What is the Function of Post-Event Processing in Social Anxiety Disorder? The Role of Metacognitive Beliefs, Memory Uncertainty and Perception of Performance

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Post-event processing (PEP) can serve to maintain and worsen anxiety symptoms and negative interpretations of social events in Social Anxiety Disorder (SAD; e.g., Cody & Teachman, 2010, 2011). However, little is known about the specific factors that might motivate individuals to engage in PEP. The aim of the current research was to investigate a novel theoretical framework in which positive metacognitive beliefs about the value of engaging in PEP, memory uncertainty, and perceptions of performance were hypothesized to contribute to the persistence of PEP among socially anxious individuals, and ultimately lead to more negatively biased recollections of past social events. A Pilot Study provided preliminary correlational evidence that social anxiety is related to both metacognitive beliefs and uncertainty for social events. Study 1 was designed to examine these constructs in the laboratory following a standardized social task among individuals with a diagnosis of SAD in comparison to anxious and healthy control participants. Results showed that relative to both control groups, individuals with SAD reported greater PEP in the days following the social task. Participants with SAD also rated their performance more negatively and felt greater uncertainty immediately after the task, although these ratings did not become worse over time. They also endorsed more metacognitive beliefs about the benefits of reviewing the social task. Importantly, bootstrapping mediation analyses suggested that both metacognitive beliefs and initial performance ratings significantly mediated the relationship between group status and PEP in the days following the event. Study 2 was an experimental study designed to investigate how repeatedly recalling a socially-relevant versus socially-irrelevant task would impact performance and certainty ratings. It was expected that recollection of a socially threatening event would lead to an increased level of certainty at the expense of increasingly negative evaluations, although these hypotheses were not supported. Idiosyncratic

metacognitive beliefs were also explored and findings suggested that socially anxious individuals reported both perceived advantages and disadvantages to mentally reviewing the socially-relevant task. The results of these studies are discussed in the context of theoretical implications and in relation to the studies' clinical applications in the treatment of SAD.

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Introduction

Social Anxiety

Social Anxiety Disorder (SAD) is among the most common psychiatric disorders (Kessler et al., 2005) and is characterized by an intense and persistent fear of social situations in which embarrassment, negative evaluation or rejection may occur (American Psychiatric Association , 2000, 2013). The social situations that are considered threatening are idiosyncratic but can involve both performance and interaction situations (e.g., public speaking, initiating a conversation). Individuals with SAD are likely to avoid anxiety provoking social situations when possible or otherwise endure them with extreme distress. The deleterious impact of SAD has been well established in the literature. Research has demonstrated that socially anxious individuals experience significant functional impairments in their interpersonal relationships (Heery & Kring, 2007; Shields, 2004), quality of life (Stein & Kean, 2000; Shields, 2004), recreation (Antony, Roth, Swinson, Huta, & Devins, 1998), and academic and occupational attainment (Bruch, Fallon, & Heimberg, 2003; Moitra, Beard, Weisberg, & Keller, 2011; Patel, Knapp, Henderson, & Baldwin, 2002; Tolman et al., 2009). Furthermore, the economic consequences of SAD for both affected individuals and public healthcare are substantive (Acarturk, et al., 2009; Patel et al., 2002; Plaisier et al., 2010; Schneier et al., 1994).

Cognitive Behavioural Models of Social Anxiety

Cognitive behavioural models of social anxiety have provided a disorder-specific conceptual framework of the factors thought to contribute to the development and maintenance of symptoms. In their seminal work, Clark and Wells (1995) proposed that individuals with social anxiety hold negative self-perceptions which lead them to engage in maladaptive

cognitive and behavioural patterns that serve to maintain and worsen anxiety symptoms. They identified four key processes that interfere with the disconfirmation of negative beliefs. First, when in a socially threatening situation, individuals with SAD turn their attention inward (i.e., toward themselves) and engage in careful monitoring of their own physiological symptoms. This information is then used to generate an impression of how they believe they appear which is based on negative self-perceptions and does not incorporate objective information of others' behaviour or feedback. Second, individuals with SAD engage in a wide range of strategies or safety behaviours designed to minimize the risk of negative social outcomes. Although designed to reduce anxiety, such behaviours prevent the individual from learning unconditionally that feared outcomes are not likely to occur; indeed, successful social interactions are attributed to the use of the safety behaviours. Furthermore, safety behaviours often have the unintentional effect of making feared outcomes more likely. For example, a socially anxious individual who, as a result of his fear that if he says something inappropriate during a social encounter others will reject him, may minimize his self-disclosure in a social interaction, which ultimately leads his interaction partners to view him unfavourably. Related to this, Clark and Wells (1995) argue that symptoms of anxiety, self-monitoring, and maladaptive coping strategies (e.g., use of safety behaviours) in social situations produce a pattern of negative social performance, which, in turn, increases the likelihood of negative evaluation. Finally, Clark and Wells (1995) described the important role of maladaptive cognitive processing both before and after social situations in the maintenance of symptoms. In advance of social situations, individuals with SAD experience anticipatory anxiety, which consists of a review of past social failures and predictions of negative performance. Such processing leads the socially anxious individual either to avoid the social interaction all

together, or to focus exclusively on negative aspects of the self and anticipate negative outcomes. Although leaving a social situation results in decreased anxiety, socially anxious individuals engage in *post-event processing* (PEP) during which they carefully review their performance in a ruminative and negatively biased manner that focuses excessive attention on the physiological anxiety symptoms they experienced during the social event, their negative self-evaluations, and perceived past failures. Such processing exacerbates individuals' negative perceptions of self and maintains anxiety symptoms by providing evidence in support of the negative self-image that lies at the heart of the problem.

Rapee and Heimberg (1997) proposed a similar model to elucidate the mechanisms that maintain social anxiety symptoms. These authors suggested that when confronted with a social situation, individuals with SAD generate a mental representation of themselves which is based on long-term memory, internal cues (e.g., feeling shaky), and external threat-cues (e.g., others' facial impressions). This mental representation is likely to be distorted as it is heavily influenced by individual's own negative sensations as well as a hypervigilence to threats in the external environment. This representation is monitored and updated continuously and such monitoring is presumed to disrupt one's ability to engage effectively in the social interaction and may paradoxically lead to more negative social outcomes. According to Rapee and Heimberg's (1997) model, individuals compare their self-generated representations with perceived social standards which vary depending on the nature of the situation. Since the socially anxious individual's representation is negatively distorted, they conclude as a result of this process that they are not performing up to audience standards. Finally, this model emphasizes that individuals with SAD overestimate the likelihood as well as the consequences of negative evaluation. In other words, socially anxious individuals assume that they are likely

to be evaluated negatively by audience members and that such evaluation will have catastrophic consequences. These predictions in turn contribute to their anxiety symptoms and serve to maintain the disorder.

More recently, Hofmann (2007) consolidated and expanded on existing cognitive behavioural theories to develop a comprehensive and disorder-specific model of SAD. He identified a broad range of factors which may serve to maintain anxiety symptoms while also acknowledging that SAD is a heterogeneous disorder and that not all factors will be relevant for every individual. According to his model, individuals with SAD assume that others have high standards for their social performance which they do not feel equipped to meet. Hofmann (2007) also argued that socially anxious individuals have particular difficulty identifying and achieving appropriate social goals in anticipation of social encounters. As with the models outlined previously, Hofmann (2007) also implicated heightened attention and monitoring of the self, safety behaviours, avoidance, and negative self-perceptions as factors contributing to the maintenance of SAD. It is also argued that socially anxious individuals perceive their own social skills as poor and lack the self-efficacy to successfully engage in social interactions. Like Rapee and Heimberg (1997), Hofmann acknowledges that individuals with SAD perceive negative social outcomes as more likely to occur, and assume that such outcomes will have disastrous consequences. Hofmann (2007) also argues that socially anxious individuals believe they have limited control over their anxiety symptoms in socially threatening situations, and that this lack of control is readily observable to others. Finally, like the Clark and Wells (1995) model, Hofmann's model highlights the role of PEP as a critical maintaining factor in SAD.

Each of the cognitive behavioural models described above provides a theoretical framework for understanding the mechanisms responsible for the development and

maintenance of anxiety symptoms within the context of SAD. The specific components of these models and supporting empirical evidence pertinent to the current line of work are outlined in greater detail below.

Interpretation Biases in Social Anxiety

Interpretation biases are not directly addressed by the models outlined above, although biased processing in SAD is certainly implied. Early work by Beck, Emery and Greenberg (1985) proposed that pathological anxiety results from the activation of maladaptive cognitive schemas, which guide the way information is understood, organized and remembered. Interpretation biases are believed to occur when anxiety-related schemas are activated in response to threatening information. A number of studies have provided evidence for the existence of interpretation biases in social anxiety (Amir, Foa, & Coles, 1998; Constans, Penn, Ihen, & Hope, 1999; Foa, Franklin, Perry, & Herbert, 1996; Hertel, Brozovich, Joormann, & Gotlib, 2008; Stopa & Clark, 2000). For example, an early study by Amir, Foa and Coles (1998) examined interpretation biases for ambiguous events among individuals with and without SAD. In this study, participants were presented with ambiguous social events (e.g., "You see a group of friends having lunch, they stop talking when you approach ...") and ambiguous non-social events ("You get your cable bill and notice that ..."). After each scenario, participants were provided with three possible interpretations (positive, negative and neutral) and asked to rank-order the likelihood that these interpretations would come to their mind and the likelihood that they would come to a "typical person's" mind in a similar situation. The results suggested that compared to non-anxious controls, individuals with SAD were more likely to offer negative interpretations of ambiguous social scenarios, but only in the socially self-relevant condition. No differences between the SAD and non-anxious control

groups were observed when making interpretations for "a typical person." Additionally, no group differences were observed for non-social events, suggesting that this bias is unique to the interpretation of social scenarios.

Similarly, Stopa and Clark (2000) found that individuals with SAD demonstrated a clear bias in their interpretation of ambiguous social events even when interpretations were obtained with open-ended questions. Furthermore, these researchers demonstrated that individuals in the socially anxious group had a tendency to interpret mildly negative social events in a catastrophic manner. Compared to non-anxious controls and individuals with other anxiety disorders, socially anxious patients were more likely to assume that mildly negative social events were due to negative self attributes (e.g., "I was boring") and that these events would have catastrophic long-term consequences (e.g., "I will lose all my friends"). A number of findings have confirmed that such interpretation biases are specific to social anxiety, as opposed to general distress or negative affect (Amir, Beard & Bower, 2005; Constans et al., 1999).

More recently, Hertel, Brozovich, Joorman and Gotlib (2008) examined how failing to distinguish between internally and externally generated events might lead individuals to commit memory errors based on interpretation biases. These researchers proposed that when recalling a prior ambiguous social event, socially anxious individuals would blur the distinction between their memory for the actual scenario and their interpretations of the event. To test this prediction, individuals with a diagnosis of generalized SAD and healthy control participants were presented with social and non-social neutrally-valenced scenarios and asked to generate one additional sentence to complete each story. After a distracter task, participants were provided with the first sentence of each scenario and asked to generate the remaining sentences

that had been provided to them in the original descriptions of each scenario. After participants finished recalling the scenarios, they were prompted to recall their own endings. Consistent with prior research, socially anxious individuals produced significantly more socially anxious continuations in response to the ambiguous social scenarios. Socially anxious continuations were defined as any mention of social evaluative threat (e.g., fear of embarrassment or negative evaluation) or the physical experience of social anxiety symptoms (e.g., experience of blushing while talking to someone). The authors then examined memory intrusions, which were defined as the addition of at least one new term that had not been presented in the original story. Interestingly, when overall intrusions were considered, regardless of their meaning, healthy controls actually reported a greater percentage of intrusions for social scenarios than individuals with SAD. This finding suggests that individuals with SAD are not less accurate in their recollections overall. However, when the meaning of the intrusions was taken into account, socially anxious individuals produced significantly more intrusions that were consistent with their initial continuations of the ambiguous scenarios. In other words, individuals with SAD produced a larger proportion of intrusions that reflected emotionally negative (but not other types of) continuations. These findings suggest that when socially anxious individuals are presented with a socially threatening situation, they have difficulty distinguishing between what actually happened during the social event and their interpretations of that event.

Repetitive Negative Thinking

Biased interpretations and thinking patterns that are repetitive have been identified in SAD as well as across a range of anxiety and mood disorders (Aldao, Nolen-Hoeksema, & Schweizer, 2010; McEvoy, Mahoney, & Moulds, 2010; McLaughlin, Nolen-Hoeksema, 2011)

and a large body of research suggests that repetitive thinking is associated with the onset and maintenance of both anxiety and mood symptoms (Nolen-Hoeksema & Morrow, 1993; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Segerstrom, Tsao, Alden & Craske, 2000; Watkins, 2008). Indeed, McLaughlin and Nolen-Hoeksema (2011) identified repetitive negative thought as a transdiagnostic factor in anxiety and depression, finding that it accounts for a significant portion of overlap in anxiety and depression symptoms.

In the depression literature, rumination has been defined as repetitive self-focused thinking which focuses on past perceived failures, depressed mood as well as the implications of these symptoms. Much like PEP, rumination is focused on negative thought content, occurs in a passive or uncontrolled manner and has been implicated in the onset and maintenance of the disorder (Ehring & Watkins, 2008; Nolen-Hoeksema, 2000). A large body of research has demonstrated that rumination in depression is associated with an increased risk of developing depressive symptoms (e.g., Spasojevic & Alloy, 2001; Wisco & Nolen-Hoeksema, 2008), that it exacerbates negative mood (e.g., Lyubomirsky & Nolen-Hoeksema, 1993, 1995; Nolen-Hoeksema & Morrow, 1993), is associated with recall of negative memories (e.g., Direnfeld & Roberts, 2006; Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Matt, Vázquez, & Campbell, 1992), leads to the maintenance of depressive symptoms (e.g., Kuehner & Weber, 1999; Nolen-Hoeksema, 2000), and interferes with effective problem solving (e.g., Donaldson & Lam, 2004; Watkins & Moulds, 2005).

Worry is another form of repetitive thought that is a defining feature of Generalized Anxiety Disorder (GAD). Worry is defined as a chain of negatively affect-laden thoughts and images that are largely uncontrollable and center around potential risks and catastrophic outcomes (Borkovec, Robinson, Pruzinsky, & DePree, 1983). Unlike depressive rumination

which is largely focused on the past, worry is focused on future uncertainties and potential threats. Chronic and excessive worry characteristic of GAD is associated with significant impairment in important areas of functioning and is accompanied by physical and psychological symptoms, including fatigue, irritability, difficulties concentrating, muscle tension, restlessness, and sleep disturbance (American Psychiatric Association, 2000, 2013). Studies have shown that worry is associated with increased anxious and depressed negative affect (Borkovec, Ray, & Stober, 1998), catastrophic predictions (e.g., MacLeod, Williams, & Bekerian, 1991; Vasey & Borkovec, 1992), reduced confidence in one's problem solving abilities (e.g., Davey, Jubb, & Cameron, 1996), and that individuals with GAD view worrying as distressing and impairing (Ruscio, 2002).

Post-Event Processing

In the context of social anxiety, repetitive negative thinking occurs following socially threatening events and the cognitive models outlined above implicate such biased processing as a maintenance factor for the disorder (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). According to these models, individuals with SAD continue to process and ruminate about social events after they occur. During PEP, the socially anxious individual is likely to focus on anxious feelings and negative self-perceptions, since these were processed in detail during the social event. This process is problematic because the individual is prone to recalling the event as being more negative than it objectively was. Furthermore, it is proposed that during PEP, socially anxious individuals may bring to mind past instances of perceived social failures. As part of this process, the most recent social event is added to the long list of past failures, thereby leading to the maintenance of negative self-perceptions and social anxiety symptoms. The unfortunate consequence of this cognitive process is that the socially anxious

individual's negative self-schemas are confirmed even in social interactions that appeared neutral or positive from an observer's perspective.

Research examining PEP in social anxiety using a variety of methods, including self-report measures, diary records, social interaction exercises, social performance tasks, and experimental paradigms has consistently found that socially anxious individuals are more likely than non-anxious controls to engage in PEP after social encounters (see Brozovich & Heimberg, 2008 for review). An early study by Rachman and colleagues gathered basic descriptive information about PEP using the Post-Event Processing Questionnaire (PEPQ; Rachman, Grüter-Andrew, & Shafran, 2000). The PEPQ consists of 13 items rated on a 100-point visual analogue scale and assesses the extent to which individuals engage in PEP following an anxiety provoking event (e.g., "After the event was over, did you find yourself thinking about it a lot?"; "Did you try to resist thinking about the event?"). In this study, 130 undergraduate students completed the PEPQ as well as the Social Phobia and Anxiety Inventory (SPAI, Turner, Beidel, Dancu & Stanley, 1989) and the Beck Depression Inventory II (BDI II; Beck, Steer, & Brown, 1996). The results demonstrated that PEP was significantly associated with social anxiety ($r = .40$, $p < .001$).), and this relationship remained significant even when symptoms of depression were statistically controlled ($r = .32$, $p < .001$). Furthermore, participants reported that PEP cognitions were intrusive and interfered with their ability to concentrate, and that they made attempts to resist having these thoughts.

A subsequent study by Lundh and Sperling (2002) used a diary method to more thoroughly assess the nature of participants' thought patterns while engaging in PEP. For a one-week period, an unselected sample of undergraduate students was asked to complete a written diary record reporting on socially distressing events as well as associated thoughts and

feelings about these events immediately after they occurred, thereby capturing PEP as it occurs in-vivo. The results of this study found that PEP is a ubiquitous phenomenon and that social anxiety (as measured by the Social Phobia Scale, Mattick & Clarke, 1998) was associated with PEP that occurred following events that had a social-evaluative component only, as opposed to social events more generally. These findings suggest some specificity of PEP's relationship to socially threatening events, as opposed to other types of emotionally distressing scenarios. Fehm and colleagues also found evidence that PEP is specific to socially distressing situations relative to other emotionally distressing events (Fehm, Schneider & Hoyrt, 2007). More specifically, in a study using an unselected sample of students, these researchers found that social situations elicit greater levels of PEP than do phobic situations. Furthermore, they demonstrated that PEP was not predicted by more generalized anxiety or depression.

Consistent with cognitive behavioural models of SAD (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997), Morgan and Banjerjee (2008) found that socially anxious individuals who engage in ruminative thinking are more likely to bring to mind anxious autobiographical memories. In this study, participants with high and low levels of social anxiety were asked to envision themselves in a hypothetical social scenario and then engage either in ruminative or reflective thought about the social event. The results showed that participants high in social anxiety who engaged in ruminative thinking about the imagined scenario recalled more anxious autobiographical memories relative to low socially anxious participants or high anxiety participants who engaged in a reflective recall. These findings provide preliminary evidence that the ruminative style adopted by socially anxious individuals during PEP in combination with elevated social anxiety symptoms leads individuals to retrieve anxiety provoking memories.

Although the content of PEP has received relatively little attention in the literature, a few recent studies have focused on exploring the nature of cognitions experienced by socially anxious individuals. Kocovski and colleagues examined the content of thoughts that occur during PEP in a sample of undergraduate students selected based on high and low scores on a social evaluation measure (Kocovski, Endler, Rector, & Flett, 2005). Participants' thoughts in response to socially relevant vignettes were recorded and their content was examined. Results indicated that individuals high in social anxiety were more likely to report negatively valenced thoughts and to report thoughts containing upward counterfactual statements (e.g., 'if only' statements about how the event could have gone better). A more recent study by Kocovski and colleagues further examined the content of PEP (Kocovski, MacKenzie, & Rector, 2011). Participants in this study consisted of a sample of unselected undergraduate students who were classified into high vs. low social anxiety groups based on the Social Phobia Scale (Mattick & Clarke, 1998). Participants completed a speech task and were randomly assigned to either a guided rumination or distraction condition. Written thought content from participants in the rumination condition was evaluated. Results showed that relative to the low social anxiety group, the high anxiety participants were more likely to report thoughts about physiological symptoms of anxiety (e.g., shaking, sweating), concerns about their posture as well as a trend ($p = .06$) towards lacking self-confidence.

A study by Makkar and Grisham (2011a) examined the content of PEP following a standardized speech task in a community sample. The results showed that during PEP, elevated levels of trait social anxiety (controlling for depression and state anxiety) were associated with thoughts regarding negative self-perceptions (e.g., criticizing one's speech performance) as

well as negative thoughts and regrets about the speech and the past more broadly (e.g., past failures, anxious sensations during the speech).

Post-event processing has largely been conceptualized as a verbal process, although given recent research implicating the role of negative imagery in SAD (Hackmann, Clark & McManus, 2000; Hackmann, Suraway, & Clark, 1998; Moscovitch, Gavric, Merrifield, Bielak, & Moscovitch, 2011), a few recent studies have also explored the effect of imagery on PEP. Makkar and Grisham (2011b) recruited a sample of undergraduate students and community participants who were selected if they scored high or low on a measure of social anxiety (Brief Fear of Negative Evaluation Scale; Leary, 1983). While completing a speech task in the lab, participants were asked to hold either a negative or a relaxed image of themselves in mind. Measures of anxiety, cognitions, perceived performance and focus of attention were measured after the speech and PEP was assessed two days later. The results suggested that all participants who held a negative image in mind experienced increased anxiety, self-focused attention, negative self-relevant cognitions, and negative perceptions of their performance. Furthermore, holding a negative image in mind resulted in an increase in negative PEP and a decrease in positive PEP at the two-day follow up assessment. Participants holding the negative image in mind also reported more negative self-relevant cognitions during PEP in comparison to the participants that held a relaxed image in mind. These results highlight the deleterious effects of negative imagery in terms of both the frequency and cognitive content of PEP.

Chiupka, Moscovitch and Bielak (2012) examined the nature and impact of mental images generated during anticipatory and post-event processing among individuals scoring high or low on a measure of social anxiety (Social Phobia Inventory, Connor et al., 2000).

These authors found that images were more likely to occur in anticipation, rather than in the aftermath, of an in-vivo social task. Additionally, in comparison to low socially anxious participants, high socially anxious individuals were more likely to endorse experiencing negative images, although the endorsement of images was common across the sample (with 81% of participants experiencing images). Moreover, this study found important group differences in the way in which participants experienced negative imagery. Compared to the low socially anxious group, the high social anxiety participants experienced more negative consequences in reaction to their mental images (e.g., increased negative affect). Interestingly, this study also found that relative to images experienced during anticipation of a social threat, those experienced during PEP were associated with more negative perceptions of the self and the world. These findings suggest that while anticipatory anxiety may increase the frequency with which negative images occur, their presence during PEP is associated with the most negative emotional consequences, especially for individuals with social anxiety.

Brozovich and Heimberg (2013) investigated the relationship between mental imagery and PEP. In this study, undergraduate students who scored either high or low on a trait measure of social anxiety were informed they would have to give an impromptu speech and were then assigned to one of three manipulation conditions: PEP-Semantic, PEP-Imagery, or a control condition. In the PEP-Semantic condition, participants were asked to review the meaning of how they performed on a prior speech task; this condition was intended to induce PEP about the overall quality of their performance and what that might mean for future social tasks. In the PEP-Imagery condition, participants were asked to use mental imagery to think about a prior speech task and were asked to describe the mental images as vividly as possible to the experimenter. Finally, in the control condition, participants were asked to complete a series of

cognitively taxing activities unrelated to their speech performance or PEP. These authors found that individuals in the imagery condition demonstrated the highest levels of anxiety; however, unlike in the Makkar and Grisham (2011b) study described above, these effects were only true for the high anxiety group.

Predictors of Post-Event Processing

Investigations of the factors predicting PEP have only recently begun receiving attention in the literature. Although studies have found support for engagement in PEP after various types of social situations (e.g., Abbott & Rapee, 2004; Mellings & Alden, 2000), findings are mixed as to whether social performance (e.g., giving a speech) or interaction (e.g., having a conversation) situations result in greater levels of PEP. An early study by Fehm, Schneider and Hoyer (2007) found that participants reported greater PEP about previously experienced interpersonal situations relative to performance situations. In contrast, using a similar methodology, Kocovski and Rector (2007) found that performance situations resulted in a greater degree of PEP relative to interaction situations. However, participants in these studies were asked to select a socially stressful situation that was previously experienced and neither used a standardized social stressor task. As a result, the findings should be interpreted with caution as they may be influenced by memory or situation selection biases. Studies that have compared engagement in PEP following standardized performance and interaction tasks have found performance tasks to be associated with greater engagement in PEP (Kiko et al, 2012; Makkar & Grisham, 2011a).

A consistent finding across clinical and analogue samples has been that trait and state social anxiety are both significant predictors of PEP (Abbott & Rapee, 2004, Dannahy & Stopa, 2007; Kiko et al., 2012; Kocovski & Rector, 2007, 2008; Laposa & Rector, 2011). More

recently, researchers have begun exploring how additional factors implicated by cognitive models impact PEP. A study by Makkar and Grisham (2011a) examined a number of theoretically derived predictors of PEP among a sample of university students and community participants. In addition to social anxiety and state anxiety, higher frequency of negative cognitions, increased use of safety behaviours, greater self-focused attention, worse performance ratings, and stronger negative beliefs and assumptions were significant predictors of PEP, although only negative assumptions (e.g., 'I have to appear intelligent') remained significant after other relevant variables were accounted for (e.g., depression, state anxiety, performance ratings, etc.). Other studies have found that PEP is predicted by self-focused and inappropriately focused attention (i.e., attention towards negative evaluation, past experiences, and physical symptoms; Chen, Rapee, & Abbott, 2013; Gaydukevych & Kocovski, 2012), dysfunctional beliefs (Kiko et al., 2012), self-perceptions of performance and positive affect (Abbott & Rapee, 2004; Chen, Rapee, & Abbott, 2013; Perini, Abbott, & Rapee, 2006; Zou & Abbott, 2012), and self and trait perfectionism (Brown, 2011; Nepon, Flett, Hewitt, & Molnar, 2011).

Effects of Post-Event Processing over Time

Research has also demonstrated that PEP can lead to the maintenance and worsening of negative self-perceptions over time amongst socially anxious individuals. Using a longitudinal design in an analogue student sample, Wong and Moulds (2012) demonstrated that PEP assessed at Time 1 significantly predicted maladaptive self-beliefs 1-4 weeks later over and above the effects of social anxiety, depression, general anxiety, and the strength of the original beliefs. In an experimental study on PEP, Abbott and Rapee (2004) instructed healthy controls and patients with SAD to engage in an impromptu speech task and evaluate their own

performance immediately after the speech and again one week later. Compared to healthy controls, individuals with SAD reported more negative self-ratings immediately after the speech and these were maintained in the week following the event. In contrast, the healthy control group's rating actually became more positive in the week following the speech task. Dannahy and Stopa (2007) showed that relative to a low anxiety group, individuals high in social anxiety rated their performance more negatively one week following a social interaction than immediately afterwards. Similarly, Brozovich and Heimberg (2011) demonstrated that socially anxious participants who had a high trait tendency to engage in PEP rated their performance of a social interaction more negatively one week after the interaction compared to immediately afterwards (again, this was not the case for the low social anxiety group).

Cody and Teachman (2010) provided individuals high and low in social anxiety with standardized positive and negative feedback following a speech task. Participants' memory for feedback was evaluated immediately after the task and again two days later, at which time engagement in PEP was also assessed. Surprisingly, results demonstrated that all participants remembered overall feedback as more positive than it actually was and that it became more positive over time, suggesting a positive recall bias. However, when positive items were examined separately, the results indicated that the high social anxiety group recalled their positive feedback as significantly more negative by the two day follow-up. The low social anxiety group did not show this pattern of results, suggesting that socially anxious individuals have a tendency to diminish positive feedback over time. The authors suggest that positive feedback may be particularly susceptible to distortion over time as it is likely to be incompatible with socially anxious individual's existing self-schemas. In terms of negative feedback, individuals in the high social anxiety group remembered this feedback as being more

negative than the low anxiety group, although these ratings did not change over time. Post-event processing predicted negatively biased memory recollections for negative, but not positive, feedback items at the 2-day follow-up assessment. This may be because the content of PEP in social anxiety is negative and the repeated activation of these memories solidifies the evaluations of poor performance. Given that cognitive models would not predict socially anxious individuals to be processing positive aspects of performance following a socially threatening situation, the lack of a predictive relationship with positive feedback items is not surprising. Furthermore, this study found that PEP mediated the relationship between trait social anxiety symptoms (as measured by the Social Interaction Anxiety Scale, Mattick & Clarke, 1998) and negatively biased memory recollections at the 2-day follow-up assessment. In other words, socially anxious individuals were more likely to remember a social event negatively after a delay because they engaged in greater PEP in the days immediately after the event.

A second study by Cody and Teachman (2011) investigated how PEP might differentially impact various types of self-evaluations. More specifically, they examined differences between global (e.g., "I made a bad impression") and local (e.g., "I stuttered") evaluations. They proposed that PEP would be particularly detrimental to global evaluations since these evaluations might be especially likely to activate negative social anxiety schema. Local evaluations on the other hand, might be more accurately encoded and therefore less susceptible to distortion. To test these hypotheses, participants with high trait social anxiety and low trait social anxiety completed four speeches. Participants rated their own performance on various global and local items after the speech as well as after a 3-day delay. The results suggest that the high social anxiety group's global ratings became more negative over time,

compared to the low social anxiety group and compared to both groups' ratings for local information. These results suggest that global information may be particularly susceptible to distortion in individuals with social anxiety. Taken together, the findings from the studies on PEP highlight how perseverative thinking about a socially threatening event may serve to worsen self-perceptions and maintain negative self-perceptions in socially anxious individuals.

Mechanisms Involved in Post-Event Processing

The research presented thus far has clearly shown that PEP is a ubiquitous phenomenon in social anxiety, that a number of variables implicated by cognitive models predict engagement in PEP, and that it may serve to maintain anxiety symptoms because the types of negative cognitions that characterize SAD appear to become amplified with the passage of time as a result of PEP. However, the specific processes by which PEP might exacerbate such negative cognitions in social anxiety continue to be poorly understood. According to influential theories of memory, such as the component process model (Moscovitch, 1992), episodic memories are stored in the hippocampus and related areas of the medial temporal lobe and retrieved when internal or external cues trigger the associated memory. Importantly, each time a memory trace is reactivated or recalled, the information is freshly re-encoded within a novel context and stored as a separate memory trace in the brain. Schacter (2012) writes, "Human memory is not a literal reproduction of the past, but instead relies on constructive processes that are sometimes prone to error and distortion" (p. 7). Thus, memory is a *reconstructive* process, in which specific recollections are susceptible to manipulation over time. When a past event is recalled in a novel context, the memory for that event is pieced together in our minds from existing knowledge and beliefs and may therefore become modified, strengthened or expanded. Cognitive researchers have repeatedly demonstrated that memories for past events

can be influenced and distorted by pre-existing schemas and beliefs (Alba & Hasher, 1983; Loftus, 2005; Schacter, 1999). It is possible, therefore, that the repeated recollection of past social events in the context of PEP facilitates the process by which socially anxious individuals' negative cognitions become amplified over time. Specifically, as the social event is recalled repeatedly during PEP it may become continually amenable to re-interpretation in a manner that is consistent with socially anxious individuals' pre-existing negative cognitive self-schemas.

Anxiety researchers have long been interested in the important role and potential negative impact of repetitive thoughts and actions on the maintenance of anxiety symptoms within the anxiety disorders. To this end, the literature on compulsive checking in Obsessive Compulsive Disorder (OCD) may be of particular relevance to our novel hypotheses about the function and impact of repetitive mental checking during PEP in social anxiety. Individuals with OCD who engage in repeated checking behaviour feel compelled to do so in a search for certainty that all threat has been removed from the situation (e.g., that the stove is in fact turned off). Although the act of checking can become quite burdensome for such individuals, it is reinforced by its anxiolytic properties (Rachman, 2002). Early researchers proposed that compulsive checking was the product of objective memory deficits, which result in an inability to recall previous checks (Tallis, 1995, 1997). Although there have been some mixed findings on this subject, most researchers now agree that OCD patients do not suffer from true memory impairments (Coles & Heimberg, 2002; MacDonald, Antony, Macleod, & Richter, 1997; McNally & Kohlbeck, 1993; Radomsky, Rachman & Hammond, 2001; van den Hout & Kindt, 2003, 2004). Rather than objective memory deficits, the need to check repeatedly has been shown to occur when an individual lacks *confidence* in their ability to remember the previous

check (Hermans, Martens, DeCort, Pieters, & Eelen, 2003). A series of experimental studies have demonstrated that the act of repeated checking does in fact lead individuals to feel *less* confident in their memories for past events, and to describe these memories as less vivid and less detailed (Boschen & Vuksanovic, 2007; Coles, Radomsky & Horng, 2006; Radomsky, Gilchrist, & Dussault, 2006; van den Hout & Kindt, 2003, 2004). These effects have also been replicated in tasks examining imagined or mental checking, in the absence of any physical checks. In a study by Radomsky and Alcolado (2010), participants were trained to either physically or mentally check a stove in a ritualized manner. The mental check contained all of the same elements as a physical check, but participants simply imagined completing the check in their minds. Consistent with previous research, greater physical and mental checking resulted in greater memory distrust, eroding participants' confidence in their memory for the vividness and detail of the stimulus checked.

If PEP can be conceptualized as a repeated mental review or check of a prior social event, then we might expect that socially anxious individuals feel more uncertain about their social performance and engage in PEP in order to resolve feelings of uncertainty. Lack of certainty in one's memory is expected to be problematic since it leaves the individual's recollections susceptible to interpretations consistent with their pre-existing negative schemas. Furthermore, if socially anxious individuals are consistently reconstructing past events in a way that makes them more negative, this process will provide them with a large bank of negative social experiences, further contributing to their anxiety symptoms. Based on the research presented thus far, we expect that the repeated recollection that occurs during PEP distorts socially anxious individuals' memories of past social events in a manner that is consistent with their negative social interpretation biases. However, given the negative

outcomes associated with PEP, it is not yet clear what factors might serve to initiate and maintain this negative thought process in the first place.

Function of Post-Event Processing

The Self-Regulatory Executive Function (S-REF) model (Matthews & Wells, 2004; Wells & Matthews, 1994) articulates a process by which repetitive negative thought may be initiated and maintained in emotional disorders. The S-REF is a multi-level model of self-regulation which identifies three levels of cognition that support information processing: knowledge and beliefs about the self that are stored in long-term memory, lower level automatic processing of external and internal stimuli, and controlled and voluntary processing that supports appraisals and initiates coping strategies. According to this model, incoming stimuli are processed automatically and may trigger intrusions in the form of self-referent beliefs. The S-REF model categories self-beliefs into two types: *declarative* and *procedural*. Declarative beliefs are evaluative beliefs about the self that are non-metacognitive in nature (e.g., "I'm worthless", "I'm incompetent"). Procedural beliefs on the other hand are aimed at directing the activities of the controlled processing system and are therefore inherently metacognitive. Procedural beliefs can impact the processes that occur and the coping strategies that are utilized. For instance, two individuals with activation of the same negative declarative belief may respond differently to the threat based on the procedural beliefs that they hold. For example, in response to the belief "I'm inadequate", one individual may engage in rumination as a coping strategy while the other may engage in active problem solving. The S-REF model therefore proposes that individuals with affective disorders engage in negative perseverative thinking because of the metacognitive beliefs they hold about such thought processes. The model further posits that both positive and negative metacognitive beliefs sustain engagement

in such repetitive thinking styles. It is suggested that positive metacognitive beliefs about the advantages of engaging in repetitive thought play an important role in initiating this maladaptive coping style (e.g., "thinking about personal inadequacies will help me gain greater insight into myself"). However, engaging in such thinking patterns in turn leads to the development of negative metacognitive beliefs about the disadvantages and uncontrollability of thought processes ("I cannot control my negative thoughts"). Therefore, according to this model, positive metacognitive beliefs play a central role in initial motivation to engage in negative thinking and serve to initiate this pervasive thought cycle. In turn, this process may paradoxically generate negative beliefs that such perseverative thinking is harmful, intrusive and out of the individual's control.

To date, a significant body of research has found support for the S-REF model and the role of metacognition in emotional disorders such as GAD and Major Depressive Disorder; however, metacognitive processes have received relatively little attention in relation to PEP in social anxiety. A preliminary study by Dannahy and Stopa (2007) used a modified version of Cartwright-Hatton and Wells' (1997) *Metacognitions Questionnaire* (MCQ) to assess the beliefs about cognitions that occur during PEP in individuals high and low in social anxiety. This measure consisted of four subscales: (1) cognitive self-consciousness (i.e., tendency to monitor one's thoughts); (2) controllability of thoughts; (3) imagery; and (4) problem solving (i.e., positive beliefs about the usefulness of thinking about social performance after a social event). The results suggested that individuals with high social anxiety reported greater cognitive self-consciousness and experienced their thoughts as being more uncontrollable (a negative metacognitive belief). Individuals in the high social anxiety group also demonstrated a

trend towards experiencing more imagery during PEP, although this would not be considered a metacognitive belief per se.

More recently, Wong and Moulds (2010) examined the relationship between social anxiety and positive metacognitive beliefs in two studies with unselected undergraduate students. In both studies, the researchers had participants complete a measure of social anxiety and depression as well as the Positive Beliefs about Rumination Scale – Adapted for Social Anxiety (PBRS- SA; adapted from Watkins & Moulds, 2005). Sample items from the PBRS-SA include "Thinking about my interactions with other people helps me understand past mistakes and failures" and "I need to think about social situations that have happened in the past to make sense of them". The results of these studies demonstrated that social anxiety was associated with stronger endorsement of positive beliefs about PEP, even when gender, depression, and level of trait rumination were controlled for statistically.

A follow-up study by Fisak and Hammond (2013) found similar results using an author-developed measure of positive metacognitive beliefs (Positive Beliefs About Post-Event Processing Questionnaire; PB-PEPQ), which they argued is a more comprehensive measure designed specifically to assess these beliefs in relation to PEP. In this study, a large unselected sample of undergraduate students completed the PB-PEPQ, a measure of PEP and a measure of social anxiety. The results indicated a significant relationship between positive metacognitive beliefs, PEP and social anxiety. Although these studies provide useful preliminary data, they employed a correlational design in unselected student samples and, therefore, further investigation of the nature of positive metacognitive beliefs in social anxiety is warranted.

In addition to metacognitive beliefs, *certainty* is a second factor that may play an important role in maintaining and motivating PEP. Previous research has provided evidence

that individuals with high, compared to low, levels of social anxiety tend to report greater uncertainty about their own attributes and social accomplishments (Moscovitch, Orr, Rowa, Gehring Reimer, & Antony, 2009; Stopa, Brown, Luke, & Hirsch, 2010; Wilson & Rapee, 2006). In one study, Wilson and Rapee (2006) examined beliefs about self-attributes as well as the level of certainty with which these beliefs were held among individuals with SAD and healthy controls. The results showed that not only do individuals with social anxiety hold fewer positive beliefs about their personality attributes, their views are also characterized by a greater level of uncertainty (this finding is true even when depression is controlled for statistically). Similarly, Moscovitch et al. (2009) had individuals with SAD and healthy controls rate themselves as well as their level of certainty on positive and negative self-attributes. Consistent with prior research, patients with SAD produced self-ratings that were significantly more negative than healthy controls. Additionally, these authors found that the healthy control group assigned greater certainty to positive self-attributes relative to negative self-attributes. In contrast, individuals with SAD did not show this pattern, suggesting that they did not differentially ascribe certainty to either positive or negative self-characteristics. These findings suggest that individuals with SAD may lack a self-protective positivity bias which may increase self-esteem and positive affect among healthy controls. Finally, using a computerized "me/not me" self-descriptor task in which participants needed to respond "yes" or "no" to positive and negative self-attributes, Stopa, Brown, Luke, and Hirsch (2010) found that high socially anxious participants reported less confidence in their judgements and showed lower overall consistency in their ratings. Taken together, the results of these studies suggest that socially anxious individuals may chronically doubt themselves and their ability to perform in social situations. However, to our knowledge, the impact of certainty has not been examined

with regards to specific social events, and it is not known whether or not feelings of uncertainty about specific aspects of one's performance might motivate individuals to engage in PEP. In a search for certainty, individuals with social anxiety may repeatedly call to mind their memory of the event in an attempt to identify whether feared outcomes occurred. Although this process may ultimately lead them to feel more certain, it also provides an opportunity for the recollections to be reconstructed in a manner consistent with the individual's existing negative self-schemas.

Research Questions

Research on PEP to date has focused primarily on describing the phenomenon and examining the frequency, valence and consequences of engaging in repetitive thinking after a social event. However, few studies have investigated the specific factors which might maintain PEP. The goal of the proposed studies is to examine a novel theoretical model of PEP (see Figure 1). This model proposes that in the aftermath of a threatening social event, socially anxious individuals experience: (a) feelings of uncertainty regarding specific aspects of the events (e.g., "did I say something stupid?"); (b) motivation to mentally "check" or review their memories to determine whether feared outcomes occurred (e.g., "reviewing the social event will help me figure out whether I said something stupid"); (c) positive metacognitive beliefs about the value of repeatedly reviewing one's social encounters (e.g., "reviewing the task will help me do better next time); and (d) consistent with previous studies, socially anxious individuals are expected to perceive their performance in a more negative and biased manner. Each of these factors is proposed to motivate socially anxious individuals to engage in PEP about the event. However, although PEP may be reinforcing because it helps to resolve uncertainty (e.g., "Ok, I am sure I did say something stupid") and is viewed as a productive thought process (e.g., "I will be more prepared next time"), it may ironically provide an opportunity for memories to become reconstructed in line with existing negative beliefs and schemas about the self, thus leading to less accurate or more negatively biased recollections. Alternately, as might be predicted from the existing literature on OCD, it is possible that engagement in PEP will result in prolonged feelings of doubt and uncertainty that persist over longer periods of time and this possibility will also be evaluated in the current research. However, cognitive behavioural models (Clark & Wells, 1995; Rapee & Heimberg, 1997;

Hofmann, 2007) and anecdotal evidence from clinical work suggests that socially anxious individuals generally report strong conviction in their poor assessments of past performance and perceived social failures; we therefore speculate that the sense of uncertainty may be a temporary phenomenon that is eventually resolved based on existing beliefs and self-knowledge.

Three studies were designed to evaluate the proposed model. The current research focused on positive, rather than negative metacognitive beliefs, given their hypothesized role in the initiation of repetitive thought. A Pilot Study provided a preliminary investigation of the constructs of memory uncertainty and positive metacognitive beliefs and the relation between

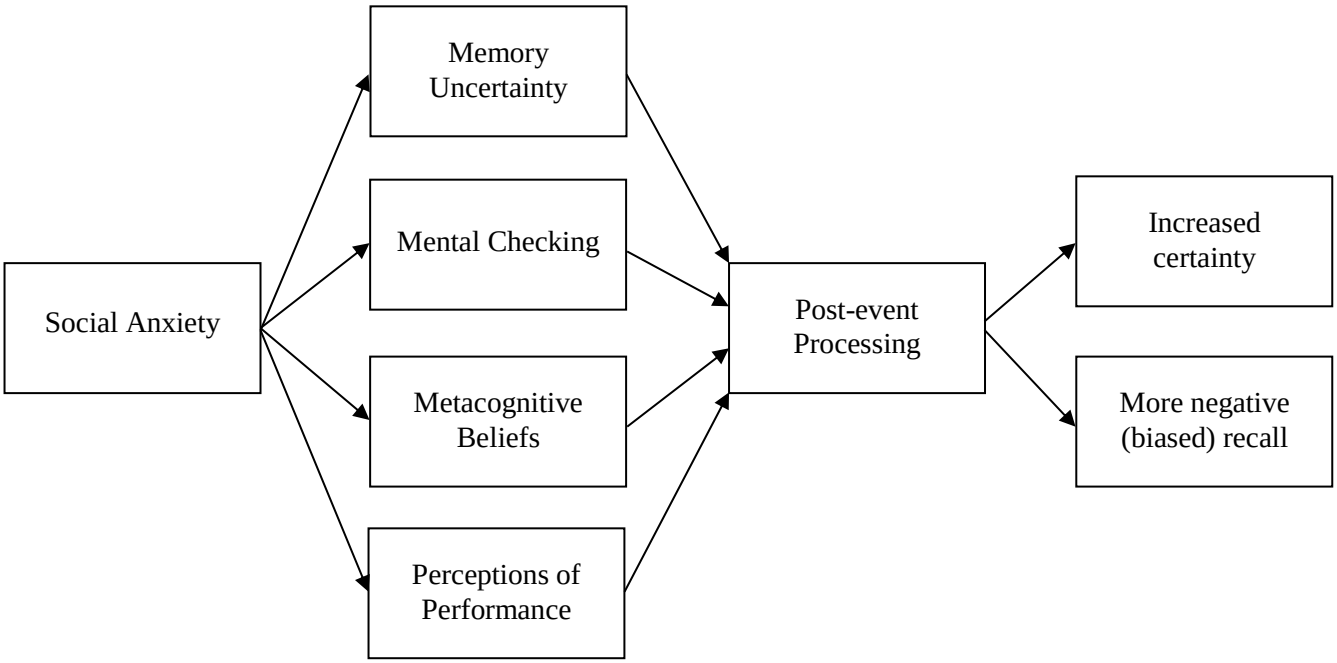

Figure 1. Hypothesized theoretical model examining the association between uncertainty, mental checking, metacognitive beliefs, perceptions of performance and post-event processing in social anxiety.

these constructs and social anxiety. Study 1 was designed to examine the proposed model within the context of a controlled study in which the hypothesized mechanisms were evaluated as they unfolded following a standardized social task in the lab among individuals with a principal diagnosis of SAD, individuals with a principal anxiety disorder diagnoses other than SAD, and non-anxious controls. Finally, Study 2 was an experimental study on socially anxious undergraduate students designed to test empirically the assumption that repeated socially-relevant mental recall directly impacts certainty and performance ratings in the manner proposed by the model.

Pilot Study – A Preliminary Investigation of the Relationships between Social Anxiety, Metacognitive Beliefs, and Memory Uncertainty

The primary goal for the Pilot Study was to provide a preliminary understanding of the nature of memory uncertainty and positive metacognitive beliefs in relation to PEP in social anxiety. A secondary goal was to evaluate an author compiled questionnaire, the *Metacognition and Certainty Scale* (MACS), as a means of investigating these constructs. The MACS and a measure of social anxiety were administered to two large samples of undergraduate students. Based on the proposed framework, we expected that higher levels of social anxiety would be significantly correlated with endorsement of metacognitive beliefs and feelings of uncertainty in relation to previously experienced past social events.

Method

Participants

Participants for this study consisted of two groups of non-overlapping University of Waterloo undergraduate students recruited through a research pool in exchange for course credit (Sample 1, n = 483; Sample 2, n = 708). No exclusion criteria were used. Of the total sample, the majority were female (69.3%) and the average age was 20.02 (SD = 3.60). Forty nine point six percent of participants were White, 27.7% were Asian (e.g., Chinese, Japanese, Korean), and 22.7% were classified as "Other" (e.g., Aboriginal, Black, Hispanic). A summary of participant characteristics in each sample can be found in Table 1.

Procedure

Participants were undergraduates who completed the mass testing screening procedure at the University of Waterloo. As part of a large online questionnaire battery, participants completed a measure of social anxiety and a measure assessing metacognitive beliefs and

degree of certainty in social situations. Questionnaires were administered in a randomized order, and participants were provided with course credit as remuneration.

Measures

Social Phobia Inventory (Connor et al., 2000; SPIN). The SPIN is a 17-item self-report questionnaire used to asses social anxiety symptoms characteristic of SAD. Sample items include: "Parties and social events scare me" and "I would do anything to avoid being criticized". The SPIN has been shown to differentiate between individuals with and without SAD, to have strong test-retest reliability (r = .86; Antony, Coons, McCabe, Ashbaugh, & Swinson, 2006), and excellent internal consistency (Cronbach's α ranging from .87 to .94; Antony et al., 2006; Connor et al., 2000). Cronbach's alpha for the SPIN in the current study was .92. See Appendix 1 for a copy of the SPIN.

Table 1

Pilot Study Demographic Characteristics by Sample

Variable	Sample 1 (n = 483)	Sample 2 (n = 708)
Age	20.12 (3.5)	19.95 (3.67)
Gender (% female)	68.3%	69.9%
Ethnicity		
White	48.4%	48.0%
Asian	25. 7%	27.8%
Other	22.4%	21.9%

Note. Standard deviations are in parentheses.

The Metacognition and Certainty Scale (MACS). The MACS was developed by the authors as a general measure of positive metacognitive beliefs and memory certainty. The MACS items were adapted from the *Metacognitions Questionnaire* (MCQ; Cartwright-Hatton & Wells, 1997) and the *Why Ruminate Scale* (WRS; Watkins & Baracaia, 2001). The original MCQ and WRS scales were developed to examine metacognitive beliefs about worry and ruminative thought typical in GAD and Major Depressive Disorder respectively. Items from these scales were modified so as to be relevant to participants' reactions in *social* situations. The scale consisted of 20 items composed of two subscales: *metacognitive beliefs* (e.g., "repeatedly thinking about previous social situations helps me gain new insights") and *memory uncertainty* (e.g., "I'm usually certain I remember everything important about prior social situations after they happen" – reverse scored). All items were scored on a 6-point Likert scale ranging from 0 (*strongly disagree*) to 5 (*strongly agree*). See Appendix 2 for a copy of the MACS used in the Pilot Study.

Results

Analytic Strategy

Data from the two samples were analyzed separately. First, principal component analysis was conducted on the MACS in order to examine its factor structure. Next, reliability analyses were conducted for each subscale of the MACS. Finally, relationships among social anxiety, metacognitive beliefs, and memory uncertainty were assessed using bivariate correlations.

Principal Component Analyses

Sample 1. Principal components analysis with an oblique rotation (direct oblimin) was used to examine the underlying structure of the MACS since the two hypothesized factors were

expected to be correlated with one another. One item ("I often check my memory after social events to evaluate how well I did") was removed from the scale because it was theoretically related to the certainty scale but was loading onto the metacognitive beliefs factor. A second item ("There are disadvantages to going back and thinking about prior social events") was likewise removed because it was the only item loading onto a third factor. An inspection of all eigenvalues greater than 1, as well as the scree plot (See Figure 2), indicated that a two-factor solution provided the best fit. Together, the two factors accounted for 54.45% of the variance. An examination of the factor loadings confirmed that the two obtained factors could be described as metacognitive beliefs (accounting for 41.49% of the variance) and memory uncertainty (accounting for 12.96% of the variance). Table 2 presents the factor loadings from the principal components analysis pattern matrix for each of the 18 items. Contrary to expectations, the two factors of the MACS were not significantly correlated ($r = .02$, $p = .71$).[1]

Sample 2. Principal components analysis with an oblique rotation (direct oblimin) was used with a second sample to see if the factor structure could be replicated. The results revealed a nearly identical pattern of results. Once again, the two items removed from the Sample 1 data were not loading as expected and were therefore removed from the scale. An inspection of eigenvalues and the scree plot (See Figure 3) again indicated a two-factor solution with metacognitive beliefs (accounting for 41.96% of the variance) and memory uncertainty (accounting for 12.61% of the variance) emerging as two distinct factors. Table 3 presents the factor loadings from the principal components analysis pattern matrix for each of

[1] Contrary to theoretically-derived hypotheses, the two scales on the MACS were not significantly correlated with each other. As such, the principal component analysis was repeated, using an orthogonal (varimax) rotation, which assumes that factors are unrelated. The two-factor model was supported for both samples using this approach.

the 18 items. Once again, the two factors of the MACS were not significantly correlated (r = .03, p = .47).

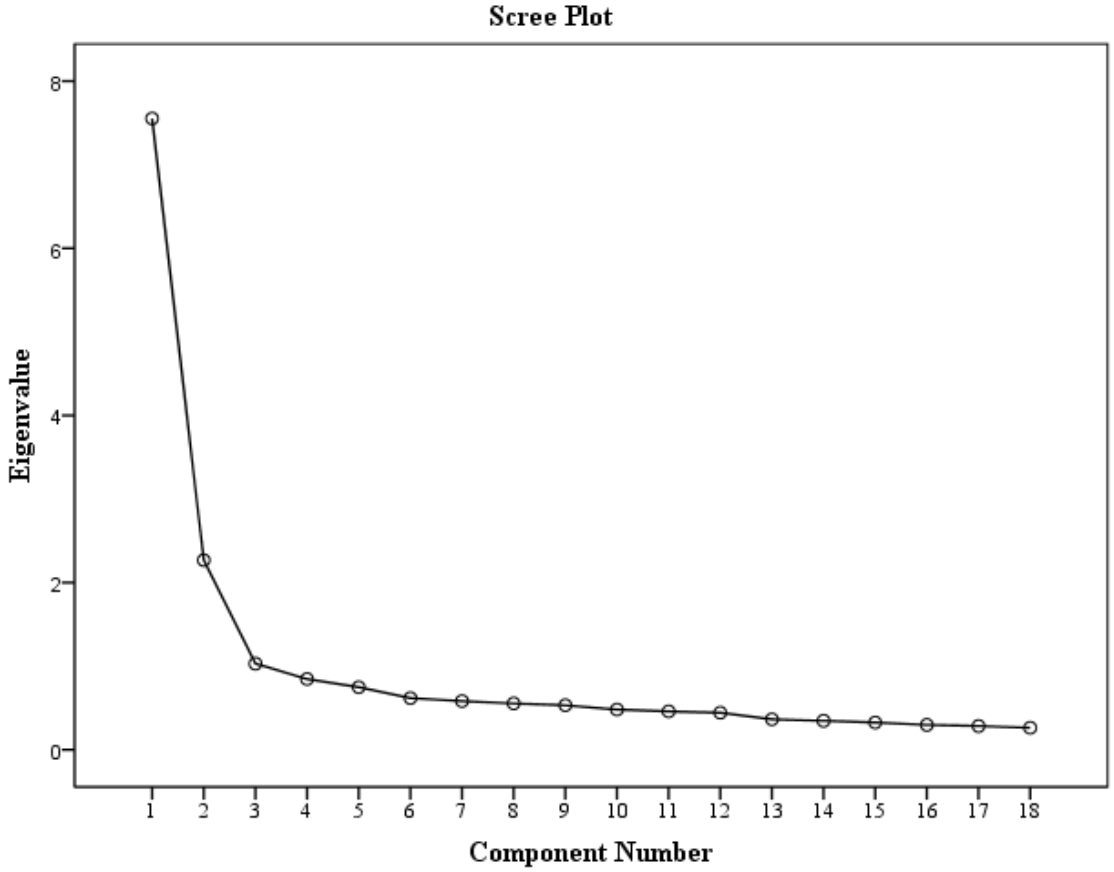

Figure 2. Metacognition and Certainty Scale revealing a two factor solution in Sample 1 (Pilot Study).

Table 2

Pilot Study Sample 1 Factor Loadings Pattern Matrix with Oblique Rotation (direct oblimin) for the Metacognition and Certainty Scale (MACS)

Item No.		Metacognitive Beliefs	Memory Uncertainty
Metacognitive beliefs			
1.	Repeatedly thinking about social interactions helps me figure out how well I did	**.81**	-.01
11.	Repeatedly thinking about a prior social event helps me think about it more clearly	**.78**	.03
16.	Repeatedly thinking about previous social situations helps me organize my thoughts	**.81**	.06
15.	Repeatedly thinking about previous social situations helps me prepare for future social events	**.78**	.03
3.	Repeatedly thinking about prior social situations helps me figure out whether I made certain mistakes	**.76**	.03
18.	Repeatedly thinking about previous social situations helps me get things sorted out in my mind	**.78**	.03
13.	Repeatedly thinking about previous social situations helps me gain new insights	**.77**	-.08
17.	Repeatedly thinking about previous social situations helps me come to terms with how I performed	**.79**	-.09
12.	Repeatedly thinking about previous social situations helps me avoid problems in future social encounters	**.70**	-.02
19.	There are advantages to going back and thinking about prior social events	**.69**	-.12
4.	Repeatedly thinking about prior social situations helps me remember the details of what happened	**.67**	-.09
2.	Repeatedly thinking about prior social situations helps me figure out how poorly I did	**.64**	.33
14.	Repeatedly thinking about previous social situations helps me cope with my emotions	**.66**	.09
Memory Uncertainty			
8.	I usually have little confidence in my memory for social situations	.03	**.76**
9.	I have trouble remembering important aspects of social situations I have been in	.01	**.76**
6.	The more I think about prior social events, the more I forget important details of what happened	-.08	**.69**
5.	I'm usually certain I remember everything important about prior social situations after they happen (Reverse Scored)	-.43	**.50**
7.	I am often unsure about my performance in social situations	.31	**.54**

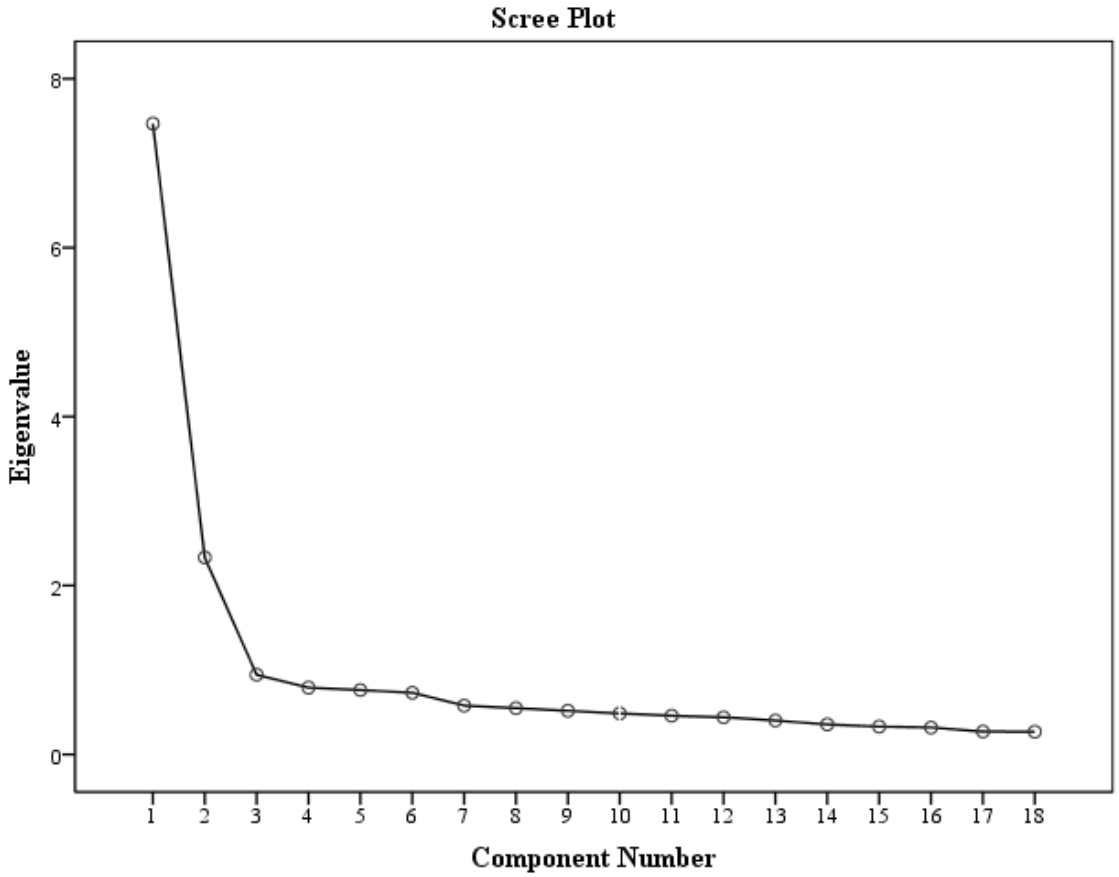

Figure 3. Metacognition and Certainty Scale revealing a two factor solution in Sample 2 (Pilot Study).

Table 3

Pilot Study Sample 2 Factor Loadings Pattern Matrix with Oblique Rotation (direct oblimin) for the Metacognition and Certainty Scale (MACS)

Item No.		Metacognitive Beliefs	Memory Uncertainty
Metacognitive beliefs			
1.	Repeatedly thinking about social interactions helps me figure out how well I did	**.81**	.10
11.	Repeatedly thinking about a prior social event helps me think about it more clearly	**.81**	-.05
16.	Repeatedly thinking about previous social situations helps me organize my thoughts	**.80**	.00
15.	Repeatedly thinking about previous social situations helps me prepare for future social events	**.79**	.01
3.	Repeatedly thinking about prior social situations helps me figure out whether I made certain mistakes	**.79**	.05
18.	Repeatedly thinking about previous social situations helps me get things sorted out in my mind	**.79**	.00
13.	Repeatedly thinking about previous social situations helps me gain new insights	**.79**	-.02
17.	Repeatedly thinking about previous social situations helps me come to terms with how I performed	**.79**	.04
12.	Repeatedly thinking about previous social situations helps me avoid problems in future social encounters	**.76**	.03
19.	There are advantages to going back and thinking about prior social events	**.66**	-.11
4.	Repeatedly thinking about prior social situations helps me remember the details of what happened	**.64**	-.17
2.	Repeatedly thinking about prior social situations helps me figure out how poorly I did	**.64**	.25
14.	Repeatedly thinking about previous social situations helps me cope with my emotions	**.63**	.07
Memory Uncertainty			
9.	I have trouble remembering important aspects of social situations I have been in	-.02	**.80**
8.	I usually have little confidence in my memory for social situations	.01	**.76**
6.	The more I think about prior social events, the more I forget important details of what happened	.03	**.65**
5.	I'm usually certain I remember everything important about prior social situations after they happen	-.42	**.54**
7	I am often unsure about my performance in social situations	.24	**.46**

Reliability Analyses. The *metacognitive beliefs* subscale of the MACS demonstrated excellent internal consistency across both samples. Cronbach's alpha for the 13-item subscale in both samples was .93. Internal reliability for the 5-item *memory uncertainty* subscale was substantially lower across both samples, with Cronbach's alpha of .65 in Sample 1 and .67 in Sample 2.

Relationship between Metacognitive Beliefs, Memory Uncertainty and Social Anxiety. Correlations were computed to examine the relationship between social anxiety and the MACS subscales. For Sample 1, the correlation between SPIN scores and metacognitive beliefs was modest but significant, $r = .25$, $p < .01$, as was the relationship between SPIN scores and memory uncertainty, $r = .27$, $p < .001$. Similar results were observed for Sample 2, with a correlation of $r = .20$, $p < .001$ between the SPIN and metacognitive beliefs and a correlation of $r = .28$, $p < .001$ between the SPIN and memory uncertainty.

Discussion

The Pilot Study provided a preliminary correlational test of the hypothesized relationships between social anxiety, memory uncertainty, and metacognitive beliefs. As expected, social anxiety was associated with greater endorsement of positive metacognitive beliefs about PEP. That is, the higher their social anxiety symptoms, the more likely participants were to hold beliefs that engaging in repetitive thinking about past social events would result in positive outcomes, such as greater insight, more effective coping with emotions, and enhanced ability to organize their thoughts.

Similarly, self-reported social anxiety symptoms were significantly correlated with memory uncertainty for past social events. Individuals with elevated social anxiety symptoms were more likely to report difficulties remembering aspects of past social situations as well as a

lack of confidence in their memories for these events. This finding provides preliminary evidence that feelings of uncertainty about one's performance in a social task may lead socially anxious individuals to use PEP to scan their memory in an effort to increase their level certainty.

Interestingly, the constructs of memory uncertainty and metacognitive beliefs were not correlated with one another. This finding suggests that these are orthogonal processes that are uniquely related to social anxiety and may therefore also exert independent influence on PEP. It is possible that one or both of these factors will emerge as independent predictors of PEP in socially anxious individuals. In other words, it is possible that socially anxious individuals may hold positive metacognitive beliefs and experience feelings of uncertainty, each of which contributes to greater engagement in PEP. Alternately, it may be that one of these factors emerges as a more significant contributor to this cognitive thought process. Further study is needed to determine the relative importance of each of these factors, and Studies 1 and 2 will seek to evaluate the contribution of each in an experimental design.

The MACS was developed for the current study as a means of assessing memory uncertainty and metacognitive beliefs, and the results largely support its continued validation and use. However, the internal consistency of the memory uncertainty scale fell just below what is typically considered an acceptable value (George & Mallery, 2003), and results should therefore be interpreted with caution. However, as Iacobucci and Duhachek (2003) point out, poorer reliability of a scale typically makes statistical tests more conservative and does therefore not undermine our confidence in the significant relationships observed among variables.

The results of the Pilot Study are preliminary and should be interpreted within the context of its limitations. First, the Pilot Study relied entirely on retrospective recall and participants could report on their experiences of metacognitive beliefs and memory uncertainty with respect to any kind or number of social situations they chose (i.e., it lacked standardization). In addition, the current study was conducted with an analogue student sample, and results may not therefore generalize to clinical populations with SAD.[2] The findings from this study provide justification for additional investigation, and Studies 1 and 2 were designed to address these limitations and evaluate the proposed theoretical framework in a more empirically rigorous manner.

[2] Future directions and limitations of this study and Studies 1 and 2 will be discussed in the General Discussion section.

Study 1 – Examining the Impact of Metacognitive Beliefs and Uncertainty on PEP following a Standardized Social Stressor

The purpose of Study 1 was to examine experimentally what motivates individuals to engage in PEP following a standardized socially threatening event, with a focus on exploring the influence of metacognitive beliefs and uncertainty in a clinical sample of individuals with SAD in comparison to anxious and healthy control participants. Following a standardized speech task, participants were asked to provide performance and certainty ratings and to complete a modified version of the MACS. Follow-up assessments of performance and certainty were assessed 1, 4, and 7 days after the speech task, as was PEP. The study was designed to test the following hypotheses:

1. Consistent with prior studies, it was expected that relative to anxious and healthy controls, individuals in the SAD group would rate their performance more negatively, less positively, and less accurately both immediately after the speech task and over time. Furthermore, as has been found in other studies (e.g., Cody & Teachman, 2011), we expected that performance ratings for the SAD group would become more negative and increasingly more biased over time relative to the control groups.
2. Individuals in the SAD group would report greater uncertainty about their performance on the speech task immediately after the task.
3. Compared to both control groups, individuals with SAD would more strongly endorse metacognitive beliefs, including the belief that mentally reviewing or "checking" their memory will help them achieve greater certainty. Although metacognitive beliefs have been identified across a number of anxiety disorders, it was theorized that beliefs specific to PEP about a social stressor would be unique to social anxiety.

4. As was proposed in the theoretical model, we expected that individuals in the SAD group would become more certain about their performance over time (i.e., by the 7-day follow-up), as perception of how they actually performed worsens (i.e., they become more certain that they performed poorly), whereas the certainty and performance ratings for the anxious and healthy controls would remain constant.
5. It was expected that PEP would be greatest in the SAD group relative to both control groups. Although it is well established that individuals with SAD engage in greater PEP relative to healthy controls or in analogue samples with high and low socially anxious participants, this is the first study to directly compare PEP in SAD relative to a clinical control sample following a standardized social stressor.
6. Finally, it was expected that a diagnosis of social anxiety would lead participants to experience poorer perceptions of performance, greater metacognitive beliefs, feelings of uncertainty, and motivation to mentally review their memories after a social stressor, which would, in turn, motivate people to engage in more PEP. Engaging in more PEP would, in turn, result in greater attainment of certainty, but at the expense of worsening perceptions of performance. To test these predictions, two mediation models were hypothesised. First, a model was proposed in which metacognitive beliefs, uncertainty, mental checking, and perception of performance immediately after the speech would mediate the relationship between diagnostic group status, on one hand, and PEP in the days following the speech, on the other. Second, it was hypothesised that PEP would mediate the relationship between metacognitive beliefs and uncertainty, on one hand, and increased certainty and more biased recall in the days following the speech (see theoretical framework represented in Figure 1).

Method

Participants

The study sample consisted of three groups of participants: (1) SAD = individuals who met DSM-IV criteria for a principal diagnosis of SAD; (2) anxious controls = individuals who met diagnostic criteria for a principal anxiety disorder other than SAD (e.g., OCD, GAD) and had no significant social anxiety symptoms; and (3) healthy controls = individuals without a history of mental health concerns. The principal diagnoses of individuals in the SAD and anxious control groups are presented in Table 4. Participants were recruited from two sources. A large majority of the clinical participants (83.8%) were recruited from the Anxiety Studies Division (ASD) at the University of Waterloo's Centre for Mental Health Research. The ASD is a collaborative research group that functions to recruit community participants with anxiety disorders into ongoing research studies. Due to initial difficulties recruiting anxious control participants from the ASD in an expeditious manner, some of the participants in this group were also recruited from the Anxiety Treatment and Research Clinic (ATRC) at St. Joseph's Healthcare Hamilton. All clinical participants were assessed using a structured clinical interview by trained graduate-level clinicians. Participants recruited through the ASD were assessed with the *Mini International Neuropsychiatric Interview* (MINI; Sheehan et al., 1998) and participants recruited from the ATRC were assessed with the *Structured Clinical Interview for DSM-IV Disorders* (SCID-I; First et al. 1996). Individuals who endorsed active and interfering symptoms of mania, psychosis, significant suicidality, and substance abuse or dependence

Table 4

Study 1 Demographic and Clinical Characteristics by Group

Variable	SAD (n = 24)	Anxious (n = 24)	Healthy (n = 25)
Gender (% female)	62.5%	75.0%	80.0%
Age – *M* (*SD*)	31.54 (12.69)	30.38 (9.43)	30.04 (9.50)
Marital Status			
Married or common-law	33.3%	45.8%	36.0%
Widowed	4.2%	0.0%	0.0%
Divorced/annulled	4.2%	4.2%	0.0%
Separated	4.2%	0.0%	8.0%
Never married	54.2%	50.0%	56.0%
Ethnicity			
Asian	12.5%	0.0%	0.0%
South Asian	4.2%	8.3%	4.0%
Black	4.2%	4.2%	0.0%
Latin American	0.0%	8.3%	0.0%
White	75.0%	70.8%	96.0%
Other	0.0%	4.2%	0.0%
Psychotropic medications	20.8%	58.3%	0.0%
Principal Diagnosis			
SAD	100%		
OCD		62.5%	
GAD		16.7%	
PDA		12.5%	
Specific Phobia		8.3%	
# of comorbid diagnoses – *M* (*SD*)	0.83 (1.34)	0.83 (.83)	
Comorbid anxiety disorder[a]	25.1%	45.9%	
Comorbid mood disorder[b]	29.2%	20.8%	
Other[c]	8.4%	8.4%	

Note. SAD = Social Anxiety Disorder; OCD = Obsessive Compulsive Disorder; GAD = Generalized Anxiety Disorder; PDA = Panic Disorder with Agoraphobia.

[a]Generalized Anxiety Disorder (n = 11); Obsessive-Compulsive Disorder (n = 1); Panic Disorder with Agoraphobia (n = 2); Panic Disorder without Agoraphobia (n = 1); Specific Phobia (n = 2).

[b]Bipolar II Disorder (n = 1); ; Dysthymia (n = 2); Major Depressive Disorder (Single, Recurrent, and In Partial Remission; n = 8).

[c] Alcohol Dependence (n = 1); Anorexia Nervosa (n = 1); Bulimia Nervosa (n = 1); Substance Abuse (n = 1).

were excluded from participating. Healthy control participants were recruited from the ASD, and were included if they reported no current mental health difficulties. Consistent with previous studies (Moscovitch et al., 2009), healthy control participants were assessed using a semi-structured diagnostic phone interview (based on the MINI) which was conducted by a trained research assistant.

Eighty participants completed the current study (SAD = 26; anxious control = 27; healthy control = 27). Participants' group status was confirmed based on SPIN scores completed during the lab portion of the study. Seven participants were excluded from analyses for the following reasons: scores on the SPIN inconsistent with diagnostic group status (e.g., high SPIN score in healthy control group; $n = 4$); missing phone screen assessment for healthy control group ($n = 1$); and significant concerns about participant's ability to engage in lab tasks ($n = 2$; one was due to difficulties with language comprehension and the second due to significant OCD rituals in which the participant reported and was observed engaging in throughout the session). The final sample size consisted of 24 SAD, 24 anxious control, and 25 healthy control participants.

Procedure

Eligible participants were contacted by telephone or email and provided with details of the study. Interested participants underwent a 15-20 minute diagnostic reassessment by a graduate level clinician to ensure that their symptoms had not changed significantly since the time of their initial diagnostic interview and to confirm their social anxiety symptom status. Participants in the control groups who endorsed any significant degree of social anxiety concerns, even sub-clinical levels, were excluded at this stage of recruitment. Eligible participants recruited from the ASD completed the study in an office in the Moscovitch

laboratory at the University of Waterloo and participants recruited from the ATRC completed the study in an office in the Fontbonne building at St. Joseph's Healthcare Hamilton.

Participants were informed that the purpose of the study was to examine the thought patterns that occur following social events. Written consent was provided by all participants prior to beginning the study. Participants then completed a battery of questionnaires assessing demographic information and symptom measures (e.g., social anxiety, depression, state anxiety). Following this, they were provided with a 3-minute period to review eight possible speech topics and prepare for the standardized speech task. The topics were designed to be controversial (e.g., euthanasia, death penalty) so as to maximize feelings of anxiety (see Appendix 3 for the list of topics). Participants were advised that they would have 10 minutes to complete the speech. They were encouraged to use the full time limit although they were permitted to terminate the task early by ringing a bell if they chose. Participants were permitted to speak about any number of the topics provided (i.e., they could focus on a single topic or cover all eight), and were instructed that the goal was to provide their opinion as well as any relevant arguments.

Following the preparation period, participants were introduced to a new researcher who they were informed would be observing the speech and gathering objective data on their performance. Participants were instructed to treat this individual as an audience member and to not engage them in conversation. The observer was instructed to maintain a neutral facial expression and to refrain from showing signs of approval/disapproval (e.g., smiling, nodding, frowning) during the duration of the speech. Observers were similarly instructed to monitor their non-verbal behaviour and to refrain from excessive movement (e.g., fidgeting). The observer made objective ratings of the participant's performance during the speech task, which

were not visible to the participant. In addition, the speech task was video recorded to increase evaluative threat and to allow for further coding of speech performance by objective observers. The camera was located in front of the participant, in their line of sight. After the speech task finished (either because 10 minutes elapsed or because the participant terminated the task early), participants completed a second questionnaire battery which assessed state anxiety, perception of performance, certainty of performance, and metacognitive beliefs.

Following this, participants were provided with $15 in remuneration. They were also provided with detailed information regarding the online component of the study. Participants were instructed that they would receive an email with a link for completing the questionnaires in 1, 4 and 7 days. They were instructed that the email would be sent in the morning and they were encouraged to complete the querstionnaires before midnight on the same day it was sent. If this was not possible, participants were asked to complete the follow-up as soon as they were able. As an incentive, participants received a $5 gift card for each of the follow-ups completed (for a maximum of $15). Furthermore, participants were advised that individuals who completed all 3 online follow-ups would be entered into a cash prize draw for $100 to take place once the study was complete.

The online follow-ups were emailed to participants by the principal investigator 1, 4, and 7 days after the speech task. Participants were provided with a web address and unique log-in information. Follow-up questionnaires were compatible with smart phones and tablets for ease of completion. The follow-ups assessed PEP, performance and certainty ratings. Participants were provided with an electronic feedback letter immediately after completing the final follow-up, which included additional details about the goals of the study as well as

treatment resources. Gift cards and a paper copy of the feedback letter were mailed within one week of the participants' completion of the study.

Measures

Social Phobia Inventory (Connor et al., 2000; SPIN). The SPIN was administered as part of a questionnaire battery at the beginning of the study to assess symptoms of social anxiety and confirm participants' diagnostic status (see Study 1 for a detailed description of the measure and Appendix 1 for a copy of the measure). In the current study, the scale demonstrated excellent internal consistency (Cronbach's $\alpha = .97$).

Depression Anxiety Stress Scale – Short Version (DASS 21; Lovibond & Lovibond, 1995). The DASS is a 21-item self-report questionnaire assessing symptoms of depression, anxiety, and stress experienced in the past week. Items are rated on a scale from 0 to 3 (0 = *did not apply to me at all*; 3 = *applied to me very much, or most of the time*). Sample DASS items include "I felt that I had nothing to look forward to" and "I found it difficult to relax". The DASS has been found to differentiate well between features of depression, physical arousal, and psychological tension and agitation and has demonstrated excellent internal consistency and concurrent validity (Antony, Bieling, Cox, Enns, & Swinson, 1998). In the current study, all three DASS subscales had good internal consistency, with Cronbach's alphas of .90 for stress, .79 for anxiety and .93 for the depression subscale. See Appendix 4 for a copy of the DASS.

Perception of Speech Performance and Certainty (PSPC; Cody & Teachman, 2011; Rapee & Lim, 1992). The PSPC consists of 23 items relevant to speech performance and assesses both positive (e.g., appeared confident) and negative (e.g., bored the audience) domains. The original 17-item scale upon which the PSPC is based has shown adequate

internal consistency (α = .75 and higher) and inter-rater reliability (Brozovich & Heimberg, 2011; Rapee & Hayman, 1996; Rapee & Lim, 1992). Six additional items developed by Cody and Teachman (2011) were added to the existing scale. These items were designed to assess a greater number of general performance domains in order to provide a more comprehensive evaluation of speech performance. The additional items were as follows: was a good public speaker, used sophisticated vocabulary, smiled appropriately, made a bad impression, was not convincing, and bored the audience.

Participants rated each item on two separate subscales: *performance* and *certainty*, with higher scores indicating better performance ratings and greater certainty. On the performance subscale, participants were asked to rate how they believed they did on each item on a scale from 0 (*not at all*) to 4 (*extremely*). On the certainty subscale, participants were asked to rate how certain they were of their performance rating ranging from 0 (*not at all certain*) to 4 (*extremely certain*). For example, if the participant rated the item "content was understandable" as *moderately*, they were asked to rate how certain or confident they felt about this rating. Written and verbal instructions, including a standardized example, were provided to each participant in order to ensure they understood how to rate each subscale. Positive and negative subscales were examined separately in relation to study hypotheses, as we expected that valence could influence performance and certainty ratings. The PSPC was administered immediately after the speech task as well as at the 1, 4 and 7 day follow-ups. In the current study, both subscales demonstrated excellent internal consistency across all timepoints, ranging from .86 to .93 for the performance subscale and from .87 to .92 for the certainty subscale. A copy of the PSPC can be found in Appendix 5.

Subjective Units of Distress Scale (SUDS; Wolpe, 1958). The SUDS (see Appendix 6) measures participants' level of state anxiety/distress and is rated from 0 (*not at all anxious*) to 100 (*extremely anxious*). The SUDS is face-valid, quick to administer and has been widely used in research studies and clinical settings (e.g., Cody & Teachman, 2010; Laposa & Rector, 2011). Participants' rated their level of state anxiety on the SUDS immediately before and after the speech task.

Metacognition and Certainty Scale – Post-Speech Version (MACS-PS). The MACS-PS is an author-compiled questionnaire designed to assess positive beliefs about engaging in PEP, memory uncertainty and mental checking and was adapted from the measure of the MACS described in the Pilot Study.[3] The MACS-PS used in the current study differed in a number of important ways from the MACS used in the Pilot Study. First, whereas the MACS assessed beliefs about social situations more generally, the MACS-PS items were designed specifically in reference to the speech task completed in the lab. For example, the item "Repeatedly thinking about prior social situations helps me remember the details of what happened" was re-worded as "Thinking about this speech will help me remember the details of what happened." Furthermore, several items were added to the current version of the scale in order to assess the construct of mental checking, which was of interest for the current study, and was hypothesized to be theoretically distinct from the other two factors. Finally, the two

[3] The MACS and MACS-PS were developed concurrently, and although the content of most items is consistent across both versions of the scale, a few of the items do differ and should be noted. The MACS contains two items not found on the MACS-PS ("Repeatedly thinking about a prior social event helps me think about it more clearly" and "The more I think about prior social events, the more I forget important details of what happened") and the MACS-PS contains one item not found on the MACS ("I have doubts about my performance on the speech task"). Of note, the factor structure of the MACS-PS was not examined in the context of the present study because the Study 1 sample size was relatively small for employing this analytic strategy, but the strong internal consistency of each of the three subscales provides promising evidence for its use. Future research is needed to investigate the factor structure of the MACS-PS.

items that were not supported by the factor analysis of the MACS in the Pilot Study are not included in the MACS-PS.

The MACS-PS therefore consists of 3 subscales: a) Metacognitive Beliefs (12 items), which measures positive beliefs about engaging in PEP about the speech task (e.g., "I need to think about this speech in order to avoid problems in the future"); b) Memory Uncertainty (5 items), which assess the extent to which participants have doubts or uncertainty about their memories for the speech task (e.g., "I have little confidence in my memory for the speech task"); and c) Mental Checking (3 items) which assess participants' beliefs that reviewing the speech task will provide them with a means of checking whether certain events occurred (e.g., "Thinking about this speech will give me an opportunity to go back and check how the audience member reacted"). The MACS-PS was administered in the lab following the speech. Cronbach's alpha was .89 for the Metacognitive Beliefs subscale, .84 for the Memory Uncertainty subscale, and .82 for the Mental Checking subscale. See Appendix 7 for a copy of the MACS-PS used in the current study.

Post Event Processing Questionnaire – Revised (PEPQ-R; McEvoy & Kingsep, 2006). The PEPQ-R is a 14-item scale assessing the extent to which individuals engaged in PEP following an anxiety provoking event and was used in the current study to assess engagement in PEP in the week following the speech task. Sample items include "did you find it difficult to forget about the event" and "did you ever wonder about whether you could have avoided or prevented your behaviour/feelings during the event"? The scale has demonstrated good internal consistency ($\alpha = .87$) and construct validity (Makkar & Grisham, 2011a; McEvoy & Kingsep, 2006). The PEPQ-R was completed at the 1, 4 and 7 day follow-ups and showed

excellent internal consistency across all time points (α ranging from .89-.90). See Appendix 8 for a copy of the PEPQ-R.

Objective Ratings of Performance

In order to obtain an objective assessment of speech performance, four research assistants, blind to the diagnostic status of the participant or study hypotheses, were involved in providing objective ratings of participants' speech performance. Each participants' performance was rated by three of the four available observers. One of the raters was a research assistant who observed the participants' speech live (i.e., the audience member). The other observers rated video recordings of the speech task. Although several of the research assistants were involved in both the live observation and video ratings, no single participant was rated by the same observer more than once to ensure independent observations. Observers used the Performance subscale of the PSPC so that their ratings could be directly compared to participants' self-evaluations of performance. All observers were trained by the principal investigator to objectively evaluate speech performance and were provided with detailed rating guidelines. Sample videos were used as part of the training process to help observers calibrate their ratings.

Inter-rater reliability was assessed using the intra-class correlation (one-way, mixed effects model for the consistency of average measures; *ICC*), which is appropriate for studies with more than two coders and for designs that are not fully-crossed (i.e., a different subset of coders is selected to evaluate each participant; Hallgren, 2012). Commonly-cited cut-offs provided by Cicchetti (1994) indicate that ICC values less than .40 are considered poor, values between .40 and .59 are fair, values between .60 and .74 are good, and values between .75 and 1.0 are excellent. The *ICC* value in the current study was .78.

In order to evaluate self-observer discrepancy, a standardized residual score was calculated (Rodebaugh & Rapee, 2005; Taylor & Alden, 2011) which uses participant's own speech ratings with observer ratings partialled out. As noted by Rodebaugh & Rapee (2005), although standardized residual and simple difference scores will generally yield similar results, a standardized residual score is conceptually more appropriate as it measures the extent to which self-ratings cannot be predicted from observer ratings. In order to calculate the discrepancy scores, observer ratings were first averaged across the three raters. To obtain the standardized residual, the rater's average score was entered as a predictor of participant self-ratings on the PSPC performance subscale into a regression analysis. The standardized residual output for this equation is a measure of the self-observer discrepancy, with scores below zero indicating that participants are negatively biased and scores above zero indicating that participants are positively biased relative to objective observers; thus, larger residual scores reflect greater bias.

Results

Data Screening

Normality of variables was explored by examining absolute values of skewness and kurtosis and with the Kolmogorov-Smirnov (K-S) test of normality. Guidelines provided by Lei and Lomax (2005) suggest that absolute skewness and kurtosis values below 1.0 indicate minimal nonnormality, values between 1.0 and 2.3 suggest moderate nonnormality and values beyond 2.3 indicate severe nonnormality. The K-S test was also examined, which compares observed scores to a sample of normally distributed scores with the same mean and standard deviation. Significant values on the K-S test indicate potential deviations from normality. However, as Field (2009) highlights, the K-S test is likely to be significant with larger samples

and a significant result does not necessarily indicate serious deviations from normality. Data should therefore be explored using both statistical tests and via visual examination with Q-Q plots.

Examination of the skewness, kurtosis values, the Kolmogorov-Smirnov statistic and Q-Q plots (see Table 5) suggested that several variables had moderate or severe distribution problems.[4] Although some studies have shown that the F statistic is robust to departures from normality when group sizes are equal (Glass, Peckham, & Sanders, 1972; Harwell, 1992), control of the Type I error rate and statistical power can be diminished when this assumption is violated. Considering recent recommendations highlighting problems with transforming variables (García-Pérez, 2012) and the challenge of interpreting transformed variables, the non-normal distributions were left untransformed. However, in order to ensure the integrity of obtained findings, results from all one-way Analysis of Variance (ANOVA) and t-test statistics were confirmed using a 95% bias-corrected confidence-interval bootstrapping procedure in SPSS (Efron & Tibshirani, 1985; Preacher & Hayes, 2004) and the pattern of results remained unchanged. Bootstrapping methods are more statistically powerful tests and are not dependent on normally distributed data (Shrout & Bolger, 2002). For statistical analyses that do not currently offer the bootstrapping procedure in SPSS (e.g., repeated measures ANOVA), a more conservative significance test (p = .01) was applied in order to avoid Type I errors and this will be highlighted in relevant analyses.

[4] Given that we had 3 groups of participants, there is reason to expect that the overall distribution for variables would not be normal because the scores come from different populations. The assumption of normality was therefore examined separately in each of the groups; the results of these analyses confirmed that the assumption of normality was not upheld for several of the variables.

Table 5

Normality Indexes for Study 1 Descriptive and Dependent Measures

Variable	*N*	Skew	SE_{skew}	Kurtosis	$SE_{kurtosis}$	K-S	*p*
Baseline							
SPIN	73	0.83	0.28	-0.35	0.56	0.17	<.001
DASS - Depression	72	1.43	0.28	1.36	0.56	0.20	<.001
DASS - Anxiety	72	1.44	0.28	2.44	0.56	0.17	<.001
DASS - Stress	72	0.71	0.28	-0.22	0.56	0.14	.002
SUDS	73	0.56	0.28	-0.56	0.56	0.20	< .001
Post-speech							
SUDS	73	0.58	0.28	-0.74	0.56	0.24	< .001
PSPC Performance Total	72	-0.42	0.28	-0.88	0.56	0.17	< .001
PSPC Performance Positive	73	-0.11	0.28	-0.91	0.56	0.11	.08
PSPC Performance Negative	72	-0.60	0.28	-0.44	0.56	0.11	.05
PSPC Certainty Total	73	-0.86	0.28	1.02	0.56	0.10	.09
PSPC Certainty Positive	73	-0.87	0.28	1.34	0.56	0.12	.015
PSPC Certainty Negative	73	-1.26	0.28	1.78	0.56	0.17	<.001
MACS-PS							
Metacognition	73	0.22	0.28	-0.05	0.56	0.08	.200[a]
Memory Uncertainty	73	-0.27	0.28	-0.62	0.56	0.08	.200[a]
Mental Checking	73	0.52	0.28	-0.40	0.56	0.12	.007
Day 1 Follow-Up							
PSPC Performance Total	67	-0.60	0.29	0.01	0.58	0.09	.200[a]
PSPC Performance Positive	69	-0.09	0.29	-0.66	0.57	0.08	.200[a]
PSPC Performance Negative	67	-0.89	0.29	-0.35	0.58	0.18	<.001
PSPC Certainty Total	73	-0.58	0.28	0.22	0.56	0.08	.200[a]
PSPC Certainty Positive	73	-0.57	0.28	0.35	0.56	0.08	.200[a]
PSPC Certainty Negative	73	-0.48	0.28	0.00	0.56	0.09	.200[a]

PEPQ-R	69	0.87	0.29	-0.45	0.57	0.17	< .001
Day 4 Follow-Up							
PSPC Performance Total	67	-0.49	0.29	-0.47	0.58	0.08	.200[a]
PSPC Performance Positive	68	-0.12	0.29	-0.43	0.57	0.10	.200[a]
PSPC Performance Negative	67	-0.75	0.29	-0.71	0.58	0.16	<.001
PSPC Certainty Total	68	-0.33	0.29	0.22	0.57	0.08	.200[a]
PSPC Certainty Positive	68	-0.35	0.29	0.41	0.57	0.08	.200[a]
PSPC Certainty Negative	68	-0.34	0.29	-0.03	0.57	0.06	.200[a]
PEPQ-R	68	0.87	0.29	-0.48	0.57	0.18	< .001
Day 7 Follow-Up							
PSPC Performance Total	68	-0.74	0.29	0.81	0.57	0.10	.17
PSPC Performance Positive	68	-0.21	0.29	-0.42	0.57	0.12	.03
PSPC Performance Negative	68	-0.88	0.29	-0.09	0.57	0.15	.002
PSPC Certainty Total	68	-0.23	0.29	-0.34	0.57	0.08	.200[a]
PSPC Certainty Positive	68	-0.23	0.29	-0.15	0.57	0.10	.200[a]
PSPC Certainty Negative	68	-0.22	0.29	-0.36	0.57	0.06	.200[a]
PEPQ-R	68	1.06	0.29	-0.04	0.57	0.22	< .001

[a] This is a lower bound of the true significance.

Note. SPIN = Social Phobia Inventory; SUDS = Subjective Units of Distress Scale; DASS = Depression Anxiety Stress Scale; PSPC = Perception of Speech Performance and Certainty; MACS-PS = Metacognition and Certainty Scale-Post Speech; PEPQ-R = Post-Event Processing Questionnaire – Revised. * p <.05, ** p < .01.

The assumption of homogeneity of variance was explored using Levene's test. Although this assumption was generally upheld, it was violated with some variables and the results of these tests are reported with relevant analyses. When this assumption was violated in one-way ANOVA and *t*-test analyses, Welch's *F* was reported as an alternative version of the F-ratio, as Welch's *F* does not require equal variances. Similarly, although group differences were generally explored with Tukey's HSD post hoc tests, when the violation of homogeneity could not be assumed, the Games-Howell procedure was used as it is robust to violations of this assumption.

Preliminary Results

Sample Characteristics

Summary demographic and clinical characteristics for each of the diagnostic groups[5] are provided in Table 4. Participants did not differ across groups in age, $F(2, 70) = .13$, $p = .88$, partial $\eta^2 = .004$, gender, $\chi^2 (2) = 1.99$, $p = .37$, Cramer's V = .17, marital status, $\chi^2(8) = 5.62$, $p = .69$, Cramer's V = .20, or ethnicity, $\chi^2(8) = 11.09$, $p = .20$, Cramer's V = .28. There were significant group differences in reported use of psychotropic medications, $\chi^2(2) = 22.14$, $p < .001$, Cramer's V = .55. Inspection of the standardized residuals revealed values exceeding the critical value of 1.96 for the anxious control and healthy control groups (SAD = -.5; anxious control = 3.1; healthy control = -2.6). These results suggest that compared to expected frequencies, the anxious controls were significantly more likely and the healthy controls were significantly less likely to report taking psychotropic medications. Participants in the SAD and anxious control groups did not differ on number of comorbid DSM-IV diagnoses, $t(45) = 0.02$, $p = .98$.

[5] Anxious control participants from the two recruitment sites did not differ on any demographic variables, including age, gender, marital status, ethnicity, or medication status, (all *p*'s >.18). The two groups also did not differ on any of the trait measures, including social anxiety, depression, anxiety, or stress (all *p*'s > .06).

The means and standard deviations for all state and trait measures are presented in Table 6 and the correlations between the variables are presented in Table 7. A series of one-way ANOVAs with post hoc tests were conducted to identify differences between groups on trait variables. Levene's test was significant for the SPIN and DASS (Depression, Anxiety and Stress subscales) and Welch's *F* statistic is therefore reported. As expected, there were significant group differences on the SPIN, Welch's $F(2, 40.39) = 94.51$, $p < .001$, partial $\eta^2 = .76$. Follow up post-hoc test using the Games-Howell procedure indicated that the SAD group had significantly higher SPIN scores than both control groups ($p < .001$). The anxious controls also reported significantly higher scores relative to the healthy controls ($p < .001$). The Depression subscale on the DASS also showed significant group differences, Welch's $F(2, 35.76) = 22.86$, $p < .001$, partial $\eta^2 = .36$. Follow-up with Games-Howell suggests that as expected, relative to the healthy controls, the SAD ($p < .001$) and anxious control ($p < .001$) groups reported significantly greater depression than the healthy ($p < .001$) controls. The SAD group also reported significantly more depression than the anxious controls ($p = .02$). There were significant group differences on the anxiety subscale of the DASS, Welch's $F(2, 36.73) = 30.10$, $p < .001$, partial $\eta^2 = .39$. Follow-up post-hoc analyses with Games-Howell suggests that the SAD group reported marginally significantly more anxiety relative to the anxious controls ($p = .06$) and significantly more relative to the healthy controls ($p < .001$). The anxious and healthy control groups also differed significantly, ($p < .001$). The groups differed significantly on the Stress subscale of the DASS, Welch's $F(2, 40.48) = 40.26$, $p < .001$, partial $\eta^2 = .46$. Follow-up analyses with Games-Howell indicated that the mean difference between the SAD and anxious control group was marginally significant ($p = .06$) and the difference between the SAD group and the healthy controls ($p < .001$) was statistically significant. The

Table 6

Means and Standard Deviations of Study 1 Variables by Group

Measure	SAD	Anxious	Healthy	Scale Range
SPIN	40.54 (11.63)	13.88 (8.28)	5.48 (4.71)	0-68
DASS-Depression	8.16 (5.87)	4.08 (3.71)	0.92 (1.41)	0-21
DASS-Anxiety	6.21 (3.92)	3.88 (2.94)	0.72 (1.17)	0-21
DASS-Stress	11.47 (5.05)	8.13 (4.84)	2.20 (2.42)	0-21
PSPC-Performance	39.87 (12.52)	54.25 (13.52)	62.08 (10.35)	0-92
PSPC-Certainty	57.10 (16.38)	66.58 (11.26)	69.03 (9.87)	0-92
MACS-PS-Metacognition	34.29 (11.79)	24.67 (12.08)	20.76 (9.87)	0-60
MACS-PS-Uncertainty	15.42 (4.64)	10.42 (5.86)	9.65 (4.81)	0-25
MACS-PS-Mental Checking	5.54 (3.59)	4.58 (4.09)	4.24 (3.03)	0-15
SUDS-Pre-speech	38.88 (23.26)	25.42 (21.62)	11.84 (12.73)	0-100
SUDS-Post-speech	50.89 (28.22)	30.42 (24.45)	16.80 (18.08)	0-100
PEPQ-R-Day 1	66.65 (25.33)	38.78 (22.28)	28.98 (15.76)	0-140
PSPC-Performance Day 1	45.87 (11.10)	56.62 (9.92)	62.39 (9.01)	0-92
PSPC-Certainty Day 1	58.69 (14.36)	59.23 (13.57)	62.00 (16.00)	0-92
PEPQ-R-Day 4	64.79 (28.08)	37.68 (22.61)	27.09 (15.55)	0-140
PSPC-Performance Day 4	45.46 (11.00)	56.91 (11.09)	62.00 (10.36)	0-92
PSPC-Certainty Day 4	59.42 (15.87)	58.85 (14.30)	61.64 (16.94)	0-92
PEPQ-R-Day 7	56.17 (26.81)	30.90 (18.90)	25.38 (12.74)	0-140
PSPC-Performance Day 7	42.52 (12.26)	54.29 (12.03)	59.71 (9.59)	0-92
PSPC-Certainty Day 7	58.00 (17.08)	58.32 (14.83)	61.46 (16.27)	0-92

Note. SPIN = Social Phobia Inventory; DASS = Depression Anxiety Stress Scale; PSPC = Perception of Speech Performance and Certainty; MACS-PS = Metacognition and Certainty Scale-Post Speech; SUDS = Subjective Units of Distress Scale; PEPQ-R = Post-Event Processing Questionnaire-Revised. Standard deviations appear in parentheses.

Table 7

Correlations amongst Study 1 Variables

Measures	1	2	3	4	5	6	7	8	9	10	11
1. SPIN	—	.61**	.66**	.66**	-.61**	-.32**	.45**	.46**	.20	.61**	.61**
2. DASS-Depression		—	.66**	.77**	-.45**	-.09	.28*	.23*	.09	.55**	.47**
3. DASS-Anxiety			—	.72**	-.56**	-.21	.29*	.35**	.17	.58**	.59**
4. DASS-Stress				—	-.56**	-.23*	.22	.32**	.09	.64**	.61**
5. PSPC-Performance				—	.11	-.27*	-.50**	-.10	-.51**	-.67**	
6. PSPC-Certainty						—	-.11	.28*	.01	-.38**	.22
7. MACS-PS-Metacognition							—	.26*	.73**	.33**	.32**
8. MACS-PS-Memory Uncertainty								—	.03	.32**	.37**
9. MACS-PS-Mental Checking									—	.14	.18
10. SUDS-Pre-speech										—	.70**
11. SUDS-Post-speech											—

Note. SPIN = Social Phobia Inventory; DASS = Depression Anxiety Stress Scale; PSPC = Perception of Speech Performance and Certainty; MACS-PS = Metacognition and Certainty Scale-Post Speech; SUDS = Subjective Units of Distress Scale. * p <.05, ** p < .01

two control groups also differed significantly ($p < .001$), with the anxious controls reporting greater stress.

Speech Length

Participants were encouraged to speak for a full 10 minutes (600 seconds) for the speech task, although were permitted to terminate the task early by ringing a bell. A one-way ANOVA indicated that there were marginally significant group differences in speech length, $F(2, 70) = 2.93$, $p = .06$, partial $\eta^2 = .08$. Levene's test was not significant, $p = .11$. Tukey HSD post hoc tests indicated that the only significant difference was between the SAD ($M = 454.38$, $SD = 140.24$) and healthy control ($M = 542.12$, $SD = 111.98$, $p = .05$) groups. The anxious controls ($M = 492.17$, $SD = 128.92$) were not significantly different from the SAD ($p = .56$) or healthy control ($p = .36$) groups.

PEP Interval Length

Most participants completed the online follow-up sessions on the appropriate days (day 1: 87.0%; day 4: 79.1%; day 7: 76.5%). The average completion time was 1.22 ($SD = .66$) days for the day 1 follow-up, 4.30 ($SD = .65$) days for the 4 day follow-up, and 7.53 ($SD = 1.46$) days for the 7 day follow-up. There were no significant group differences in the length of time interval for the day 1 [$F(2, 66) = 1.20$, $p = .31$, partial $\eta^2 = .03$], day 4 [$F(2, 64) = 2.07$, $p = .14$, partial $\eta^2 = .0$], or day 7 [$F(2, 65) = .29$, $p = .75$, partial $\eta^2 = .0$] follow-ups.

State Anxiety

A 3 (group: SAD, anxious controls, healthy controls) × 2 (time: pre-speech, post-speech) mixed-measures ANOVA was conducted with SUDS ratings as the dependent variable to assess whether there were any group differences or changes in anxiety from pre- to post-speech. As expected, results demonstrated a significant main effect of group, $F(2, 70) = 15.07$,

$p < .001$, partial $\eta^2 = .30$. There was also a significant main effect of time, $F(1, 70) = 10.00$, $p = .002$, partial $\eta^2 = .13$, with higher levels of anxiety reported after the speech relative to before the speech. There was no group × time interaction, $F(2, 70) = 1.02$, $p = .37$, partial $\eta^2 = .03$, suggesting that the speech task increased state anxiety equally for all groups. Levene's test indicated that the homogeneity of variance assumption was violated for the pre-speech rating ($p = .04$) but not for the post-speech rating ($p = .09$).

To explore the nature of group differences at the two time points, two follow-up one-way ANOVAs with post hoc tests were conducted. Given that Levene's test for the SUDS rating was significant at pre-speech, differences in anxiety were explored using Welch's *F*. Results from this test indicated significant group differences in state anxiety prior to the speech, Welch's $F(2, 42.35) = 13.53$, $p < .001$, partial $\eta^2 = .25$. Post-hoc tests using the Games-Howell procedure suggest that the SAD group ($M = 38.88$, $SD = 23.26$) experienced significantly greater state anxiety prior to the speech task relative to the healthy ($M = 11.84$, $SD = 12.73$, $p < .001$) but not the anxious controls ($M = 25.42$, $SD = 21.62$, $p = .11$). The anxious and healthy control groups were also significantly different from one another on state anxiety immediately before the speech, $p = .03$.

A second ANOVA exploring group differences in state anxiety at post-speech again indicated significant differences, $F(2, 70) = 12.62$, $p < .001$, partial $\eta^2 = .27$ (the homogeneity of variance assumption was met for this variable and the test is therefore reported as usual). Post-hoc tests using Tukey's HSD test indicate that the SAD group ($M = 50.89$, $SD = 28.22$) reported significantly greater state anxiety at post-speech relative to the anxious ($M = 30.42$, $SD = 24.45$, $p < .01$) and healthy controls ($M = 16.80$, $SD = 18.08$, $p < .001$), although the two controls groups did not differ significantly ($p = .12$).

Primary Analyses[6]

Perception of Speech Performance (Hypothesis 1 and 4)

Overall Performance. Participants' perception of speech performance (as reported on the performance subscale of the PSPC) was assessed immediately after the speech, as well as at each of the follow-ups (See Figure 4 a). A 3 × 4 mixed-design ANOVA was conducted on individual's performance ratings with group (SAD, anxious controls, healthy controls) as the between-subjects factor and time (post-speech, day 1, day 4, day 7) as the within-subjects factor. Levene's test indicated that variances were homogeneous for all levels of the performance variable (all *p*'s > .09). Mauchly's Test of Sphericity was significant suggesting that the assumption of sphericity had been violated, $\chi^2(5) = 51.36$, $p < .001$, and a Greenhouse-Geisser correction was therefore employed on the repeated measures variables. There was a significant main effect of time, $F(1.85, 107.35) = 13.17$, $p < .001$, partial $\eta^2 = .19$ and the within-subjects contrast showed that this effect was quadratic in nature, $F(1, 58) = 47.36$, $p < .001$, partial $\eta^2 = .45$ (the linear effect was non-significant, $F(1, 58) = .09$, $p = .77$, partial $\eta^2 = .00$). The effect was such that all participants reported an improvement in overall perception of performance at the day 1 and day 4 follow-ups, before reporting a decline in performance perception at day 7. As expected, there was also a significant main effect of group, $F(2, 58) =$

[6] Given that the SAD group reported significantly higher scores on the DASS depression subscale, to rule out the influence of depression on results, all of the primary ANOVAs were repeated as an analysis of covariance (ANCOVA) with DASS depression subscales entered as a covariate. Although a few significant effects of depression did emerge, the inclusion of depression as a covariate did not impact the overall pattern of results and our interpretation of them. For example, depression was significantly related to state anxiety, $F(1, 69) = 8.63$, $p = .02$, partial $\eta^2 = .11$, but the main effect of group remained significant even when controlling for depression scores, $F(2, 69) = 4.13$, $p = .02$, partial $\eta^2 = .11$. These analyses are not highlighted in the current work, as Miller and Chapman (2001) have argued that attempting to "remove" or "control" variables that are conceptually and non-randomly related is problematic and removes important shared variance. These authors argue that ANCOVA is an appropriate statistical approach when the covariate does not systematically differ between groups. However, when a variable differs in a meaningful way across groups, attempting to remove or covary out its effect is problematic as it compromises the grouping variable itself as well as the interpretation of results. Given that depression and anxiety share many underlying symptoms and have high rates of comorbidity, attempting to separate the effects of depression in the current study is inappropriate and is therefore not emphasized.

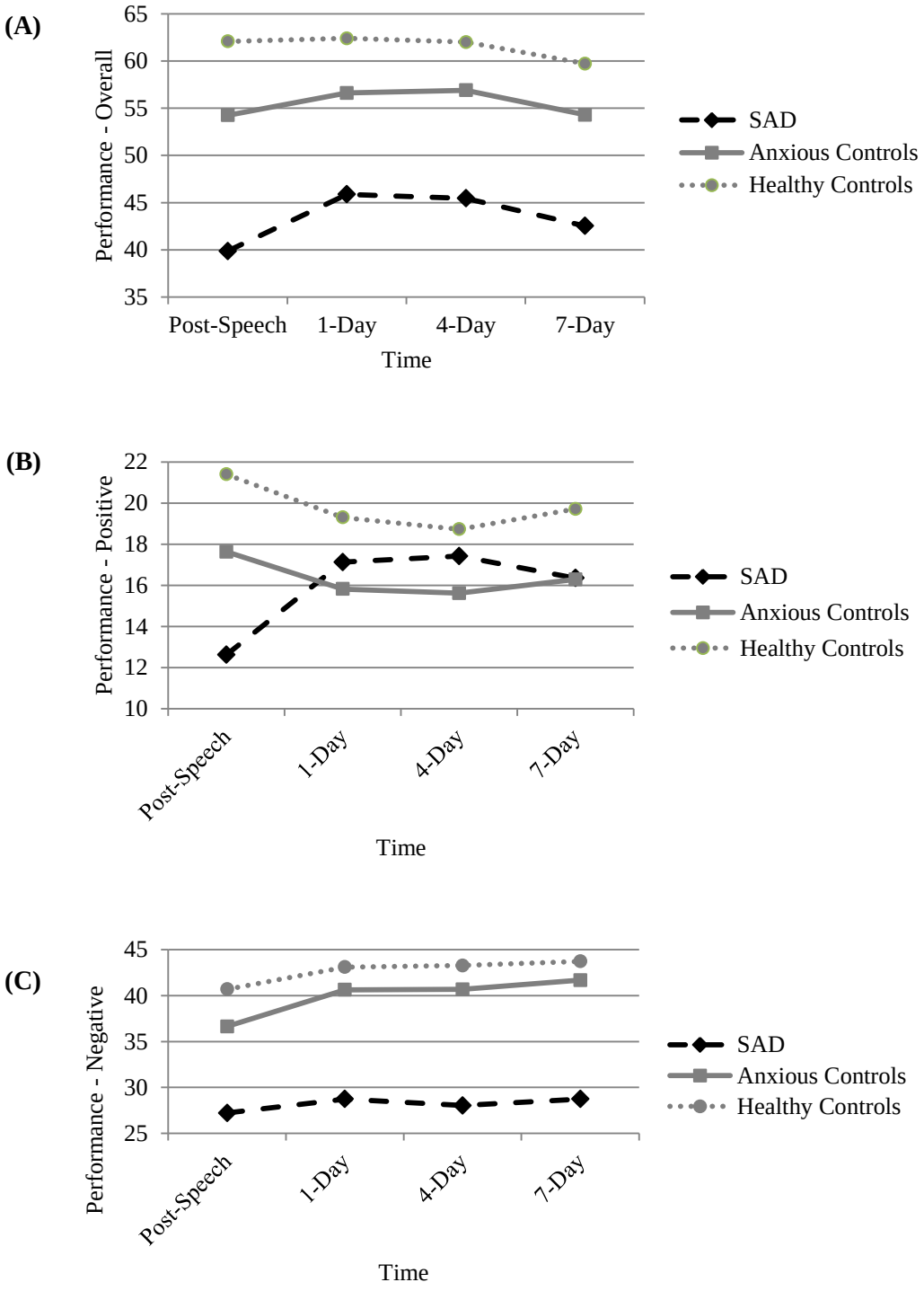

Figure 4. Study 1 PSPC performance ratings in SAD, anxious controls and healthy controls at post-speech, 1, 4, and 7 day follow-ups for a) overall perception of performance, b) perception of performance for positive items, and c) perception of performance for negative items. Higher scores indicate better perceived performance.

13.62 $p < .001$, partial $\eta^2 = .32$, although the group × time interaction did not reach significance, $F(3.70, 107.35) = 1.89$, $p = .12$, partial $\eta^2 = .06$.

To examine the group effect at each time point, four follow-up one way ANOVAs with post hoc test examining group differences were conducted. Levene's test indicated that variances were homogeneous for all variables (all p's > .11). The pattern of results was similar across all time-points, with socially anxious individuals reporting significantly poorer perception of performance relative to both control groups. The first ANOVA examining performance scores immediately after the speech showed significant group differences, F (2, 69) = 20.36, $p < .001$, partial $\eta^2 = .37$. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the SAD group ($M = 1.73$, $SD = .54$) was significantly lower (indicating worse perceived performance) than the anxious ($M = 2.36$, $SD = .59$) and healthy ($M = 2.70$, $SD = .45$) control groups at $p = .001$ level of significance. The anxious and healthy controls did not differ significantly, $p = .07$. These analyses were repeated at the 1-day [F (2, 66) = 15.98, $p < .001$, partial $\eta^2 = .33$], 4-day [F (2, 66) = 14.17, $p < .001$, partial $\eta^2 = .31$], and 7-day [F (2, 65) = 14.06, $p < .001$, partial $\eta^2 = .30$] follow-ups. Post hoc comparisons indicated that the SAD group reported significantly worse overall performance than both the anxious and healthy control groups at each follow-up (all p's ≤ .003), while the anxious and healthy control groups did not differ significantly at any of the follow-up assessments (all p's > .15).

Positive and Negative Aspects of Performance. Next, positive and negative items on the PSPC performance subscale were examined separately, as we expected that the groups may differentially recall positive and negative aspects of performance (See Figure 4, b and c). A 3 (group: SAD, anxious controls, healthy controls) × 4 (time: post-speech, day 1, day 4, day 7) mixed-design ANOVA was conducted with positive PSPC items only. Mauchly's Test of

Sphericity was significant suggesting that the assumption of sphericity had been violated, $\chi^2(5) = 83.04$, $p < .001$, and a Greenhouse-Geisser correction was employed on the repeated measures variables. Levene's test indicated that the assumption of homogeneity of variance was violated at the post-speech assessment and 1 day follow-up (both *p*'s < .05). Since there is no robust *F*-statistic available for mixed measures designs in SPSS, Field (2009) recommends following up a significant Levene's statistic with Hartley's F_{MAX}, which provides an alternate test of differences in group variances since Levene's test can be biased in larger sample sizes. The F_{MAX} examines the ratio of the variances between the group with the biggest and smallest variance and compares this to critical values published by Hartley (1950). It can be assumed that the variances are homogeneous if the calculated F_{MAX} value is smaller than the value in the published table (based on the number of groups and the number of cases per group minus 1). In the variables of interest, the calculated F_{MAX} values were smaller than the critical F_{MAX} value of 2.95 (at .05 level of significance); we therefore proceeded with the analyses. For perception of positive items, there were no main effects of time, F (1.64, 99.85) = 0.23, p =.75, partial η^2 = .00, or group, F (2, 61) = 2.12, p =.13, partial η^2 = .07. However, the group × time interaction was significant, F (3.27, 99.85) = 5.00, p = .002, partial η^2 = .14.

To further examine the nature of this interaction effect, one way ANOVAs with post hoc tests were conducted. Levene's test was not significant (all *p*'s > .06) with the exception of the day 1 follow-up (p = .003). In this case, Welch's *F* test is reported. The first ANOVA examining the positive PSPC items immediately after the speech showed significant group differences, $F(2, 70) = 11.67$, $p < .001$, partial η^2 = .25. Post hoc comparisons using Tukey HSD suggested that the SAD group (M = 1.26, SD = .57) reported significantly less positive perception of performance than the anxious (M = 1.76, SD = .77; p = .02) and healthy (M =

2.14, *SD* = .56; $p < .001$) control groups. The anxious and healthy control participants did not differ significantly, $p = .10$. Additional one way ANOVAs at the 1-day [Welch's $F(2, 42.47) = 2.29$, $p = .11$, partial $\eta^2 = .04$], 4-day [$F(2,65) = 1.06$, $p = .35$, partial $\eta^2 = .03$], and 7-day [$F(2,65) = 1.63$, $p = .20$, partial $\eta^2 = .05$] follow-ups suggested no significant group differences.

Next we examined negative aspects of performance using a 3 (group: SAD, anxious controls, healthy controls) × 4 (time: post-speech, day 1, day 4, day 7) mixed-design ANOVA with negative PSPC items only. Mauchly's Test of Sphericity was significant for the repeated measures variables, $\chi^2(5) = 33.37$, $p < .001$, and a Greenhouse-Geisser correction was employed. Levene's test indicated that the assumption of homogeneity of variance was violated at the 1, 4 and 7 day follow-ups (all p's $< .01$). Hartley's F_{MAX} values exceeded the recommended critical values for the 1 and 7 day follow-ups, confirming the violation of this assumption. As such, a more conservative significance cut-off of $p < .01$ was adopted for the following analyses. Results of the ANOVA suggested that even with the more stringent significance test, there was a main effect of time, $F(2.18, 126.42) = 15.48$, $p < .001$, partial $\eta^2 = .21$, and the within-subjects contrast showed that this effect was best described as linear in nature, $F(1, 58) = 28.53$, $p < .001$, partial $\eta^2 = .33$ (the quadratic effect was also significant although had a smaller effect size, $F(1, 58) = 7.84$, $p < .007$, partial $\eta^2 = .12$). The main effect of group was also highly significant, $F(2, 58) = 25.51$, $p < .001$, partial $\eta^2 = .47$. The group × time interaction showed an interesting trend, although did not reach statistical significance, $F(4.36, 126.42) = 1.99$, $p = .09$, partial $\eta^2 = .06$. As can be seen in Figure 4 c, the results are such that both anxious and healthy controls show an improvement in negative aspects of performance ratings from post-speech to Day 1 which are maintained over the course of the week, whereas the SAD groups ratings remain consistent across all assessment time-points.

One way ANOVAs with post-hoc tests were conducted at each time point to examine group differences in negative perception of performance items. Levene's test was significant for all 3 follow-up time points (all *p*'s < .01); thus Welch's *F* is reported for these results. The results suggest that the groups differed immediately after the speech [F (2, 69) = 22.14, p <.001, partial η^2 = .39], as well as at the 1-day [Welch's F(2, 40.55) = 20.61, p <.001, partial η^2 = .46], 4-day [Welch's F(2, 41.39) = 24.90, p <.001, partial η^2 = .48], and 7-day [Welch's F(2, 38.84) = 25.72, p <.001, partial η^2 = .48] follow-ups. Post hoc comparisons with the Games-Howell test suggested that the SAD group rated their performance significantly more negatively (all *p*'s <.001) than both control groups at each of the time points. The anxious and healthy groups did not significantly differ (all *p*'s >.09).

Self-Observer Performance Discrepancy (Hypothesis 1)

To analyze accuracy of participant ratings of performance across time, a 3 (group: SAD, anxious controls, healthy controls) × 4 (time: post-speech, day 1, day 4, day 7) mixed-design ANOVA was conducted with the standardized residual discrepancy scores at each time point (See Figure 5). The homogeneity of variance assumption was met according to Levene's test (all *p*'s > .05). Because Mauchly's Test of Sphericity was significant, $\chi^2(5) = 37.83$, p <.001, a Greenhouse-Geisser correction was implemented. There was no main effect of time on discrepancy ratings, F(2.03, 117.59) = .99, p =.40, partial η^2 = .02. There was a significant main effect of group, F(2, 58) = 12.85 p < .001, partial η^2 = .31, but the group × time interaction did not reach significance, F(4.06, 117.59) = .71, p = .64, partial η^2 = .02.

Group differences in self-observer discrepancy ratings were further explored with four one way ANOVAs with post hoc tests at each time point. Levene's test indicated that variances were homogeneous for all variables (all *p*'s > .14). The pattern of results was consistent at each

time-point, with socially anxious individuals reporting more negatively biased performance ratings relative to both control groups. The first ANOVA examining degree of discrepancy immediately after the speech showed significant group differences, $F(2, 69) = 19.61$, $p < .001$, partial $\eta^2 = .36$. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the SAD group ($M = -.82$, $SD = .77$) was significantly more negatively biased than the anxious ($M = .16$, $SD = .92$) and healthy ($M = .61$, $SD = .71$) control groups at $p < .001$ level of significance. The anxious and healthy controls did not differ significantly in their discrepancy ratings, $p = .14$. These analyses were repeated at the 1-day [$F(2,64) = 13.76$, $p < .001$, partial $\eta^2 = .30$], 4-day [$F(2,64) = 12.74$, $p < .001$, partial $\eta^2 = .29$], and 7-day [$F(2,65) = 13.21$, $p < .001$, partial $\eta^2 = .29$] follow-ups. Further examination of group differences with post hoc tests

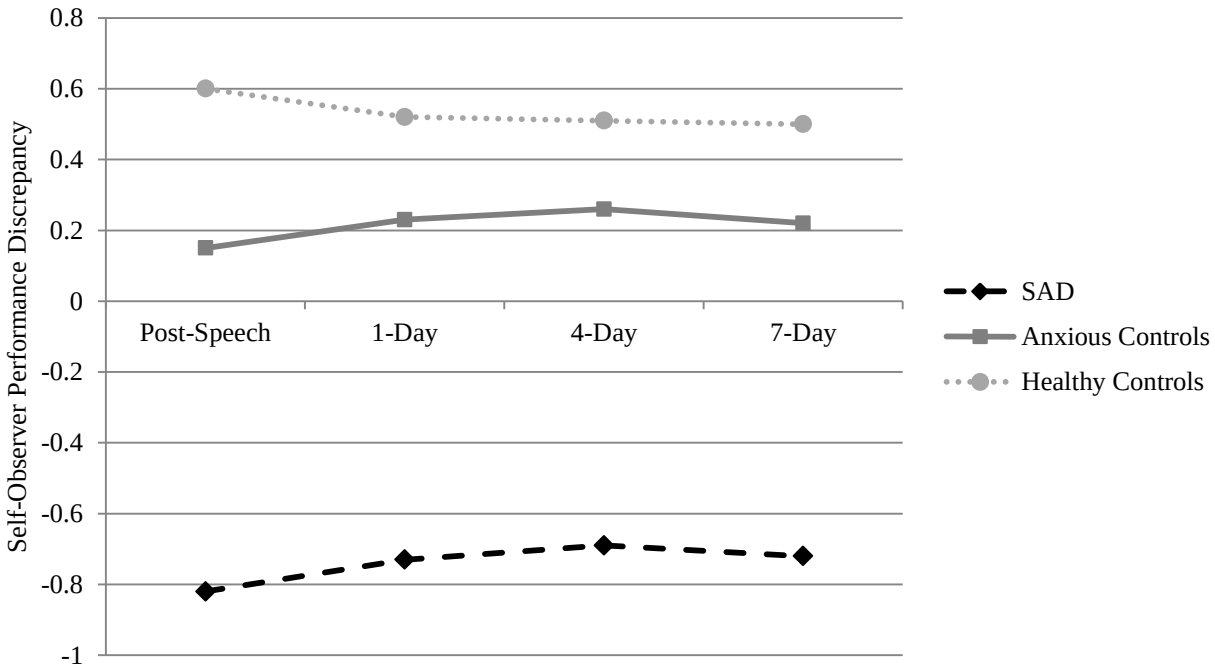

Figure 5. Study 1 PSPC performance discrepancy ratings (standardized residual scores) for each of the groups across time. Relative to objective observers, scores above zero indicate positive bias while scores below zero indicate negative bias. The absolute value is an indicator of the degree of bias, with larger scores indicating greater bias.

suggests that relative to both control groups, the SAD group's ratings were significantly more discrepant from objective observers at each follow-up assessment (all p's $\leq .001$). There were no significant differences between the anxious and healthy control groups (all p's $> .14$). These results indicate that participants in the SAD group had more negatively biased perception of performance across time, relative to the control groups. However, contrary to predictions, perceptions did not become more biased in the week following the speech.

Certainty (Hypothesis 2 and 4)

Overall Certainty. Participants rated the extent to which they felt certain about each of the items on the PSPC certainty subscale; these ratings were immediately after the speech as well as at each of the follow-ups. A 3 (group: SAD, anxious controls, healthy controls) × 4 (time: post-speech, day 1, day 4, day 7) mixed-design ANOVA was conducted on the PSPC certainty scores to examine group differences in certainty ratings as well as changes over time. According to Levene's test, the homogeneity of variance assumption was met for all variables (all p's > 15). The test of Sphericity was significant, $\chi^2(5) = 39.47$, $p < .001$, so a Greenhouse-Geisser correction used. There was a small main effect of time $F(2.10, 130.06) = 3.39$, $p < .04$, partial $\eta^2 = .05$, and the group × time interaction approached significance, $F(4.20, 130.06) = 2.08$, $p = .08$, partial $\eta^2 = .06$. The main effect of group was not significant, $F(2, 62) = 1.39$, $p = .26$, partial $\eta^2 = .04$. As can be seen in Figure 6, the SAD group felt greater uncertainty about their speech immediately after the speech compared to both control groups and these ratings remained unchanged over time; in contrast, control participants' higher initial certainty ratings gradually declined in the week following the speech task.

To examine the marginally significant group interaction and further explore group differences, four one-way ANOVAs with group as the between subjects factor and the PSPC

certainty scores at each time point were conducted. Levene's test indicated that variances were homogeneous for all variables (all *p*'s > .38). These analyses revealed a significant difference between groups immediately after the speech, F (2, 70) = 4.82, p =.01, partial η^2 = .12. Tukey HSD post hoc tests showed that the SAD group (M = 2.48, SD = .71) reported marginally less overall certainty relative to the anxious controls (M = 2.90, SD = .49, p = .06) and significantly less certainty relative to the healthy controls (M = 3.00, SD = .62, p = .01). The two control groups did not differ from one another (p = .82). These analyses were repeated at each of the follow-up time points and indicated no significant group differences (all F's < .36, all p's > .70).

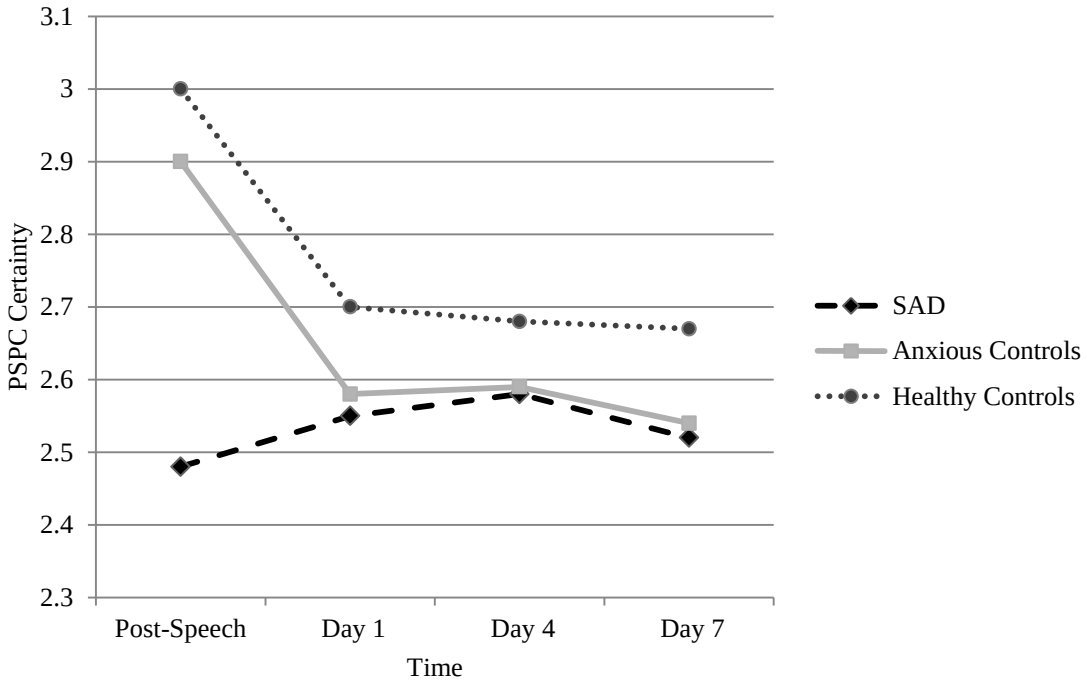

Figure 6. Study 1 PSPC certainty ratings in SAD, anxious controls and healthy controls at post-speech, 1, 4, and 7 day follow-ups. Higher scores indicate greater certainty.

Positive and Negative Aspects of Certainty. Certainty on positive and negative PSPC items was examined separately to determine whether participants felt more certain depending on the valence of the items. A one-way ANOVA with group as the between subjects factor indicated that participants differed significantly in their certainty for *positive* aspects of speech performance, $F(2, 70) = 11.67$, $p < .001$, partial $\eta^2 = .25$. Post hoc comparisons with Tukey HSD indicated that the SAD group ($M = 1.26$, $SD = .57$) reported significantly less certainty than both the anxious ($M = 1.76$, $SD = .77$, $p = .02$) and healthy ($M = 2.14$, $SD = .56$, $p < .001$) control groups. The mean difference between the anxious and healthy control groups was not significant ($p = .10$). A second one-way ANOVA conducted with *negative* PSPC certainty items as the dependent variable showed similar results, $F(2, 69) = 22.14$, $p < .001$, partial $\eta^2 = .39$. The Tukey HSD test indicated that the SAD group ($M = 2.09$, $SD = .64$) reported significantly less certainty on negative items than both the anxious ($M = 2.82$, $SD = .57$, $p < .001$) and healthy ($M = 3.13$, $SD = .43$, $p < .001$) control groups. The group difference between the anxious and healthy controls did not reach significance ($p = .12$).

Certainty for positive relative to negative items was explored with a 3 (group: SAD, anxious controls, healthy controls) × 2 (valence: positive, negative) mixed-design ANOVA at each of the time points and these results are presented in Figure 7. Levene's test was not significant for any of the analyses, all p's > .09. Immediately after the speech, as was already described, there was a significant main effect of group, with the SAD participants reporting significantly less certainty across both positive and negative items, $F(1, 70) = 22.14$, $p < .001$, partial $\eta^2 = .39$. Interestingly, there was also a significant main effect of valence, $F(1, 70) = 4.16$, $p = .05$, partial $\eta^2 = .06$, suggesting that participants felt more uncertain about positive aspects of their performance. The group × valence interaction was not significant, $F(2, 70) =$

.76, p =.47, partial η^2 = .02 indicating that immediately after the speech all participants felt more uncertain about positive aspects of performance.

A second ANOVA was repeated at the 1-day follow-up, and as has already been found, the main effect of group was no longer significant, $F(2, 70) = .31$, p =.73, partial η^2 = .01. Similar to post-speech, the main effect of valence was significant and was also a larger effect than had been found at post-speech, $F(1, 70) = 21.72$, p <.001, partial η^2 = .24, as was the group × valence interaction, $F(2, 70) = 3.37$, p =.04, partial η^2 = .09. To further explore the nature of the omnibus time × valence group interaction effects, paired-sampled *t*-tests were conducted within each group separately across the positive and negative certainty subscales. A Bonferroni correction was applied to control for multiple comparisons thus setting the new level of statistical significance to p = .02 (p = .05/3). Results indicated that one day after the

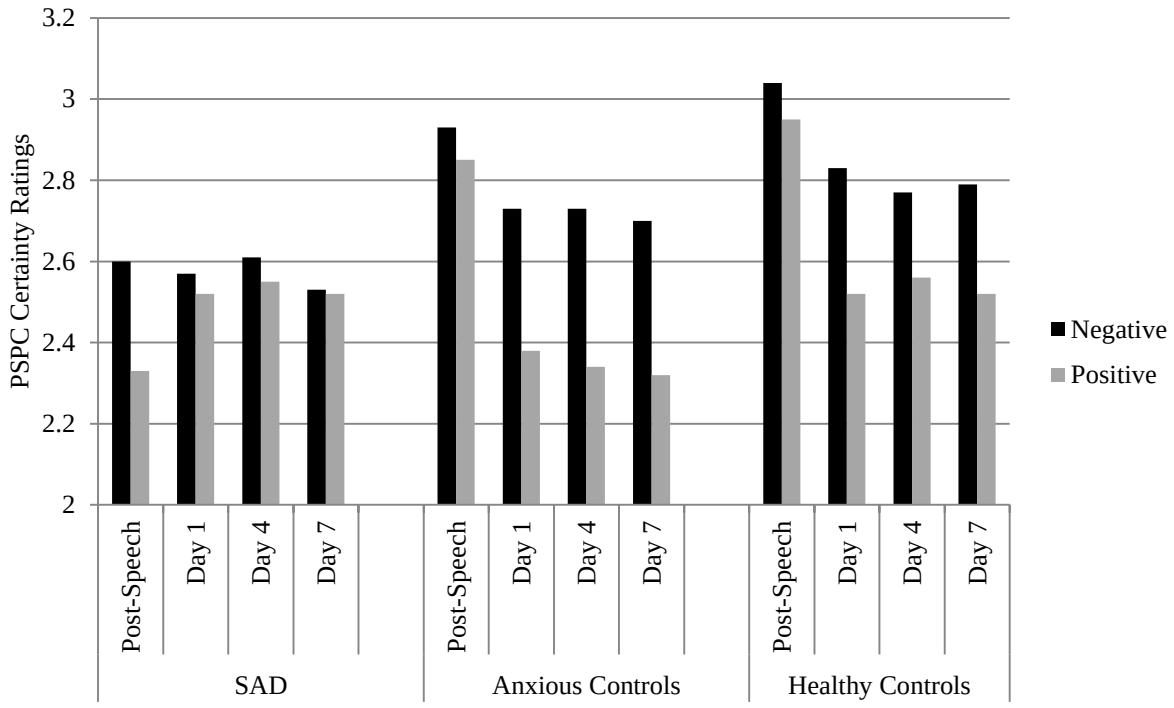

Figure 7. Positive and negative PSPC certainty ratings in the SAD, anxious and healthy control groups across time (Study 1). Higher scores indicate greater certainty. Higher scores indicate greater certainty.

speech, participants in the SAD group felt equally certain about positive and negative aspects of performance, $t(23) = .62$, $p = .54$, $r = .13$. In contrast, the anxious control [$t(23) = 3.43$, $p = .002$, $r = .58$] and healthy control [$t(24) = 3.96$, $p = .001$, $r = .63$] participants continued to feel more uncertain about positive relative to negative aspects of performance (consistent with their ratings immediately after the speech).

This same pattern of results was found at the 4-day follow up with a non-significant main effect of group [$F(2, 65) = .21$, $p = .81$, partial $\eta^2 = .01$], a significant effect of valence [$F(1, 65) = 16.81$, $p < .001$, partial $\eta^2 = .21$], and a significant interaction, [$F(2, 65) = 3.12$, $p = .05$, partial $\eta^2 = .09$]. Once again, the interaction was explored with paired-samples *t*-tests, applying a Bonferroni correction for multiple comparisons ($p = .02$), and showed a pattern consistent with Day 1 follow-up. Once again, the SAD group was equally certain regardless of valence of items, [$t(23) = .72$, $p = .48$, $r = .15$], whereas the anxious [$t(21) = 3.90$, $p = .001$, $r = .65$] and healthy [$t(21) = 2.21$, $p = .04$, $r = .43$] controls were less certain about positive relative to negative aspects of performance.

The pattern was similar by the 7-day follow-up, with no main effect of group, [$F(2, 70) = .76$, $p = .47$, partial $\eta^2 = .02$], no main effect of valence, [$F(2, 65) = .30$, $p = .74$, partial $\eta^2 = .009$], and a significant interaction, [$F(2, 65) = 5.80$, $p = .005$, partial $\eta^2 = .15$]. Follow-up paired-samples *t*-tests (Bonferroni correction, $p = .05$) again indicated no difference in certainty in the SAD group across valence, [$t(22) = .11$, $p = .92$, $r = .02$], whereas the anxious [$t(20) = 3.51$, $p = .002$, $r = .62$] and healthy [$t(23) = 5.04$, $p < .001$, $r = .72$] controls reported less certainty about positive than negative aspects of performance.

Memory Uncertainty (Hypothesis 2)

Consistent with the results obtained from the PSPC certainty subscale, there was a significant difference between groups on memory uncertainty reported after the speech task, $F(2, 70) = 9.05$, $p < .001$, partial $\eta^2 = .21$. Specifically, socially anxious individuals ($M = 3.08$, $SD = .93$) reported greater uncertainty in their memory for the speech relative to the anxious ($M = 2.08$, $SD = 1.17$, $p = .003$) and healthy controls ($M = 1.93$, $SD = .96$, $p = .001$). The two control groups did not differ significantly from each other, $p = .86$. Levene's test was not significant, $p = .51$.

Metacognitive Beliefs (Hypothesis 3)

A one-way ANOVA was conducted to evaluate group differences in metacognitive beliefs. Levene's test was not significant, $p = .41$. Results demonstrated a significant effect, $F(2, 70) = 8.29$, $p < .001$, partial $\eta^2 = .19$, with Tukey HSD post hoc test showing that the SAD group ($M = 2.63$, $SD = .93$) reported significantly greater endorsement of such beliefs relative to both anxious ($M = 1.91$, $SD = .98$, $p = .01$) and healthy ($M = 1.63$, $SD = .75$, $p < .001$) controls. There were no significant differences between the two control groups, $p = .50$.

Mental checking (Hypothesis 3)

Differences in beliefs about mentally checking or reviewing the speech task were evaluated with a one-way independent ANOVA. Results revealed that there were no significant group differences in beliefs about mentally checking or reviewing the speech task, $F(2, 70) = .86$, $p = .43$, partial $\eta^2 = .02$. Levene's test was not significant, $p = .34$.

Post-Event Processing (Hypothesis 5)

Post-event processing was evaluated 1, 4, and 7 days after the speech task and a 3 (group: SAD, anxious controls, healthy controls) × 3 (time: day 1, day 4, day 7) mixed-

measures ANOVA was used to evaluate group differences and changes over time. As expected, there was a significant main effect of group, $F(2, 61) = 18.42$, $p < .001$, partial $\eta^2 = .38$. There was also a significant main effect of time, $F(2, 122) = 13.64$, $p < .001$, partial $\eta^2 = .18$, with PEP decreasing over the course of the week for all participants. The within-subjects contrast showed that the effect of time was linear in nature, $F(1, 61) = 24.36$, $p < .001$, partial $\eta^2 = .29$ (the quadratic effect was non-significant, $F(1, 61) = 1.00$, $p = .32$, partial $\eta^2 = .02$). Contrary to expectations, the group × time interaction was not significant, $F(4, 122) = .99$, $p = .42$, partial $\eta^2 = .03$.

Group differences in PEP at each of the time points was further explored with three one-way ANOVAs with post hoc tests at each time point. Levene's test indicated that the homogeneity of variance assumption was violated (all *p*'s <.003), and Welch's *F*-ratio is therefore reported. The pattern of results was similar across all three follow-ups and is consistent with previous findings in the literature. The first ANOVA examining PEP one day after the speech showed significant group differences, $F(2, 41.42) = 22.81$, $p < .001$, partial $\eta^2 = .42$. Post hoc comparisons using the Games-Howell test indicated that the mean score for the SAD group ($M = 4.85$, $SD = 2.27$) was significantly higher than the anxious ($M = 2.25$, $SD = 1.91$) and healthy ($M = 1.16$, $SD = 1.28$) control groups at $p < .001$ level of significance. The anxious and healthy controls did not differ significantly in their level of PEP, $p = .07$. These analyses were repeated at the 4-day [$F(2, 41.33) = 18.19$, $p < .001$, partial $\eta^2 = .37$] and 7-day [$F(2, 38.20) = 14.21$, $p < .001$, partial $\eta^2 = .35$] follow-ups. Post hoc tests for the remaining two follow-ups were comparable to Day 1, with the SAD group engaging in significantly more PEP relative to both control groups (all *p*'s < .002). The anxious and healthy control groups did not differ from one another at either of these time points (all *p*'s > .15).

Mediation Analyses[7] (Hypothesis 6)

The relationship between group status and PEP in the days following the speech was explored using a multiple mediator model with perception of overall speech performance, overall certainty of performance ratings, metacognitive beliefs, memory uncertainty, and mental checking (measured at post-speech) entered as potential mediating variables.[8] It was expected that the proposed mediators would be more strongly related to PEP in the SAD group relative to both control groups. Given that the independent variable was multicategorical, dummy coding was used to represent the groups for these analyses. The SAD group was chosen as the reference group as we were most interested in exploring the unique effect of having a SAD diagnosis relative to other anxiety disorders or no mental health concerns. Using this method, two dummy-coded variables were created as the independent variables: a) SAD group vs. anxious controls; and b) SAD group vs. healthy controls.

To test the indirect effect of the independent variables on PEP via the proposed mediators, bias-corrected bootstrapping procedures (Preacher & Hayes, 2008) were implemented using a macro program for SPSS developed by Hayes and Preacher (in press). Boostrapping procedures are recommended as the preferred method of analyzing mediation (Jose, 2013) and do not require symmetry or normality in the sampling distribution. For these data, a 95% bias-corrected and accelerated confidence interval was used to generate 5,000

[7] In addition to mediation analyses, we reasoned that the association between PEP and metacognitive beliefs, PSPC certainty, memory uncertainty, and mental checking might be moderated by participants' perceptions of speech performance. For instance, it is possible that the hypothesized relationships would only occur among individuals who perceived their performance to be poor. This hypothesis was evaluated using linear regression moderation analyses with each of the constructs of interest entered separately as a predictor variable (metacognitive beliefs, PSPC certainty, memory uncertainty and mental checking), PEP at each of the time points entered as the outcome variable, and perception of performance immediately after the speech entered as the moderating variable. No significant moderating relationships were found, all *p*'s >.11.

[8] The mediation model was re-run with depression scores included as a mediator. The pattern of results did not change, although depression scores were also identified as a mediating variable at the Day 1 and Day 7 follow-ups.

bootstrap samples. Figure 8 depicts the results of this mediation model and results. Path *a* represents the direct paths from the independent variables to each of the mediators; path *b* represents the direct paths from each of the mediators to the outcome variable while the independent variable is held constant; path *c* represents the total effect of the independent variables on the outcome variable; and path c′ represents the effect of the independent variable on the dependent variable after accounting for the mediators. The indirect effect (*ab*) is considered significant if the confidence interval does not straddle zero.

In the total effects mediation model, group status and the 5 mediators accounted for a significant amount of the variance in predicting PEP at the Day 1 follow-up, R^2 = .42, F (2, 65) = 23.94, p < .001. Consistent with results presented previously, examination of the direct effects suggest that the SAD group reported significantly more engagement in PEP relative to the anxious (path *c1; B* = -2.67, *SE* = .56, *t* = -4.79, *p* <.001) and healthy controls (path *c2*; *B* = -3.76, *SE* = .56, *t* = -6.74, *p* <.001). Examination of the *a* paths indicates that relative to both control groups, participants in the SAD group also reported significantly worse speech performance ratings (SAD vs. anxious: *B* = .58, *SE* = .16, *t* = 3.70, *p* <.001; SAD vs. healthy: *B* = .90, *SE* = .16, *t* = 5.68, *p* <.001), greater uncertainty (SAD vs. anxious: *B* = .37, *SE* = .19, *t* = 2.00, *p* =.05; SAD vs. healthy: *B* = .51, *SE* = .19, *t* = 2.72, *p* =.008), more metacogitive beliefs (SAD vs. anxious: *B* = -.81, *SE* = .26, *t* = -3.15, *p* =.002; SAD vs. healthy: *B* = -1.09, *SE* = .26, *t* = -4.26, *p* <.001), and greater memory uncertainty (SAD vs. anxious: *B* = -.87, *SE* = .30, *t* = -2.91, *p* =.005; SAD vs. healthy: *B* = -1.07, *SE* = .30, *t* = -3.58, *p* <.001). For mental checking, the SAD group reported significantly greater checking relative to the healthy (*B* = -.68, *SE* = .33, *t* = -2.04, *p* =.05), but not the anxious (*B* = -.56, *SE* = .33, *t* = -1.69, *p* =.10) controls. The associations between two mediators and the outcome variable were also

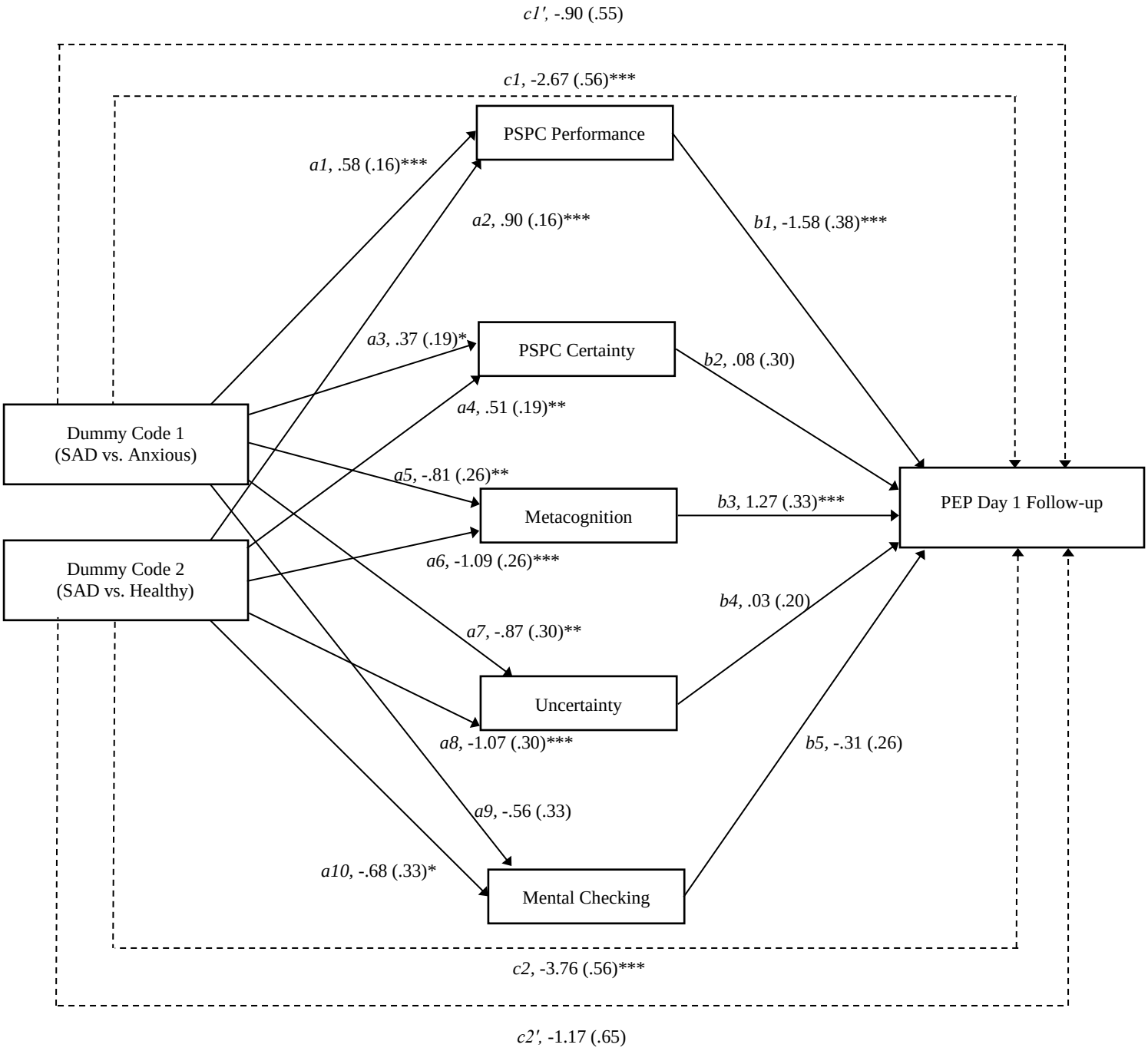

Figure 8. Study 1 mediation model of group (dummy coded with SAD group as reference) on PEP at the Day 1 follow-up through multiple mediators (perception of speech performance, certainty, metacognitive beliefs, memory uncertainty, and mental checking). Unstandardized regression coefficients and standard errors (in parentheses) are provided. Direct effects of group status on PEP are represented with dotted-lines. * p <.05. ** p <.01. *** p <.001.

significant (*b* paths). More specifically, the effects of worse performance ratings (*B* = -1.58, *SE* = .38, *t* = -4.20, *p* <.001) and greater endorsement of positive metacognitive beliefs (*B* = 1.27, *SE* = .33, *t* = 3.79, *p* <.001) were associated with greater PEP one day after the speech. The other mediators were not significantly associated with PEP while holding the independent variable constant (all absolute *B*'s < .31, all *p*'s > .23) Furthermore, when looking at the indirect effects, the only mediators whose 95% confidence intervals did not overlap with zero were performance ratings and metacognitive beliefs indicating that these variables are significant mediators (see Table 8).

Table 8

Indirect Effects (ab) of Group Status on PEP Day 1 Through Proposed Mediators for Study 1

Criterion	Indirect Effect	*SE*	95% CI
PSPC Performance			
SAD vs Anxious	-0.93	0.35	[-1.68, -0.34]
SAD vs Healthy	-1.42	0.43	[-2.31, -0.67]
PSPC Certainty			
SAD vs Anxious	0.03	0.13	[-0.22, 0.31]
SAD vs Healthy	0.04	0.17	[-0.29, 0.40]
MACS-PS-Metacognition			
SAD vs Anxious	-1.02	0.42	[-1.93, -0.30]
SAD vs Healthy	-1.38	0.49	[-2.45, -0.53]
MACS-PS-Memory Uncertainty			
SAD vs Anxious	-0.03	0.18	[-0.41, 0.34]
SAD vs Healthy	-0.03	0.22	[-0.48, 0.40]
MACS-PS-Mental Checking			
SAD vs Anxious	0.18	0.20	[-0.14, 0.66]
SAD vs Healthy	0.21	0.22	[-0.15, 0.75]

Note. SE = Standard Error; CI = Confidence Interval; SAD = Social Anxiety Disorder; PSPC = Perception of Speech Performance and Certainty; MACS-PS = Metacognition and Certainty Scale - Post Speech.

The mediation analyses were repeated with PEP at Days 4 and 7 entered as the outcome variables. The model parameters and pattern of results were similar for both time points and are therefore not reported here. Importantly, the indirect mediation effects were confirmed at both time points, suggesting that perception of performance and metacognitive beliefs continued to mediate the relationship between group status and PEP for at least one week following a social stressor task.

The second mediation hypothesis that was proposed was that feelings of uncertainty and metacognitive beliefs would lead participants to engage in PEP, which in turn would result in increased certainty and worsening perceptions of performance. To test this hypothesis two multiple mediator models were explored.[9] First, post-speech metacognitive beliefs, performance uncertainty, and memory uncertainty were entered as predictors with changes in performance certainty from post-speech to Day 1 (difference score: PSPC Certainty post speech – PSPC Certainty Day 1 follow-up[10]) entered as the dependent variable and PEP at Day 1 entered as the mediator (See Figure 9). The total effects model was significant, suggesting that PEP, memory uncertainty, and metacognitive beliefs accounted for a significant amount of the variance in predicting changes in certainty one day after the speech, $R^2 = .36$, $F\ (3, 65) = 12.08$, $p < .001$. The direct effects (path *c*) indicated that changes in certainty at Day 1 were significantly related to reported PSPC certainty scores assessed immediately after the speech, $B = .48$, $SE = .08$, $t = 5.94$, $p < .001$, and marginally significantly related to general memory uncertainty, $B = .10$, $SE = .05$, $t = 1.94$, $p = .06$. The direct effect of metacognition was not

[9] The second and third mediation models were re-run including depression as a predictor variable. Although depression was significantly related to PEP at each of the follow-ups and was associated with worsening performance appraisals at Day 1 and Day 4 follow-ups, it did not emerge as a significant mediator of these relationships.

[10] A difference score was used as the dependent variable (rather than certainty ratings at Day 1) because it was theorized that PEP would result in *increased* PSPC certainty ratings over time, and this model examines whether the predictor and mediating variables are associated with changes in certainty.

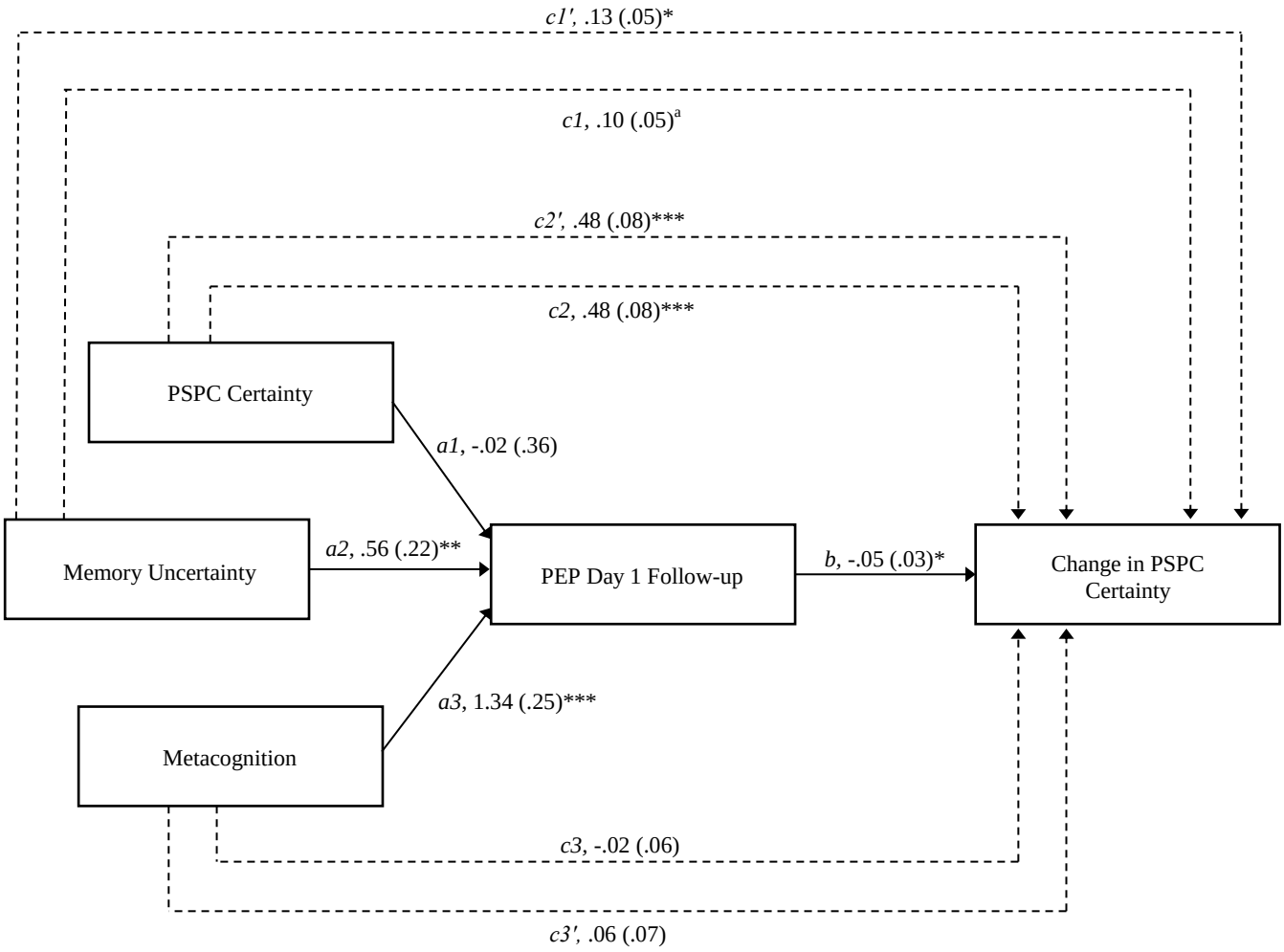

Figure 9. Study 1 mediation model of metacognitive beliefs, performance uncertainty (PSPC certainty scale), and memory uncertainty on changes in certainty ratings at the Day 1 follow-up via post-event processing (Day 1). Unstandardized regression coefficients and standard errors (in parentheses) are provided. Direct effects of the predictor variables on certainty change scores are indicated with dotted-lines. * p <.05. ** p <.01. *** p <.001.

significant, B = -.02, SE = .06, t = -.26, p =.79. Examination of the *a* paths indicated significant relationships between metacognitive beliefs, B = 1.34, SE = .25, t = 5.41, p <.001, and memory uncertainty, B = .56, SE = .22, t = 2.54, p =.01, with PEP at Day 1. The PSPC certainty scores were not significantly related to PEP, B = -.02, SE = .36, t = -.07, p =.95. The association between PEP and changes in certainty was also significant, B = -.05, SE = .03, t = -1.97, p =.05. The indirect effects, identified by examining the mediators whose 95% confidence intervals do not straddle zero, were all non-significant, suggesting that PEP is not a significant mediator between the proposed variables. These mediation analyses were repeated with PEP at Day 4 and Day 7 as well and the pattern of results was very similar. The only notable difference was that path *b* was no longer significant, indicating that the relationship between PEP and changes in certainty at the remaining follow-ups were no longer substantial (both p's > .30).

The final proposed mediation model tested was based on the premise that PEP would mediate the relationship between post-speech metacognitive beliefs and uncertainty and changing perceptions of performance over time (See Figure 10). Based on the previous analyses suggesting that only perceptions for negative aspects of performance changed over time, the negative subscale of the PSPC was used to test the mediation model. Similar to the previous mediation analysis, metacognitive beliefs, performance uncertainty (PSPC certainty scores), and memory uncertainty (MACS-PS) were entered as predictors and PEP at Day 1 was entered as the mediator. The dependent variable in this model was change in performance[11], which was calculated as the difference between performance appraisals post speech minus performance appraisals at the one day follow-up (for negative items only). The total effects

[11] As with the previous mediation analysis, a difference score was used as the dependent variable (rather than PSPC performance ratings at Day 1) because it was theorized that PEP would result in *changes* in performance ratings over time.

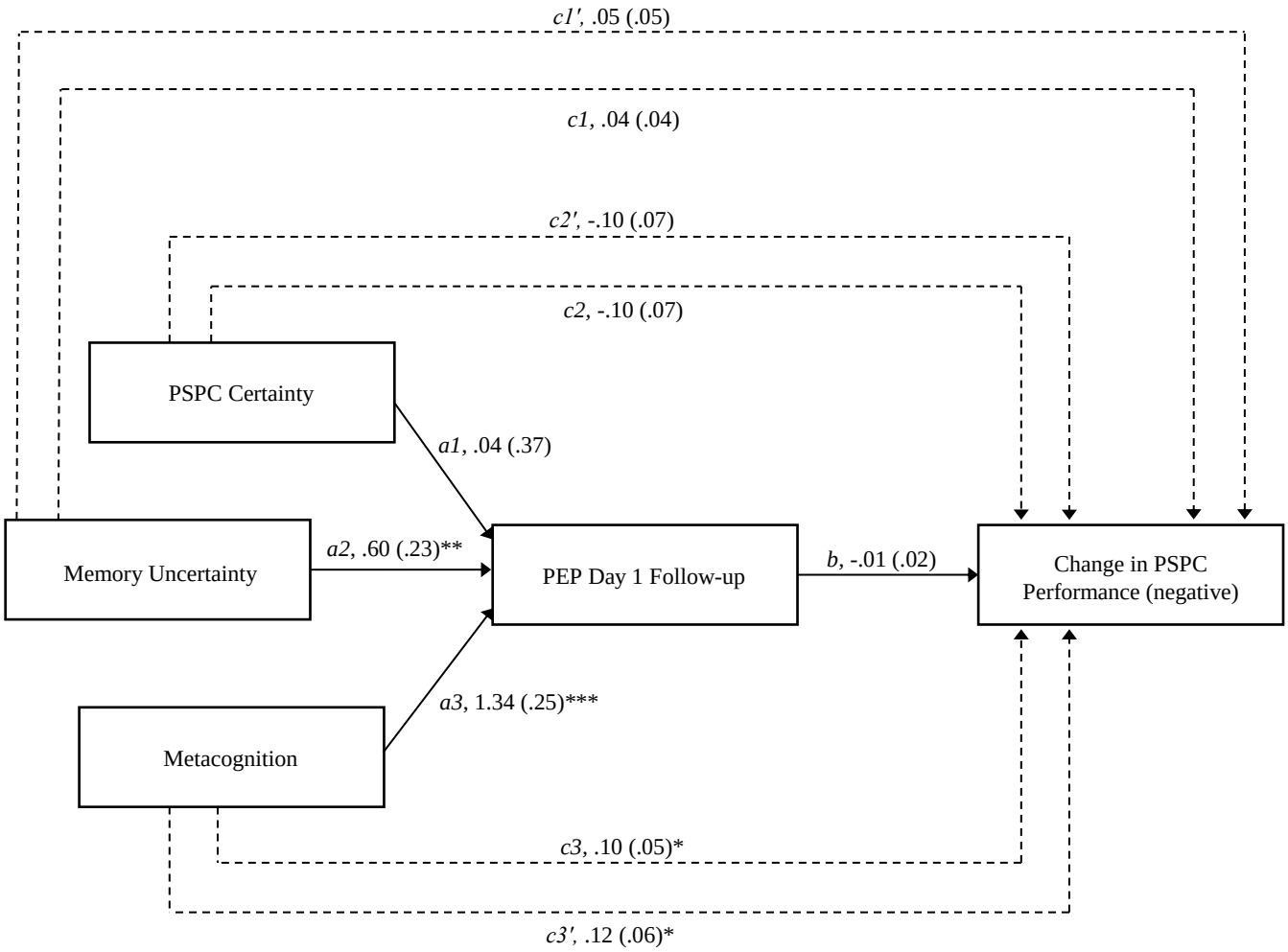

Figure 10. Study 1 mediation model of metacognitive beliefs, performance uncertainty (PSPC certainty scale) and memory uncertainty on changes in worsening performance ratings (for negative items only) at the Day 1 follow-up through post-event processing (Day 1). Unstandardized regression coefficients and standard errors (in parentheses) are provided. Direct effects of the predictor variables on certainty change scores are indicated with dotted-lines. * p <.05. ** p <.01. *** p <.001.

model was significant, suggesting that PEP, PSPC certainty, memory uncertainty, and metacognitive beliefs accounted for a significant amount of the variance in predicting worsening changes in perception of performance one day after the speech, R^2 = .15, F (3, 62) = 3.50, p =.02. The direct effects (path *c*) indicated that metacognitive beliefs were significantly related to changes in perceptions of performance at Day 1, B = .10, SE = .05, t = 2.06, p =.04. Neither feelings of certainty as measured by the PSPC certainty scale, B = -.10, SE = .07, t = -1.39, p =.17, nor general memory uncertainty, B = .04, SE = .04, t = .87, p =.39, were significantly related to changes in performance appraisals. Examination of the *a* paths indicated significant relationships between metacognitive beliefs, B = 1.34, SE = .25, t = 5.30, p <.001, and memory uncertainty, B = .60, SE = .23, t = 2.63, p =.01, with PEP at Day 1. The PSPC certainty scores were not significantly related to PEP, B = .04, SE = .37, t = .12, p =.91. The association between PEP at Day 1 and changes in performance appraisals was not significant, B = -.01, SE = .02, t = -.58, p =.56. Similarly, the 95% confidence intervals crossed zero for all variables, indicating that PEP was not a significant mediator. These analyses were repeated with PEP at Day 4 and Day 7 and the pattern of results was consistent.

Discussion

The primary aims of the current study were to explore how memory uncertainty and positive metacognitive beliefs were related to perceptions of performance and PEP following a standardized speech task in the lab among individuals with a diagnosis of SAD in comparison to clinical and healthy controls. A number of interesting results emerged from this study, some of which support the proposed theoretical model. This was the first study to evaluate the presence of PEP among individuals with SAD relative to an anxious control sample. Consistent with prior studies which have found that individuals with a diagnosis of SAD and socially

anxious analogue samples engage in more PEP relative to healthy controls and low social anxiety participants, the current study found that individuals with SAD engage in greater PEP relative to both anxious and healthy controls. Despite recent suggestions that repetitive negative thought may best be conceptualized as a transdiagnostic factor (McEvoy, Mahoney, & Moulds, 2010; McLaughlin & Nolen-Hoeksema, 2011) results of the current study suggest that engagement in PEP following a social stressor is unique to SAD.

This study also found that, as expected and consistent with previous studies (e.g., Brozovich & Heimberg, 2011; Hackman, Surawy, & Clark, 1998; Zou & Abbott, 2012), participants in the SAD group rated their overall performance more poorly and in a more biased manner (compared to objective observers) relative to anxious and healthy controls, both immediately after the speech as well as during the week that followed. Unexpectedly, all participants rated their performance more positively one day after the speech compared to immediately after, and this increased positivity was maintained at the 4-day follow-up. However, when performance ratings were assessed one week later, they were once again becoming more negative, and this was true across all participants. Although this finding was unexpected, it is consistent with findings from Cody & Teachman (2010) who likewise found that overall perceptions of performance became more positive over time (although high socially anxious participants had more negative perceptions relative to low anxious participants). In their study, perceptions of speech performance were assessed immediately after a speech task as well 3 days later, and findings suggested that individuals both high and low in social anxiety reported more positive self-perceptions at the 3-day assessment. The results from the present study corroborate this finding, however, the additional assessment one week later indicates that perceptions of performance may continue to change and that the

improved perceptions of performance may not persist. To date, studies have not explored how perceptions change over longer time intervals, and this will be an important area for future studies to explore. Although no group differences were observed in the current study, it is possible that the perceptions of individuals with SAD would become more negative given more time.

Positive and negative aspects of performance were also explored separately, as previous studies suggest that socially anxious individuals may perceive and recall information differently based on valence (Cody & Teachman, 2011). The results of these findings suggest that as expected, participants in the SAD group rated their performance less positively immediately after the speech task relative to both anxious and healthy controls. However, by the one day follow-up, they were comparable to both control groups in their perceptions of positive aspects of performance. In other words, while individuals without social anxiety are consistent in their positive self-evaluations of performance, individuals with SAD initially view their performance less positively but eventually "catch up" to anxious and healthy controls. Given that individuals with SAD experienced greater state anxiety both before and after the speech task, one possible explanation for these findings is that during a period of heightened arousal, individuals with SAD may be prone to diminishing positive aspects of their performance. However, once their anxiety has subsided their perception may become more positive. If this is the case, and given that individuals with SAD frequently experience feelings of state anxiety in social situations, they may be in a chronic state of de-valuing their positive performance abilities, continuously leaving social situations with a sense that they did not do well. Even if these perceptions eventually improve, the cumulative effect of this pattern is likely to be detrimental to participants' views that they can perform well socially.

With regards to perceptions of negative aspects of performance, while the SAD group rated their performance more negatively at every time point, all participants exhibited less negative perceptions of performance over time. However, although not statistically significant, the group × time interaction was trending towards significance (p=.09). The pattern of results was such that perceptions of performance for negative items remained stable over time for the SAD group. In contrast, in both control groups, negative items became more positive from post-speech to the Day 1 follow-up, and this was maintained over the course of the week. Although there has been some inconsistency with regards to this in the research literature, these findings are consistent with findings from several other studies. For example, Cody and Teachman (2011) found that negative items became more positive over time but only for individuals with low social anxiety, and that high socially anxious participants' negative ratings remained stable. In contrast, in a different study by these same authors, results suggested that ratings for negative items did not change significantly over time regardless of social anxiety status (Cody & Teachman, 2010). Other studies, which have found that perceptions of performance for socially anxious individuals become more negative, did not examine positively versus negatively valenced items separately (e.g., Abbott & Rapee, 2004; Dannahy & Stopa, 2007). Furthermore, other studies examining changes in perception of performance over time provided standardized feedback to participants and evaluated how recollections for feedback changed (Cody & Teachman, 2010, 2011), which was different from the methodology used in the current study.

Participants' performance was evaluated by objective observers, and as expected, participants in the SAD group were significantly less accurate in their performance ratings relative to both control groups. The proposed theoretical model predicted that with time,

individuals with SAD would become increasingly more biased in their recollections. However, this finding was not supported, as perceptions did not become more biased in the week following the speech.

A novel aspect of the current study was its investigation of feelings of certainty about speech performance. It was hypothesized that individuals with SAD would report greater feelings of uncertainty immediately after the speech task, which may then be associated with increased motivation to engage in PEP. Results from this study suggest that, as expected, individuals with SAD reported feeling less certain about their performance immediately after the speech task compared to the control participants, and these ratings remained relatively unchanged over the course of the week. In contrast, both control groups started out more certain about their performance, and showed a decline in certainty ratings by the next day, so that participants across all groups were equally certain about their performance during all 3 follow-up assessments. These results are interesting, as the SAD group clearly exhibits a different pattern of results than both control groups. The findings suggest that among individuals without social anxiety, a normative process is for certainty about aspects of performance to decline with time, perhaps as the memory for the event is put aside or forgotten. It is possible that since individuals with SAD are engaging in greater PEP relative to both control groups, memory of the speech task is being continuously activated in their minds and they do not therefore show the typical declines in certainty observed in the control participants. Once again, it would be informative to examine how these certainty ratings might continue to change over a longer period of time to explore whether degree of certainty is maintained or whether the SAD group would eventually show a decline in certainty as more time passes.

There were also some interesting findings comparing certainty for negative relative to positive items across groups. Immediately after the speech, all participants felt more certain about negative aspects of their performance relative to positive aspects. However, while this pattern was maintained by the anxious and healthy control groups at each of the follow-up assessments, the SAD group was equally uncertain about both positive and negative items at these time points. Although examinations of certainty in SAD have been relatively sparse in the literature, a study by Moscovitch et al. (2009) is of particular relevance, as these authors found that while control participants attributed greater certainty to positive self-attributes relative to negative self-attributes, individuals with SAD did not demonstrate this bias. The results from the current study show the opposite pattern. Anxious and healthy controls reported feeling more certain about negative aspects of performance relative to positive aspects, while the SAD group demonstrated no difference in certainty across valences. Of course, several methodological differences may account for these discrepant findings. Of primary importance, the Moscovitch et al. (2009) study explored more general perceptions of attributes and associated certainty, rather than the certainty experienced following a lab-based social stressor. In the context of the current study, given that control participants rated their performance less negatively (and more accurately) relative to the SAD group, feeling confident that they did not do poorly on this task is likely to be adaptive. With this frame of mind, non-socially anxious participants can leave social situations thinking "I'm not sure if I did a great job, but I'm certain I did not mess up". In contrast, individuals with SAD appear to lack confidence for both positive and negative aspects of performance which is likely to be particularly detrimental given their negative self-perceptions and schemas.

Another aim of the current study was to evaluate whether, in response to feelings of uncertainty, individuals with SAD would report a greater desire to mentally "check" or review their memories in an effort to gain certainty about their performance. It was hypothesized that this motivation may in turn lead individuals to engage in PEP in an effort to increase feelings of certainty. Contrary to predictions, participants with SAD were not more motivated than control participants to mentally review their memories for the speech task in order to increase certainty. Although individuals with SAD report greater uncertainty immediately after the speech, this does not appear to be related to engagement in PEP. These findings imply that factors other than mental checking are responsible for maintaining PEP.

A second factor that was hypothesized to motivate engagement in PEP was positive metacognitive beliefs about the benefits of reviewing the speech task. Metacognitive beliefs have been implicated in maintaining worry and depressive rumination in GAD and Major Depressive Disorder, respectively, and have only recently become a topic of investigation in SAD. Previous studies (Fisak & Hammond, 2013; Wong & Moulds, 2010), as well as results from the Pilot Study described earlier, provide support for the presence of metacognitive beliefs in SAD. However, to our knowledge, this was the first study to evaluate such beliefs among individuals with a diagnosis SAD in relation to PEP. The results from the current study were consistent with hypotheses, with individuals with SAD endorsing significantly more positive metacognitive beliefs about the value of reviewing or processing the speech task relative to anxious and healthy controls. Consistent with the S-REF model reviewed in the introduction, these findings provide support that as in other emotional disorders, positive metacognitive beliefs may contribute to the initiation and persistence of PEP in SAD, despite its negative consequences.

The final aim of this study was to test the mediation models that follow from the proposed theoretical framework. First, we were interested in examining whether group status would predict greater metacognitive beliefs, uncertainty, motivation to mentally check, and poor perceptions of performance which, in turn, would lead to greater engagement in PEP. The proposed mediation model was partially supported. Metacognitive beliefs and perceptions of performance emerged as the only significant mediating variables. These results suggest that a diagnosis of SAD, relative to another anxiety disorder or a healthy control, is more strongly related to PEP because individuals hold stronger metacognitive beliefs and have more negative perceptions of their own performance following the speech task. Contrary to predictions, certainty, as assessed with both the general memory uncertainty scale on the MACS-PS and the PSPC certainty subscale, was not a significant mediator, nor was motivation to mentally check or review the speech task. These findings suggest that within the context of social anxiety, PEP may be driven by individuals' perceptions of their own performance, which is consistent with results of previous studies (Chen, Rapee, & Abbott, 2013; Perini, Abbott, & Rapee, 2006; Rapee & Abbott, 2007). The current results build on these findings with the inclusion of the anxious control group, as they establish that this relationship between performance ratings and PEP is indeed unique to social anxiety. Another novel contribution of this study is the finding that metacognitive beliefs are also at least partially responsible for the relationship between SAD and PEP. Implications of these findings will be discussed in further detail within the General Discussion section.

Based on the premise that participants would engage in PEP due to feelings of uncertainty and metacognitive beliefs, it was expected that PEP would, in turn, lead to greater certainty and worsening perceptions of performance; two mediation models were tested to

evaluate these predictions. Since our earlier findings suggested that only negative aspects of performance changed over time, these were the only items included in the mediation analysis. The results suggested that although PEP was significantly related to metacognitive beliefs and general memory uncertainty, the proposed mediation models were not supported.

In Study 1, the proposed theoretical framework was evaluated in the context of naturally occurring PEP. Although this study found that individuals in the SAD group engaged in greater PEP following the social task, the study design did not permit us to isolate the effects of repeated recall on memory for performance and certainty ratings. Study 2 was therefore designed to experimentally manipulate the recollection of a social versus non-social task in order examine the direct impact on performance, certainty, and accuracy ratings.

Study 2 – Examining the Causal Effects of PEP: The Impact of Socially-Relevant vs. Socially-Irrelevant Mental Review on Perception of Speech Performance and Certainty

Study 2 was designed to experimentally manipulate repetitive thought in the laboratory in order to enable a more direct investigation of the theoretical premise that PEP might function as a mental checking strategy. According to our model of PEP (see Figure 1), in the aftermath of a social task or encounter, socially anxious individuals experience strong feelings of uncertainty about their performance, and such feelings might motivate them to engage in repeated mental review or "check" of that event, in order to attain greater certainty. As was outlined in the introduction, the repeated reactivation of the social memory would then be expected to make the memory susceptible to the influence of cognitive biases, which, for high trait socially anxious individuals, would likely involve negatively distorted self-appraisals.

Cognitive models of compulsive checking in the OCD literature have demonstrated that the act of repeatedly checking an object degrades one's confidence or certainty in their memory for that event. For example, Radomsky, Gilchrist, and Dussault (2006) instructed an unselected sample of undergraduate students to engage in repeated, standardized checking trials of either a stove (relevant checking) or a kitchen sink (irrelevant checking). All participants completed one check of the stove before and after the repeated trials, and their memory confidence, vividness, and detail was assessed at these time points. Results indicated that participants reported significantly less confidence in their memories, rated their memories as less vivid and less detailed following the checking trials, but only in the *relevant* checking condition. Research with clinical populations has demonstrated similar results. For example, Boschen and Vuksanovic (2007) had participants with and without OCD complete a similar checking task, and found that repeated relevant checking resulted in reductions in memory

confidence, vividness and detail for all participants, regardless of OCD status. A number of other studies have demonstrated similar findings, all of which highlight the detrimental effects of repeated checking on memory certainty (Coles, Radomsky & Horng, 2006; Tolin et al., 2001; van den Hout & Kindt, 2003, 2004). These findings have also been extended to repeated *mental* checking of threatening stimuli. For example, Radomsky and Alcolado (2010) had participants engage in repeated checking of a physical stove or imagine checking a stove in their minds. They found that both physical and mental checking had similar results, leading to decreased memory confidence, as well as decreased vividness and detail.

Taken together, the findings from the OCD literature suggest that the act of repeatedly checking or reviewing a task can be detrimental to memory confidence and certainty, and this is true even in the absence of physical checking (Radomsky & Alcolado, 2010). Given the definition of PEP as a mental review of a past social event, it is possible that it might function, at least in part, as a mental "check" to determine whether certain feared outcomes occurred. If PEP does in fact serve a mental checking function, it is possible that the cognitive processes and associated effects on memory confidence observed with repeated checking in OCD would likewise be observed for memories of past social events in socially anxious participants. That is, we might expect that as socially anxious individuals repeatedly call to mind their memories for a past social event, this not only impacts their certainty for the event but also potentially exposes that memory to distortion and bias. As was reviewed in the introduction, the reactivation of a memory makes it susceptible to manipulation and may lead to increasingly negative perceptions.

The results from Study 1 indicated that individuals with SAD do experience greater uncertainty immediately after a speech task, although this study did not support the

conceptualization that “mental checking” was one of the primary functions of PEP. However, we were interested in exploring this hypothesis further in an experimental study within a controlled environment, as has been done in the studies on OCD, reviewed above. To this end, in the current study socially anxious undergraduate students completed an impromptu speech task as well as a word definition task in counterbalanced order. Following these tasks, they were randomly assigned to one of two conditions in which they engaged in a repeated mental review or “mental check” that was either socially-relevant (speech) or socially-irrelevant (word definition). Both mental review conditions were designed to elicit equivalent levels of anxiety and perceptions of failure to meet expected standards, although only the socially-relevant condition involved a social context in which task performance was public (i.e., observable by an “audience” rather than private) and carried with it the prospect of negative evaluation by others. Speech performance appraisals and certainty ratings were completed both before and after the mental review period. The main hypothesis was that compared to participants in the socially-irrelevant review condition, participants assigned to the socially-relevant review condition would experience more negatively biased appraisals of their speech performance and greater certainly associated with these appraisals. To formulate this hypothesis, we reasoned that if PEP in social anxiety leads to outcomes such as biased performance appraisals and increased certainty ratings because PEP functions as a type of socially-relevant mental checking strategy, then such outcomes should only be observed when participants are instructed to conduct a repeated mental review of the speech itself but should not be observed when they are instructed to conduct a repeated review of an irrelevant non-socially threatening task, even if the latter task is associated with heightened anxiety and negative affect. On the other hand, if the two conditions yield comparable outcomes or a pattern of results other than

that which is hypothesized, it may be unlikely that PEP functions as a type of socially-relevant mental checking strategy, and alternative functions of PEP must be considered.

In addition to mental checking, socially anxious individuals may engage in PEP for numerous alternate reasons. The results of Study 1 provide some initial evidence that individuals with SAD endorse a greater number of positive metacognitive beliefs on a standardized questionnaire about the value of reviewing past social events. However, the use of a questionnaire to assess motivations to engage in PEP does not permit the exploration of individual's idiosyncratic reasons for engaging in this form of thought, and may therefore exclude potentially important motivating factors. Therefore, an additional purpose of Study 2 was to investigate the phenomenology of individuals' metacognitive beliefs about PEP using qualitative methods. Thus, in addition to completing the MACS-PS described in Study 1, all participants were asked to report, in an open-ended manner, the perceived advantages and disadvantages of reviewing the speech task. We hoped that these reports would provide additional information about the perceived benefits and risks of engaging in review of past social events, without limiting the scope of potential responses.

Method

Participants

Participants were recruited from the University of Waterloo's undergraduate research pool and received course credit for participation. Consistent with previous studies (e.g., Moscovitch et al., 2011), participants were invited to take part in the current study if they scored high on a measure of social anxiety (SPIN scores > 30) and were able to speak, read and write English fluently, which was administered as part of a larger online questionnaire battery to undergraduates at the start of the semester. Based on these criteria, 85 participants were

recruited for the study from the research pool, but since the SPIN was administered days or even weeks earlier along with a series of other questionnaires that were included in the prescreening measures, none of them knew the specific eligibility criteria by which they had been selected. The SPIN was re-administered on the day of the study (as part of a questionnaire battery administered at the end), and 22 participants no longer met the pre-determined cut-off score for study inclusion. Given that a SPIN score of 30 is considered a conservative cut-off, and in order to avoid discarding such a large proportion of participants (26%), the cut-off score for inclusion was subsequently modified to 19, a somewhat less stringent score but one that has been recommended by others and has been shown to distinguish reliably between individuals with and without SAD (Connor et al., 2000). Of the participants who completed the study, 16 individuals were removed from analyses for the following reasons: a) did not meet the modified cut-off criteria on the SPIN (n = 3); b) did not comply with the study protocol (e.g., disclosed in the questionnaire data that they did not engage in the recall tasks; n = 9); c) experimenter concerns that language comprehension interfered with ability to understand study tasks (n = 2); d) left majority of the questionnaire data blank (n = 1); and e) malfunctions with the lab equipment which were believed to confound the data (n = 1). The final sample consisted of 69 socially anxious participants.

Procedure

An overview of Study 2 procedures is presented in Figure 11. Upon arriving at the lab, participants were informed that the current study was designed to examine the types of thoughts individuals have in response to different situations and events, and that they would be asked to complete a number of different tasks over the course of the study. All participants completed both an impromptu speech task and a word definition task in counterbalanced order.

These tasks were designed to provide participants with experimental material to review during the recall trials (see below). Importantly, we wanted to ensure that both tasks induced comparable levels of anxiety and negative affect, but differed only in terms of their social relevance and perceived evaluative consequences.

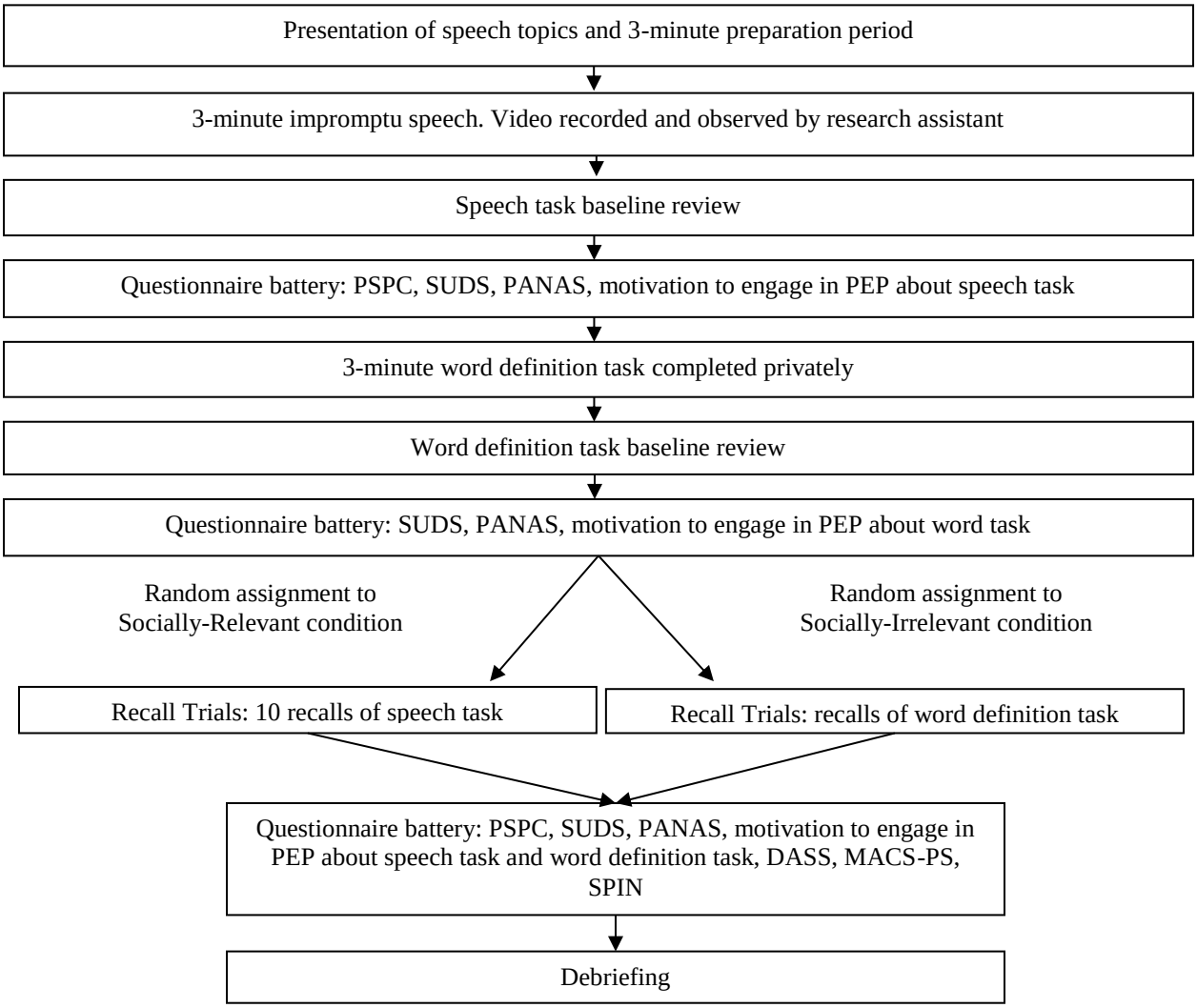

Figure 11. Overview of Procedure for Study 2. The speech and word definition tasks were presented in counterbalanced order.

Participants were also provided with false information about average performance for each of the tasks in an effort to induce feelings of anxiety. The standards provided were intentionally designed so that most or all participants would not be able to reach the supposed "average". In the speech task, participants were provided with three controversial topics (animal research, euthanasia, and cloning) and were asked to provide their opinion and supporting arguments for one or more of these topics during a 3 minute speech. Participants were encouraged to speak for the full 3 minutes if possible, but were permitted to terminate the task early by ringing a bell. The speech task was observed and evaluated (using the PSPC performance subscale) by the experimenter, who was trained to remain neutral during the duration of the speech, as in Study 1. The speech task was also video recorded to increase social evaluative threat and to allow for coding of performance by additional researchers (to establish greater reliability in coded performance ratings). The script for the speech task contained the following information:

> *For the first part of the study, I'm going to give you a list of topics that I would like you to give a speech about. The topics provided are ones that people have different opinions on, and there are no right or wrong answers. The goal for this task is to give your opinion on the issues and provide arguments, ideas, or stories you can think of to support your opinion. Most university students are able to generate 4-5 arguments in support of their opinion for each of topics in the time provided so that will probably be the case for you as well, but just do your best. The list that I will give you contains 3 topics to choose from, and you are welcome to talk about one, two or all three of these. You will have 3 minutes to do this part of the study, and we would really like you to take the full 3 minutes if possible. However, if you finish before the 3 minutes are up,*

just ring the bell , and I will give you further instructions at that time. Don't worry about keeping track of the time, I will do that for you. As I mentioned at the beginning, I will be sitting in the room observing the speech so you can treat me like an audience member, and this portion of the study will also be videotaped. The reason for this is to allow us to gather objective information for the purposes of this study.

In the word definition task, participants were provided with a list of English words varying in difficulty from relatively easy (e.g., communicate) to relatively difficult (e.g., meretricious) and asked to write down definitions for as many words as possible during a 3-minute period (see Appendix 9). The task was designed in a way that enhanced the likelihood of perceived failure, thereby inducing negative affect and making the affective consequences of the task similar to the speech task. To mirror the high standards that socially anxious participants perceive audience members to hold for social performance (see Moscovitch & Hofmann, 2007), participants were provided with instructions that conveyed unreasonably high standards for the number of words that could be defined by the average undergraduate student. Based on pilot testing conducted prior to data collection, it was decided that most students would not be able to define 11-12 words during the 3-minute period, and this was therefore the standard that was provided. In addition, because the purpose of this task was to provide an anxiety-provoking control condition that was not socially relevant, it was stressed to participants that their performance on this task would remain completely private and would not be made available to the experimenters. The following specific instructions were provided to participants prior to the word definition task:

For the next part of the study, I'm going to give you a list of randomly selected English words that I would like you to provide definitions for. The goal for this task is to write

down thorough, comprehensive and accurate definitions for as many words as possible in the 3-minute period. Most university students are able to correctly define 11-12 words in that time, so that will probably be the case for you as well, but just do your best. The list that I will give you contains 24 words, and you are welcome to provide definitions for whichever words you choose. You will have 3 minutes to do this part of the study, and we would really like you to take the full 3 minutes if possible. However, if you finish before the 3 minutes are up, just ring the bell , and I will come into the room to give you further instructions. Don't worry about keeping track of the time, I will do that for you. I also want you to know that your performance on this task will be completely private, and you won't be asked any questions about how you did on this task and you will not be asked to provide the researcher with the definitions that you generate. It is however important for this study that you try your best to define as many words as possible.

All participants mentally reviewed the speech task and the word definition task once, immediately after each task was completed. Participants were permitted to review the tasks for as much time as they wanted, in an effort to limit experimenter interference in this thought process. The experimenter was not in the room during the recall period, but participants were instructed to contact the experimenter by ringing a bell once they had completed their review. The following instructions were provided to participants prior to the mental review periods:

Now I would like you to spend some time thinking about the [speech/word definition] task you just completed. You do not need to write anything for this task, it will all be done in your head. During the review, please think about the [speech/word definition] in your mind in as much detail as possible. Focus on how you did, as well as any

sensations, thoughts, judgements, observations, or feelings that you had during the task. Please spend as much time as you need to think about the [speech/word definition] task, really going over everything you remember in your mind. It is very important for the purposes of this study that you engage in this recollection task to the best of your abilities, and we would appreciate if you would try to do so. You will be asked to rate your ability to stay focused on this task at the end of the study. You can begin now and please ring the bell when you have completed a thorough review of the [speech/word definition] task.

After each of these review periods, participants completed a short questionnaire battery assessing their state anxiety, positive and negative affect, and motivation to review the given task. In addition, after reviewing the speech task, participants provided performance and certainty ratings for that task using the PSPC.

At this point, participants were randomly assigned to the socially-relevant or socially-irrelevant review conditions. Participants in the socially-relevant review condition were instructed to recall and review the speech 10 more times in succession, in the same manner as outlined above. Participants in the socially-irrelevant review condition recalled and reviewed the word definition task 10 more times in the same manner. The following instructions were provided prior to the first recollection trial:

Now I would like you to spend some time thinking about the [speech/word definition] task you completed earlier. I'd like you to once again review the [speech/word definition] task in your mind in as much detail as possible. Focus on how you did, as well as any sensations, thoughts, judgements, observations, or feelings that you had during the task. It is really important for this study that you complete a thorough review

of the [speech/word definition] task as instructed each time. Even though you have done this already, please bring the thoughts to mind again each time I ask you to and we really appreciate you doing so. You can begin now and please ring the bell when you have completed a thorough review of the [speech/word definition] task.

The participant sat alone in the room during the recall trials, although the beginning of each trial was guided by the experimenter via an intercom system. The length of each recall trial was determined by the participant, as they were instructed to ring a bell once they were finished recalling the event. Participants completed 10 trials, and abbreviated instructions about the task were provided by the experiment each time. After the final recall trial, participants once again rated their state anxiety, positive and negative affect, and motivation to review each task, and provided ratings of speech performance and certainty. Finally, all participants completed a questionnaire battery consisting of symptom measures and demographic variables, prior to being debriefed about the purposes of the study and the use of deception.

Measures

Social Phobia Inventory (Connor et al., 2000; SPIN). The SPIN was used to pre-select individuals who experience significant levels of social anxiety and to confirm ongoing symptoms at the time of the study. A detailed description of the SPIN can be found in the Pilot Study, and a copy can be found in Appendix 1. The SPIN in this study showed good internal consistency, $\alpha = .86$

Depression Anxiety Stress Scale – Short Version (DASS 21; Lovibond & Lovibond, 1995). The DASS provideed a measure of depression, anxiety, and stress symptoms. See Study 1 for a detailed description of this measure and Appendix 4 for a copy. In

the current study, all three subscales had good internal consistency, with Cronbach's alphas of .84 for the stress, .85 for the anxiety, and .89 for the depression subscales.

Perception of Speech Performance and Certainty (PSPC; Cody & Teachman, 2011; Rapee & Lim, 1992). The same version of the PSPC as in Study 1 was used to assess perception of performance and certainty ratings for the speech task. The PSPC was administered immediately after the first recall of the speech task, as well as following the repeated recall trials. The performance subscale of the PSPC was used by the researchers coding participants' performance to obtain an objective assessment of speech performance. In the current study, both subscales demonstrated adequate internal consistency. Cronbach's alpha for the performance subscale was .86 for the post-speech administration and .87 for the post-recall administration. Similarly, for the certainty subscale, Cronbach's alpha was .88 for the post-speech administration and .92 for the post-recall administration. A copy of the PSPC can be found in Appendix 5 and a detailed overview of the scale is provided in Study 1.

Motivation Questionnaire. Participants' *motivation to engage in PEP* about the speech (MQ-S) and word definition (MQ-WD) tasks was assessed immediately after the task as well as following the recollection periods using two items developed by the authors to assess this construct. Immediately after the speech and word definition tasks, participants were asked to rate the extent to which they wanted to review *that* task using a 0 (*not at all*) to 100 (*extremely*) scale. See Appendix 10 for a copy of this measure.

Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item measure consisting of adjectives that describe different affective states. The measure consists of two subscales measuring positive affect (PANAS-PA; e.g., "excited," "determined") and negative affect (PANAS-NA; e.g., "distressed," "guilty).

Participants were asked to rate each item on a scale of 1 (*very slightly or not at all*) to 5 (*extremely*) based on how they were feeling at that moment. The PANAS is widely used in experimental studies and demonstrates good reliability and validity (e.g., Chiupka, Moscovitch & Bielak, 2012; Mackinnon et al., 1999; Sloan & Kring, 2007). The PANAS was administered immediately after the speech task, word definition task, and after the recall period. In the current study, Cronbach's alpha values ranged across administrations from .87 to .91 for the PANAS-PA subscale and from .88 to .91 for the PANAS-NA subscale. See Appendix 11 for a copy of this scale.

Metacognition and Certainty Scale – Post-Speech Version (MACS-PS). The MACS-PS was administered at the end of the study to assess positive beliefs about engaging in PEP. For this study, Cronbach's alpha was excellent for the Metacognitive Beliefs scale, α= .90 and adequate for the Mental Checking subscale, α = .69. However, in contrast to Study 1, the internal reliability was low for the Memory Uncertainty Scale, α = .47 and results pertaining to this subscale should, therefore, be interpreted with caution. See Study 1 for a detailed description of the MACS-PS and Appendix 7 for a copy of the measure.

Objective Ratings of Speech Performance

Objective ratings of performance were obtained from two research assistants who were blind to the purposes of the study or the condition to which participants were assigned. Observers viewed video recordings of each participants' speech and coded their performance using the PSPC performance subscale. As in Study 1, observers were trained by the principal investigator and were provided with rating guidelines. Sample videos were used as part of the training process to help coders calibrate their ratings. Inter-rater reliability across the two coders was excellent (Cicchetti, 1994), *ICC* = .76 (one-way, mixed effects model, consistency

in ratings, and based on average of ratings). As in Study 1, standardized residual scores were calculated based on participants' ratings of their own performance and the average of the coder ratings in order to obtain a measure of self-observer discrepancy.

Results

Data Screening

The assumption of normality for all variables was explored by examining absolute values of skewness and kurtosis and with the K-S test of normality. The results of these analyses can be found in Table 9. Examination of the skew and kurtosis values indicate that there were no serious concerns with the distribution of any Study 2 variables. The K-S test was significant for several variables. However, as was noted in Study 1, the K-S test is likely to be significant in larger sample sizes and significant results do not necessarily indicate a distribution problem. The data were therefore further explored with Q-Q plots, and a visual examination of these plots suggested minimal deviation. This information, combined with the acceptable skew and kurtosis values suggested that the assumption of normality was met. The homogeneity of variance assumption was explored using Levene's test. In a few cases, this assumption was violated, and these analyses are provided in the relevant results section.

Preliminary Results

Sample Characteristics

Summary demographic and sample characteristics for each of the conditions can be found in Table 10. Across conditions, participants did not differ in age [$t(67) = .56$, $p = .58$, $r = .07$], gender [$\chi^2(1) = .003$, $p = .96$, Phi = .01], marital status [$\chi^2(1) = 2.12$, $p = .15$, Phi = .18], ethnicity [$\chi^2(6) = 7.20$, $p = .30$, Cramer's V = .32], or medication status [$\chi^2(1) = .00$, $p = 1.00$, Phi = .00].

The means and standard deviations for all scales are presented in Table 11 and the correlations between the variables are presented in Table 12. A series of independent samples *t*-tests was conducted to identify if there were any significant differences between conditions on trait variables. Levene's test for equality of variances was not significant for any variables (all *p*'s > .14). The groups were comparable on SPIN scores [$t(67) = -.58$, $p = .56$, $r = .07$], DASS – Depression [$t(67) = -.40$, $p = .69$, $r = .05$], DASS – Anxiety [$t(67) = .45$, $p = .66$, $r = .05$], and DASS – Stress [$t(67) = .70$, $p = .48$, $r = .09$].

Recall Length

Immediately after the speech and word definition tasks, each participant recalled that task a single time so that everyone recalled each task at least once. The average length of this baseline recall trial after the speech task was 110.04 (*SD* = 79.47) seconds and the average length of the baseline recall trial following the word definition task was 102.10 (*SD* = 63.57). The results of a paired samples *t*-test indicated that the conditions did not differ in length for the baseline recall, $t(67) = .83$, $p = .41$, $r = .10$. Next, the average length of recall across the 10 repeated trials was explored, and the results of an independent samples *t*-test indicated that there were no significant differences between length of recall across the two conditions, $t(67) = 1.51$, $p = .14$, $r = .18$. Across all participants, the average recall time was 78.14 (*SD* = 49.22) seconds, with the range of scores falling between 15.90 and 258.80 seconds.

Changes in length of recall across the 10 trials in the two conditions was assessed using a 2 (condition) × 10 (time) mixed-design ANOVA. Levene's test indicated that variances were homogeneous for all but trials 5, 6, and 7 where this assumption was not met. Levene's test for these variables was followed up with Hartley's F_{MAX} to determine whether the unequal variances were significant enough to be of concern. The calculated F_{MAX} values were smaller

Table 9

Normality Indexes for Study 2 Descriptive and Dependent Measures

Variable	*N*	Skew	SE_{skew}	Kurtosis	$SE_{kurtosis}$	K-S	*p*
Post-speech							
SUDS	64	0.30	0.30	-0.18	0.59	0.21	<.001
MQ-S	64	0.43	0.30	-1.03	0.59	0.17	<.001
PANAS-PA	64	0.11	0.30	-1.09	0.59	0.10	.200 [a]
PANAS-NA	64	0.98	0.30	0.04	0.59	0.15	.001
PSPC-Performance	64	0.34	0.30	-0.39	0.59	0.09	.200 [a]
PSPC-Certainty	64	-0.25	0.30	-0.26	0.59	0.07	.200 [a]
Post-word definition							
SUDS	64	0.13	0.30	-0.31	0.59	0.20	<.001
MQ-WD	64	0.07	0.30	-0.90	0.59	0.13	.01
PANAS-PA	64	0.99	0.30	1.18	0.59	0.13	.01
PANAS-NA	64	0.81	0.30	-0.05	0.59	0.12	.02
Post-recall							
SUDS	64	0.50	0.30	-0.63	0.59	0.19	<.001
MQ-S	64	1.14	0.30	0.42	0.59	0.24	<.001
MQ-WD	64	0.95	0.30	-0.46	0.59	0.23	<.001
PANAS-PA	64	0.88	0.30	-0.09	0.59	0.14	.002
PANAS-NA	64	0.94	0.30	-0.24	0.59	0.24	<.001
PSPC-Performance	64	-0.41	0.30	-0.43	.59	0.08	.200 [a]
PSPC-Certainty	64	-0.36	0.30	0.40	0.59	0.08	.200 [a]
SPIN	64	0.42	0.30	-0.25	0.59	0.08	.200 [a]
DASS-Depression	64	0.48	0.30	-0.50	0.59	0.13	.01
DASS-Anxiety	64	0.22	0.30	-0.96	0.59	0.11	.07
DASS-Stress	64	-0.09	0.30	-0.73	0.59	0.07	.200 [a]
MACS-PS-Metacognition	64	-0.08	0.30	0.14	0.59	0.07	.200 [a]
MACS-PS-Uncertainty	64	-0.18	0.30	0.72	0.59	0.10	.200 [a]
MACS-PS-Mental Checking	64	-0.03	0.30	-0.28	0.59	0.11	.07

[a] This is a lower bound of the true significance.

Note. SUDS = Subjective Units of Distress Scale; MQ-S = Motivation Questionnaire - Speech; MQ-WD = Motivation Questionnaire - Word Definition; PANAS-PA = Positive and Negative Affect Scale, positive affect; PANAS-NA = Positive and Negative Affect Scale, negative affect; PSPC = Perception of Speech Performance and Certainty; SPIN = Social Phobia Inventory; DASS = Depression Anxiety Stress Scale; MACS-PS = Metacognition and Certainty Scale - Post Speech.

Table 10

Study 2 Demographic Characteristics by Condition

Variable	Socially-Relevant (n = 34)	Socially-Irrelevant (n = 35)
Age	20.12 (2.01)	19.86 (1.87)
Gender (% female)	82.4%	82.9%
Marital status		
Married/cohabiting	5.9%	0.0%
Never married	94.1%	100.0%
Ethnicity		
Asian	20.6%	25.7%
South Asian	11.8%	25.7%
Southeast Asian	5.9%	0.0%
West Indian	2.9%	0.0%
Black	2.9%	2.9%
White	38.2%	40.0%
Other	17.6%	5.7%
Psychotropic medications	5.9%	5.7%

Note. Standard deviations are in parentheses.

Table 11

Means and Standard Deviations of Study 2 Variables by Condition

Measure	Socially-Relevant	Socially-Irrelevant	Scale Range
Post-speech			
SUDS	40.73 (24.50)	49.17 (25.37)	0 - 100
PANAS-PA	21.32 (6.53)	19.00 (6.30)	10 - 50
PANAS-NA	18.29 (7.21)	21.06 (9.78)	10 - 50
PSPC-Performance	40.23 (10.48)	41.83 (13.44)	0 - 92
PSPC-Certainty	61.91 (10.95)	65.66 (11.48)	0 - 92
Post-word definition			
SUDS	37.94 (23.62)	41.11 (23.39)	0 - 100
PANAS-PA	21.70 (7.71)	17.69 (6.27)	10 - 50
PANAS-NA	18.58 (7.20)	21.14 (8.66)	10- 50
Post-recall			
SUDS	28.09 (27.0)	35.14 (28.53)	0 - 100
PANAS-PA	16.82 (7.24)	15.46 (5.24)	10 - 50
PANAS-NA	16.82 (7.24)	18.11 (7.79)	10 - 50
PSPC-Performance	42.23 (11.29)	42.29 (13.34)	0 - 92
PSPC-Certainty	66.32 (14.27)	67.14 (13.06)	0 - 92
MACS-PS-Metacognition	34.39 (13.77)	34.03 (12.91)	0 - 60
MACS-PS-Uncertainty	13.26 (4.33)	14.66 (3.32)	0 –-25
MACS-PS-Mental Checking	7.26 (3.26)	6.71 (3.58)	0 – 15
SPIN	35.88 (9.81)	37.46 (12.51)	0 - 68
DASS-Depression	8.41 (5.60)	8.97 (5.92)	0 - 21
DASS-Anxiety	8.21 (5.00)	7.62 (5.65)	0 - 21
DASS-Stress	10.47 (5.08)	9.63 (4.86)	0 - 21

Note. SUDS = Subjective Units of Distress Scale; PANAS-PA = Positive and Negative Affect Scale, positive affect; PANAS- NA = Positive and Negative Affect Scale, negative affect; PSPC = Perception of Speech Performance and Certainty; SPIN = Social Phobia Inventory; DASS = Depression Anxiety Stress Scale; MACS-PS = Metacognition and Certainty Scale-Post Speech. Standard deviations appear in parentheses.

Table 12

Correlations amongst Study 2 Variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Post-Speech																				
1.SUDS	–	-.02	.74**	-.47**	.15	.50**	.02	.57**	.27*	.01	.34**	-.48**	-.30*	.35**	.36**	.21	.47**	.43**	.48**	.22
2. PANAS-PA		–	-.02	.30	-.12	.05	.69**	.04	.19	.68**	.24	.19	.29*	.37**	.08	.40**	.03	-.15	.16	.07
3. PANAS-NS			–	-.50**	.17	.51**	.09	.76**	.21	.16	.60	-.48**	-.25*	.32**	.31*	.31*	.54**	.46**	.55**	.34**
4. PSPC-Performance				–	-.40**	-.28*	.18	-.33**	-.01	.12	-.07	.90**	.73**	-.14	-.17	-.06	-.40**	-.27*	-.34**	-.11
5. PSPC-Certainty					–	.15	-.20	.19	.12	-.14	.13	-.45**	-.48**	.19	.17	.11	.29*	.02	.01	-.17
Post-word definition																				
6. SUDS						–	.00	.80**	.56**	.20	.48**	-.26*	-.13	.22	.23	.32**	.42**	.44**	.51**	.51**
7. PANAS-PA							–	-.09	.06	.66**	.13	.12	.23	.32**	-.01	.43**	.01	-.15	.05	-.03
8. PANAS-NA								–	.48**	.13	.71**	-.31**	-.16	.16	.30*	.20	.55**	.54**	.58**	.51**
Post-recall																				
9. SUDS									–	.18	.57**	-.01	.04	.05	.07	.07	.21	.22	.25*	.23
10. PANAS-PA										–	.14	.16	.28*	.37**	.02	.46**	-.03	-.08	.16	.08
11. PANAS-NA											–	-.16	-.07	.16	.29*	.21	.43**	.41**	.56**	.40**
12. PSPC-Performance												–	.85**	-.24	-.57*	-.13	-.86**	-.34**	-.34**	-.10
13. PSPC-Certainty													–	-.20	-.17	-.07	-.38**	-.32**	-.12	.05
14. MACS-Metacogn.														–	.22	.85**	.11	.16	.14	.06
15. MACS-Uncertainty															–	.14	.21	.40**	.30*	.33**
16. MACS-Checking																–	.05	.15	.18	.18
17. SPIN																	–	.49**	.43**	.41**
18. DASS-Depression																		–	.58**	.66**
19. DASS-Anxiety																			–	.67**
20. DASS-Stress																				–

Note. SUDS = Subjective Units of Distress Scale; PANAS-PA = Positive and Negative Affect Scale, positive affect; PANAS-NA = Positive and Negative Affect Scale, negative affect; PSPC = Perception of Speech Performance and Certainty; SPIN = Social Phobia Inventory; DASS = Depression Anxiety Stress Scale; MACS-PS = Metacognition and Certainty Scale - Post Speech. Standard deviations appear in parentheses.

than the critical F_{MAX} value of 2.63 and we therefore proceeded with the analyses. Mauchly's Test of Sphericity was significant suggesting that the assumption of sphericity had been violated, $\chi^2(44) = 327.33$, $p < .001$, and a Greenhouse-Geisser correction was therefore employed. The main effect of time was not significant, $F(3.81, 255.38) = 1.68$, $p = .16$, partial $\eta^2 = .02$. The condition × time interaction was approaching significance, although the effect size was small, $F(3.81, 255.38) = 2.03$, $p = .09$, partial $\eta^2 = .03$. Although not quite reaching significance, the pattern of results suggests that over time, participants in the speech recall condition increased the length of time they spent reviewing the task whereas the opposite was true of participants in the word definition recall condition (see Figure 12).

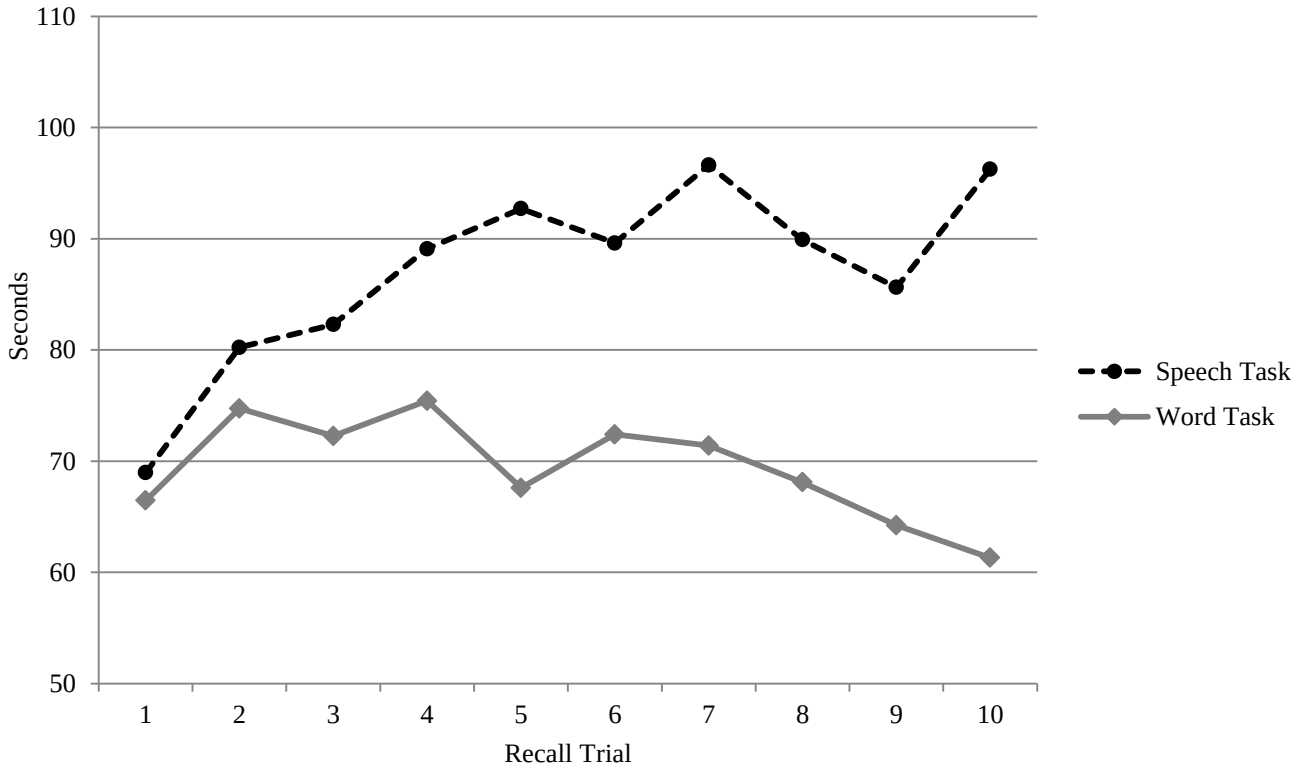

Figure 12. Study 2 length of repeated recall across trials for all participants.

Subjective Emotional Responses

Anxiety. Participants' level of anxiety as assessed by the SUDS was examined to evaluate the impact of each task and changes over time using two *t*-tests. To control for multiple comparisons, a Bonferroni correction was applied (p = .05/2) and the level of significance was set to p = .025. First, we examined differences in level of self-reported anxiety immediately after the speech and word definition tasks using a paired-samples *t*-test. Results indicated no significant differences in state anxiety between the two tasks, $t(68) = 1.87$, p =.07, r = .22, suggesting that the word task was successful at eliciting a level of anxiety comparable to the speech.

Next, participants' level of anxiety following the repeated recall trials was examined to evaluate whether repeatedly reviewing the speech versus the word definition task differentially impacted state anxiety. Results from an independent samples *t*-test indicated no significant differences between the conditions, $t(67) = -1.05$, p =.30, r = .13, indicating, as hoped, that reviewing both tasks resulted in comparable feelings of anxiety. Means and standard deviations for all Study 2 state and trait variables can be found in Table 11.

Negative Affect. Participants' experience of negative affect in response to each task as well as changes over time were assessed using two *t*-tests. A Bonferroni correction (.05/2) was applied to control for multiple comparisons, and the alpha level was set to p = .025. First, to determine whether the speech and word definition tasks were comparable in eliciting negative affect, a paired samples *t*-test was conducted with the PANAS-NA ratings provided immediately after each task. Results suggested, as hoped, that the word definition task was successful at eliciting negative affect at a level that was comparable to the speech task, $t(65) = .13$, p =.90, r = .02.

Next, differences across conditions in negative affect after the recall trials were assessed to see if recollection of the tasks was comparable in eliciting negative affect. Results from an independent samples *t*-test indicated no significant differences in experience of negative affect, $t(67) = -1.51$, $p = .14$, $r = .18$.

Positive Affect. Participants' self-reported positive affect was assessed using the PANAS-PA and differences across tasks and time were analyzed using two *t*-tests (Bonferroni correction with alpha set to $p = .025$). As with state anxiety and negative affect, participants rated their positive affect consistently across the speech and word definition tasks, $t(65) = .61$, $p = .55$, $r = .08$. Similarly, the results from an independent samples *t*-test indicated that repeatedly reviewing the speech versus the word definition task had similar impacts on positive affect, $t(67) = .90$, $p = .37$, $r = .11$.

In sum, preliminary analyses suggested that the tasks (speech, word definition) as well as the conditions (socially-relevant, socially-irrelevant review) were equivalent in terms of participants' reported state anxiety, positive and negative affect. These findings suggest, as anticipated, that the word definition task was successful at eliciting negative affect comparable to that observed in response to the speech task.

Primary Analyses

Perception of Performance

Perception of Speech Performance. Changes in overall perception of speech performance from post-speech to post-recall were examined with the PSPC performance subscale in each of the conditions to determine whether repeated recall in the socially-relevant review condition was associated with degradation in performance ratings relative to the socially-irrelevant review condition. The homogeneity of variance assumption was met (Levene's test, all

p's > .11). Results of a 2 (condition: socially-relevant, socially-irrelevant) × 2 mixed-design (time: post-speech, post-recall) ANOVA indicated that there was no main effect of condition, F (1, 67) = .08, p =.78, partial η^2 = .001. The main effect of time was approaching significance, F (1, 67) = 3.56, p = .06, partial η^2 = .05, while the condition × time interaction was not significant, F (1, 67) = 1.40, p = .24, partial η^2 = .02. Contrary to predictions, participants rated their overall speech performance somewhat more positively following the repeated recall period relative to baseline across both conditions (See Figure 13 a).

Next, changes in perception of positive and negative aspects of performance were examined separately from post-speech to post-recall (See Figure 13, b and c). With the positive subscale, there was a significant main effect of time such that all participants rated their speech performance less positively following the repeated recall task, F (1, 67) = 7.31, p =.009, partial η^2 = .10. There was no main effect of condition, F (1, 67) = 0.44, p = .51, partial η^2 = 0.007, and no significant interaction, F (1, 67) = 1.08, p = .30, partial η^2 = 0.02. With the negative subscale, once again, there was a main effect of time with perception of performance becoming less negative following the repeated recall task, F (1, 67) = 16.29, p <.001, partial η^2 = .20. The main effect of condition was not significant, F (1, 67) = 0.002, p = .97, partial η^2 = 0.00, nor was the interaction, F (1, 67) = 0.64, p = .43, partial η^2 = .009. The homogeneity of variance assumption was met for all variables (all *p*'s>.13).

Self-Observer Discrepancy Ratings of Speech Performance. To examine how accurate participants were in their performance ratings, two paired-samples *t*-tests were conducted where self-ratings at post-speech and post-recall were compared to objective observer ratings on the performance subscale of the PSPC. The results suggested that across both conditions, participants rated their performance more negatively than observers immediately after the speech

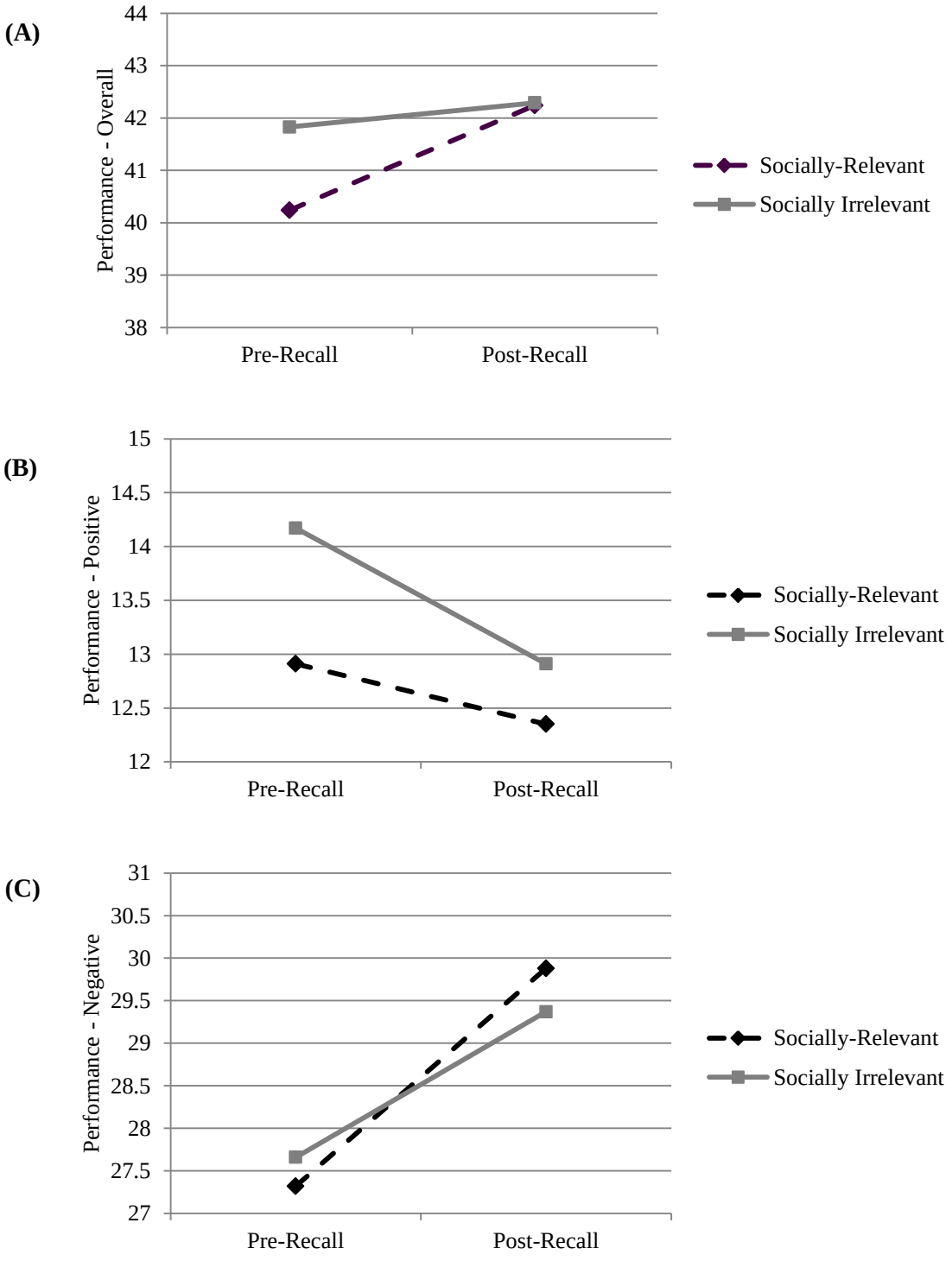

Figure 13. Study 2 PSPC performance ratings in socially-relevant and socially-irrelevant conditions for pre- and post-recall for a) overall perception of performance, b) perception of performance for positive items, and c) perception of performance for negative items. Higher scores indicate better performance ratings.

task, $t(48) = -14.98$, $p < .001$, $r = .92$, as well as after the recall task $t(43) = -13.52$, $p < .001$, $r = .90$.

Next, as in Study 1, standardized residual scores were computed as a means of assessing whether participants' accuracy changed from post-speech to post-recall and whether there were any differences by condition. The post-speech and post-recall discrepancy scores were then entered into a mixed-design ANOVA as the within subjects factors and condition entered as the between subjects factor. The results of this analysis suggested that there were no significant main effects of time [$F(1, 42) = 0.01$, $p = .91$, partial $\eta^2 = 0.00$], or condition [$F(1, 42) = 0.05$, $p = .83$, partial $\eta^2 = 0.001$], and no significant interaction [$F(1, 42) = 0.43$, $p = .52$, partial $\eta^2 = 0.01$]. These results indicate that participants in neither condition became more biased in their perceptions of speech performance following the recall period (See Figure 14).

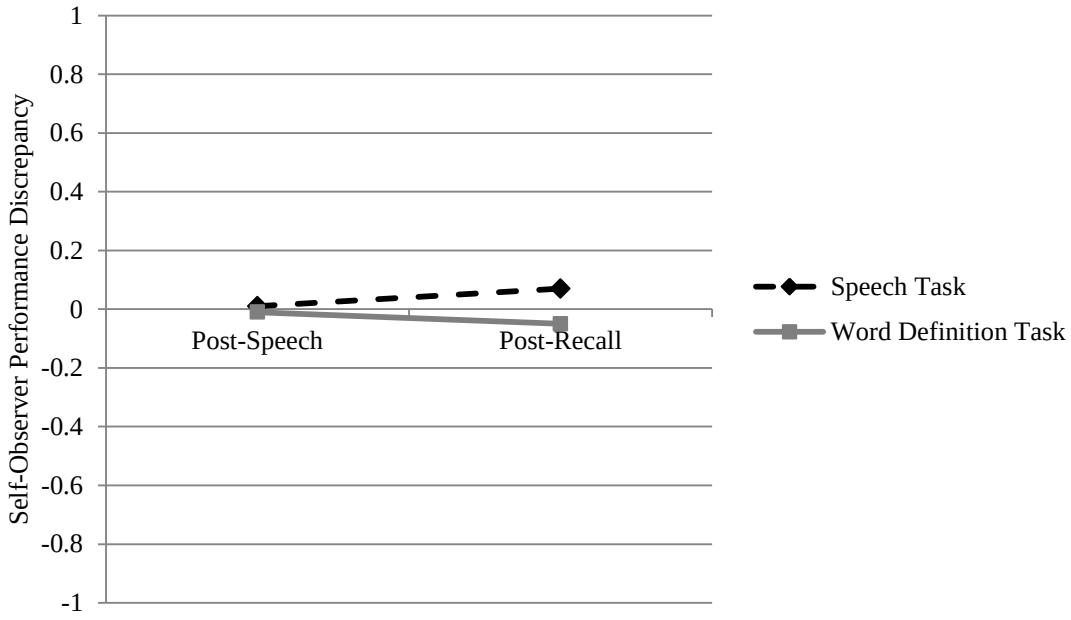

Figure 14. Study 2 PSPC performance discrepancy ratings (standardized residual scores) for the socially-relevant and socially-irrelevant conditions for pre- and post-recall.

Motivation to Engage in Recall

Motivation to engage in PEP about the speech was assessed following the repeated recall manipulation. It was expected that if PEP functions as a mental checking strategy, then after the recall trials, participants in the socially-irrelevant review condition (reviewed the word task) would be particularly motivated to engage in PEP about the speech, whereas those who reviewed the speech (i.e., those in the socially-relevant review condition) would be somewhat less motivated to think about it further. We expected that all participants, regardless of condition would not be motivated to engage in PEP about the word definition task following the repeated recall trials. A one-way ANOVA was conducted with condition as the between subjects factor and motivation to review the speech task as the dependent variable. Levene's test indicated that the homogeneity of variance assumption was met (p =.85). The results of this analysis suggested that contrary to hypotheses, there were no differences between conditions in motivation to engage in PEP about the speech task, F (1, 67) = .03, p =.87, partial η^2 = 0.00.

Certainty

PSPC Certainty Ratings for the Speech Task. A mixed-measures ANOVA was conducted to examine the effect of condition on changes in speech performance certainty ratings (PSPC, certainty subscale) from post-speech to post recall. Levene's test was not significant for the certainty ratings at either time point, p's > .55. Results suggested a significant main effect of time, with all participants becoming more certain about their speech performance following the repeated recall trials, F(1, 67) = 6.04, p =.02, partial η^2 = 0.08. Contrary to hypotheses, the main effect of condition was not significant, F(1, 67) = 0.68, p = .41, partial η^2 = 0.01, nor was the time × condition interaction, F(1, 67) = 1.49, p = .23, partial η^2 = 0.02. These results are presented in Figure 15 and suggest that repeatedly recalling the speech task relative to the word

definition task does not differentially impact certainty ratings, although all participants reported feeling more certain about their performance after the recall period.

Memory Uncertainty. The extent to which people reported general uncertainty in their memory for the speech task was assessed post-recall with the MACS-PS (memory uncertainty subscale). The results of an independent *t*-test suggest that there were no significant differences across the two conditions , $t(67) = -1.50$, $p = .14$, $r = .18$.

Mental Checking. Differences in tendency to mentally check or review the speech task were evaluated with an independent samples *t*-test. Results revealed that there were no significant differences between conditions, $t(67) = .67$, $p = .50$, $r = .08$.

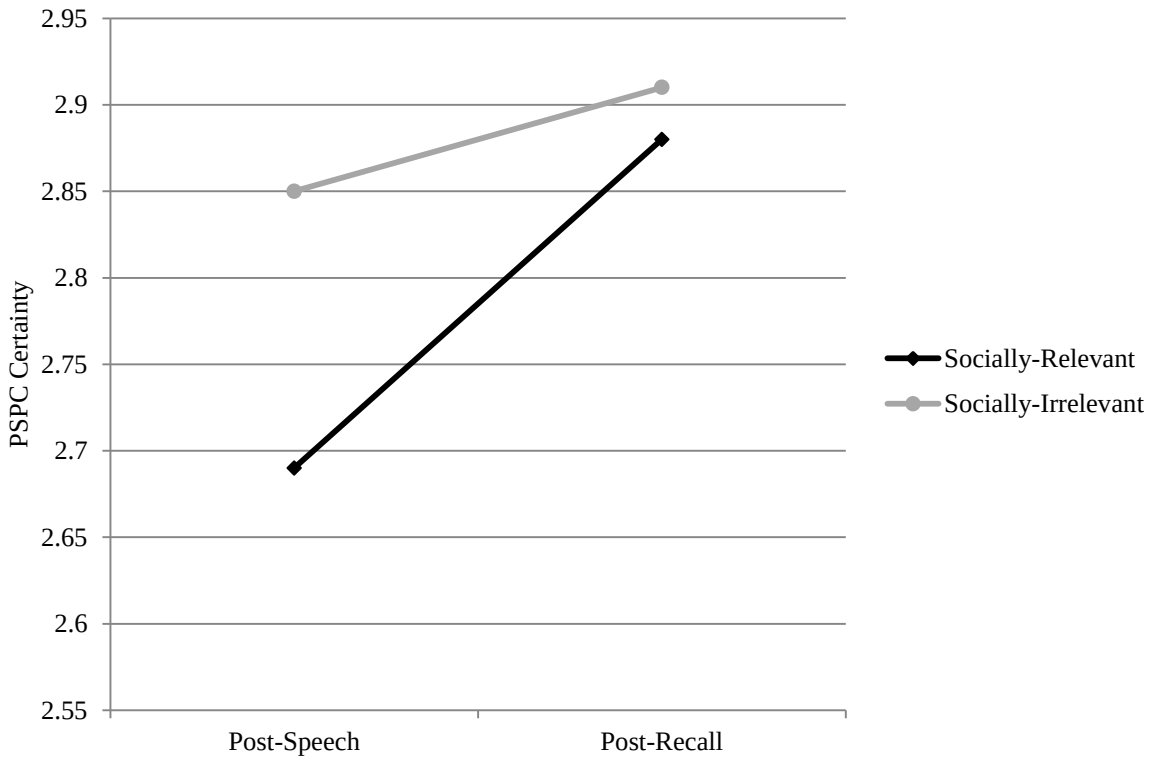

Figure 15. Study 2 PSPC certainty ratings in the socially-relevant and socially-irrelevant conditions at the post-speech and post-recall assessments.

Metacognitive Beliefs

MACS-PS. Metacognitive beliefs about engaging in PEP about the speech task were assessed with the metacognitive beliefs subscale of the MACS-PS following the recall period. An independent samples *t*-test indicated that there were no significant condition differences in endorsement of these beliefs, $t(66) = .11$, $p = .91$, $r = .01$.

Advantages and Disadvantages. To assess metacognitive beliefs about PEP for social events more directly, participants were asked open-ended questions post-recall about the advantages and disadvantages of reviewing the speech task. Across all participants,[12] approximately 75% reported some benefit to engaging in PEP about the speech task. More specifically, 47.8% of participants reported one advantage to reviewing the speech, 23.2% reported two advantages, and 4.3% reported three advantages. Sample advantages reported by participants included "self-awareness", "identifying areas to be improved", and "practice for future public speaking". Inspection of the advantages reported by participants' revealed common themes. The most frequently endorsed advantages were to improve next time, to gain greater self-understanding and insight, to prevent future mistakes, to organize one's thoughts, and to view performance more objectively. The frequency with which these categories were endorsed can be found in Table 13.

Most participants also endorsed disadvantages to reviewing the speech task, with almost 70% endorsing at least one disadvantage. More specifically, 47.8% reported one disadvantage, 17.4% reported two disadvantages, and 2.9% reported three disadvantages. Sample disadvantages reported included "lingering on negative thoughts", "if you get too hung up, it will distract you from other tasks", and "makes me feel bad about myself". The most commonly

[12] To ensure that the conditions did not differ in number of self-reported advantages and disadvantages, two independent samples *t*-tests were performed which confirmed that the groups were equivalent (both *p*'s >.67).

reported disadvantages could be categorized into the following themes: increasing negative emotions (e.g, anxiety, guilt, sadness), increasing negative beliefs about oneself or one's performance, the content of thoughts is focused on the negative, thoughts become more negative over time, and it increases self-doubt (see Table 13 for frequency of endorsement for each category).

The majority of participants, 57.7%, reported both advantages and disadvantages to reviewing the speech task. Sixteen point nine percent reported only advantages, 9.9% reported only disadvantages, and 15.5 % did not report any advantages or disadvantages.

Table 13

Study 2 Advantages and Disadvantages of Reviewing Speech Task Categorized into Common Themes

Categories	Frequency	
	n	%
Advantages		
Improve next time	30	43.5
Understanding/insight into self	12	17.4
Prevent future mistakes	6	8.7
Organize thoughts	5	7.2
View performance more objectively	3	4.3
Disadvantages		
Increase negative emotions	20	29.0
Increase negative beliefs about self/performance	12	17.4
Thoughts focused on negative	8	11.6
Thoughts become more negative	5	7.2
Increase doubt (i.e., self and situation)	2	2.9

Discussion

The primary aims of Study 2 were to experimentally evaluate the effects of repeatedly recalling a socially-relevant versus irrelevant task on participants' performance, certainty and accuracy ratings and to examine idiosyncratic motivations for engaging in PEP. The results of the current investigation suggest that repeatedly reviewing a socially-relevant task, relative to a socially-irrelevant task, did not result in the hypothesized effects. That is, participants who were asked to repeatedly review the speech task showed similar ratings on performance, certainty, and accuracy ratings compared to participants who reviewed the word definition task. These results are in contrast to study hypotheses, and are inconsistent with cognitive behavioural theories and prior research which has demonstrated that engagement in PEP results in more negative self-perceptions. It is unclear what may be contributing to this pattern of results. One possibility is that regardless of condition and the instructions provided, all participants may have engaged in recall of both the speech and the word definition task throughout the recall periods. All of the recall trials were conducted in participant's minds, and they were instructed to notify the experimenter once they had finished a recall trial. This methodology was used in order to simulate a more ecologically-valid process (rather than, for example, having participants write down their thoughts after each trial). However, this design provided less experimental control over measuring the precise content of the recollection process and, thus, it was impossible to know what participants were actually doing during this time. Indeed, several participants made comments in the post-recall questionnaire that they did not engage in the exercise as instructed. Although these individuals were excluded from the analyses, it is possible that other participants likewise did not engage in the recall task but did not communicate this to the experimenters.

The results from the current study suggest that all participants showed overall improved performance ratings after the recall periods. These findings were unexpected, and suggest that engagement in experimenter guided recall trials may not adequately replicate naturalistically-occurring PEP. During the recall trials, participants in the current study were instructed to focus on how they performed, as well as any sensations, thoughts, judgements, observations, or feelings they experienced during the task. These instructions were generated based on cognitive behavioural models of PEP but were presented in a neutral manner (i.e., not focused on negative or positive aspects of performance) in order to minimize undue experimenter influence on participants' thought processes. However, it is possible that these instructions may have altered the way in which PEP occurred and the recall trials may not have mimicked real world PEP, thus failing to facilitate the expected decline in perceived performance. Difficulties inducing naturalistic PEP in individuals with SAD have been previously identified in the literature. A study by Rowa et al. (2013) had participants with SAD complete a lab based speech task and then engage in a PEP induction (focus on speech performance) or a distraction condition (listen to a neutral audiotaped recording and note when certain words are presented). Contrary to expectations, they found that the PEP induction did not result in greater engagement in PEP relative to the distraction condition, although individuals in the distraction condition did experience some benefit in terms of anxiety reduction. These findings suggest that PEP may be difficult to induce experimentally and that intentional engagement in this cognitive process functions differently, and is less harmful, than PEP that unfolds naturally in an unprovoked manner. A study by Makkar and Grisham (2012) lends support to this hypothesis. In their study, participants engaged in a speech task and were immediately assigned to either a PEP or distraction condition. The PEP condition was based on the Clark and Wells (1995) model as well

as previous research and was designed to elicit negative thoughts and perceptions of the speech task. Participants in this condition were instructed to focus on portions of their speech that went poorly, anxious feelings and sensations that were experienced, things they wished they had done differently, negative cognitions, imagining their appearance during the most uncomfortable moments, recalling past speeches that went poorly, and considering what being negatively evaluated on the speech would mean about the themselves and their future. In contrast, participants in the distraction condition were asked to think about and visualize a series of non-self-relevant and neutral topics. Surprisingly, the authors found that relative to the distraction condition, engaging in PEP actually resulted in positive outcomes for socially anxious participants, including an improved perception of speech quality, reduced perceived visibility of negative behaviours, and an increased willingness to complete a subsequent speech. The authors postulated that the PEP condition in their study may have actually elicited a more constructive form of repetitive thought by encouraging the speech task to be processed in a concrete and experiential manner rather than in a more abstract way (Watkins, 2008). There are of course some important methodological differences between the current study and the Rowa et al., (2013) and Makkar and Grisham (2012) studies, including the repeated recall trials, the socially-relevant and socially-irrelevant review conditions, the absence of a control condition, as well as the fact that the PEP instructions in the current study were presented in a more neutral manner. However, the results of all three of these studies suggest that there may be some substantive differences between experimenter guided PEP compared to the negative processing that occurs more intrinsically among socially anxious individuals.

The results of the present study did not support the hypothesized effects of repeatedly reviewing a socially-relevant vs. irrelevant task on feelings of certainty. The effects of repeated

physical and mental checking on memory confidence, vividness and detail are well established in the OCD literature. The current study sought to extend these findings to social anxiety, in order to evaluate whether similar effects would be observed with repeated recall or checking of a socially threatening event. The results from the current investigation indicate that, contrary to hypotheses, all participants became more certain of their speech performance after the recall period regardless of whether they repeatedly reviewed the speech or the word definition task. It is possible that repeated socially-relevant mental checking in the aftermath of a social task does not impact socially anxious individuals' performance certainty in the same manner that repeated mental checking of threat stimuli erodes participants' memory certainty in the context of OCD. Alternatively, as reviewed above, it is also possible that, unbeknownst to the experimenters, the participants did not engage in the repeated recollection of the tasks as instructed. Future studies may wish to more directly assess participant compliance with the experimental procedures.

A final aim of the current study was to explore the types of metacognitive beliefs reported by socially anxious individuals about engaging in PEP about the speech task. When asked about advantages to reviewing the speech task, 75% of participants generated at least one advantage. Most of the reported advantages could be summarized by one of the following categories: to improve next time, to gain understanding/insight into oneself, to prevent future mistakes, to organize one's thinking, and to view performance more objectively. Importantly, all but the last theme (to view performance more objectively) were assessed by the MACS-PS, suggesting that this measure provides a reasonably thorough assessment of the beliefs participants hold about the value of PEP. Alongside the advantages, most participants (70%) also reported at least one disadvantage of engaging in PEP about the speech, suggesting at least some level of ambivalence about the process. Indeed, a majority of participants endorsed both

advantages and disadvantages (57.7%). Beliefs about the disadvantages of mentally reviewing are considered negative metacognitive beliefs as they pertain to the negative consequences of this thought process. Most of the endorsed disadvantages of PEP could be categorized as follows: increases negative affect, increases negative self-perceptions about performance, thoughts are predominantly negative, thoughts become more negative with time, and increases doubt about oneself and the situation. Interestingly, participants did not spontaneously report that reviewing the speech task would result in a loss of control over their thought process as might be predicted by the S-REF model of negative metacognitive beliefs. However, the current methodology, which simply asked participants to report on the disadvantages of mentally reviewing the speech task, may not have been designed to elicit such responses, even if they are present.

Importantly, a remarkably similar pattern of results regarding the advantages and disadvantages of repetitive thought has emerged in the depression literature. Watkins and Baracaia (2001) asked individuals who self-identified as ruminators to report on the advantages and disadvantages of rumination. These authors found that 80% of participants endorsed at least one perceived advantage and 70% endorsed at least one perceived disadvantage. Furthermore, several of the themes were similar to the ones found in the current study, including understanding/insight, preventing future mistakes, and maintaining/worsening negative affect. The findings from the current study suggest that similar beliefs may exist in social anxiety, and may contribute to the persistence of negative PEP following social situations.

In the present study, a word definition task served as the control task, and was designed to elicit negative affect and induce feelings of perceived failure. The preliminary analyses presented above suggest that it was effective at doing so, and that feelings of state anxiety,

positive and negative affect were similar across both tasks. This task was chosen in order to reduce the likelihood that any obtained results were due simply to differences in negative affect between the conditions. It is possible however, that with a university sample, the word definition task may have been particularly relevant and upsetting given the implications of doing poorly on such a task in terms of school success. A review of the thoughts generated post-recall revealed that a number of participants commented on their university student status and indicated that the word definition task led them to compare themselves to other students (e.g., "I felt not as smart compared to other university students", "it felt like an exam where I didn't know the answers", "I thought I didn't do well since I only got 3 definitions out of the 11 to 12 definitions expected as a university student"). The current study did not evaluate perceptions of performance for the word definition task or changes in such perceptions over time, although it might be interesting to compare whether similar results are found for social and non-social tasks. Furthermore, future studies may wish to address some of the limitations of the current study design and sample. For example, the word definition task used in the current study elicited a high degree of anxiety for participants. Although this was done intentionally so that the unique effects of *social* threat could be explored, it is possible that the induction of negative affect in both conditions masked the effects of repeated recall. Future studies may wish to evaluate these hypotheses using a threatening relative to a non-threatening task. Similarly, it is possible that the word definition task was particularly threatening to a student sample, given its implications for educational attainment and success, and future studies may wish to explore these relationships in community samples. Finally, this study only explored the hypothesized relationships among individuals with elevated social anxiety and lacked a low social anxiety comparison group. It is possible that meaningful differences would emerge on the constructs of interest if high versus low socially

anxious participants were compared. Future studies in this area should include a low anxiety control group.

General Discussion

The primary aim of the current studies was to investigate mechanisms that may contribute to the maintenance of PEP in social anxiety. Although ample research has identified the nature and consequences of this phenomenon, few studies have investigated the specific factors that may serve to perpetuate PEP. The current line of research was developed to evaluate a novel theoretical framework which proposed that feelings of uncertainty, positive metacognitive beliefs, motivation to mentally review, and poor perceptions of performance would motivate individuals with SAD to engage in PEP following a threatening social event. It was further hypothesized that engagement in such processing would be viewed as a productive and beneficial thought process and would be reinforcing as it may serve to resolve feelings of uncertainty about one's social performance. However, despite these perceived advantages, it was expected that engagement in such repetitive thinking would leave individuals' memories susceptible to interpretation biases and ultimately more negative and biased interpretations. Findings across three studies provide partial support for the proposed theoretical framework. Specifically, results demonstrated that holding positive metacognitive beliefs and negatively biased perceptions of performance immediately after a social task fueled engagement in PEP in the days that followed. In contrast, although individuals with social anxiety reported feeling greater uncertainty about their social performance, these feelings did not appear related to PEP. Similarly, contrary to expectations and previous research (e.g., Brozovich & Heimberg, 2011; Wong & Moulds, 2012), degree of PEP was not associated with more negative perceptions of performance or changes in certainty over time.

One of the novel aspects of this line of research was the evaluation of PEP as it occurs in SAD relative to both healthy *and* anxious controls. Negative repetitive thinking is common in a

number of psychological disorders. Traditionally, each of these negative thinking styles has been studied exclusively within the context of the associated disorder (e.g., worry has been studied in the context of GAD). However, in recent years, a number of authors have recognized the similarities in perseverative negative thinking patterns across psychopathologies and have argued that repetitive thought may be best conceptualized as a transdiagnostic factor (McEvoy et al., 2010; McLaughlin & Nolen-Hoeksema, 2011). To test this conceptualization, McEvoy, Mahoney and Moulds (2010) developed and administered the Repetitive Thinking Questionnaire (RTQ) to a large sample of undergraduate students. The RTQ was derived exclusively from items on existing measures of PEP (PEPQ-R), worry (Penn State Worry Questionnaire; Meyer, Miller, Metzger, & Borkovec, 1990), and rumination (Response Style Questionnaire; Nolen-Hoeksema & Morrow, 1991). The RTQ was designed to be non-disorder specific and participants were instructed to respond to the items in reference to a recent distressing event of their choosing. Results from a common factor analysis indicated a two-factor solution, with positively worded items loading on one factor and negatively worded items loading on a separate factor. The authors interpreted these findings as suggesting that rumination, worry, and PEP share a number of similarities. They further examined the relationships between the RTQ and both depression (Beck Depression Inventory II; Beck, Steer, & Broen, 1996) and anxiety (Beck Anxiety Inventory; Beck, Epstein, Brown, & Steer, 1988); the findings indicated that the RTQ was moderately correlated with both measures. Furthermore, multiple regression analyses demonstrated that depression and anxiety were both uniquely predictive of RTQ scores, which the authors argued provides support for repetitive thought as a 'trans-emotional' process.

In contrast to the findings and conclusions of McEvoy et al., (2010) and as was reviewed in the introduction, a number of studies have found that individuals with SAD are more likely to

engage in PEP relative to healthy controls, even when depression is accounted for (e.g., Abbott & Rapee, 2004; Mellings & Alden, 2000). Furthermore, social situations have been found to uniquely elicit engagement in PEP relative to other distressing events (Fehm et al., 2007). The results of Study 1 are consistent with these studies, as individuals with SAD engaged in greater PEP relative to both anxious and healthy controls, signifying that PEP about a specific socially threatening task may be a SAD-specific phenomenon. Taken together, the available empirical evidence suggests that individuals with emotional disorders may have a propensity to engage in negative repetitive thinking in response to distressing events; however, in social situations this cognitive process is uniquely triggered amongst individuals with social fears. To provide evidence for this hypothesis, future research could include a general measure of negative thinking (e.g., RTQ) as well as a disorder specific measure (e.g., PEPQ-R) within the same study.

The role that certainty plays in fueling PEP was explored in all three of the current studies. The pilot study found preliminary correlational evidence for a moderate but significant association between social anxiety symptoms and uncertainty for past social events in two large samples of unselected undergraduate students. Expanding on these findings, Study 1 demonstrated that compared to both anxious and healthy controls, individuals with a diagnosis of SAD experienced significantly greater uncertainty immediately after a standardized speech task. When certainty ratings were examined across time, the data suggested an interesting pattern of results. While socially anxious individuals were initially less certain than controls, their ratings remained unchanged over time. In contrast, individuals in the two control groups reported greater certainty about their performance (for both positive and negative items) than those with SAD in the immediate aftermath of the speech task, but their certainty ratings declined by the following

day and these lower ratings remained constant throughout the week. These data appear to suggest that initial certainty about performance after a social task, followed by a reduction in certainty that remains stable in the days following the task, represents the "normative" pattern, to which both healthy and anxious control participants conformed, but participants with SAD did not. One possible explanation for these findings is that individuals in the SAD group, who also exhibited heightened levels of PEP in the days following the speech task, were continuing to think about the task throughout the week, thus keeping the memory for the event active in their minds and preventing decreases in certainty that might otherwise be expected. It would be interesting to examine how certainty might continue to change over the course of time. Do participants with social anxiety simply start out less certain and maintain this level of certainty indefinitely, or would they eventually show the decline in certainty that was observed in the control groups? These are empirical questions that require further research.

Although research on feelings of certainty in the context of social anxiety has been relatively sparse, a few recent studies have examined certainty in the context of positive and negative self-attributes. First, Wilson and Rapee (2006) found that relative to non-anxious controls, individuals with SAD held less favourable beliefs about their self-attributes, even when depression was partialled out. With regards to certainty, individuals with SAD were less confident in their ratings for both positive and negative qualities of the self. Furthermore, relative to healthy controls, they were slower to respond on a reaction time task requiring them to indicate whether specific characteristics were representative of them. Importantly, the authors found evidence that decreased certainty among socially anxious individuals was specific to self-relevant personality attributes, rather than a more general tendency to feel uncertain. A later study by Moscovitch et al. (2009) found that non-anxious control participants attributed greater

certainty for positive relative to negative self-attributes while individuals with SAD did not show this bias. In other words, non-anxious individuals had greater confidence in their positive, relative to their negative, traits whereas individuals with SAD reported feeling equally uncertain across all personality characteristics. These authors argued that a positive bias for viewing self-attributes likely serves a self-protective function, by increasing self-esteem and psychological well-being. Finally, Stopa et al. (2010) found that, relative to non-anxious controls, socially anxious individuals were less consistent in their endorsement of self-attributes, suggesting a greater sense of uncertainty about the self. However, when consistency for positive and negative self-attributes was examined separately, socially anxious individuals were significantly more certain for negative self-attributes while reporting less certainty for positive self-attributes compared to non-anxious controls. Taken together, these studies suggest that socially anxious individuals report less certainty for both positive *and* negative self-attributes, although this may be particularly salient for positive aspects of the self.

The results from Study 1 suggest that participants from all diagnostic groups felt more certain about negative relative to positive aspects of their performance immediately after the speech. Anxious and healthy control participants continued to show this bias throughout the week, whereas by the 1-day follow-up, participants in the SAD group felt equally uncertain about both positive and negative aspects of performance. These findings appear inconsistent with previous studies on self-certainty (Moscovitch et al., 2009; Stopa et al., 2010), which have generally found that socially anxious individuals lack certainty for positive aspects of the self but tend to feel more certain for negative self-attributes. However, the current study specifically assessed certainty for speech performance, whereas prior studies have examined certainty in the context of more general self-attributes. In general, it is likely adaptive for individuals to feel

certain and confident in their positive attributes and abilities and to know that they possess these qualities in their day-to-day social interactions. In contrast, in the current study, feelings of certainty were assessed for performance ratings with regards to a structured, lab-based, speech task. Given that anxious and healthy controls rated their performance less negatively and more accurately, it may be that the most adaptive response in this context is to leave the situation feeling confident that you performed "well enough". In other words, individuals without social anxiety may leave the speech task feeling less certain about whether they did a great job, but feeling confident that they did not perform poorly. In contrast, individuals with SAD appear to feel uncertain about both positive and negative aspects of their speech performance.

It was hypothesized that certainty may be one mechanism which maintains the persistence of PEP in SAD; however, the results of these studies do not support this conclusion. In Study 1, contrary to expectations, certainty was not significantly related to PEP at any of the follow-up assessments and did not mediate the relation between diagnostic status and engagement in PEP. Similarly, we did not find support for the idea that wanting to mentally check or review one's memory was associated with increased engagement in PEP, and once again, this variable was not found to be a significant mediator. Study 2 further explored how engaging in PEP about a socially threatening task impacted feelings of certainty. It was hypothesised that PEP might serve a mental checking function, and that participants who were instructed to repeatedly recall and mentally review a socially-relevant relative to a socially-irrelevant event would report increases in certainty while at the same time showing decreases in performance appraisals. However, the findings from this study did not support this hypothesis. Regardless of which task was recalled, participants in Study 2 showed a general increase in certainty following the recall period. Study 2 consisted only of participants with high levels of

trait social anxiety; thus, it is possible that including a comparison group of low socially anxious individuals may have revealed significant group differences that were not observable within the context of our design.

In the proposed framework outlined in the introduction, positive metacognitive beliefs about the value and benefit of reviewing past social events were identified as an additional mechanism which may serve to motivate engagement in PEP. The presence and function of metacognitive beliefs in emotional disorders, such as GAD and Major Depression, has received support in the research literature, although these ideas have only recently been investigated in the context of PEP and social anxiety. Prior studies in this area have found some evidence for the relationship between metacognitive beliefs, PEP, and social anxiety (Fisak & Hammond, 2013; Wong & Moulds, 2010). The current research provides additional support for these relationships and expands on previous work by including a clinical sample and evaluating the role of metacognitive beliefs in the context of a standardized experimental design. The Pilot Study provided evidence that social anxiety symptoms and metacognitive beliefs are moderately but significantly correlated – a finding that is consistent with results reported elsewhere (e.g., Fisak & Hammond, 2013; Wong & Moulds, 2010). The goal of Study 1 was to further evaluate whether positive metacognitive beliefs would be related to PEP following a social stress task. Results from this study suggested that individuals with SAD more strongly endorsed metacognitive beliefs relative to both anxious and healthy controls. Furthermore, we found support for the hypothesized relationship between positive metacognitive beliefs and PEP. Results from the mediation analyses suggest that metacognitive beliefs mediated the relationship between diagnostic group status and engagement in PEP. In other words, relative to both control groups, individuals with SAD engaged in PEP because they held metacognitive beliefs about the

value of doing so. The second set of mediational analyses indicated that although metacognitive beliefs predicted PEP, PEP in turn did not mediate the relationship between metacognitive beliefs and worsening perceptions of performance or increases in certainty. Contrary to expectations, this suggests that while metacognitive beliefs may lead individuals to engage in PEP, this engagement is not associated with greater feelings of certainty or more negative perceptions of performance over time.

The results of Study 2 expanded on these findings by exploring the phenomenology of beliefs held by socially anxious individuals. The main finding from this study suggested that most socially anxious individuals believed that there were both advantages (75%) and disadvantages (70%) to reviewing the speech task. Participants' self-generated advantages and disadvantages were reviewed, and a number of common themes emerged. Interestingly, the frequency with which participants endorsed *both* advantages and disadvantages was similar to a study by Watkins & Baracaia (2001) who examined these constructs in a sample of self-identified ruminators. In their study, they found that 80% of their participants reported at least one advantage and 70% reported at least one disadvantage to engaging in rumination. Furthermore, the themes that were identified in this study were likewise similar to those obtained in Study 2 (e.g., greater understanding/insight, preventing future mistakes, maintaining/worsening negative affect, not understanding self/problems).

The results presented here, in combination with data emerging from the literature on metacognitive beliefs, suggests that there may be an underlying tendency to engage in "thinking about thinking" across diagnostic categories, but that the specific situations in which these thoughts manifest are specific to the disorder. Consistent with this, the presence of metacognitive beliefs across anxiety and mood disorders has been well documented (e.g., Janeck,

Calamari, Riemann, & Heffelfinger, 2003; Bailey & Wells, 2013; Wells, 2005; Watkins & Moulds, 2005). In the current studies, we were particularly interested in understanding the impact of positive metacognitive beliefs in reference to a standardized social stressor task given that these beliefs have been proposed to initiate repetitive thinking styles (Matthews & Wells, 2004; Wells & Matthews, 1994, 1996). Given that socially anxious individuals in Study 1 more strongly endorsed items on a measure of positive metacognitive beliefs regarding a speech task relative to anxious and healthy controls, it appears that although such beliefs may be prevalent across emotional disorders, beliefs about the benefit of reviewing social events is unique to SAD. One possible explanation for these findings is that individuals across anxiety and mood disorders may see value in reviewing emotionally distressing events. The notion that repetitive thinking occurs *in response* to distressing events has been previously proposed. In the context of response style theory, Nolen-Hoeksema (1991) argued that rumination is a means of responding to distress that involves repeatedly dwelling on symptoms, causes, and consequences of that distress. Similarly, the concept of cognitive processing has emerged which refers to the tendency for people to think about distressing events, including their emotional impacts and future implications (see Watkins, 2008 for a review). The cognitive processing account proposes that individuals think about distressing events in an effort to resolve them so that these events can be successfully incorporated into their understanding of the world. Cognitive processing has been largely studied in the context of traumatic events (e.g., Greenberg, 1995; Lindstrom, Cann, Calhoun, & Tedeschi, 2013), although some studies have also evaluated this process in response to non-traumatic, yet distressing situations (e.g., Lepore & Greenberg, 2002). These theories may help to provide a framework for understanding the current findings. In Study 1, individuals in the SAD group experienced significantly higher levels of state anxiety in response to the speech task

and it may be that this increased level of distress signalled to participants that this was a significant event. This interpretation may in turn have activated positive metacognitive beliefs about the value of reviewing the event in order to reach a resolution. According to these theories, metacognitive beliefs about reviewing distressing events may therefore be best be conceptualized as a transdiagnostic factor which is activated in response to the individuals' idiosyncratic fears. In other words, individuals across a range of anxiety and mood disorders may hold beliefs that it is valuable and important to review distressing events when they occur. However, the specific events that trigger distress are expected to vary across disorders and endorsement of metacognitive beliefs would therefore only be expected in situations that the individual considers particularly distressing. Of course, at this stage this suggestion is largely conjectural and future studies may wish to test this assumption by examining metacognitive beliefs across a range of distressing situations.

The final set of findings from the current studies involved participants' perceptions of performance on a standardized speech task. Consistent with prior research, the results of Study 1 suggested that relative to both anxious and healthy control participants, individuals with SAD tended to rate their performance more poorly and less accurately (compared to objective observers). As has been found in previous studies (e.g., Abbott & Rapee, 2004; Brozovich & Heimberg, 2011), it was expected that as a result of PEP, participants with SAD would rate their performance more negatively over time while the control participants would not show this pattern. Contrary to predictions, results from Study 1 indicated that overall performance ratings improved over time for all participants, regardless of diagnostic status. Although improvements observed at the 1-day follow-up were maintained at the 4-day follow-up, perceptions of performance began to decline again by the 7-day assessment.

When positive and negative aspects of performance were evaluated separately, the findings suggested that individuals with SAD initially rated their performance less positively relative to both control groups, but that these appraisals improved by the day-1 follow-up assessment. For negative items, participants across all groups reported less negative perceptions of performance over time. However, in addition to the main effect of time, an interesting trend emerged in the data. These results indicated that perceptions of negative aspects of performance tended to remain fairly stable over time for the SAD group, whereas both control groups showed improvements by the 1-day follow-up (these data should be interpreted with caution as they did not reach statistical significance). Although prior studies have generally found that perceptions of performance tend to become worse over time, and that this is unique to social anxiety, there have been some findings to suggest this is not always the case (Cody & Teachman, 2010). These discrepant findings may be due to methodological differences across studies. For example, Cody and Teachman (2011) provided false feedback to participants and assessed how their recollections for this feedback changed over time, which was not done in the current studies. Furthermore, few studies have examined positively and negatively valenced items separately, and the results from Study 1 suggest that there are clear differences in how positive versus negative items are recalled by individuals with SAD and that this may be an important distinction when assessing perceptions of performance. Our results suggest that negative aspects of performance tended to be particularly stable and remained negatively biased over time for socially anxious individuals. In contrast, positive aspects of performance seemed to improve over time for individuals with SAD, and were indistinguishable from control participants by the 1-day follow-up. These findings are consistent with the predictions of cognitive behavioural models of social anxiety (Clark & Wells, 1995; Hofmann, 2007, Rapee & Heimberg, 1997) which argue

that individuals with SAD have well engrained negative self-schemas. In contrast, positive aspects of performance may be less well developed and therefore more susceptible to influence and change. Future studies should consider both types of performance appraisals in order to develop a better understanding of how these are expressed and experienced by socially anxious individuals.

The results from Study 1 also highlight the importance of assessing PEP and perceptions of performance over longer intervals of time. In this study, we found that individuals with SAD continued to engage in significant PEP in the week following the speech; in fact, no significant declines in PEP were observed over the course of the study. This implies that individuals with SAD were continuing to actively recall and reactivate their memories for the speech task even at the final follow-up whereas control participants seemed to have put the event "behind them". As was reviewed in the introduction, memory is a reconstructive process, and each time a memory is recalled it is stored as a separate memory trace in the brain and is therefore susceptible to manipulation (Moscovitch, 1992; Schacter, 2012). In terms of perceptions of performance, we found that although overall ratings initially improved, they started to decline again by the 7-day follow-up. Given that socially anxious individuals were continuing to engage in PEP, thereby reactivating their memories for this event, it seems plausible that additional changes in perceptions could have occurred given more time. To our knowledge, no studies have evaluated PEP or performance for more than a one-week period, and future studies are needed to assess these variables over longer periods of time to determine if any group differences emerge at longer intervals.

Perceptions of performance immediately after the speech task were found to be a significant mediator of the relationship between diagnostic group status and PEP in the days

following the task, indicating that socially anxious individuals' negative evaluations of their performance in the immediate aftermath of a social task subsequently cause them to ruminate about their performance. Although similar findings have been reported previously (e.g., Chen, Rapee, & Abbott, 2013), the present study was the first to demonstrate that such mediation occurs exclusively for individuals with a diagnosis of SAD and not for either healthy or anxious controls. Interestingly, Study 1 showed that participants' performance was rated equally well across all diagnostic groups by objective observers. Therefore, consistent with cognitive models (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997), it is socially anxious individuals' inaccurate perceptions, rather than actual performance, which leads them to engage in maladaptive thinking about social events.

In Study 2, we hypothesized that socially anxious participants who were instructed to review their speech repeatedly in their minds would report increasingly worse perceptions of their performance relative to those who repeatedly reviewed the socially-irrelevant task (and only reviewed the speech once). Contrary to expectations, all participants – irrespective of the condition to which they were assigned – demonstrated improved ratings of their speech performance following the recall period. A possible reason for these unexpected findings may be that all participants engaged in PEP about the speech and word definition tasks regardless of which condition they were in. Indeed, in designing the study, we intended to simulate naturalistic PEP by having participants simply review the tasks in their mind rather than disrupting this process by having them write down their thoughts. However, this design provided less than optimal structure and experimental control, while providing participants the opportunity to violate experimental instructions by simply thinking about anything they wished. If this is the case and we assume that all participants engaged at least in some repeated recollection of the

speech task during the recall period, it is of interest to consider why performance ratings might have improved.

One possibility for the improved performance ratings observed in Study 2 comes from recent theories on the nature of constructive versus unconstructive styles of thinking (Watkins, 2008). Constructive styles are characterized by concrete, specific and process-focused thinking whereas unconstructive styles are characterized by abstract, general and evaluative thinking. Research in the depression literature has shown that depressed clients are more likely to engage in abstract-evaluative rumination compared to recovered-depressed and never-depressed individuals (Watkins & Moulds, 2005). Furthermore, when depressed individuals are instructed to engage in abstract-evaluative thinking, they report higher ratings of depressed mood, over-general autobiographical memory, increasingly negative views of the self, and impaired problem solving (Watkins & Moulds, 2005; Rimes & Watkins, 2005; Watkins & Teasdale, 2001, 2004). In contrast, these studies have found that depressed individuals who are instructed to engage in concrete-experiential thought do not exhibit the same negative effects. Similar findings have also emerged in relation to negative thought in the context of social anxiety. Vassilopoulos (2008) had high and low socially anxious individuals engage in an imaginal exercise where they either adopted an abstract-analytical or a concrete-experiential thinking style. The results indicated that socially anxious individuals in the concrete-experiential condition reported a decrease in anxious mood and an increase in positive thoughts relative to the abstract-analytical condition. More recently, Makkar and Grisham (2012) found that their structured, lab-based induction of PEP resulted in positive changes in cognition and behaviour amongst participants high on social anxiety. It is therefore possible that the structured design of the PEP induction in Study 2, unintentionally elicited a form of constructive repetitive thought by encouraging engagement in

concrete, rather than abstract, recall of the task, thereby improving participants' perceptions of performance.

A second possibility for the improved performance ratings observed in Study 2 comes from recent studies which have shown that socially anxious individuals may benefit from using distraction to disrupt the negative outcomes associated with post-event processing. For example, Kocovski and colleagues (2011) found that, in comparison to a guided rumination condition, socially anxious undergraduate students in a distraction condition experienced more positive thoughts following a speech task. Similar findings have been reported by Wong and Moulds (2009) in a student sample and by Rowa et al., (2013) in a clinical sample, suggesting some benefit to engaging in distraction. Although we did not use distraction as our control condition in Study 2 per se, we were surprised that repeatedly reviewing the word definition task did not differentially benefit socially anxious participants relative to those assigned to review their speech performance, at least by virtue of preventing them from engaging in socially-relevant PEP. Unlike distraction however, our control condition was specifically designed to induce concerns about failing to achieve expected standards and elicit heightened negative affect even in the absence of public social evaluation. Given that all participants had improved perceptions of performance following the recall trials, it is also possible that the PEP instructions used in the current study did not adequately mimic PEP as it unfolds following real-world social events. Although participants in this study were permitted to determine the length of each recall trial, the experimenter provided instructions guiding the start of the next trial. It is possible that these instructions and experimenter involvement disrupted the natural process of PEP. Rowa et al. (2013) have argued that naturalistic PEP may be difficult to induce experimentally in a lab-based task such as the one used in Study 2. If we assume – as Studies 1 and 2 suggest – that socially

anxious individuals hold metacognitive beliefs about the value of engaging in PEP, then perhaps this thought process must be motivated by the activation of such beliefs rather than imposed externally by an experimenter. It is also possible that one particularly distressing element of such a thought process is the individuals' perception that these thoughts are intrusive and uncontrollable. Such negative metacognitive beliefs are identified by the S-REF model outlined in the introduction although were not the focus of the current work. Future studies are needed to explore the differences between intrinsically versus naturally-occurring PEP and to understand the conditions under which PEP is particularly harmful.

In summary, the results of the current study appear to support some, but not all, aspects of the proposed theoretical framework. In terms of certainty, it does appear that individuals with SAD experience greater uncertainty about their performance immediately after the event; however, this in turn does not appear to motivate them to engage in PEP in order to resolve these feelings. On the other hand, socially anxious individuals were found to hold more positive metacognitive beliefs about the benefits of engaging in PEP and these beliefs were found to uniquely predict engagement in perseverative thinking following a socially distressing event. Similarly, individuals with SAD were more critical of their own performance, and these negative perceptions led them to engage in perseverative thinking about the social task. Contrary to predictions, engaging in PEP about a socially distressing event did not seem to worsen perceptions of performance or impact feelings of certainty. A summary of the significant and non-significant findings are graphically represented in Figure 16.

The results of these studies have important implications for the treatment of SAD. Current cognitive-behavioural treatments for social anxiety focus on identifying and challenging

negative self-perceptions using techniques such as disputing negative automatic thoughts, behavioural experiments and in vivo exposure exercises. Recent evidence suggests that such protocols can be enhanced by incorporating additional cognitive and behavioural strategies. For example, Rapee, Gaston and Abbott (2009) found that enhancing standard CBT with additional treatment techniques (e.g., elimination of safety behaviours, provision of performance feedback, attention retraining) resulted in more favourable outcomes, including less anxiety during a speech task, less negative self-perceptions, and reductions in how costly negative evaluation was perceived to be. There is growing support for the use of metacognitive based treatments for a wide range of psychological disorders, including depression, GAD, OCD and PTSD (e.g., Fisher & Wells, 2007; Hans, 2009; Wells, 2013; Wells & King, 2006; Wells, Welford, et al., 2008)

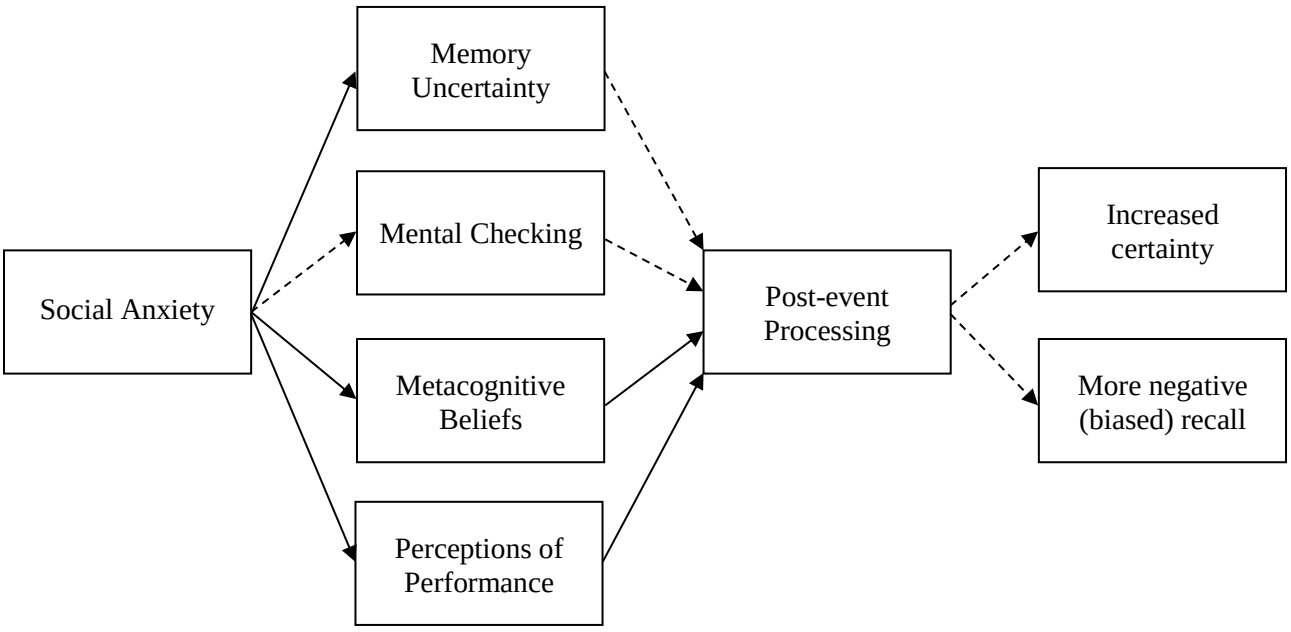

Figure 16. The proposed theoretical framework revisited based on results from the current studies. Solid lines indicate the relationships that were supported, while dotted lines indicate the relationships that were not supported by the current investigation.

and some preliminary evidence that such interventions may also be effective for SAD (Wells & Papageorgiou, 2001). Our findings suggest that positive metacognitive beliefs are held by individuals with SAD and motivate engagement in maladaptive thought patterns. The inclusion of intervention techniques aimed at helping socially anxious clients to identify and challenge such beliefs may therefore further enhance treatment protocols and improve outcomes. For example, individuals may learn to identify their perceived advantages to engaging in PEP; cognitive restructuring techniques can then be used to help evaluate and challenge such beliefs. Relatedly, given that a majority of participants in Study 2 endorsed disadvantages to engaging in PEP, these should be highlighted in treatment to help clients recognize the harmful effects of negative rumination. Furthermore, standard CBT protocols instruct participants to discontinue engagement in PEP by challenging the negative content of such thoughts. However, these findings suggest that helping clients identify the factors which maintain such thinking patterns may be a useful intervention. Further research is needed to examine whether such interventions are successful at reducing PEP and improving treatment outcomes in cognitive behavioural treatments.

The results from these studies also provided evidence that individuals with SAD perceive their performance more negatively than objective observers and this leads them to engage in negative perseverative thinking. This supports cognitive behavioural models (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997) that individuals with social anxiety have biased perceptions of performance rather than objective performance deficits and lends support to interventions which seek to modify negative self-perceptions (e.g., thought records, behavioural experiments). Additionally, these findings provide evidence for the use of video feedback interventions since socially anxious individuals did not perform objectively worse than

control participants but rather – inaccurately – perceived their performance to be more negative than it was (Orr & Moscovitch, 2010; Rodebaugh & Rapee, 2005).

A number of limitations should be considered when interpreting the findings from these studies. First, Studies 1 and 2 were intentionally designed to evaluate the constructs proposed by the theoretical framework following a *standardized* speech task in the lab. However, the use of such a controlled, lab-based task may make the findings more difficult to generalize to real world situations. More specifically, a speech task completed as part of a research study is likely to be less personally relevant and therefore less threatening than speech tasks encountered in participants' daily lives (e.g., in a work or classroom setting) since the consequences of negative evaluation are less significant (e.g., there is no threat of job loss). Similarly, during the informed consent procedure participants were made aware that all of the data gathered over the course of the study would be kept confidential and that their names would not be associated with any of the information provided or their performance on the tasks. Although a necessary and vital part of ethically responsible research, such anonymity may have provided participants with a sense of security that poor performance would have few real-world consequences and the task may therefore have been perceived as less threatening. Although socially anxious participants in both studies reported moderate levels of anxiety in response to the speech task that are comparable to previous studies utilizing similar designs (Cody & Teachman, 2010; Laposa & Rector, 2011; Rowa et al., 2013), it is possible that a more novel research methodology may have produced a different pattern of results. For example, future studies may consider using deception to mislead participants into believing that their performance would be made public to induce a more personally-relevant social threat and observe the impact of such a manipulation on variables of interest.

The content of the speech task used in Studies 1 and 2 may have similarly impacted research findings. Controversial topics were selected in order to increase the threat and ambiguity of the task as participants were not made aware of the researchers' personal opinions on the topics and had no way of knowing whether they were offending the observers (especially given that the audience member maintained a neutral demeanor throughout the speech). Research has demonstrated that socially anxious individuals have a tendency to limit the amount and depth of self-disclosures they provide (Orr, 2013) which would have been difficult to do given the nature of this task. Nevertheless, future studies might consider a methodology in which participants are led to believe that the observer holds the opposite point of view which may increase the sense that participants have committed a social blunder and may therefore differentially impact PEP, metacognitive beliefs, certainty, and performance appraisals.

Furthermore, both Studies 1 and 2 used a speech task, which was chosen given that public speaking is a common fear in SAD and studies have more consistently demonstrated the presence of PEP following speech relative to interaction tasks (e.g., Kocovski & Rector, 2007; Makkar & Grisham, 2011a). However, a number of important differences exist between performance and interaction situations that should be considered when interpreting the results. First, performance tasks such as the one used in the current studies are inherently more evaluative, and participants were explicitly informed that their performance would be evaluated by objective observers. Furthermore, it has been argued that performance tasks are more ambiguous and therefore contain a greater degree of uncertainty, as participants receive minimal feedback and therefore have less available information to gage how they are doing (Makkar & Grisham, 2011a). This fact was further emphasized in the current study by having experimenters maintain a neutral demeanor throughout the duration of the speech task. As was reviewed in the

introduction, individuals with social anxiety tend to interpret neutral information in a negatively biased manner (e.g., Amir, Foa, & Coles, 1998; Hertel, Brozovich, Joorman, & Gotlib, 2008). Each of these factors should have increased negative evaluative concerns among socially anxious individuals, thereby increasing the propensity to PEP. In contrast, others have argued that interpersonal interactions may be particularly challenging for socially anxious individuals as they necessitate continued bi-directional interaction (Fehm et al., 2007), are inherently less structured (Voncken & Bögels, 2008), and require more complex interpersonal social behaviour (Voncken & Bögels, 2008). Furthermore, some studies have found that socially anxious individuals are less skillful in their social interactions and may therefore be perceived more negatively by interaction partners (Alden & Wallace, 1995; Creed & Funder, 1998; Meleshko & Alden, 1993; Thompson & Rapee, 2002). One of the contents of PEP includes others' reactions, and socially anxious individuals may dwell on what is said or done by evaluative others. The audience observer was included in Studies 1 and 2 specifically for this reason – i.e., so that participants would have information of this type to process. However, in the current design, the audience member simply listened and did not speak or provide any verbal or nonverbal feedback. Participants therefore had less material of this type to engage with during PEP. An interaction situation would naturally include this type of social information. Given these important differences between performance and interaction situations, further research is needed to determine whether the observed findings could be replicated and applied to interaction scenarios, less structured tasks, or more naturalistic performance situations.

Further, although the hypothesized role of certainty in predicting PEP was not supported, the findings from Study 1 do suggest that relative to healthy and anxious controls, individuals with SAD do experience greater feelings of uncertainty immediately after a social performance

which are maintained over time. Taken together with their more negative overall self-perceptions, this may indicate that although socially anxious individuals have a hunch that they performed poorly, they may not be fully committed to this perspective and these perceptions may therefore be particularly amenable to modification. In the current study, individuals with SAD reported consistent certainty ratings for up to one week post-speech; although it is not clear if such ratings would be maintained over longer periods. It would be interesting for future studies to examine whether there is an optimal "window" of time following a social exposure during which participants are at least somewhat uncertain about their performance and therefore more open to alternative, and less biased, perspectives.

Another limitation of Study 1 is that participants in the anxious control group reported fewer symptoms of depression, stress and anxiety as measured by the DASS. The primary analyses in this study were replicated while statistically controlling for depression, which was considered particularly important given the similarities between PEP and depressive rumination. Although depression was significantly related to some of the constructs of interest, accounting for depression did not result in any meaningful differences in the interpretation of results. However, it has been argued that attempting to artificially "remove" the effects of a conceptually related phenomenon such as depression is inappropriate and removes meaningful variance from the constructs being evaluated (Miller & Chapman, 2001). As a result, these analyses were not emphasized in the current work, and although they do provide some evidence that the obtained findings are likely not attributable solely to depression, this possibility cannot be entirely ruled out. Future studies wishing to explore the unique impacts of social anxiety versus depression would need to recruit "pure" samples of participants who only meet diagnostic criteria for one of

these disorders. Including a depression, rather than an anxiety control group might be of particular interest.

The anxious control group was included in Study 1 in order to ensure that obtained results could be attributed specifically to social, rather than more general anxiety psychopathology. Unexpectedly, individuals in the anxious control group were more likely to report taking psychotropic medications. In combination with the findings that they endorsed fewer symptoms of depression, stress and anxiety on the DASS, it is plausible that the symptoms in this group of individuals were less clinically severe due to the effects of medication. The current studies did not assess for overall distress or symptom severity, although future studies comparing clinical groups of participants may wish to include such a measure.

Another limitation in Study 1 was the composition of the anxious control group itself, which consisted of individuals with heterogeneous anxiety disorder diagnoses. The inclusion of a range of anxiety disorders in this group may have masked potentially important group differences. For example, the presence of metacognitive beliefs have been well established in some disorders (e.g., GAD, OCD; Gwilliam et al., 2004; Myers & Wells, 2005; Wells & Carter, 2001) but are not as well understood in others (e.g., panic disorder, specific phobia). It is therefore possible that combining these diverse symptom presentations into a single anxiety group obscured potentially meaningful differences amongst participants. Relatedly, the inability to tolerate feelings of uncertainty has been identified as particularly characteristic of individuals with GAD (e.g., Koerner & Dugas, 2008; van der Heiden et al., 2010). Although in the current studies, we were interested in evaluating feelings of certainty, rather than an intolerance for uncertainty, these are arguably related constructs. It is possible therefore that some individuals in the anxious control group experienced more difficulty tolerating uncertainty and this could have

impacted the results. However, recent research has found that despite the fact that the construct of intolerance of uncertainty originated in the GAD literature, it appears to be pervasive across anxiety disorders, including social anxiety (Carleton et al., 2012; McEvoy & Mahoney, 2011; Mahoney & McEvoy, 2012). Given these findings, it is reasonable to assume that individuals in both the SAD and anxious controls groups experienced some difficulty tolerating feelings of uncertainty in the context of the current studies. Given that intolerance of uncertainty is emerging as an important construct across anxiety disorders, future studies should explicitly focus on understanding how this variable might impact feelings of certainty following social events, metacognitive beliefs, perceptions of performance and PEP.[13]

The MACS and the MACS-PS were developed for the purposes of the current research. The measures were designed to enable a brief assessment of the constructs of interest, and were not intended to be comprehensive measures of metacognitive beliefs, memory uncertainty, or mental checking. Although the Pilot Study was designed to provide initial psychometric validation of the scale, this was a preliminary investigation, and additional validation is required. Furthermore, the MACS-PS administered in Studies 1 and 2 was a slightly modified version of the questionnaire which had been validated in the Pilot Study. The factor structure of the MACS-PS has not yet been validated, as the sample sizes in these studies were not large enough to support a factor analytic data analysis strategy. Further research is needed to increase confidence in the validity of this measure.

Relatedly, the PEPQ-R was selected to assess PEP in Study 1 because its psychometric properties have been well documented in both clinical and analogue samples (Makkar & Grisham, 2011a; McEvoy & Kinsep, 2006; Rachman et al., 2000) and it provides a general

[13] It should be noted that Study 2 did include the Intolerance of Uncertainty scale (Buhr & Dugas, 2002). However, the socially-relevant and socially-irrelevant review conditions did not differ on this measure and it was therefore not included in the analyses.

evaluation of the frequency, intrusiveness, and persistence of perseverative thought following a social event. However, one of the limitations of the PEPQ-R is that it does not assess the content or valence of thoughts as has been done in other studies (Dannahy & Stopa, 2007; Kocovski, MacKenzie, & Rector, 2011) and it is therefore impossible to know what exactly participants were thinking about or processing and how that may have differed across diagnostic groups or changed over time. In order to continue enhancing our understanding of the factors that maintain PEP, further research in understanding its content is warranted.

Finally, the current studies focused primarily on the impact of positive metacognitive beliefs on PEP. However, the S-REF model of affective disorders implicates both *positive* and *negative* metacognitive beliefs on engagement in the persistence of negative thinking (Matthews & Wells, 2004; Wells, 2009; Wells & Matthews, 1994, 1996). Proponents of these models argue that individuals with emotional disorders hold positive metacognitive beliefs, such as the ones assessed in the current studies, in which they view engagement in repetitive negative thinking as beneficial. In addition to positive beliefs however, they also hold negative metacognitive beliefs which lead them to believe that engaging in negative thinking is uncontrollable, intrusive, dangerous, and harmful. As a result, they make unsuccessful attempts to control or suppress their thinking, which only serves to maintain maladaptive cognitive patterns. Indeed, qualitative data from Study 2 suggested that most individuals with elevated social anxiety symptoms spontaneously reported disadvantages to thinking about the speech task. Consistent with this finding, results from a recent study found evidence that negative metacognitive beliefs mediated the relationship between neuroticism and engagement in repetitive negative thought in a sample of participants with an anxiety disorder diagnosis (McEvoy & Mahoney, 2013). These results nicely compliment the current set of findings, and suggest that both positive and negative

metacognitive beliefs may contribute to the persistence of PEP. Existing measures of PEP, including the PEPQ-R used in the current studies, include items assessing the intrusiveness of thoughts about past social events as well as the attempts made to resist thinking about these events. Given that individuals with SAD consistently endorse these items more strongly than anxious and healthy controls, it is reasonable to assume that they find thoughts about past social events difficult to control and make attempts to push them out of their minds. It is therefore likely that in the aftermath of a socially distressing event, individuals may initially engage in PEP because of positive beliefs about its utility, but the persistence of PEP may continue as a result of beliefs that this form of thought is out of their control. The results of the current studies and existing literature support this idea, although it remains an empirical question in need of further investigation.

In sum, despite their limitations, these studies are informative in helping to understand the cognitive processes which may function to maintain negative thinking patterns in SAD. These findings provide evidence that socially anxious individuals' biased evaluations of performance, in combination with beliefs about the value of reviewing past social events, leads them to engage in PEP. This provides evidence that it may be helpful to challenge negative beliefs about *thinking*, rather than simply focusing on the negative content of thoughts. In contrast, although individuals with social anxiety seemed to feel less certain about their performance on a social task, these feelings of uncertainty did not appear to motivate a desire to mentally "check" their memories or engage in PEP. Additional research is needed to more fully understand the role that metacognitive beliefs and feelings of uncertainty play in the development and maintenance of PEP as well as the intervention strategies that may help to reduce this negative thinking pattern.

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Appendix 1

SOCIAL PHOBIA INVENTORY (SPIN)

Please check how much the following problems have bothered you during the past week. Mark only one box for each problem, and be sure to answer all items.

		Not at all	A little bit	Somewhat	Very much	Extremely
1.	I am afraid of people in authority.	☐	☐	☐	☐	☐
2.	I am bothered by blushing in front of people.	☐	☐	☐	☐	☐
3.	Parties and social events scare me.	☐	☐	☐	☐	☐
4.	I avoid talking to people I don't know.	☐	☐	☐	☐	☐
5.	Being criticized scares me a lot.	☐	☐	☐	☐	☐
6.	Fear of embarrassment causes me to avoid doing things or speaking to people.	☐	☐	☐	☐	☐
7.	Sweating in front of people causes me distress.	☐	☐	☐	☐	☐
8.	I avoid going to parties.	☐	☐	☐	☐	☐
9.	I avoid activities in which I am the centre of attention.	☐	☐	☐	☐	☐
10	Talking to strangers scares me.	☐	☐	☐	☐	☐
11	I avoid having to give speeches.	☐	☐	☐	☐	☐
12	I would do anything to avoid being criticized.	☐	☐	☐	☐	☐
13	Heart palpitations bother me when I am around people.	☐	☐	☐	☐	☐
14	I am afraid of doing things when people might be watching.	☐	☐	☐	☐	☐
15	Being embarrassed or looking stupid are among my worst fears.	☐	☐	☐	☐	☐
16	I avoid speaking to anyone in authority.	☐	☐	☐	☐	☐
17	Trembling or shaking in front of others is distressing to me.	☐	☐	☐	☐	☐

Appendix 2

PILOT STUDY METACOGNITION AND CERTAINTY SCALE (MACS)

The following questions ask you to describe the thoughts you have following social situations. A social situation is any situation in which there is at least one other person present who has the potential evaluate you in some way. Some examples of social situations include, but are not limited to, giving a speech in front of an audience, having a conversation, going to a job interview, eating in public, going to a party, going to the gym etc.

0	1	2	3	4	5
Strongly Disagree	**Moderately Disagree**	**Slightly Disagree**	**Slightly Agree**	**Moderately Agree**	**Strongly Agree**

	Item
1.	Repeatedly thinking about social interactions helps me figure out how well I did
2.	Repeatedly thinking about prior social situations helps me figure out how poorly I did
3.	Repeatedly thinking about prior social situations helps me figure out whether I made certain mistakes
4.	Repeatedly thinking about prior social situations helps me remember the details of what happened
5.	I'm usually certain I remember everything important about prior social situations after they happen
6.	The more I think about prior social events, the more I forget important details of what happened
7.	I am often unsure about my performance in social situations
8.	I usually have little confidence in my memory for social situations
9.	I have trouble remembering important aspects of social situations I have been in
10.	I often check my memory following social situations to evaluate how well I did
11.	Repeatedly thinking about a prior social event helps me think about it more clearly
12.	Repeatedly thinking about previous social situations helps me avoid problems in future social encounters
13.	Repeatedly thinking about previous social situations helps me gain new insights
14.	Repeatedly thinking about previous social situations helps me cope with my emotions
15.	Repeatedly thinking about previous social situations helps me prepare for future social events
16.	Repeatedly thinking about previous social situations helps me organize my thoughts about the events
17.	Repeatedly thinking about previous social situations helps me come to terms with how I performed
18.	Repeatedly thinking about previous social situations helps me get things sorted out in my mind
19.	There are advantages to going back and thinking about prior social events
20.	There are disadvantages to going back and thinking about prior social events

Appendix 3

STUDY 1 SPEECH TOPICS

Below is a list of 8 topics that people have different opinions on. There are no right or wrong answers for these issues, but we would like you to provide your opinion. You are welcome to choose as many or as few topics as you would like to talk about. Please try to talk for the full 10 minutes, but if you finish before the 10 minutes are up, just ring the bell provided.

1. Do you agree or disagree with the practice of Euthanasia? (terminating the life of a person or an animal because they are perceived as living an intolerable life). Why or why not?

2. Do you agree or disagree with Canada‘s decision to abolish (eliminate) the death penalty? Why or why not?

3. Do you agree or disagree with censoring material in books, magazines, videos and the internet that certain persons—individuals, groups or government officials—find objectionable or dangerous? Why or why not?

4. Do you agree or disagree with Canada‘s legalization of same-sex marriage? Why or why not?

5. Do you agree or disagree with gun control? (efforts to regulate or control sales of guns). Why or why not?

6. Do you agree or disagree with the practice of cloning and other reproductive technologies (e.g. in vitro fertilization, genetic manipulation of embryos). Why or why not?

7. Do you agree or disagree with using of animals for research purposes. Why or why not?

8. Do you agree or disagree that Marijuana should be legalized in Canada. Why or why not?

Appendix 4

DEPRESSION ANXIETY STRESS SCALE – SHORT VERSION (DASS 21)

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all

1 Applied to me to some degree, or some of the time

2 Applied to me to a considerable degree, or a good part of time

3 Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Appendix 5

PERCEPTION OF SPEECH PERFORMANCE AND CERTAINTY (PSPC)

Please read each question carefully. This measure asks you to provide information about two areas.

Using the Performance scale, assess how **you think you did** in all of the areas listed below.

Using the Certainty scale, please rate how **certain you are of you performance** ratings (e.g., how sure are you that the "content was understandable").

PERFORMANCE RATINGS
0 = Not at all
1 = Slightly
2 = Moderately
3 = Very
4 = Extremely

CERTAINTY RATINGS
0 = Not at all certain
1 = Slightly certain
2 = Moderately certain
3 = Very certain
4 = Extremely certain

		PERFORMANCE					CERTAINTY				
1.	Content was understandable	0	1	2	3	4	0	1	2	3	4
2.	Kept eye contact with audience	0	1	2	3	4	0	1	2	3	4
3.	Stuttered	0	1	2	3	4	0	1	2	3	4
4.	Used sophisticated vocabulary	0	1	2	3	4	0	1	2	3	4
5.	Fidgeted	0	1	2	3	4	0	1	2	3	4
6.	Kept audience interested	0	1	2	3	4	0	1	2	3	4
7.	Seemed to tremble or shake	0	1	2	3	4	0	1	2	3	4
8.	Appeared nervous	0	1	2	3	4	0	1	2	3	4
9.	Face twitched	0	1	2	3	4	0	1	2	3	4
10.	Made a good impression	0	1	2	3	4	0	1	2	3	4
11.	"Um'ed" and "Ah'ed."	0	1	2	3	4	0	1	2	3	4
12.	Had long pauses (more than 5 seconds)	0	1	2	3	4	0	1	2	3	4
13.	Was a good public speaker	0	1	2	3	4	0	1	2	3	4
14.	Sweated	0	1	2	3	4	0	1	2	3	4
15.	Smiled appropriately	0	1	2	3	4	0	1	2	3	4
16.	Appeared confident	0	1	2	3	4	0	1	2	3	4
17.	Made a bad impression	0	1	2	3	4	0	1	2	3	4
18.	Had a clear voice	0	1	2	3	4	0	1	2	3	4
19.	Bored the audience	0	1	2	3	4	0	1	2	3	4
20.	Generally spoke well	0	1	2	3	4	0	1	2	3	4
21.	Blushed	0	1	2	3	4	0	1	2	3	4
22.	Voice quivered	0	1	2	3	4	0	1	2	3	4
23.	Was not convincing	0	1	2	3	4	0	1	2	3	4

Appendix 6

SUBJECTIVE UNITS OF DISTRESS SCALE (SUDS)

This scale is a 0-100 rating scale that allows you to label the amount of distress or anxiety you are experiencing currently. A score of "0" is the least distress possible and a score of "100" is the most distress you can imagine. A score of "50" is a moderate amount of distress/anxiety, and although this level of distress is challenging, it is something you believe you can manage.

1. Using the scale below, please circle how nervous/anxious you are right now.

0	25	50	75	100
No Anxiety	Mild Anxiety	Moderate Anxiety	Severe Anxiety	Extreme Anxiety

Appendix 7

METACOGNITION AND CERTAINTY SCALE – POST-SPEECH VERSION (MACS - PS)

Please use the scale provided to answer the following questions about the speech task you just completed.

0	**1**	**2**	**3**	**4**	**5**
Strongly Disagree	**Moderately Disagree**	**Slightly Disagree**	**Slightly Agree**	**Moderately Agree**	**Strongly Agree**

1. I have trouble remembering important aspects of the speech. [Memory Uncertainty]
2. Thinking about this speech will help me figure out how well I did. [Metaocgnitive Beliefs]
3. Thinking about this speech will help me get new insights into myself. [Metaocgnitive Beliefs]
4. Thinking about this speech will help me remember the details of what happened. [Metaocgnitive Beliefs]
5. Thinking about this speech will help me figure out whether I made certain mistakes. [Metaocgnitive Beliefs]
6. I want to think about the speech so that I can figure out whether certain things happened. (Mental Checking]
7. Thinking about the speech will help me get things sorted out in my mind. [Metaocgnitive Beliefs]
8. I have doubts about my performance on the speech task. [Memory Uncertainty]
9. I'm not sure whether I did well on the speech task. [Memory Uncertainty]
10. Repeatedly thinking about this speech will help me cope. [Metacognitive Beliefs]
11. I need to think about this speech in order to do well next time. [Metaocgnitive Beliefs]
12. I need to think about this speech in order to keep my thoughts organized. [Metaocgnitive Beliefs]
13. I need to think about this speech to avoid problems in the future. [Metaocgnitive Beliefs]
14. I have little confidence in my memory for the speech. [Memory Uncertainty]
15. I'm certain I remember everything important about the speech. [Memory Uncertainty - Reverse scored]
16. Thinking about this speech will allow me to check my memory for how well I did on the task. [Mental Checking]
17. Thinking about the speech will help me come to terms with how I performed. [Metaocgnitive Beliefs]
18. Thinking about this speech will give me an opportunity to go back and check how the audience member reacted. [Mental Checking]
19. Thinking about this speech will help me figure out how poorly I did. [Metaocgnitive Beliefs]
20. There are advantages to going back and thinking about the speech. [Metaocgnitive Beliefs]

Appendix 8

POST EVENT PROCESSING QUESTIONNAIRE – REVISED (PEPQ-R)

Please answer the following questions pertaining to the speech task you completed earlier this week at the University of Waterloo. Please answer by circling the number that best represents how you have felt since the speech.

		0 Not at all	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10 Totally agree**
1.	How much anxiety did you experience?	0	1	2	3	4	5	6	7	8	9	10
2.	After the event was over, did you find yourself thinking about it a lot?	0	1	2	3	4	5	6	7	8	9	10
3.	Did your memories and thoughts about the event keep coming into your head even when you did not wish to think about it again?	0	1	2	3	4	5	6	7	8	9	10
4.	Did the thoughts about the event ever interfere with your concentration?	0	1	2	3	4	5	6	7	8	9	10
5.	Were the thoughts/memories about the event ever welcome to you?	0	1	2	3	4	5	6	7	8	9	10
6.	Did you find it difficult to forget about the event?	0	1	2	3	4	5	6	7	8	9	10
7.	Did you try to resist thinking about the event?	0	1	2	3	4	5	6	7	8	9	10
8.	If you did think about the event, over and over again, did your feelings about the event get worse and worse?	0	1	2	3	4	5	6	7	8	9	10
9.	If you did think about the event, over and over again, did your feelings about the event get better and better?	0	1	2	3	4	5	6	7	8	9	10
10.	While thinking about the event, I viewed it from my point of view.	0	1	2	3	4	5	6	7	8	9	10
11.	While thinking about the event, I viewed it from another person's point of view.	0	1	2	3	4	5	6	7	8	9	10
12.	Did you ever wish that you could turn the clock back and do it again, but do it better?	0	1	2	3	4	5	6	7	8	9	10
13.	As a result of the event, do you now avoid similar events and did this event reinforce a decision to avoid similar situations?	0	1	2	3	4	5	6	7	8	9	10
14.	Did you ever wonder about whether you could have avoided or prevented your behaviour/feelings during the event?	0	1	2	3	4	5	6	7	8	9	10

Appendix 9

STUDY 2 WORD DEFINITION TASK

Below is a list of 24 randomly selected English words. **Your task is to provide <u>accurate definitions</u> for these words. Try to make the definitions as thorough and comprehensive as you can in the 3-minute period.**

Most university students are able to provide correct written definitions for 11-12 words in this amount of time.

Please note, <u>this task is completed privately</u>, and you will not be asked any questions about how you did on this task or to provide your definition to the researchers. It is nevertheless important that you try your best and define as many words as you can.

- Petulant:
- Alacrity:
- Superlative:
- Harangue:
- Capricious:
- Modicum:
- Dissonance:
- Poised:
- Sedulity:
- Communicate:
- Esoteric:
- Idiosyncratic:
- Gregarious:
- Meretricious:
- Abate:
- Dubious:
- Moderate:
- Imperturbability:
- Abysmal:
- Compliment:
- Deliberate:
- Extemporize:
- Debacle:
- Conflagration:

Appendix 10

MOTIVATION QUESTIONNAIRE - SPEECH

1. At this moment, to what extent do you want to review or think about the speech task you completed, including any aspects of your performance, any thoughts, sensations, feelings or observations that came up for you during the task?

0---------10---------20---------30---------40---------50---------60---------70---------80---------90---------100
Not at all Slightly Moderately Very Extremely

2. Please take a few moments to explain why you responded the way you did in the previous answer:

_____

_____

_____

_____

MOTIVATION QUESTIONNAIRE – WORD DEFINITION

1. At this moment, to what extent do you want to review or think about the word definition task you completed, including any aspects of your performance, any thoughts, sensations, feelings or observations that came up for you during the task?

0---------10---------20---------30---------40---------50---------60---------70---------80---------90---------100
Not at all Slightly Moderately Very Extremely

2. Please take a few moments to explain why you responded the way you did in the previous answer:

_____

_____

_____

_____

Appendix 11

POSITIVE AND NEGATIVE AFFECT SCHEDULE (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer (number) in the box next to that word. Indicate to what extent <u>you are feeling this way currently.</u>

Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

- ☐ **(1) interested**
- ☐ **(2) distressed**
- ☐ **(3) excited**
- ☐ **(4) upset**
- ☐ **(5) strong**
- ☐ **(6) guilty**
- ☐ **(7) scared**
- ☐ **(8) hostile**
- ☐ **(9) enthusiastic**
- ☐ **(10) proud**
- ☐ **(11) irritable**
- ☐ **(12) alert**
- ☐ **(13) ashamed**
- ☐ **(14) inspired**
- ☐ **(15) nervous**
- ☐ **(16) determined**
- ☐ **(17) attentive**
- ☐ **(18) jittery**
- ☐ **(19) active**
- ☐ **(20) afraid**