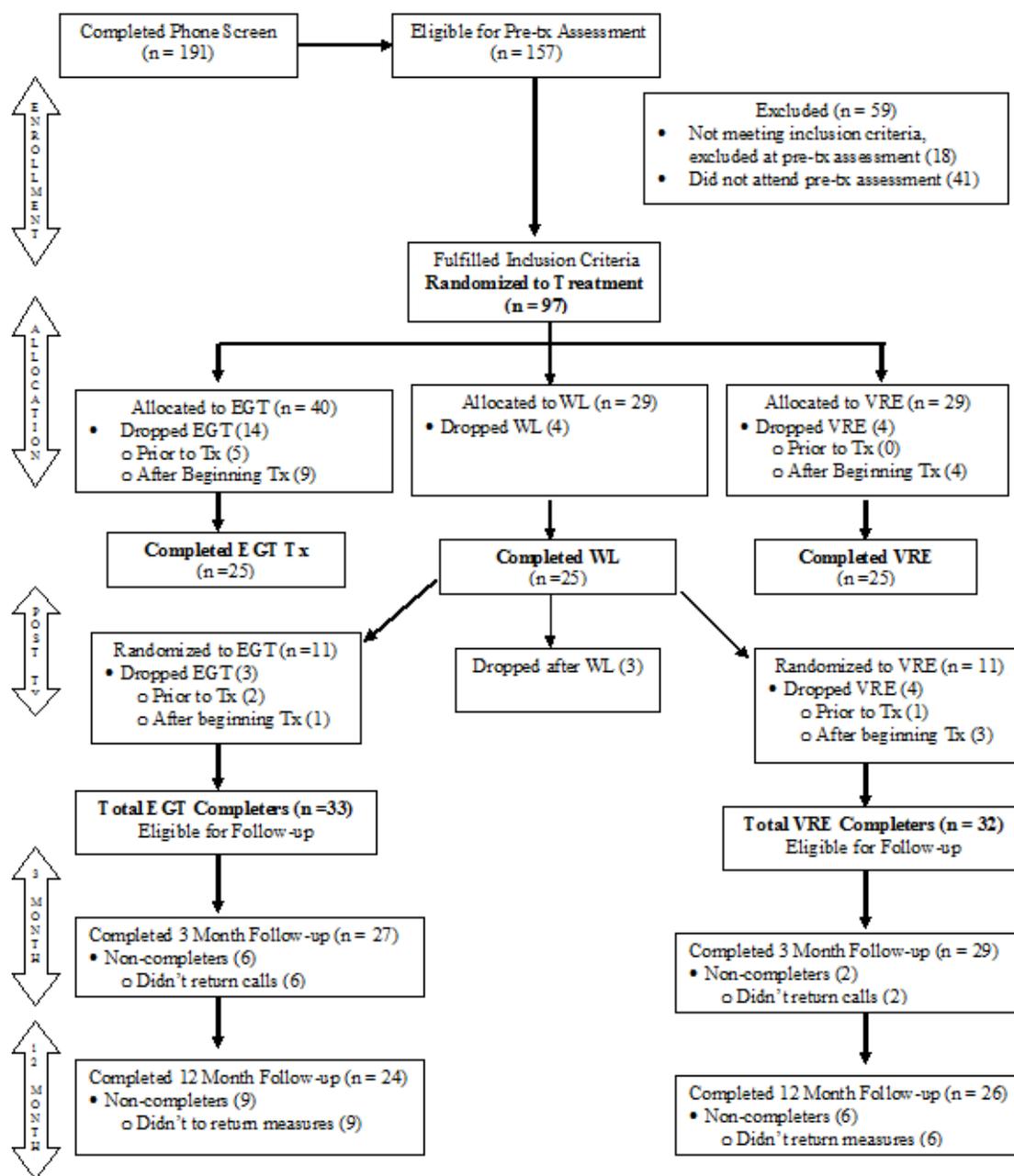
Figure 2.1 Flow Chart of Participants Through Study

Table 2.2 Timeline for Administration of Measures

Measure	Pretreatment	Midtreatment	Posttreatment	3-month Follow up	12-month Follow up
FNE	✓	✓	✓	✓	✓
PRCA	✓	✓	✓	✓	✓
PRCS	✓	✓	✓	✓	✓
OPQ	✓	✓	✓	✓	✓
OCQ	✓	✓	✓	✓	✓
RQ	✓	✓	✓	✓	✓
SCID	✓			✓	

completed all of the self report measures. The midtreatment and posttreatment assessments

consisted of completing all self report measures at the end of the respective treatment sessions.

The 3 month follow up assessment consisted of the administration of the full SCID to determine

if participants still met criteria for social anxiety disorder and other diagnoses as well as all self

report measures. For the 12-month follow up assessment, participants were mailed measures to

complete at home.

Treatment. Treatment was conducted across eight weeks for both treatment conditions.

Therapists attended a two day intense training workshops by the developers of the respective

treatments prior to administering the therapy. Therapists received weekly supervision by the

primary investigator of the study. Ratings of treatment integrity and competence were made by

the developers of the treatments for a randomly selected subset of the sessions.

The virtual reality exposure (VRE) was administered according to a manualized protocol.

The first session covered the treatment rationale, breathing training, and taught participants to

use the subjective unit of discomfort scale (SUDs) to make in session anxiety ratings. The focus

of the second session was teaching and practicing cognitive restructuring. Participants were

presented with the purpose of the exercise and asked to complete an ABC sheet for several

cognitions commonly associated with social anxiety. The third session dealt with self

perceptions during speaking. During this session, participants reviewed their pretreatment

speech and were asked to compare how anxious they appeared while to how anxious they rated

themselves during the speech. The discrepancy between these ratings was then processed. The

fourth session addressed safety behaviors and self focused attention by video taping the

participant while they gave a speech to an audience displayed on a computer screen. Participants

were then asked to review their performance to assess the difference between the outward

appearance and their internal experience of anxiety. The fifth through eighth session focused on exposure to a virtual audience. The virtual reality (VR) scenarios included, 1) a conference room, 2) a classroom, and 3) a large stadium. These scenarios were presented via a head mounted display (HMD) that consisted of a helmet with headphones and goggles. Exposure was done according to a personalized fear hierarchy. The participant was exposed to the least fearful items on their hierarchy until fear was reduced by 50 percent. The client was then exposed to the next item on the hierarchy. Treatment concluded with a review of the different anxiety management and relapse prevention strategies.

CBGT also was conducted according to a manualized protocol. Treatment was conducted in groups of 3-6 participants led by two therapists. The first session introduced participants to the cognitive behavioral models of social anxiety, the theoretical underpinnings of exposure therapy, and helped them identify treatment goals. The second session began with a review of the treatment models. Participants were then asked to give a brief speech on the models in front of the other group members. These speeches were also taped to provide video feedback. After completing the speech, the participant was asked to compare their level of anxiety during the speech to their observed anxiety on the recording. The group was also asked to provide positive feedback about the speech. Sessions three through six followed a similar model to that of session two. The seventh session involved real world exposures in which the group went to a public location and interacted with people not enrolled in therapy. Participants were asked to rate their anxiety for the experience, the outcome of the situation, and how long the consequences of the event lasted. The final session provided participants with tools to prevent relapse and a review of what was learned during the course of therapy.

3.   Results

An initial review of the data indicated that none of the values were classified as outliers and there was a minimal amount of missing data across the variables (8% - 10%). Also, the variables did not greatly violate normality (standardized kurtosis or skew score > 2). A series of ANOVAs and chi-squares were conducted to assess pretreatment differences amongst the CBGT, VRE, and WL conditions (Table 3.1). For measures of social anxiety, there were no pretreatment differences across the three conditions, PRCA: F (2, 72) = 0.68, p = 0.51; PRCS: F (2, 72) = 0.27, p = 0.77; FNE: F (2, 72) = 1.42, p = 0.29. A test of independence revealed no significant differences in the demographic characteristics across the treatment conditions, Gender: χ^2 (2) = 2.02, p = 0.33; Ethnicity: χ^2(8) = 5.32, p = 0.72; Education: χ^2(12) = 7.00, p = 0.86; Marital Status: χ^2(10) = 5.67, p = 0.84; Income: χ^2(10) = 10.58, p = 0.39.

The hypotheses were assessed using hierarchical linear modeling (HLM). HLM is a relatively underutilized technique in the clinical literature, but has several advantages in working with longitudinal data. This method models variation in a single dependent variable on two levels, individual change over time and differences in the rates of change across participants. These components are further divided into two pieces: fixed effects and random effects. Fixed effects estimate variation attributed to a specified variable such as time or PEP. Random effects are estimates of residual variation. By being able to divide variance in this manner, HLM provides more accurate estimates of standard errors than more traditional OLS approaches (Singer & Willett, 2003). Another strength of HLM is its improved ability to handle missing data due to the iterative estimation approach that is used to obtain parameter estimates. Analyses will be performed with the HLM 6.06 program (Raudenbush, Bryk, Cheong, & Congdon, 2004) and the SAS 9.0 computing environment.

3.1 Descriptive Statistics for the Three Treatment Arms

	FNE	PRCA	PRCS	RQ$_1$	RQ$_2$
Pretreatment					
VRE	41.72 (10.65)	44.47 (6.31)	23.75 (2.37)	23.56 (4.80)	24.63 (5.23)
CBGT	43.97 (7.64)	45.07 (6.19)	24.61 (2.14)	25.12 (6.70)	25.39 (6.24)
WL	-	-	-	26.92 (5.83)	
Mid Treatment					
VRE	-	41.48 (7.26)	22.87 (3.53)	-	20.32 (6.75)
CBGT	-	38.06 (7.06)	18.90 (5.02)	-	16.97 (6.67)
Posttreatment					
VRE	-	36.86 (6.66)	16.72 (6.44)	14.48 (6.09)	15.06 (6.09)
CBGT	-	32.42 (6.84)	11.50 (5.22)	13.88 (5.40)	14.06 (5.21)
WL	-	-	-	24.08 (6.45)	-
3 Month Follow up					
VRE	-	37.07 (6.99)	17.31 (6.40)		16.55 (5.61)
CBGT	-	32.57 (8.29)	12.71 (5.86)		13.89 (6.05)
12 Month Follow up					
VRE	-	35.69 (6.94)	17.04 (6.29)		14.96 (5.89)
CBGT	-	32.50 (8.37)	12.67 (5.83)		13.17 (6.36)

Note: Values in parentheses are standard deviations. FNE = Fear of Negative Evaluation. PRCA = Personal Report of Communication Apprehension. PRCS = Personal Report of Confidence as a Speaker. RQ$_1$ = Rumination Questionnaire for on the initial group assignment for participants. RQ$_2$ = Rumination Questionnaire including participants that were reassigned to treatment after completing WL. VRE = Virtual Reality Exposure. CBGT = Exposure Based Group Therapy. WL = Waitlist. Scores for the FNE, PRCA, PRCS, include participants that completed treatment after WL.

A power analysis using the Optimal Design software was conducted to determine the necessary sample size to detect a medium effect (Spybrook, Raudenbush, Liu, Congdon, & Martinez, 2008). Conducting a power analysis for HLM is difficult because estimates for effect size, variability of the level 1 residual, and variability of the level 1 fixed effects are required. Accurate estimates for the present study could not be obtained because of a lack of prior research. A medium effect ($\delta = 0.50$) was anticipated and values of 1 were used as estimates of the variability for level 1 fixed effects and residuals. Using these values, a power of .8, and a significance level of 0.05, 126 individuals ($n = 42$ in each treatment group) was required to complete the randomized portion of the study and have a follow-up efficacy assessment at 12 months. Because the recommended n was larger than the obtained n for the current study ($n = 25$ per group), the sample used for the analyses included participants who were randomized after completing waitlist. This increased the sample of the current study to $n_{VR} = 32$ and $n_{group} = 33$.

3.1   Comparison of PEP across the three treatment conditions

The first hypothesis compared changes in PEP across CBGT, VRE, and WL. A linear change model could not be fitted to the data because there were only two waves of data for the WL condition, pretreatment and posttreatment. However, HLM was used to address the partial nesting of the data. Partially nested data refers to a scenario in which a portion of the sample is organized into groups and the rest are treated as individuals (Bauer, Sterba, & Hallfors, 2008). The current study contained partially nested data as participants assigned to the CBGT condition completed treatment in groups whereas those in the VR condition received treatment individually. The participants in the CBGT condition may have related outcomes due to shared aspects of their treatment experience such as group member effects, socialization, and/or a common treatment provider. Partially nested data is addressed by including an additional level

in the model in which a random effect is added to the group intervention (r^2_{2i}) but not the

individual intervention. This allows hypotheses about the extent that outcome varies across the

separate groups to be tested.

This model specifies PEP as the dependent variable, a fixed effect for the VR condition

($\pi_{1i}VR_{ij}$), a fixed effect for the Group condition ($\pi_{2i}Group_{ij}$), a fixed effect for pretreatment

scores (π_{3i} Pretreatment$_{ij}$), and a random effect (e^2_{ei}) (Table 3.2). The level two model specifies

a random effect for the group condition (r^2_{2i}) that will determine if posttreatment PEP varied

across the groups. The findings suggested that PEP scores significantly declined from

pretreatment to posttreatment for VRE and CBGT as compared to WL, VR: β_{10i} = -8.82, $p <$

0.01; CBGT: β_{20i} = -9.85, $p < 0.01$.

Table 3.2 Comparison for CBGT and VRE to WL

	Parameter	RQ
Fixed Effects		
Intercept	β_{00i}	17.66**
		(3.88)
VRE	β_{10i}	-8.83**
		(1.85)
CBGT	β_{20i}	-9.81**
		(1.63)
Pretreatment	β_{30i}	0.24
		(0.13)
Random Effects		
Level 1	e^2	32.52
Level 2	r^2_{2i}	0.06
ICC for CBGT Condition		< 0.01

Note: * = $p < 0.05$. ** = $p < 0.01$. RQ = Rumination Questionnaire.

3.2   Effect of PEP on changes in social anxiety

The subsequent hypotheses utilized piecewise models, which allowed different rates of change for distinct time periods to be modeled (Raudenbush & Bryk, 2002). For the current study, the treatment and follow up portions were defined as being distinct time periods for which different rates of change are expected. Prior work on exposure therapy has suggested that the rate of change differs across these periods (Price, Anderson, Henrich, & Rothbaum, 2008). Time was measured in weeks.

The second and third hypotheses, that PEP decreased during the course of exposure therapy during treatment and follow up and that this differed across treatment type, were assessed with the linear change models. Separate models were used for each measure of social anxiety, public speaking subtype (PRCA, PRCS). This was assessed by using the measures of social anxiety as the dependent variable where $\pi_{1i} a_{1tij}$ represents change during treatment controlling for the effects of PEP, where $\pi_{2i} a_{2tij}$ represents change during following up controlling for the effects of PEP, $\pi_{3i} \text{PEP}_{ij}$ represents the relation of PEP to social anxiety over time, $\pi_{1i} a_{1tij} \times \pi_{3i} \text{PEP}_{ij}$ represents the relation effect of PEP on the change in social anxiety during treatment, and $\pi_{2i} a_{2tij} \times \pi_{3i} \text{PEP}_{ij}$ represents the relation effect of PEP on the change in social anxiety during follow up. The coefficient for the treatment (a_{1ti}) and follow up period (a_{2ti}) follow a coding scheme that is used to differentiate time periods (Table 3.3). The level 2 and 3 models assess differences between treatment groups and the account for the partial nesting of the data respectively. Pretreatment FNE scores were included in the level 2 model to control for initial levels of generalized social anxiety.

Table 3.3 Coding scheme for the piecewise linear model.

Piece	Pretreatment	Midtreatment	Posttreatment	3-month Follow up	12-month Follow up
Treatment	0	5	8	8	8
Follow up	0	0	0	44	60

Note: Time is scaled in 1-week intervals.

The random effects in the level 3 model were not significant for all coefficients across the PRCA and PRCS (Table 3.4). The ICC for the PRCS and PRCA suggested that the group structure of the data for the CBGT condition accounted for a substantial portion of the variance for the treatment (PRCS: $\rho = 0.08$; PRCA: $\rho = 0.17$) and follow up (PRCS: $\rho = 0.17$; PRCA: $\rho = 0.85$) portions. The findings suggested that PEP reduced the rate of change for social anxiety during treatment. However, there were mixed findings for the follow up period. For the treatment period, the interaction between PEP and time was significant for the PRCS ($\gamma_{400} = 0.21$, $p < 0.01$) and the PRCA ($\gamma_{400} = 0.51$, $p < 0.01$). For the follow up period, the interaction between PEP and time was not significant for the PRCS ($\gamma_{500} = -0.02$, $p = 0.11$), but was for the PRCA ($\gamma_{500} = -0.07$, $p < .05$). However, it should be noted that the rate of change for the follow up period for both measures was not significant, suggesting that participants did not experience a change in symptoms after treatment. For both measures, the effect of PEP on the rate of change during treatment did not differ between the treatment groups.

3.3   Effect of PEP on changes in OPQ and OCQ

The fourth hypothesis, PEP after a session of exposure therapy was positively related to self-reported estimates of the probability and cost of a negative outcome at the next session of

exposure therapy (Table 3.5). A separate model was used for Outcome Cost and Outcome

Probability. The model used PEP as a time varying predictor and Outcome Cost and Outcome

Table 3.4 Piecewise Model Examining the Impact of RQ on the Rate of Change in the PRCA and

PRCS

	Parameter	PRCA	PRCS
Fixed Effects			
PEP	γ_{300}	-0.09 (0.12)	0.07 (0.05)
Difference between VRE & CBGT for PEP	γ_{310}	0.01 (<0.01)	0.02 (0.02)
Pretreatment FNE	γ_{320}	0.01* (< 0.01)	<0.01 (<0.01)
Interaction between PEP and Treatment Period	γ_{400}	0.51** (0.13)	0.21** (0.06)
Difference between VRE & CBGT	γ_{410}	-0.10 (0.06)	-0.10 (0.09)
Pretreatment FNE	γ_{420}	-0.01** (<0.00)	-0.10 (0.09)
Interaction between PEP and Follow Up Period	γ_{500}	-0.07* (0.01)	-0.02 (0.01)
Difference between VRE & CBGT	γ_{510}	0.02 (0.01)	-0.01 (0.02)
Pretreatment FNE	γ_{520}	<0.00 (<0.00)	<0.00 (<0.01)
Random Effects			
Level 3			
	u_{12}	0.25	0.83
	u_{22}	0.06	0.48
	u_{32}	<0.01	0.11
	u_{42}	<0.01	0.02
	u_{52}	<0.01	0.02

Note: * = $p < 0.05$. ** = $p < 0.01$. Values in parentheses are standard errors. FNE = Fear of Negative Evaluation. PRCA = Personal Report of

Communication Apprehension. PRCS = Personal Report of Confidence as a Speaker.

Table 3.5 Piecewise Model Examining the Impact of RQ on the Rate of Change in the OCQ and OPQ

	Parameter	OCQ	OPQ
Fixed Effects			
PEP	γ_{300}	0.42** (0.14)	0.41* (0.20)
Difference between VRE & CBGT for PEP	γ_{310}	0.21** (0.08)	0.19 (0.12)
Pretreatment FNE	γ_{320}	0.02** (<0.01)	0.03** (<0.01)
Interaction between PEP and Treatment Period	γ_{400}	0.02 (0.03)	<0.01 (0.03)
Difference between VRE & CBGT	γ_{410}	0.04 (0.05)	-0.04 (0.05)
Pretreatment FNE	γ_{420}	<0.01 (<0.01)	<0.01 (<0.01)
Interaction between PEP and Follow Up Period	γ_{500}	<0.01 (<0.01)	0.01 (<0.01)
Difference between VRE & CBGT	γ_{510}	<0.01 (0.01)	<0.01 (0.01)
Pretreatment FNE	γ_{520}	<0.01 (<0.01)	<0.01 (<0.01)
Random Effects			
Level 3			
	u_{12}	2.71	1.41
	u_{22}	0.24	0.02
	u_{32}	<0.01	0.01
	u_{42}	0.01	<0.01
	u_{52}	<0.01	<0.01
ICC for CBGT Condition			
Treatment		0.52	0.48
Follow Up		0.92	0.41

Note: * = $p < .05$. ** = $p < 0.01$. OPQ = Outcome Probability Questionnaire. OCQ = Outcome Cost Questionnaire. RQ = Rumination Questionnaire. VRE = Virtual Reality Exposure. CBGT = Exposure Based Group Therapy.

Probability ratings as the dependent variable where π_{1i} represented the rate of change over treatment controlling for the relation of PEP, $\pi_{2i}\text{PEP}_{ij}$ represented the relation of PEP on the level of the dependent variable over time, and the interaction between these two fixed effects (π_{1i} x $\pi_{2i}\text{PEP}_{ij}$) represented the relation of PEP to the rate of change in the dependent variable. The level 2 model determined if there was a significant difference between the treatment groups and the level 3 model accounted for the partially nested aspect of the data.

The ICC for the CBGT condition was substantial for treatment (OPQ: $\rho = 0.47$; OCQ: $\rho = 0.52$) and follow up (OPQ: $\rho = 0.60$; OCQ: $\rho = 0.92$) across both measures. This suggest that group membership for the CBGT condition had a strong influence on outcome. There was no support for the effect of PEP on the rate of change of OCQ and OPQ during treatment or follow up. For treatment, the fixed effect for the interaction between PEP and time was not significant for the OCQ ($\gamma_{400} = -0.02$, $p = 0.60$) and time was not significant for the OCQ ($\gamma_{500} < 0.01$, $p = 0.45$) and OPQ ($\gamma_{500} < 0.01$, $p = 0.13$).

3.4   Changes in PEP during the course of treatment

The fifth hypothesis was assessed by a model in which PEP served as the dependent variable and fixed effects for time were included in the level 1 model. First, a linear change model was fitted to the data. Given the level 1 random effect (σ^2_{ei}) is significant, then a quadratic term (π^2_{1ij}) will be added. If the level 1 the random effect remains significant, then a cubic term (π^3_{1ij}) will be added. This method of exploration was continued until a non significant random effect was obtained or seven polynomial functions (π^7_{1ij}) were added. This is the maximum number of polynomial terms allowed for eight waves of data. The level 2 and 3 models accounted for the differences between treatment groups and the account for the

partial However, this hypothesis could not be fully assessed due to the high degree of

multicollinearity between the higher order polynomial terms for time. A solution could not be

found for a model that contained more than three terms for time due to the collinearity

between the terms for time. Of the models for which a solution was obtained (linear, quartic,

cubic), a linear change model best approximated the data (Table 3.6).

4.   Discussion

To summarize, the findings for the current study supported the hypotheses that PEP

declined as a result of treatment and that PEP reduced the rate of change for social anxiety

during treatment. This effect was observed for both individual and group treatments. PEP did

not influence the rate of change of social anxiety across the follow-up period. Finally, although

PEP had an effect on overall social anxiety, it did not impact the rate of change in outcome cost

and outcome probability during treatment or follow up.

The finding that PEP reduced the rate of change during treatment is consistent with the

current theoretical models for exposure therapy (Moscovitch, et al., 2009). The proposed

explanation for this finding is that PEP during treatment maintained a higher level of anxiety

across sessions that interfered with the acquisition of extinction learning. However, the precise

mechanism by which this occurs is unknown. Prior research offers two potential explanations.

Telch and colleagues (2004) argued that distraction reduces treatment response by increasing

the client's cognitive load during exposure, which, in turn, prevents the complete consolidation

of nonfearful learning. Using this rationale, PEP may have increased the cognitive load of

participants between sessions, which limited the resources that were available for

consolidating extinction learning. Alternatively, other theorists have argued that treatment

response is determined by the strength of nonfearful associations that are formed during

exposure (Craske, et al., 2008). The strength of such associations are determined by contexts

and the amount of time

Table 3.6 Models of Linear and Nonlinear Change for the RQ

	Parameter	Linear	Quadratic	Cubic
Fixed Effects				
Pretreatment	γ_{000}	25.55**	25.64**	25.41**
		(0.64)	(0.66)	(0.69)
Linear rate of change	γ_{100}	-1.36**	-1.54**	-1.25
		(0.12)	(0.39)	(0.77)
Difference between VRE & CBGT	γ_{110}	-0.02	0.18	0.63
		(0.15)	(0.48)	(1.09)
Quadratic rate of change	γ_{200}	-	0.02	-0.07
			(0.05)	(0.23)
Difference between VRE & CBGT	γ_{210}	-	-0.03	-0.19
			(0.06)	(0.36)
Cubic rate of change	γ_{300}	-	-	0.01
				(0.02)
Difference between VRE & CBGT	γ_{310}	-	-	0.01
				(0.03)
Follow up rate of change	γ_{400}	0.01	0.01	0.01
		(0.02)	(0.02)	(0.02)
Difference between VRE & CBGT for Follow Up	γ_{410}	<0.01	0.01	<0.01
		(0.04)	(0.02)	(0.04)
Level 1				
	e^2	4.12	16.45	15.72
Level 2				
	r^2_0	4.41	16.26	15.39
	r^2_1	0.54	1.52	1.13
	r^2_2	-	<0.01	0.09
	r^2_3	-	-	<0.01
Follow Up	r^2_4	0.07	<0.01	<0.01
Level 3				
	u_{11}	0.02	0.03	4.25
	u_{21}	-	<0.01	0.54
	u_{31}	-	-	<0.01

Follow Up	u_{41}	0.01	0.02	0.02

Note: * = p < .05. ** = p < 0.01. RQ = Rumination Questionnaire. VRE = Virtual Reality Exposure. CBGT = Exposure Based Group Therapy.

since the last contact with the feared stimulus. Novel contexts and increased temporal spacing between encounters with the feared stimulus are believed to strengthen the activation of the nonfearful association. Using this rationale, PEP increases the chances that the fear pathway would become activated between sessions. This would allow the fear response to generalize to more contexts and would reduce the time between encounters with the stimulus. Thus, the strength of the nonfearful associations that were acquired during exposures would be weakened, which would limit overall treatment response. Further research on the mechanisms of change for exposure therapy is needed to better understand how PEP interferes with treatment outcome, whether it be increasing cognitive load, reducing the strength of nonfearful pathways, or another mechanism.

The current study also demonstrated that PEP did not impact the rate of change for the OPQ and OCQ during treatment or follow up. There are several possible explanations for these null results. Outcome cost and outcome probability may represent improvements in social anxiety that are separate from those associated with PEP. Theorists have suggested that there are multiple cognitive processes that are involved with the maintenance and treatment of anxiety disorders (Grillon, 2009; Hofmann, 2000). These processes have been divided into two broad categories, explicit and implicit. Explicit processes are higher order cognitive functions of which a person is aware, such as outcome cost and outcome probability. Implicit processes are lower order cognitive functions of which a person is mostly unaware, such as biases towards threat cues or a focus on negative rather than positive information. PEP may be more closely tied with implicit processes rather than explicit processes. Although PEP involves active recall

of prior social experiences, which could be considered an explicit process, it is the implicit biases that are present within the recall that are believed to preserve fear (Coles, et al., 2002; Edwards, et al., 2003). That is to say, the act of remembering a past social situation does not maintain fear, but rather it is the emphasis on the negative or threatening parts of the memory that contribute to the disorder. The association between PEP and implicit cognitive processes would also explain why PEP was unrelated to change in outcome cost and probability, yet was related to change in overall symptoms. Further support for this would come from future studies demonstrating that PEP was associated with the rate of change in indicators of the implicit cognitive processes such as in-session anxiety ratings, physiological reactions during exposure, or behavioral changes during exposure.

An alternative explanation for the null finding may deal with the emphasis that was placed on outcome cost and outcome probability during treatment. Outcome cost and outcome probability are theorized to be important mediators of change for social anxiety (Hofmann, 2000). This has led current CBT interventions, including the ones used in the current study, to specifically address these processes. The intense focus that was placed on these symptoms during treatment may have mitigated the effect that PEP had on their rate of change. This is consistent with prior work that has demonstrated that outcome cost and outcome probability are highly responsive to direct intervention (McNally, 2001).

There was mixed support for the influence of PEP on change during the follow up period for social anxiety symptoms. However, the rate of change for symptoms during follow up was consistently not significant across all analyses, suggesting that participants maintained their gains after completing treatment but did not continue to improve. This is consistent with

findings from other studies that have used this analytic approach to assess response to exposure therapy (Price, et al., 2008). This suggests the therapeutic context, interaction with the therapist, or other factors associated with the treatment process may be necessary to obtain substantial symptom change. Also, the significant interaction between PEP and the rate of change for follow up may not be valid due to the timeframe during which PEP was assessed during the follow-up period. PEP has been shown to be strongest in the week following a social experience (Dannahy & Stopa, 2007). The measurements for the follow up period were taken several months apart, which would not accurately capture PEP for events during these intervals. To more fully assess the impact of rumination during this period, assessments should be conducted within a week of a meaningful encounter with a feared (or previously feared) stimulus. This could be done via remote electronic means in which participants are cued via a signal such as a text message or e-mail and asked to indicate their level of PEP (Boschen, 2009). This would provide a more ecologically valid assessment of PEP during the follow up period.

The findings from the current study highlight the need to incorporate interventions for PEP into exposure treatments. Current treatment packages do not fully address PEP beyond telling the client to avoid thinking about the past session. Furthermore, there have not been any investigations into treatments for PEP. This represents an area of need as PEP does appear to be a core element of social anxiety and the findings of the current study indicate that it reduces treatment response. Subsequent projects should assess if incorporating treatments for rumination into exposure interventions improves overall treatment response. There have been several attempts to examine treatments for depressive rumination with acceptance based approaches recently proving to be effective (Jones, Papadakis, Hogan, & Strauman, 2009).

These interventions involve training participants to observe their thoughts in a non-judgmental manner and have been shown to be successful at reducing the ruminative thoughts for distressing events (Jain, et al., 2007). Acceptance would mitigate the effect of PEP by enabling clients to distance themselves from negatively valenced thoughts that occur between sessions. This would allow for a deeper processing of the extinction learning obtained during treatment.

The current study also has several implications for clinical work. Clinicians can use PEP as a means to determine salient threat cues for a client. Typically, this process occurs at the start of treatment in developing a fear hierarchy. However, the client may encounter additional stimuli that elicit fear after the exposures have begun. In reviewing the PEP for a past exposure , the client and therapist may learn of new threat cues to be integrated into the fear hierarchy for subsequent exposures. Integrating these cues into future exposures will help further tailor treatment to the specific needs of the client. For example, a client may engage in PEP about an audience member who fell asleep during their presentation. The therapist can then incorporate this element into subsequent exposures to best target this specific fear. This can be especially helpful for VRE as prior research has shown that including more salient threat cues is associated with an increase in presence, a construct that is theorized to be necessary in order for a virtual stimulus to elicit fear (Price & Anderson, 2007).

The current study had several limitations. First, the impact of PEP on changes in between session anxiety could not be assessed. This could not be addressed due to the high rate of missingness (20% - 70%) for in session anxiety ratings across all of the treatment sessions. The relation between in session anxiety ratings and PEP has been supported in prior work demonstrating that PEP is positively associated with state anxiety for past events, predictive of increased state anxiety for future events, and that these associations are active

during exposure interventions (Kocovski & Rector, 2008; McEvoy & Kingsep, 2006). Taken in conjunction with the findings from the current study, the following is theorized to occur during treatment: the individual participates in a session of exposure therapy that elevates their state anxiety. The elevated state anxiety during exposure leads to an increase in PEP during the following week, resulting in greater state anxiety for the next session. This cycle continues, and results in an overall higher level of anxiety throughout treatment and poorer outcome at its conclusion. Further research is needed to test this hypothesis, in which the impact of PEP on changes in peak fear across session can be directly assessed.

Another issue is the manner in which PEP is assessed. The current study examined PEP for the previous week at the end of an exposure therapy session. PEP assessed in this manner can be especially prone to recall bias. A more accurate method of assessing PEP would involve methods to assess their rumination throughout the course of the week. This could involve journaling in which participants note their thoughts about their past speech. Another method that may be useful would be sending participants cues throughout the day electronically (e.g. text messages, e-mails) asking them to note the frequency of their PEP.

Overall, the findings of the current study suggest that PEP negatively impacts the rate of change in social anxiety symptoms during the course of treatment but not follow up. This is among the first studies to use HLM to evaluate the effect of PEP on change during exposure therapy. The proposed method by which PEP limits treatment response is through limiting the acquisition of nonfearful learning. Future work should attempt to further understand how PEP reduces response to exposure and develop interventions to reduce its impact on the treatment process.

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APPENDICES

Appendix A
Fear of Negative Evaluation – Brief Form
Read each of the following statements and then use the scale below to indicate the degree to which each statement applies to you (fill in the bubble that corresponds with your answer).

1	2	3	4	5
Not at All	Slightly	Moderately	Very	Extremely

	1	2	3	4	5
1. I worry about what other people will think of me even when I know that it doesn't make any difference.	O	O	O	O	O
2. I am unconcerned even if I know people are forming an unfavorable opinion of me.	O	O	O	O	O
3. I am frequently afraid of other people noticing my short comings.	O	O	O	O	O
4. I rarely worry about what kind of impression I am making on someone.	O	O	O	O	O
5. I am afraid that others will not approve of me.	O	O	O	O	O
6. I am afraid that people will find fault in me.	O	O	O	O	O
7. Other people's opinions of me do not bother me.	O	O	O	O	O
8. When I am talking to someone, I worry about what they may be thinking about me.	O	O	O	O	O
9. I am usually worried about what kind of impression I make.	O	O	O	O	O
10. If I know someone is judging me, it has little effect on me.	O	O	O	O	O
11. Sometime I think I am too concerned with what other people think of me.	O	O	O	O	O
12. I often worry that I will say or do wrong things.	O	O	O	O	O

Appendix B

PRCA – Short Form

This instrument is composed of statements concerning your communication with other people. Please indicate the degree to which each statement applies to you by using the following scale. There is no right or wrong answer. Work quickly, just record your first impression.

1	2	3	4	5
Strongly Agree	Agree	Are Undecided	Disagree	Strongly Disagree

	1	2	3	4	5
1. I look forward to expressing my opinions at meetings.	O	O	O	O	O
2. I am afraid to express myself in a group.	O	O	O	O	O
3. I look forward to an opportunity to speak in public.	O	O	O	O	O
4. Although I talk fluently with friends, I am at a loss for words on the platform.	O	O	O	O	O
5. I always avoid speaking in public if possible.	O	O	O	O	O
6. I feel that I am more fluent when talking to people than most other people are.	O	O	O	O	O
7. I like to get involved in group discussions.	O	O	O	O	O
8. I dislike to use my voice and body expressively.	O	O	O	O	O
9. I'm afraid to speak up in conversations.	O	O	O	O	O
10. I would enjoy presenting a speech on a local television show.	O	O	O	O	O

Appendix C

PRCS

This instrument is composed of 30 items regarding your feelings of confidence as a speaker. After each question there is a "true" and a "false." Try to decide whether "true" or "false" most represents your feelings associated with your most recent speech, then fill in the bubble to indicate "T" or "F." Work quickly and don't spend much time on any one question. We want your first impression on this questionnaire.

1. I look forward to an opportunity to speak in public.

2. My hands tremble when I try to handle objects on the platform.

3. I am in constant fear of forgetting my speech.

4. Audiences seem friendly when I address them.

5. While preparing a speech I am in a constant state of anxiety.

6. At the conclusion of a speech I feel that I have had a pleasant experience.

7. I dislike to use my body and voice expressively.

8. My thoughts become confused and jumbled when I speak before an audience.

9. I have no fear of facing an audience.

10. Although I am nervous just before getting up I soon forget my fears and enjoy the experience.

11. I face the prospect of making a speech with complete confidence.

12. I feel that I am in complete possession of myself while speaking.

13. I prefer to have notes on the platform in case I forget my speech.

14. I like to observe the reactions of my audience to my speech.

15. Although I talk fluently with friends I am at a loss for words on the platform.

16. I feel relaxed and comfortable while speaking.

17. Although I do not enjoy speaking in public I don't particularly dread it.

18. I always avoid speaking in public if possible.

19. The faces of my audience are blurred when I look at them.

20. I feel disgusted with myself after trying to address a group of people.

21. I enjoy preparing a talk.

22. My mind is clear when I face an audience.

23. I am fairly fluent.

24. I perspire and tremble just before getting up to speak.

25. My posture feels strained and unnatural.

26. I am fearful and tense all the while I am speaking before a group of people.

27. I find the prospect of speaking mildly unpleasant.

28. It is difficult for me to calmly search my mind for the right words to express my thoughts.

29. I am terrified at the thought of speaking before a group of people.

30. I have a feeling of alertness in facing an audience.

Appendix D
Outcome Probability Questionnaire

Please rate how **likely** it is that the following outcomes will happen to you in a public speaking situation within the next year. Use the "0-8" scale below to indicate your answer, with "0" indicating that the outcome listed is *not at all likely* and "8" indicating the outcome listed is *extremely likely*.

0	1	2	3	4	5	6	7	8
Not at all likely								Extremely likely

1. You will feel embarrassed by something you did

2. You will sound dumb while talking to others

3. You will feel flustered in front of others

4. People will think that you are boring

5. At a party, others will notice that you are nervous

6. During a job interview or evaluation, you will freeze

7. While you are talking with several people, one of them will leave

8. You will be ignored by someone you know

9. You will do something foolish in public

10. You will fail to accomplish an important goal

11. You will fail to cope in your day-to-day living

12. You will be unexpectedly called in to see your supervisor at work

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O

o o o o o o o o o

Appendix E
Outcome Cost Questionnaire

Please rate how bad or distressing the following outcomes would be for you if they were to occur in a public speaking situation? Use the "0-8" scale below to indicate your answer, with "0" indicating that the outcome listed would be *not at all distressing* and "8" indicating the outcome listed would be *extremely distressing*.

0	1	2	3	4	5	6	7	8
Not at all likely						Extremely likely		

1. You will feel embarrassed by something you did

2. You will sound dumb while talking to others

3. You will feel flustered in front of others

4. People will think that you are boring

5. At a party, others will notice that you are nervous

6. During a job interview or evaluation, you will freeze

7. While you are talking with several people, one of them will leave

8. You will be ignored by someone you know

9. You will do something foolish in public

10. You will fail to accomplish an important goal

11. You will fail to cope in your day-to-day living

12. You will be unexpectedly called in to see your supervisor at work

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O

o o o o o o o o o

Appendix F
RQ

Directions: Please consider your thoughts and feelings about the last speech or talk you gave, use the scale to answer the following questions by filling in the bubble that corresponds with your answer choice.

In regards to your last talk or speech, to what extent did you think about the speech since giving it?

1	2	3	4	5	6	7
O	O	O	O	O	O	O

Not at all   Very Much

Were your thoughts positive, negative or neutral?

1	2	3	4	5	6	7
O	O	O	O	O	O	O

Positive   Neutral   Negative

To what extent did you criticize yourself about not giving the talk well?

1	2	3	4	5	6	7
O	O	O	O	O	O	O

Not at all   Very Much

How much did you think about past talks or speeches?

1	2	3	4	5	6	7
O	O	O	O	O	O	O

Not at all   Very Much

To what extent did you think about the anxiety you felt during your last speech?

1	2	3	4	5	6	7
O	O	O	O	O	O	O

Not at all   Very Much