Discerning the Role of Executive Function on Repetitive Negative Thinking in Social Anxiety: Investigation Using Attentional Control Theory

Rachel A. Sluis
B Psych (Hons)
Griffith University, School of Applied Psychology

Submitted as a partial requirement of candidature for Doctor of Philosophy in Clinical Psychology; Griffith University, School of Applied Psychology, Gold Coast, Australia.

I declare that the current document is my original work and does not include material from published sources without proper acknowledgment or material copied from the work of other students.

Submitted: March, 2018

Principal Supervisor: Dr Mark J. Boschen (Griffith University)
Associate Supervisor: Prof David L. Neumann (Griffith University)
Associate Supervisor: Dr Karen Murphy (Griffith University)
Abstract

Cognitive models of social anxiety disorder (SAD) emphasize repetitive negative thinking as a prominent maintaining factor that occurs both before (anticipatory processing) and after (post-event processing) social-evaluative events. While evidence suggests that repetitive negative thinking is a maladaptive process that has damaging cognitive, behavioural, and affective consequences for those with SAD, the cognitive mechanisms thought to underlie ineffective control of attention on these modes of thought was unclear. Cognitive interference theories, such as attentional control theory, propose that high levels of anxiety negatively impact the processing efficiency on tasks that require high cognitive resources. Accordingly, this thesis aimed to elucidate the role of executive functions on repetitive negative thinking in social anxiety by employing a combination of self-report and experimental methodologies with social anxiety analogue samples. Studies 1A and 1B explored the correlational relationships between social anxiety, anticipatory processing and post-event processing, and attentional control, as an initial step prior to conducting experimental studies. Poorer total attentional control was associated with social anxiety in both studies and diminished attentional shifting was associated with increased levels of PEP, but not AP. Mediation modelling suggested that trait anxiety mediated the relationship between attentional shifting and PEP, and positive affect mediated the relationship between total attentional control and PEP. Drawing from attentional control theory, studies 2 and 3, manipulated both anticipatory processing (study 2) and post-event processing (study 3), to examine the underlying executive functions responsible for ineffective control of attention in anxiety (i.e., inhibition and shifting) using the mixed emotional saccade task. Both studies 2 and 3 did not demonstrate an anxiety-related effect on attentional control and were comparable in showing that both AP and PEP appear to have an adaptive component on attentional control for low socially anxious individuals as
indicated by improved task performance. Taken together, these findings highlight that other potential factors may underlie anticipatory and post-event processing in social anxiety, which appear to be complex and interacting. For example, other potential contributing factors that underlie AP and PEP may include the role of motivation, manipulating the cognitive load of the task, self-control strength, and valence of AP and PEP thoughts. However, an examination of these factors was beyond the aim and scope of the current PhD research program and needs to be investigated in future research.
Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Rachel A. Sluis
# Table of Contents

Abstract ............................................................................................................................. ii
Statement of Originality ................................................................................................... iv
List of Tables .................................................................................................................... xi
List of Figures ................................................................................................................. xii
Glossary of Terms and Acronyms ................................................................................. xiii
Acknowledgements ........................................................................................................ xiv
Publications and Conference Presentations .................................................................... xvi
General Introduction ....................................................................................................... 2

CHAPTER 1: REPETITIVE NEGATIVE THINKING IN SOCIAL ANXIETY

DISORDER 1: ANTICIPATORY PROCESSING ........................................................... 4

Notes .................................................................................................................................. 5

Abstract .............................................................................................................................. 7

Introduction ....................................................................................................................... 8

Procedure for Systematic Review ...................................................................................... 9

Repetitive Negative Thinking ............................................................................................ 9

Social Anxiety Disorder ................................................................................................. 11

Cognitive-Behavioural Models of Social Anxiety ............................................................ 12

   Rapee and Heimberg’s (1997) Cognitive-Behavioural Model ........................................ 12


   Comparison of the Models .......................................................................................... 14

Anticipatory Processing and Social Anxiety .................................................................... 14

   Anticipatory Processing as Disorder-Specific or Transdiagnostic .............................. 20

Consequences of Anticipatory Processing ...................................................................... 20
Executive Function and Repetitive Negative Thinking

Anticipatory Processing and Attentional Bias ............................................................. 24
Changes in Anticipatory Processing in Response to Treatment ............................ 25
Limitations of Existing Evidence in Anticipatory Processing ............................... 26
Cognitive Control and Cognitive Performance ......................................................... 28
Conclusions and Directions for Future Research ..................................................... 31
Chapter 1 Conclusion ............................................................................................... 36

Chapter 2: Repetitive Negative Thinking in Social Anxiety Disorder

Disorder 2: Post-Event Processing ............................................................................. 37
Notes .......................................................................................................................... 39
Abstract ...................................................................................................................... 41
Introduction ............................................................................................................... 42
Procedure for Systematic Review ............................................................................. 42
Repetitive Negative Thinking .................................................................................... 43
Cognitive-Behavioural Models of Social Anxiety ...................................................... 44
Post-Event Processing and Social Anxiety ............................................................... 44
  Post-Event Processing in Response to a Social Interaction .................................... 54
  Post-Event Processing in Response to a Speech Performance ............................. 55
  Post-Event Processing as Disorder-Specific or Transdiagnostic ............................ 56
  Changes in Post-Event Processing in Response to Treatment .............................. 57
Causes and Consequences of Post-Event Processing .............................................. 59
  Post-Event Processing and Memory ..................................................................... 59
  Post-Event Processing, Self-Focused Attention and Attention Bias ...................... 60
  Modes of Post-Event Processing .......................................................................... 63
  Post-Event Processing and Imagery ..................................................................... 66
EXECUTIVE FUNCTION AND REPETITIVE NEGATIVE THINKING

Post-Event Processing and Self-Appraisal ................................................................. 67

Adaptive Effects of Post-Event Processing ............................................................... 68

Limitations of Existing Evidence in Post-Event Processing ................................. 69

A Theory of Attentional Control ............................................................................. 71

Conclusions and Future Directions ...................................................................... 73

Chapter 2 Conclusion ............................................................................................. 75

Aims of the Program of Research .......................................................................... 75

CHAPTER 3 (STUDIES 1A AND 1B): ATTENTIONAL CONTROL ASSOCIATED
WITH CORE COGNITIVE SYMPTOMS OF SOCIAL ANXIETY .............................. 77

Abstract ................................................................................................................. 78

Introduction .......................................................................................................... 79

Aims, Overview and Hypotheses ........................................................................... 80

Method .................................................................................................................... 81

Participants ........................................................................................................... 81

Measures ............................................................................................................. 82

Procedure ............................................................................................................. 84

Results ................................................................................................................... 84

Study 1A ............................................................................................................... 84

Study 1B ............................................................................................................... 85

Mediation Analyses of PEP and Attentional Shifting with Trait Anxiety .......... 87

Mediation Analyses of PEP and Attentional Control with Positive Affect  .... 88

Discussion ............................................................................................................. 90

Implications ......................................................................................................... 93

Limitations and Future Directions ....................................................................... 93
List of Tables

Table 1.1. Characteristics of anticipatory processing in social anxiety..............15
Table 2.1. Characteristics of post-event processing in social anxiety............45
Table 2.2. Causes and consequences of post-event processing in social anxiety....48
Table 3.1. Means, standard deviations, and range of scores for the primary measures (N = 50)........................................................................................................84
Table 3.2. Correlations between SAD, AP, and attentional control (N = 43).......85
Table 3.3. Means, standard deviations, and range of scores for the primary measures (N = 50)........................................................................................................86
Table 3.4. Correlations between SAD, AP, and attentional control (N = 43).......86
Table 4.1. Means and standard deviations for each measure for both high and low social anxiety groups.................................................................106
Table 5.1. Means and standard deviations for each measure for both high and low social anxiety groups.................................................................130
List of Figures

Figure 1. Overview of the three studies and research questions for the current thesis…1

Figure 3.1. Mediation model for trait anxiety as a mediator between attentional shifting and post-event processing with standardised regression coefficients (*$p < .05$, **$p < .001$). The indirect effect ($ab$) was significant at the 95% confidence interval (lower limit = -3.3813, upper limit = -.3154).…………………………………………………………………………..88

Figure 3.2. Mediation model for positive affect as a mediator between attentional control and post-event processing with standardised regression coefficients (*$p < .05$, **$p < .01$). The indirect effect ($ab$) was significant at the 95% confidence interval (lower limit = -.8705, upper limit = -.0648)…………………………………………………………………………...89

Figure 4.1. Antisaccade and pro-saccade experimental tasks (mixed task block requires randomly switching between tasks). Inter-trial interval varied randomly between 750-1250 ms……………………………………………………………………………………...109

Figure 4.2. Mean correct saccade latencies (with standard errors) of task by group in the anticipate and control conditions………………………………………………………………………...……112

Figure 4.3. Mean percentage of errors (with standard errors) of task by group in the anticipate and control conditions…………………………………………………………………….………..113

Figure 4.4. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition………………………………………………………………………………114

Figure 4.5. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition for switch versus repeat trials in the mixed-task block…………………………………………………………………………….…….116

Figure 5.1. Mean correct saccade latencies (with standard errors) of task by group in the PEP and control conditions………………………………………………………………………...……135

Figure 5.2. Mean percentage of errors (with standard errors) of task by group in the PEP and control conditions…………………………………………………………………….………..137

Figure 5.3. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition………………………………………………………………………………138
# Glossary of Terms and Acronyms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAD</td>
<td>Social Anxiety Disorder</td>
</tr>
<tr>
<td>RNT</td>
<td>Repetitive Negative Thinking</td>
</tr>
<tr>
<td>AP</td>
<td>Anticipatory Processing</td>
</tr>
<tr>
<td>PEP</td>
<td>Post-Event Processing</td>
</tr>
<tr>
<td>GAD</td>
<td>Generalised Anxiety Disorder</td>
</tr>
<tr>
<td>OCD</td>
<td>Obsessive Compulsive Disorder</td>
</tr>
<tr>
<td>ATT</td>
<td>Attention Training</td>
</tr>
<tr>
<td>ICT</td>
<td>Individual Cognitive Therapy</td>
</tr>
<tr>
<td>CBT</td>
<td>Cognitive Behavioural Therapy</td>
</tr>
<tr>
<td>CBGT</td>
<td>Cognitive Behavioural Group Therapy</td>
</tr>
<tr>
<td>HSA</td>
<td>High Socially Anxious</td>
</tr>
<tr>
<td>LSA</td>
<td>Low Socially Anxious</td>
</tr>
</tbody>
</table>
Acknowledgements

First and foremost, I would like to express my sincere gratitude to my supervisor, Dr Mark Boschen. Mark’s wealth of knowledge, direction and guidance, ongoing encouragement and support, and ability to patiently listen to my own repetitive negative thought processes throughout this journey, have been a valuable contribution to the completion of this PhD thesis. I am grateful for the thought-provoking and inspiring discussions which have aided in my transition from student to colleague within the academic community.

I would also like to thank my associate supervisors, Professor David Neumann and Dr Karen Murphy, for their ongoing availability and invaluable guidance on this research project. I was extremely fortunate to be blessed with a supervisory team whose combined wealth of knowledge and expertise is second to none.

I would like to thank my parents, Marianne and Garry, and my partner, Clint, for their unwavering support throughout this entire journey. For always encouraging and believing in me, and for knowing ‘just what to say at just the right moment’. I would also like to thank my beautiful daughter, Savannah, who has never known life without ‘mummy studying’. Savannah’s understanding and patience is wise beyond her years, and her timely ability to flash a smile with a warm hug brought me back to reality just when I needed it most.

I would also like to thank each of my PhD colleagues who provided me with many interesting and stimulating discussions, both PhD and non-PhD related, which aided in keeping my work-life balance on track.
Lastly, I would also like to thank all of the students who participated in my studies and so willingly and graciously shared their precious time, even if it meant delivering an anxiety-provoking speech!
Publications and Conference Presentations

Included in this thesis are papers in *Chapters 1, 2, 3, 4 and 5* which are co-authored with other researchers. My contribution to each co-authored paper is outlined at the front of the relevant chapter. The bibliographic details (if published or accepted for publication)/status (if prepared or submitted for publication) for these papers including all authors, are:


(Textrum Publishing permits the use of The Contribution for inclusion in a thesis or dissertation as long as full acknowledgement of The Contribution’s published source is given.)


Repetitive Negative Thinking in Social Anxiety Disorder 2: Post-Event Processing. *Psychopathology Review, 4*, 263-289

(Textrum Publishing permits the use of The Contribution for inclusion in a thesis or dissertation as long as full acknowledgement of The Contribution’s published source is given.)


Attentional control associated with core cognitive symptoms of social anxiety.


(Elsevier Publishing permits the use of The Contribution for inclusion in a thesis or dissertation as long as full acknowledgement of The Contribution’s published source is given.)


(Signed) (Date): 17/02/2018
Rachel A. Sluis

(Countersigned) (Date): 17/02/2018
Primary Supervisor: Mark J. Boschen

(Countersigned) (Date): 17/02/2018
Associate Supervisor: David L. Neumann

(Countersigned) (Date): 17/02/2018
Associate Supervisor: Karen Murphy
### Discerning the Role of Executive Function on Repetitive Negative Thinking in Social Anxiety: Investigation Using Attentional Control Theory

<table>
<thead>
<tr>
<th>Studies 1A and 1B (Chapter 3)</th>
<th>Study 2 (Chapter 4)</th>
<th>Study 3 (Chapter 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong> To examine the relationships between anticipatory processing and post-event processing with dimensions of self-reported attentional control</td>
<td><strong>Purpose:</strong> To examine attentional control using the mixed saccade paradigm in high and low socially anxious individuals that engaged in either anticipatory processing prior to the threat of a speech task or a control condition</td>
<td><strong>Purpose:</strong> To examine attentional control using the mixed saccade paradigm in high and low socially anxious individuals that engaged in either anticipatory processing following a speech task or a control condition</td>
</tr>
<tr>
<td><strong>Sample:</strong> First year undergraduate students scoring higher than non-anxious samples on social anxiety</td>
<td><strong>Sample:</strong> First year undergraduate students scoring high and low on social anxiety</td>
<td><strong>Sample:</strong> First year undergraduate students scoring high and low on social anxiety</td>
</tr>
<tr>
<td><strong>Analysis:</strong> Correlational and mediation analyses</td>
<td><strong>Analysis:</strong> Mixed Factorial ANCOVAs</td>
<td><strong>Analysis:</strong> Mixed Factorial ANCOVAs</td>
</tr>
</tbody>
</table>

**Research Question 1:** Is reduced attentional control associated with higher levels of anticipatory processing and post-event processing in social anxiety?

**Research Question 2:** Does trait anxiety and positive and negative affect explain the relationship between attentional control and repetitive negative thinking processes in social anxiety?

**Research Question 1:** Do high socially anxious individuals exhibit greater impairment on executive functioning than low socially anxious individuals?

**Research Question 2:** Do high socially anxious who anticipate exhibit greater impairment on executive functioning than high socially anxious individuals who don’t anticipate or low socially anxious individuals in either the anticipate or control condition?

**Research Question 1:** Do high socially anxious individuals exhibit greater impairment on executive functioning than low socially anxious individuals?

**Research Question 2:** Do high socially anxious who engage in post-event processing exhibit greater impairment on executive functioning than high socially anxious individuals who don’t engage in post-event processing or low socially anxious individuals in either the post-event or control condition?

---

*Figure 1. Overview of the three studies and research questions for the current thesis.*
General Introduction

This thesis examines attentional control processes that underlie repetitive negative thinking (RNT) in social anxiety (i.e., anticipatory processing and post-event processing). Cognitive models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997) emphasize RNT as a central maintaining factor; however there was a paucity of research examining the cognitive functions thought to be responsible for these perseverative modes of thought. Taking into account this lacuna in the literature, this thesis applied attentional control theory (Eysenck et al., 2007) to the phenomena of RNT in social anxiety in an endeavour to better understand the impact of these underlying cognitive mechanisms on these modes of thinking. Attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007) is a framework for understanding attentional control in the context of anxiety and cognitive performance, and assumes that anxiety impairs attentional control. Attentional control theory aligns with the main aim of the current program of research and is the framework used to examine the underlying cognitive processes of anticipatory processing (AP) and post-event processing (PEP).

Initially, a comprehensive review of the literature for both AP and PEP is presented. Accordingly, both reviews incorporate discussion of attentional control theory within the context of social anxiety in order to provide the rationale for research undertaken in this thesis. As a result, the studies included in this program of research incorporate both subjective (i.e., self-report) and objective (i.e., behavioural) paradigms employing social anxiety analogue samples to examine attentional control within the context of social anxiety, and in particular RNT processes (i.e., AP and PEP). Finally, discussion of the overall findings and implications of the research are presented, incorporating critical appraisal of developments and limitations.
The following chapters from 1 through to 5 comprise the papers prepared throughout this thesis and are consistent with the published and submitted versions. Additionally, the references have all been removed and combined into a single reference section at the end of the thesis to assist with ease of reading. Questionnaires used in the studies are not included in an appendix at the end of the thesis due to copyright.
CHAPTER 1: REPETITIVE NEGATIVE THINKING IN SOCIAL ANXIETY

DISORDER 1: ANTICIPATORY PROCESSING

Abstract .................................................................................................................................. 7
Introduction ............................................................................................................................ 8
Procedure for Systematic Review .......................................................................................... 9
Repetitive Negative Thinking ............................................................................................... 9
Social Anxiety Disorder ....................................................................................................... 11
Cognitive-Behavioural Models of Social Anxiety ............................................................... 12
  Rapee and Heimberg’s (1997) Cognitive-Behavioural Model ........................................ 12
  Comparison of the Models ......................................................................................... 14
Anticipatory Processing and Social Anxiety ...................................................................... 14
Table 1.1 ............................................................................................................................ 15
  Anticipatory Processing as Disorder-Specific or Transdiagnostic ................................ 20
Consequences of Anticipatory Processing ....................................................................... 20
  Anticipatory Processing and Attentional Bias ........................................................... 24
  Changes in Anticipatory Processing in Response to Treatment ................................ 25
  Limitations of Existing Evidence in Anticipatory Processing ................................... 26
Cognitive Control and Cognitive Performance ............................................................... 28
Conclusions and Directions for Future Research ............................................................ 31
Chapter 1 Conclusion ........................................................................................................ 36
Notes

Paper Published:


_Psychopathology Review, 4_, 244-262.

The candidate is first author on this paper and accepts responsibility of its publication. All co-authors meet the criteria for authorship and take responsibility for their part in the publication. The candidate was responsible for manuscript preparation including systematic review of the literature and writing the manuscript. All co-authors are members of the candidate’s supervisory team and their contribution to the paper was supervisory in nature.

Textrum Publishing permits the use of The Contribution for inclusion in a thesis or dissertation as long as full acknowledgement of The Contribution’s published source is given.

(Signed) (Date): 17/02/2018
Rachel A. Sluis

(Countersigned) (Date): 17/02/2018
Primary Supervisor: Mark J. Boschen

(Countersigned) (Date): 17/02/2018
Associate Supervisor: David L. Neumann
(Countersigned)                (Date): 17/02/2018

Associate Supervisor: Karen Murphy
Abstract

Cognitive models of social anxiety disorder (SAD) emphasize anticipatory processing (AP) as a prominent maintaining factor that occurs before social-evaluative events. AP occurs when a socially anxious individual is expecting a social event and can be described as a mode of repetitive negative thinking (RNT) dominated by past failures, negative images of oneself, predictions of poor performance and rejection. The present review examined the literature on AP in social anxiety in an effort to highlight important findings pertaining to this construct. Correlational and experimental studies have investigated the relationship between AP and the behavioural, physiological, cognitive and affective outcomes for socially anxious individuals. Studies investigating the characteristics, causes, and consequences of AP according to models of social anxiety were included for review. The majority of study designs include those investigating AP prior to social-evaluative threat. Directions for future research are discussed and an overview of a framework for explaining AP biases in social anxiety is presented.

KEYWORDS: Social Anxiety Disorder, Social Phobia, Repetitive Negative Thinking, Anticipatory Processing, Attentional Control.
Repetitive Negative Thinking in Social Anxiety Disorder 1: Anticipatory Processing

**Introduction**

Cognitive models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997) emphasize anticipatory processing (AP) as a central maintaining factor that contributes to enduring symptoms of social anxiety. AP has been identified as a mode of repetitive negative thinking (RNT) responsible for the maintenance of social anxiety. More recently, AP has received increasing attention by researchers warranting a review in this field. This review concentrates on the current literature on AP by evaluating the characteristics, causes, and consequences of this RNT process according to models of social anxiety. Extending the review, an explanation of the underlying functions of AP is proposed regarding higher order cognitive functions of attentional control. Initially, the construct of RNT is outlined by comparing two similar modes of RNT (e.g., worry and AP). An overview of two prominent cognitive models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997) is presented, followed by a comprehensive review of the available and relevant literature on AP in social anxiety. This review focuses specifically on the characteristics, causes and consequences, and changes following treatment of AP, before providing a theoretical explanation of cognitive attentional control. Finally, critical appraisal of developments and limitations are documented within each section, concluding with ideas for future research within the field. The evidence from correlational and experimental studies reviewed here, supports the contention that AP is a dysfunctional mode of thought implicated in the maintenance of social anxiety disorder (SAD).
**Procedure for Systematic Review**

One of the largest databases of English-language psychological/psychiatric literature, PsycINFO, was used for the search in June 2016. The number of articles published regarding social anxiety and AP was estimated by using the search terms “SOCIAL ANXIETY” and “ANTICIPATORY PROCESSING”. A total of 25 articles were retrieved that were then examined for relevance of which 18 articles were included. Inclusion criteria comprised: only articles specifically investigating AP within the context of social anxiety; use of an adult population; and no comorbid effects of substance use on AP. Any articles retrieved that investigated post-event processing (PEP) in social anxiety were not included as these were comprehensively reviewed in the second paper of this two-part review (Sluis, Boschen, Neumann, & Murphy, 2017b). The references section of each article retrieved was also examined to locate other related articles that were not located in the original search. This yielded a total of 1 article which met the inclusion criteria.

**Repetitive Negative Thinking**

The ability to reflect on one’s own thoughts, experiences and feelings is a common process unique to human beings. This type of self-focused thinking can have adaptive qualities when it comes to evaluating one’s own goals, actions, and the consequences of their actions (Brozovich & Heimberg, 2008). However, maladaptive forms of self-focused thinking can be associated with negative affect as seen in psychological disorders, such as depression and anxiety (American Psychiatric Association, 2013). This type of maladaptive thinking is a repetitive and perseverative pattern of thinking, which is negatively valenced and perceived to be intrusive or unwanted (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Rachman, 1981), otherwise termed, RNT (McEvoy, Mahoney, & Moulds, 2010). Such thinking usually occurs in the presence of stress or a negative mood state, and is believed to consume
cognitive resources that limit their availability for the effective operation of other cognitive functions.

Much of the research on RNT has focused primarily on worrisome and ruminative cognitive styles, the former a primary attribute of generalised anxiety disorder (GAD; Borkovec et al., 1998), and the latter identified as a core feature of depression (Nolen-Hoeksema, Parker, & Larson, 1994). While some of the literature suggests RNT is a transdiagnostic process that is characteristic of a range of psychopathologies (Harvey, Watkins, Mansell, & Shafran, 2004; McEvoy et al., 2010), other research suggests that these processes may uniquely influence symptoms and discriminate between disorders (Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Goring & Papageorgiou, 2008). Theoretically, there appears to be a great deal of overlap between rumination and worry in terms of particular appraisals and strategies used (e.g., goal-discrepancy reduction and meta-cognitive accounts), however they appear to differ in specific content (Watkins, 2004). Thus, identifying the similarities and differences between modes of RNT is important in order to understand the underlying cognitive processes of these phenomena, and for designing appropriate, disorder specific, interventions. As previously mentioned, one of the most studied forms of RNT is: worry, defined as “a chain of thoughts and images, negatively affect-laden, and relatively uncontrollable” (Borkovec, Robinson, Pruzinsky, & DePree, 1983, p.10) and is considered a primary attribute of GAD (Borkovec, Ray, & Stober, 1998). More recently, accumulating evidence has identified AP as an important example of RNT that plays a role in the maintenance of SAD (Clark & Wells, 1995). AP occurs when a socially anxious individual is anticipating a social/performance event and can be described as a mode of RNT that is difficult to disengage from and is dominated by past failures, negative images of oneself, predictions of poor performance and rejection (Clark & Wells, 1995). Worry and AP are similar modes of RNT in that they are both
future-focused and associated with less certainty and more perceived control, although slight differences tend to distinguish these two modes of RNT. For example, research has found that worry in GAD is primarily verbal in nature (Behar, Zuellig, & Borkovec, 2005), whereas preliminary findings on AP indicate that imagery may be more characteristic of this mode of thought for socially anxious individuals (Chiupka, Moscovitch, & Bielak, 2012). Furthermore, distinct factors within various RNT styles have different predictive properties. For example, rumination in depression can be distinguished into separate brooding and reflective factors (Treynor, Gonzalez, & Nolen-Hoeksema, 2003), while AP can be conceptualised into avoidant and preparatory factors (Mills, Grant, Lechner, & Judah, 2013). These differences highlight that there may be specificity of different RNT processes across disorders which have diagnostic utility.

Social Anxiety Disorder

According to the *DSM-5* (APA, 2013), the core feature of SAD (also known as social phobia) is “a marked fear or anxiety about one or more social situations in which the individual is exposed to possible scrutiny by others” (p. 202). SAD can be subtyped further to a “performance only” specifier, which denotes those who fear a single performance situation, such as public speaking (APA, 2013). Typically, the onset of SAD begins in childhood or adolescence, with lifetime prevalence rates of 12.1%, making it one of the most common mental disorders (Kessler et al., 2005). Consequently, SAD tends to precede most other comorbid disorders, such as depression, substance abuse, or other anxiety disorders, making these individuals less likely to seek help for their problem (Ohayon & Schatzberg, 2010).

When exposed to social or performance situations, individuals with SAD fear that they will act in a certain way, or show anxiety symptoms (i.e., blushing, sweating, trembling) that will be considered embarrassing or humiliating, ultimately leading to
negative evaluation by others. As a result, individuals either avoid feared social situations, or endure them with intense anxiety and distress. The fear or anxiety is recognised as disproportionate to the actual threat posed by the social situation, and symptoms must persist for six months or more and cause significant impairment (APA, 2013). Despite the dichotomous nature of diagnosis in the DSM system, social anxiety is typically regarded as a dimensional construct, existing on a continuum of severity, based on the degree of functional impairment and extent of behavioural avoidance (Heimberg, Liebowitz, Hope & Schneier, 1995). Consequently, empirical studies commonly employ social anxiety analogue samples and clinical samples to study cognitive processes involved in the maintenance of SAD (Stopa & Clark, 2001).

Cognitive-Behavioural Models of Social Anxiety

Many researchers have proposed models to explain social anxiety over the past three decades (e.g., Clark & Wells, 1995; Hirsch & Clark, 2004; Hofmann, 2007; Rapee & Heimberg, 1997; Schlenker & Leary, 1982). Two of the most widely cited and applied models explain the processes that shape and maintain social anxiety with emphasis on the relevance of cognitive constructs such as, interpretation, attention, and memory. Clark and Wells (1995) cognitive model of social phobia, and Rapee and Heimberg’s (1997) cognitive-behavioural model of social anxiety provide useful frameworks for understanding the role of AP in social anxiety. Both models are similar in that they propose that individuals with social anxiety engage in AP before they enter a social-evaluative situation, consequently maintaining anxiety symptoms.

Rapee and Heimberg’s (1997) Cognitive-Behavioural Model

According to Rapee and Heimberg (1997) individuals with social anxiety attach fundamental importance to being appraised positively by others, while also assuming that others are inherently critical evaluators. In this mode when socially anxious individuals encounter a social situation, a distorted mental representation of their
external appearance and behaviour, emphasizing negative qualities, is formed as seen by
the audience. The individual simultaneously focuses attention to this internal
representation and external perceived threat in the environment. This internal mental
representation is then compared with what they believe is expected by the audience.
This creates a discrepancy between perceptions of the audience’s appraisal, and
perceptions of the audience’s expected standard for evaluation. Consequently, the
perceived likelihood of being negatively evaluated is predicted by the individual, which
in turn elicits physiological (e.g., blushing, sweating), cognitive (e.g., negative
thoughts) and behavioural (e.g., avoiding eye contact) symptoms of anxiety. These
anxiety symptoms subsequently negatively influence the individual’s mental
representation of themselves, continuing the cycle.

Clark and Wells (1995) Cognitive Model

Similarly, Clark and Wells (1995) propose that individuals with social phobia
experience significant anxiety when anticipating a social-evaluative situation, where
they engage in a detailed prediction of what they believe might happen. As a result,
their thoughts are governed by negative images of themselves in the situation, memories
of past failures, and predictions of poor performance and rejection. Occasionally, this
process leads the individual to avoid the social-evaluative situation. However, if the
individual enters the situation, they are already likely to be in a self-focussed processing
mode and less likely to focus attention externally on their environment. Given that
feared outcomes are deemed probable, heightened awareness of physiological arousal
becomes the focus of attention. This interoceptive information is then used to construct
a negative impression of the self which is assumed to be an accurate representation of
how they appear to the audience. In an attempt to minimize the likelihood of being
negatively evaluated, the socially anxious individual may engage in a variety of in-
situation safety behaviours (e.g., avoiding eye contact), which may ultimately lead to
social performance deficits. After leaving the social-evaluative situation, it is not uncommon for the individual to conduct a post-mortem of the event (i.e., PEP). The situation is reviewed in detail, prominently featuring negative self-perceptions and appraisal of the situation as being much more negative than it actually was. Other instances of perceived social failures are also retrieved, and the recent social-evaluative event is added to the list of past failures thus strengthening dysfunctional beliefs of social incompetence.

Comparison of the Models

While both Rapee and Heimberg (1997) and Clark and Wells’ (1995) models highlight similar processes that occur to socially anxious individuals before, during and after a social-evaluative event, there are also notable differences. For example, Rapee and Heimberg (1997) suggest that the processes they propose to maintain social anxiety are the same regardless of whether a social-evaluative situation is encountered, anticipated, or retrospectively brooded over. Despite this suggestion, Rapee and Heimberg (1997) do not explicitly emphasise AP as a distinct and important maintaining factor of social anxiety. On the other hand, Clark and Wells (1995) specifically highlight the significance of AP as a unique maintaining factor for socially anxious individuals. On the basis of Clark and Wells (1995) explicit account of AP, much of the literature on AP in social anxiety has predominantly employed the Clark and Wells (1995) framework thus allowing for ease of comparison between studies. The following sections provide a comprehensive review of the AP literature and how cognitive models can be useful in understanding the characteristics and impact of this RNT style in the context of social anxiety.

Anticipatory Processing and Social Anxiety

Table 1.1 provides a detailed description of the study details, measures used and a summary of findings for each study included in this review. Based on Clark and
Table 1.1.  
**Characteristics of Anticipatory Processing in Social Anxiety**

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Social-evaluative threat induction</th>
<th>AP measure (additional measures)</th>
<th>Summary of findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correlational studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vassilopoulos (2004)</td>
<td>147 undergraduates (high and low SA)</td>
<td>No</td>
<td>APQ (scale development; FNE, BDI-II, STAI-T, SPAI)</td>
<td>AP before social situations is specific to high levels of SA. High SA individuals engage in more prolonged AP.</td>
</tr>
<tr>
<td>Vassilopoulos, Brouzos, and Moberly (2015)</td>
<td>301 undergraduates</td>
<td>No</td>
<td>PB-APQ, APQ, PBRS (SIAS, BDI-II, MCQ-30)</td>
<td>PB-APQ was found to be a valid and reliable measure. Anticipatory processing partially mediated the relationship between positive beliefs about anticipatory processing and social interaction anxiety.</td>
</tr>
<tr>
<td>Hinrichsen and Clark (2003)</td>
<td>40 undergraduates (high and low SA)</td>
<td>Study 1 – No</td>
<td>ASBQ (FNE, STAI-T)</td>
<td>Study 1 – High SA recalled more past perceived failures, more negative bodily sensations, more escape and catastrophic thoughts, reported images from observer perspective.</td>
</tr>
<tr>
<td>Mills et al. (2013)</td>
<td>861 undergraduates (high and low SA)</td>
<td>Study 1 – No Study 2 – No Study 3 – No</td>
<td>ASBQ (SIAS, SPS, SMIB, FAQ, PSWQ, CES-D)</td>
<td>ASBQ best conceptualised as a two-factor model (Avoidance and Preparation).</td>
</tr>
<tr>
<td>Vassilopoulos (2008)</td>
<td>46 undergraduates (high and low SA)</td>
<td>No</td>
<td>MMAP (FNE, STAI, BDI-II)</td>
<td>High SA more likely to engage in AP, reported more negative thoughts, more thoughts related to hiding anxiety and avoidance of situation, fewer thoughts of improving in-situation performance behaviours, and recalled less positive events from their past.</td>
</tr>
<tr>
<td>Scott et al. (2014)</td>
<td>245 community sample</td>
<td>No</td>
<td>MMAP (LSAS, DASS, FMPS)</td>
<td>Maladaptive perfectionism and maladaptive anticipatory processing were positively associated with social anxiety and maladaptive anticipatory processing uniquely predicted social anxiety, even after controlling for depression and maladaptive perfectionism. Maladaptive anticipatory processing mediated the relationship between maladaptive perfectionism and social anxiety.</td>
</tr>
<tr>
<td>Campbell, Bierman and Molenaar (2016)</td>
<td>10 undergraduate females</td>
<td>No</td>
<td>ASBQ (SADS, BFNE, PEPQ)</td>
<td>Same-day fear of negative evaluation was associated with maladaptive anticipatory processing which influenced social withdrawal behaviours.</td>
</tr>
<tr>
<td>Mills et al. (2014c)</td>
<td>326 undergraduates (high and low SA)</td>
<td>Study 1 – No Study 2 – No</td>
<td>ASBQ (RRS (PSWQ, SIAS, SPS, CES-D, GAD-Q)</td>
<td>Anticipatory processing, worry and rumination predicted social anxiety, however only worry predicted trait anxiety, and only rumination predicted depressive symptoms. Only worry predicted future social anxiety, however social anxiety predicted later anticipatory processing and rumination.</td>
</tr>
<tr>
<td><strong>Experimental studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hinrichsen and Clark (2003)</td>
<td>40 undergraduates (high and low SA)</td>
<td>Study 2 – Speech</td>
<td>Two questions related to AP rated on 0-100 scale (FNE, STAI-T)</td>
<td>Study 2 – AP maintained self-reported anxiety, distraction decreased anxiety.</td>
</tr>
<tr>
<td>Mellings and Alden (2000)</td>
<td>116 undergraduates (high and low SA)</td>
<td>Social Interaction</td>
<td>RQ (SADS, FAQ, STAI, BSQ, BDI)</td>
<td></td>
</tr>
<tr>
<td>Vassilopoulos (2005)</td>
<td>80 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>One question related to AP anxiety on 0-10 scale (FNE, STAI, BDI-II, SPAI)</td>
<td>Compared to distraction, high SA individuals reported stronger feelings of anxiety when engaged in AP, predicted a more negative overall appearance in upcoming speech. High SA in distraction recalled more negative and less positive information about public selves.</td>
</tr>
</tbody>
</table>
Compared to distraction, AP increased self-reported anxiety in all participants. High SA showed increased skin conductance, stronger conditional and high standard beliefs, and poorer speech performance.

High SA participants adopting an experiential processing mode had stronger high standard and conditional beliefs during AP.

High SA individuals in AP condition endorsed more negative images and memories, and reported more negative emotional consequences associated with bringing images and memories to mind.

Compared to distraction, high SA in AP condition were more anxious, experienced more negative and unhelpful self-images, and used more of an observer perspective. Both high and low SA reported better speech performance after AP.

High socially anxious individuals who anticipated experienced an increase in information from Time 1 to Time 2 compared to high socially anxious individuals in the distraction condition and low socially anxious individuals in either condition who experienced no changes.

Anticipatory processing was more consistently associated with attentional control at pre-treatment, and increased attentional control during treatment was associated with reductions in anticipatory processing.

Improvement in ICT was mainly mediated by reductions in avoidance and self-focused attention, whereas improvement in CBGT was mediated by changes in self-focused attention, and anticipatory and post-event processing.

Both techniques improved overall anxiety scores, however detached mindfulness also led to reductions in the observer-perspective, negative beliefs, and anticipatory processing.

Note: AP = anticipatory processing; SA = social anxiety; SAD = Social Anxiety Disorder; SFA = self-focused attention; NC = normal controls; APQ = Anticipatory Processing Questionnaire; ASBQ = Anticipatory Social Behaviours Questionnaire; MMAP = Measure of Mental Anticipatory Processes; VAS = Visual Analogue Scale; PANAS = Positive and Negative Affect Scale; FAQ = Focus of Attention Questionnaire; FNE = Fear of Negative Evaluation Scale; STAI = State Trait Anxiety Inventory; BDI-II = Beck Depression Inventory; SADS = Depression, Anxiety and Stress Scale; SPS = Social Phobia Scale; SIAS = Social Interaction and Anxiety Scale; BAI = Beck Anxiety Inventory; PSWQ = Penn State Worry Questionnaire; CES-D = Center for Epidemiological Studies-Depression Scale; FAQ = Focus of Attention Questionnaire; CBGT = Cognitive Behavioural Group Therapy; ATT = Attention Training; ICT = Individual Cognitive Therapy; ACS = Attentional Control Scale; MCQ = Meta-Cognitions Questionnaire; SPWSS = Social Phobia Weekly Summary Scale; SADS = Social Avoidance and Distress Scale; SSPS = Self-Statements during Public Speaking Scale; PB-APQ = Positive Beliefs about Anticipatory Processing Questionnaire; PBRS = Positive Beliefs about Rumination Questionnaire; MCQ-30 = Metacognitions Questionnaire-30; SMIB = Self-Report Measure of Interpretation Bias; RQ = Rumination Questionnaire; BSQ = Body Sensations Questionnaire; RRS = Ruminative Response Questionnaire; GAD-Q = Generalised Anxiety Disorder Questionnaire; MMAP = Measure of Mental Anticipatory Processes; FMPS = Frost Multidimensional Perfectionism Scale;
Wells (1995) idea that anticipatory anxiety is a common feature of social anxiety; several studies have shown robust positive relationships between self-reported engagement in AP and social anxiety. Vassilopoulos (2004) developed the first measure of AP (APQ; Anticipatory Processing Questionnaire), in order to measure its relationship with social anxiety. Using a sample of 147 undergraduates, Vassilopoulos (2004) showed that high socially anxious individuals, compared to their low socially anxious counterparts, reported thinking a great deal about the event. Moreover, these thoughts were intrusive and interfered with their ability to concentrate, and AP increased their anxiety. It was also found that AP before social situations was specific to social anxiety, even after controlling for trait anxiety and depression. Further to the development of the APQ and given the commonalities observed between worry and AP, Vassilopoulos, Brouzos, and Moberly (2015) developed the Positive Beliefs about Anticipatory Processing Questionnaire (PB-APQ) in order to gain a greater understanding of how metacognitive theory applies to AP. Employing a sample of 301 undergraduates they demonstrated the PB-APQ to be a valid and reliable measure. Furthermore, they found that AP partially mediated the relationship between positive beliefs about AP and social interaction anxiety. These findings provide preliminary evidence indicating that positive metacognitive beliefs facilitate AP, similar to that of worry observed in GAD (Wells, 2006). However it is important to note that only one measure of social anxiety was used (Social Interaction and Anxiety Scale [SIAS]; Matticke & Clarke, 1998) which may not capture the entire range of social anxiety symptoms, and they also neglected to examine negative metacognitive beliefs about AP which would be useful for future studies to examine.

Other researchers have investigated the nature of cognitive processes that underlie AP. Hinrichsen and Clark (2003) conducted two studies to investigate these processes. In the first study, they employed a sample of 40 undergraduates who were
split into high and low social anxiety groups and used a semi-structured interview to examine reported mental processes during AP and develop the Anticipatory Social Behaviours Questionnaire (ASBQ). They found that high socially anxious individuals recalled more past perceived failures, experienced more negative bodily sensations, had more catastrophic and escape related thoughts, and reported images from more of an observer perspective than low socially anxious individuals. While these findings are broadly consistent with the Clark and Wells’ (1995) model of social anxiety, the research findings were based on an analogue population making it unclear as to what degree the findings would be generalizable to a clinical population. Extending the work of Hinrichsen and Clark (2003) on the development of the ASBQ, Mills, Grant, Lechner, and Judah (2013) examined the factor structure of the ASBQ and found that AP was best conceptualised as a two-factor model (Avoidance and Preparation) in two separate samples of undergraduates ($N = 861$ and $N = 485$, respectively). Furthermore, using a third sample of high socially anxious undergraduates ($N = 59$), they found that the Avoidance factor was more maladaptive than the Preparation factor. By conducting three separate studies, the authors were able to demonstrate the robustness of the factor structure of the ASBQ across different samples and identify that some components of AP (i.e., escape and avoidance), may be more maladaptive than others (i.e., planning or preparation) for socially anxious individuals.

Vassilopoulos (2008) compared 24 high and 24 low socially anxious individuals that were presented with vignettes which involved anticipating an anxiety-provoking social situation, subsequently recording their thoughts and recalled memories. They found that when anticipating a feared social event those high in social anxiety reported more negative thoughts, more thoughts related to hiding their anxiety, and avoidance of the stressful situation. They also had fewer thoughts concerning improvement of in-situation performance behaviours, and they recalled less positive events from their past
than low socially anxious individuals. Similarly, Scott, Yap, Francis, and Schuster (2014) examined the moderating and mediating role of AP on the relationship between perfectionism and social anxiety. They had 245 individuals from the community complete a number of online questionnaires, and then rated their levels of AP in response to vignettes describing future anxiety-provoking social interaction or performance situations. They found that maladaptive perfectionism and maladaptive AP were positively associated with social anxiety and that maladaptive AP uniquely predicted social anxiety, even after controlling for depression and maladaptive perfectionism. Furthermore, maladaptive AP mediated the relationship between maladaptive perfectionism and social anxiety. While these findings extend that of previous research (Vassilopoulos, 2008; Wong & Moulds, 2011) and highlight the importance of targeting AP during treatment, it is important to note that the vignettes may not have elicited experiential AP and recollection of previous AP experiences may have been prone to recall bias.

Using a more ecologically valid methodology, Campbell, Bierman, and Molenaar (2016) employed a sample of 10 new undergraduate students starting their first semester at university to investigate how day-to-day processes of social anxiety influenced future social anxiety and social withdrawal. Throughout the 13 weeks of their first semester, participants were required to complete brief online daily diaries outlining salient anxiety-provoking social interactions. For most individuals, they found that same-day fear of negative evaluation was associated with maladaptive AP which influenced social withdrawal behaviours. While their methodology was more ecologically valid, the study was limited by a small sample size and they neglected to control for depression.

The maladaptive characteristics of AP identified in these studies illustrates why this processing mode maintains high anxiety levels. As high socially anxious
individuals regard being positively appraised as important, it is reasonable to assume that anticipating how the social-evaluative event will unfold may be a helpful strategy. As these individuals begin to think about what could go wrong, confidence in their ability to convey a favourable impression is misjudged, negative information about past failures is retrieved, and enhanced perception of bodily sensations all contribute to further confirming their fears and increasing their anxiety.

**Anticipatory Processing as Disorder-Specific or Transdiagnostic**

While there is a growing body of research examining the role of cognitive processes in a range of psychopathology independently, other researchers suggest that AP may be described as a RNT style similar to that of worry and rumination observed in GAD and depression, respectively (McEvoy et al., 2010). Mills, Grant, Lechner and Judah (2014c) conducted two studies to examine whether individual differences in AP were associated with social anxiety symptoms above and beyond worry and rumination. Employing a sample of 326 undergraduates for their first study, they found that AP, worry and rumination predicted social anxiety, however only worry predicted trait anxiety, and only rumination predicted depressive symptoms. The second study used a prospective design with a sample of 353 undergraduates and found that only worry predicted future social anxiety, however social anxiety predicted later AP and rumination. These findings highlight the value of examining the unique relationships among these RNT styles and symptom profiles. Taken together, the findings lend some support for RNT as a unitary construct; however also suggest that worry and rumination may be more transdiagnostic than AP.

**Consequences of Anticipatory Processing**

Researchers have also begun to experimentally investigate the relationship between AP and the behavioural, physiological, cognitive, and affective consequences in socially anxious individuals. Experimental studies (see Table 1.1) typically induce
both high and low socially anxious participants to engage in either AP or distraction prior to social-evaluative threat (e.g., a speech task; Hinrichsen & Clark, 2003; Vassilopoulos, 2005; Wong & Moulds, 2011). Research shows that high socially anxious individuals who engage in induced AP prior to the threat of a speech task, report stronger feelings of anxiety (Hinrichsen & Clark, 2003; Vassilopoulos, 2005; Wong & Moulds, 2011), predict a more negative overall appearance of themselves in the upcoming speech (Vassilopoulos, 2005), and show increased relative skin conductance (Wong & Moulds, 2011). Distraction tends to significantly decrease self-reported anxiety (Hinrichsen & Clark, 2003; Vassilopoulos, 2005).

In one of the first studies to examine AP and how it contributes to biases in judgments and memory for social events, Mellings and Alden (2000) had 58 socially anxious undergraduates and 58 non-anxious controls participate in a social interaction and then complete measures of self-focused attention and anxiety-related physiological and behavioural symptoms. Interestingly, they found no support for the notion that AP activated selective retrieval of negative information about previous social events and no group differences emerged between socially anxious individuals who anticipated a second social interaction and those who did not. These findings highlight that selective attention may play a greater role than selective retrieval in anxiety-provoking situations and suggest that AP may indeed be a separate construct from PEP (which is a mode of RNT that occurs following a social-evaluative event).

Vassilopoulos (2005) employed a sample of 80 high and low socially anxious undergraduates who were randomly assigned to either an anticipation or distraction condition prior to giving a speech. Unexpectedly, they found that high socially anxious individuals in the distraction condition, as opposed to facilitated AP, recalled more negative and less positive information about their public selves using a self-referent words recall task. However, it should be noted that while those in the distraction
condition were not instructed to engage in facilitated anticipation, manipulation checks revealed that these participants still engaged in AP, but to a lesser extent than those in the AP condition. It appears that when AP is limited, occasional and incomplete (i.e., through the use of distraction) rather than prolonged and facilitated, memory biases for negative salient words may be found in social anxiety. In contrast, Chiupka et al. (2012) utilised a sample of 85 undergraduates high and low in social anxiety that were advised to focus on images/memories in anticipation of giving a speech. They found that negative images and memories were endorsed more frequently by high socially anxious individuals induced in anticipation of a speech task, compared to their low socially anxious counterparts. One possible reason for these different findings may be that memory biases occur in response to the salience of autobiographical images in anticipation of a social-evaluative situation (Chiupka et al., 2012), as opposed to negative words (Vassilopoulos, 2005), which may have relatively mild threat value during facilitated anticipation.

Another possible explanation for the conflicting findings may be differences in the duration of anticipation. Chiupka et al. (2012) restricted induced duration of facilitated anticipation to 60 seconds of reflection, while Vassilopoulos (2005) facilitated 8-9 minutes of AP. It may be that thought suppression, or limiting the time the participant has to engage in AP (e.g., distraction), enhances negative memory biases which are more readily available for socially anxious individuals than positive information (Vassilopoulos, 2005). This explanation would be consistent with the suggestion that these individuals tend to exhibit a weakened attentional control system (Linville, 1996), indicating impairment in attentional control relative to their own negative thoughts. However these interpretations are only conjecture and firm conclusions will need to come from future empirical studies.
Brown and Stopa (2006) instructed 20 high and 20 low socially anxious undergraduates to give two speeches in a fixed order. The first was preceded by distraction and the second was preceded by ten minutes of AP. In the anticipation condition, they found that high socially anxious individuals were more anxious ($\eta^2 = .08$), experienced more negative self-images ($\eta^2 = .10$), and took more of an observer perspective ($\eta^2 = .12$) than low socially anxious individuals. However, both high and low socially anxious participants reported less frequency and belief in negative thoughts after AP compared to the unanticipated speech, and rated their second speech performance more positively than the first. Brown and Stopa (2006) concluded that AP may have adaptive qualities and potential benefits for speech performance prior to giving a speech. Despite this conclusion, it is notable to mention that the order of distraction and AP was not counterbalanced (i.e., all participants completed the distraction speech first). Accordingly, practice effects may have been carried over from the first speech to the second speech. For example, prior practice giving the first speech exposed participants to the anxiety-provoking event therefore habituating them to the situation. This habituation resulted in better predicted and actual performance on the second speech.

Although most studies have examined AP prior to giving a social-evaluative speech task, Mills, Grant, Judah and Lechner (2014a) investigated the relationship between AP, self-focused attention, and interpretation prior to a threatening social interaction with a confederate. They employed 108 undergraduates high and low in social anxiety who were randomly assigned to either an anticipation or distraction condition prior to a social interaction. They found that high socially anxious individuals exhibited higher self-focused attention than both normal controls in the anticipation condition, and high socially anxious participants in the distraction condition. Moreover, the anticipation condition produced greater endorsement of negative interpretations than
those who engaged in distraction, regardless of social anxiety status. This finding suggests that any individual who enters a social situation with negative expectations is susceptible to the negative effects of AP. In particular, when one expects the worst, information is interpreted in such a way that confirms those expectations.

In summary, the research to date largely supports cognitive-behavioural models emphasizing AP as a maintaining factor of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). Despite the fact that AP has been shown to exhibit some adaptive qualities, findings primarily support the notion that this style of RNT has damaging consequences for those with social anxiety. It appears reasonable to assume that AP is a maintaining mechanism that negatively influences attentional processes and consumes cognitive resources. However future empirical studies are needed to specifically examine whether the cognitive demands of AP limits available resources required for processing of information that may disconfirm one’s negative beliefs and cognitions.

**Anticipatory Processing and Attentional Bias**

On the basis of strong empirical support and theoretical predictions that socially anxious individuals exhibit attentional biases, Mills, Grant, Judah, and White (2014b) examined the effect of AP on attentional bias for both internal (e.g., heart rate feedback) and external (e.g., emotional faces) threat information using a sample of 59 undergraduates high and low in social anxiety symptoms. Participants were required to complete a modified version of the dot probe paradigm, which is a valid and reliable attention task, prior to (Time 1) and after (Time 2) an AP (i.e., social interaction with a confederate) or distraction task. They found that high socially anxious individuals who anticipated experienced an increase in attentional bias for internal information from Time 1 to Time 2 compared to high socially anxious individuals in the distraction condition and low socially anxious individuals in either condition, who experienced no changes. Consistent with Clark and Wells’ (1995) model, these findings suggest that
AP results in an increased shift of attention toward internal physiological information. While these findings contribute important information to the body of literature, they only used one measure of social anxiety (SIAS; Mattick & Clarke, 1998) which may not capture the entire range of social anxiety symptoms and they neglected to control for depression. Given that social anxiety and depression are highly comorbid, controlling for this covariate is important to determine specificity of the findings.

**Changes in Anticipatory Processing in Response to Treatment**

The authors are aware of only three studies to date that have examined changes in AP following psychotherapeutic interventions. McEvoy and Perini (2009) studied a clinical sample of 81 participants with a primary diagnosis of social phobia. They aimed to determine whether or not supplementing cognitive-behavioural group therapy (CBGT) with attention training (ATT; Wells, 1990) could produce greater changes in social anxiety, depression, attentional control, metacognitive beliefs, and AP. Utilising self-report measures, McEvoy and Perini (2009) found that ATT did not potentiate greater change on any outcome variable (both the CBGT group and the ATT group significantly improved on every outcome and to the same degree). Furthermore, AP was more consistently associated with attentional control at pre-treatment, and increased attentional control during treatment was associated with reductions in AP. These findings provide support for the importance of increased attentional control in relieving symptoms of social anxiety, along with reduced engagement in maladaptive RNT.

Hedman et al. (2013) studied a clinical sample of 94 individuals with social anxiety disorder to examine whether changes in several maintenance processes of social anxiety mediate clinical improvement in either individual cognitive therapy (ICT) or CBGT. They found significant between-treatment differences whereby improvement in ICT was mainly mediated by reductions in avoidance and self-focused attention, whereas improvement in CBGT was mediated by changes in self-focused attention, and
AP and PEP. While these results suggest that CBGT is more effective in reducing AP than ICT, the participants were collected from two separate studies so the results are not based on random allocation of a single cohort to ICT or CBGT.

Gkika and Wells (2015) compared two techniques including, detached mindfulness and thought evaluation, for dealing with negative thoughts. Employing a sample of 12 female students high in social anxiety, participants were assigned to practice either detached mindfulness or thought evaluation following the delivery of three speeches. They found that both techniques improved overall anxiety scores, however detached mindfulness also led to reductions in the observer-perspective ($r = - .45$), negative beliefs ($r = -.41$), and AP ($r = -.57$). While these findings provide preliminary evidence that metacognitive techniques, such as detached mindfulness, are beneficial in reducing maintaining processes of social anxiety, the study is limited by a small female analogue sample and so replication of the findings with a larger clinical sample is needed.

**Limitations of Existing Evidence in Anticipatory Processing**

While research on AP in social anxiety is still in its infancy, several limitations are worth mentioning. Firstly, the majority of studies reviewed have had high socially anxious individuals as analogues to those diagnosed with SAD. It is generally accepted that social anxiety is continuously distributed in the general population (Stopa & Clark, 2001). On this basis, using an analogue sample for identifying processes that may be important in SAD has been justified by existing research that supports the validity of this sampling strategy (i.e., results obtained using an analogue sample are largely similar to results found using a clinical sample; Stopa & Clark, 2001). However, the key novel findings should always be contrasted between a clinical sample of SAD individuals and normal controls to really enhance understanding in this area.
Secondly, many of the SAD studies examining AP are correlational in nature thus precluding the ability to identify causal relationships between components proposed by models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). It has been suggested that maintaining factors of social anxiety do not operate in isolation, but rather interact with one another (cf. combined cognitive bias hypothesis; Hirsch & Clark, 2004; Hirsch, Clark, & Mathews, 2006). Experimental studies examining the interaction of these maintaining constructs are starting to emerge (Wong & Moulds, 2011; Wong & Moulds, 2012). However, the precise cognitive control functions (e.g., executive control functions; Eysenck, Derakshan, Santos, & Calvo, 2007) that may underlie RNT in social anxiety remain unknown. Establishing causal relationships between executive functions thought to be responsible for the maladaptive attentional control strategies of RNT in social anxiety would allow greater understanding of this maintaining process (currently under investigation by the authors).

Thirdly, the majority of studies have relied solely on self-report methods to investigate AP. While self-report measures are convenient and may provide useful insight from participants, the ability for humans to introspect is limited. Therefore, self-report data may be susceptible to response biases, and common method variance may inflate results. Only one study to date has utilised psychophysiological measures to assess AP outcomes (Wong & Moulds, 2011). This is surprising given that models of social anxiety emphasize the cognitive, affective, somatic and behavioural changes associated with this disorder (Clark & Wells, 1995; Rapee & Heimberg, 1997). Thus, future studies incorporating multi-method paradigms are needed.

Given that AP involves persistent and recurrent thoughts that revolve around a reduced ability to shift attention away from one’s current stream of thought, researchers have begun to explore the attentional mechanisms underlying these phenomena (Linville, 1996). In particular, cognitive deficits (e.g., RNT) resulting from stress and
depression are thought to be the consequence of a weakened attentional control system (Linville, 1996), yet no research exists examining the cognitive functions thought to be responsible for AP in social anxiety. The following section proposes one potential theoretical explanation as to the underlying mechanisms of AP focusing specifically on attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007).

**Cognitive Control and Cognitive Performance**

The preceding review on AP in social anxiety indicates that researchers have neglected to answer the question of how and why AP exerts its effects on those with social anxiety. Cognitive interference theories, such as attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007) propose that performance on cognitive tasks, especially those that require a high load of cognitive resources, are negatively impacted by high levels of anxiety. The underlying link between reduced cognitive performance and anxiety has been explained via the operation of two attentional systems. The goal-directed attentional system (i.e., “top-down” control of attention) is influenced by knowledge, expectations and goals, and the stimulus-driven attentional system (i.e., “bottom-up” control of attention) is affected by stimuli that are salient and conspicuous (Corbetta & Shulman, 2002; Posner & Petersen, 1990). According to attentional control theory, the balance of these two attentional systems is disrupted by anxiety which is associated with an increased stimulus-driven attentional system, and a decreased goal-directed attentional system (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007). Miyake et al., (2000) identified three main executive functions, which are associated with the control and regulation of cognitive processes. These three processes are: (1) Inhibition (i.e., the ability to deliberately inhibit automatic, prepotent responses); (2) Shifting (i.e., shifting
between multiple tasks, or mental sets); and (3) Updating (i.e., updating and monitoring of information in working memory; Miyake et al., 2000).

According to attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007), the presence of threat-related stimuli, external (e.g. angry faces) or internal (e.g., RNT), triggers anxiety and impairs processing efficiency thereby reducing attentional control. Each of the three executive functions (outlined previously) has unique relevance to attentional control theory. The inhibition function restricts the allocation of attentional resources to task-irrelevant stimuli. The shifting function allocates attention to focus on or move to task-relevant stimuli. The updating function is less related to attentional control, as it is associated with monitoring and updating the temporary storage of information (Eysenck et al., 2007; Miyake et al., 2000). Thus, the effects of anxiety are assumed to be weaker on the updating function than on the inhibition and shifting functions because of their roles in attentional control. While the inhibition, shifting and updating functions are partly symbiotic and partly separable (Miyake et al., 2000), they are all part of the “top-down” attentional control system. Consequently, if demands on one function are high (e.g., due to AP) then the processing resources available for other executive functions will be reduced (Eysenck et al., 2007).

Recent research developments examining the effect of attentional control as a predictor of outcomes for ‘best practice’ interventions, such as cognitive behavioural therapy (CBT), have started to emerge. Preliminary research in this area by Klumpp, Fitzgerald, Angstadt, Post, and Phan (2014) studied a sample of 21 participants with a diagnosis of SAD to examine pre-treatment brain activity in brain regions implicated in attentional control. They found that the direction of brain activity at pre-treatment in individuals with intact attentional control were more likely to benefit from CBT. In other words, these individuals exhibited more regulatory capacity (i.e., enhanced dorsal
prefrontal activity) during attentional control in the presence of emotional distractors (e.g., facial expressions), and were less reactive (i.e., reduced amygdala activity) to such faces during emotion processing. However these findings only provide preliminary support for the relative importance of attentional control in predicting treatment outcomes and fail to provide specific information regarding the mechanism by which attentional control hinders or facilitates specific maintaining factors of social anxiety. Similarly, other researchers have examined the utility of attentional bias retraining in conjunction with standard CBT. For example, Rapee et al., (2013) integrated attentional bias towards threat re-training (i.e., attentional bias modification) into a standard 12-week CBT package for 134 individuals with social phobia. Attentional bias modification was conducted using the dot probe task which is a widely used and commonly accepted measure of attentional bias assessment. In contrast to Klumpp et al., (2014), they found no significant differences between groups in attentional bias towards threat or in treatment response. While the authors suggest that the results do not indicate that integration of attentional bias modification procedures with CBT augments attentional change or enhances treatment efficacy, they do acknowledge that the attentional probe task used may not have been sufficiently sensitive to detect attenuation of attentional control. As such, future research would benefit from further examination into the role of attentional control in reducing symptoms of social anxiety using other paradigms. For example, an eye-tracking paradigm, such as the antisaccade task, may be more sensitive in attenuating attentional control given that it is a covert measure of attentional control that is not reliant on manual reaction times and less susceptible to demand characteristics or compensatory strategies (Ainsworth & Garner, 2013).

While the aforementioned studies provide conflicting evidence on the role of attentional control as an underlying mechanism of maintaining features of social
anxiety, attentional control is only one potential explanation that warrants further investigation. It is important to note that multiple factors may contribute to the explanation of, and differentially impact, why socially anxious individuals find it difficult to disengage from AP. Some of these factors may include the role of motivation (Kouneiher, Charron, & Koechlin, 2009), the cognitive load of task demands (Gazzaley, 2011), the threat load of the task (Van Dillen & Koole, 2009), and differences in ability to regulate emotion (McRae et al., 2010; Kanske, Heissler, Schöpfeld, Bongers, & Wessa, 2011).

Although this theory has not been used to investigate the underlying mechanisms of AP specifically, this approach appears to provide utility to understand why socially anxious individuals find it particularly difficult to disengage from RNT. Identification of the underlying mechanisms responsible for AP may encourage researchers and practitioners to incorporate attentional control strategies into standard interventions, using sufficiently sensitive measures, which are targeted specifically towards specific maintaining mechanisms to reduce some of the dysfunctional outcomes associated with RNT in social anxiety.

**Conclusions and Directions for Future Research**

Given the limitations of research on AP in social anxiety, it is evident that much work is needed to increase our understanding of this construct. As it stands, the existing literature demonstrates that AP increases anxiety for socially anxious individuals and appears to be unique to social anxiety (Vassilopoulos, 2004). Given this preliminary evidence, future research is needed to further elucidate whether AP is a unique maintaining factor for social anxiety and is therefore different to other forms of RNT (e.g., worry). Verifying the specificity of this construct is important for understanding the characteristics and detrimental effects of AP and for highlighting whether interventions aimed at decreasing RNT need to be disorder specific or transdiagnostic.
For example, research on worry in GAD has found these thoughts to be primarily verbal in nature (Behar et al., 2005). In contrast, preliminary findings on AP indicate that imagery may be more characteristic of this mode of thought for socially anxious individuals (Chiupka et al., 2012). Distinguishing differences in reactivity to various constructs, such as mental imagery, may prove useful when trying to achieve differential diagnoses among comorbid anxiety disorders and also for designing appropriate interventions.

The lack of experimental studies on AP also limits the ability to identify causal relationships between maintaining factors of social anxiety. It has been proposed that biased cognitive processes often operate simultaneously rather than in isolation to maintain social anxiety (cf. combined cognitive bias hypothesis; Hirsch & Clark, 2004; Hirsch et al., 2006). Research has begun to investigate the interaction of such biases (Chiupka et al., 2012; Mills et al., 2014b; Wong & Moulds, 2011), showing that AP tends to increase negative imagery and interpretations, biased recall of memories, and maladaptive self-beliefs. In extending these studies, it would be useful to compare the interaction of such biases relative to other disorders that feature similar RNT processes, such as GAD, in order to more thoroughly understand these processes across disorders.

Duration of AP also appears to be an important determinant of dysfunctional outcomes. Future research may benefit from systematically manipulating the durations of facilitated anticipation in an attempt to determine at which point AP becomes most detrimental. Given the findings of previous research (Chiupka et al., 2012; Vassilopoulos, 2005), the preliminary evidence suggests that when AP is limited or incomplete, negative images and memories may be endorsed more frequently by socially anxious individuals. It would also be worth investigating if limited duration of AP fosters an increase in other outcomes, such as physiological arousal, in conjunction with biased negative images and memories. Using multi-method paradigms to
investigate these ideas would provide insight into the interaction of these biases proposed by cognitive-behavioural models in a more holistic manner (Clark & Wells, 1995; Rapee & Heimberg, 1997).

Furthermore, given that a small number of studies have identified some adaptive effects of AP (Brown & Stopa, 2006), it would be beneficial for research to establish the specific aspects of AP which have adaptive qualities. Preliminary research in this area has found that AP can be conceptualised as a two-factor model (e.g., Avoidance and Preparation), indicating that the preparation factor is more adaptive than the avoidance factor (Mills et al., 2013). Further research examining the adaptive and maladaptive features of AP would aid in confirming existing findings and enhancing our knowledge toward understanding to what extent, under which circumstances, and for whom this processing mode may be advantageous. Another potential avenue for examining the adaptive and maladaptive features of AP includes the role of cognitive interference theories (Derakshan & Eysenck, 2009; Eysenck & Calvo, 1992; Eysenck & Derakshan, 2011; Eysenck et al., 2007). For example, ineffective control of attention may underlie the perpetual nature of RNT. Thus, it seems plausible that exploration of individual differences may indicate that high socially anxious individuals with higher levels of cognitive attentional control may exhibit decreased dysfunctional outcomes compared to high socially anxious individuals with lower levels of cognitive attentional control.

Finally, a small amount of empirical evidence has explored the effects of treatment protocols, such as CBGT, in reducing the effects of AP (McEvoy & Perini, 2009). This is surprising given that AP has been identified as an important contributing factor in the maintenance of SAD (Clark & Wells, 1995). While the existing literature indicates that ATT and CBGT assist in reducing AP, it is still unclear as to which components of a treatment would result in the most change. Future research is warranted to determine which treatment techniques are most effective for reducing the
dysfunctional effects of AP in social anxiety. For example, research has identified
predominant characteristics of AP involving memory perspective, memory retrieval,
imagery, and self-focused attention. Future research may benefit from assessing which
elements of cognitive restructuring lead to better outcomes. It may be that reducing
self-focused attention and altering biased retrieval of past social failures may potentiate
greater changes than treatment strategies counteracting memory perspective and
imagery (or vice versa). Moreover, preliminary findings from McEvoy and Perini
(2009) identified attentional control during treatment to be associated with reductions in
AP. The authors compared CBGT with ATT revealing no differences between
treatments regarding improvement on AP (both groups significantly improved on AP).
This is an interesting line of research that prompts a number of additional research
questions worthy of investigation. For example, would a combination of strategies from
both treatment packages incur greater changes than either treatment package alone? If
so, whom does this type of treatment package benefit the most (e.g., only socially
phobic individuals who exhibit attentional control deficits, or only those exhibiting
increased levels of trait RNT)? And, do the combined effects of attention training and
CBGT contain a carry-over effect on the interaction of other cognitive biases implicated
in the maintenance of social anxiety? Furthermore, examining the impact of attentional
control more specifically on maintaining mechanisms of social anxiety may be a first
step in achieving a deeper understanding of these processes. While there is preliminary
research that refutes the utility of attentional control training in improving outcomes for
socially anxious individuals (Rapee et al., 2013), other research has shown that
increasing our understanding of the role of attentional control provides valuable
information that is worthy of further investigation (Klumpp et al., 2014). This line of
research emphasizes the relative importance of individual differences toward treatment
approaches, highlighting that idiosyncratically designed assessments and interventions may be more beneficial for certain individuals.

There is still much work to be done on AP in social anxiety. Future research that addresses some of the main methodological limitations of previous research should facilitate clarification of past research findings and assist in simplifying the comparison of analogous studies. There are still a number of interactive effects between AP and other components proposed by cognitive models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997) that have yet to be elucidated. Addressing these limitations and gaps in the existing literature will not only provide added insight into the underlying aetiology and maintenance of SAD by informing theoretical models, but it will also facilitate expansion of the assessment and disorder specific treatment packages for those with SAD.
Chapter 1 Conclusion

This chapter provided a comprehensive review of the available and relevant literature on AP in social anxiety. In particular, the chapter highlighted how AP contributes to the maintenance of SAD by outlining the maladaptive characteristics of this RNT process. Furthermore, the chapter also reviewed the literature illustrating the behavioural, physiological, cognitive, and affective consequences in socially anxious individuals. While the current literature on AP supports the contention that AP is a key maintaining factor of social anxiety as proposed by theoretical models (Clark & Wells, 1995; Rapee & Heimberg, 1997), the literature is limited with researchers neglecting to answer the question of how and why AP exerts its effects on those with social anxiety. Consequently, the chapter also described a theoretical explanation as to the cognitive mechanisms that may underlie AP in social anxiety. Specifically, the application of attentional control theory aligns with the main aim of the current program of research and is the framework used to examine the underlying cognitive processes of AP. The following chapter, chapter 2, is the second part of this two part review and similarly focuses on the relevant literature on PEP in social anxiety.
CHAPTER 2: REPETITIVE NEGATIVE THINKING IN SOCIAL ANXIETY

DISORDER 2: POST-EVENT PROCESSING

Abstract .......................................................................................................................... 41

Introduction .................................................................................................................. 42

Procedure for Systematic Review ................................................................................ 42

Repetitive Negative Thinking ....................................................................................... 43

Cognitive-Behavioural Models of Social Anxiety .......................................................... 44

Post-Event Processing and Social Anxiety ................................................................. 44

Table 2.1 ..................................................................................................................... 45

Table 2.2 ..................................................................................................................... 48

Post-Event Processing in Response to a Social Interaction ....................................... 54

Post-Event Processing in Response to a Speech Performance .................................. 55

Post-Event Processing as Disorder-Specific or Transdiagnostic ................................ 56

Changes in Post-Event Processing in Response to Treatment .................................... 57

Causes and Consequences of Post-Event Processing .................................................. 59

Post-Event Processing and Memory ......................................................................... 59

Post-Event Processing, Self-Focused Attention and Attention Bias ......................... 60

Modes of Post-Event Processing .............................................................................. 63

Post-Event Processing and Imagery ......................................................................... 66

Post-Event Processing and Self-Appraisal ............................................................... 67

Adaptive Effects of Post-Event Processing ............................................................... 68

Limitations of Existing Evidence in Post-Event Processing ...................................... 69

A Theory of Attentional Control ............................................................................... 71

Conclusions and Future Directions .......................................................................... 73
Chapter 2 Conclusion .................................................................................................................. 75
Aims of the Program of Research.................................................................................................. 75
Notes

Paper Published:
*Psychopathology Review, 4,* 263-289.

The candidate is first author on this paper and accepts responsibility of its publication. All co-authors meet the criteria for authorship and take responsibility for their part in the publication. The candidate was responsible for manuscript preparation including systematic review of the literature and writing the manuscript. All co-authors are members of the candidate’s supervisory team and their contribution to the paper was supervisory in nature.

Textrum Publishing permits the use of The Contribution for inclusion in a thesis or dissertation as long as full acknowledgement of The Contribution’s published source is given.

(Signed) (Date): 17/02/2018
Rachel A. Sluis

(Countersigned) (Date): 17/02/2018
Primary Supervisor: Mark J. Boschen

(Countersigned) (Date):17/02/2018
Associate Supervisor: David L. Neumann
(Countersigned) (Date): 17/02/2018

Associate Supervisor: Karen Murphy
Abstract

Cognitive models of social anxiety disorder (SAD) emphasize post-event processing (PEP) as a prominent maintaining factor that occurs after social-evaluative events. PEP involves repetitive negative thinking (RNT) revolved around perceived social failure. The present review concentrates on the relevant and available empirical literature on PEP in social anxiety which centres on Clarke and Wells (1995) theoretical framework. Correlational and experimental studies have investigated the relationship between PEP and the behavioural, physiological, cognitive and affective outcomes for socially anxious individuals. The majority of study designs include those investigating PEP in response to social-evaluative threat, and in response to treatment. Limitations of the existing literature are discussed and suggestions for future research examining the underlying cognitive functions of PEP are proposed.

KEYWORDS: Social Anxiety Disorder, Social Phobia, Repetitive Negative Thinking, Rumination, Post-Event Processing, Attentional Control.
Introduction

This review focuses on the empirical literature which centres on Clark and Wells’ (1995) theoretical framework of the cognitive maintaining factors of social anxiety. This review extends previous work in the area by outlining the cognitive mechanisms thought to be responsible for this perseverative mode of thought. As a more detailed description of repetitive negative thinking (RNT) has been outlined in the first paper of this two-part review (Sluis, Boschen, Neumann, & Murphy, 2017a), the construct of RNT will only be briefly touched upon in this article. The review will focus on the relevant literature on post-event processing (PEP) in social anxiety. Two renowned cognitive models of social anxiety will be outlined (Clark & Wells, 1995; Rapee & Heimberg, 1997), followed by a theoretical explanation regarding attentional control. Limitations of prior research in the area are noted and suggestions for future research within the social anxiety field are presented.

Procedure for Systematic Review

One of the largest databases of English-language psychological/psychiatric literature, PsychInfo, was used for the search in June 2016. The number of articles published regarding social anxiety and PEP was estimated by using the search terms “SOCIAL ANXIETY” and “POST-EVENT PROCESSING”. A total of 66 articles were retrieved that were then examined for relevance of which 43 articles were included. Inclusion criteria comprised: only articles specifically investigating PEP within the context of social anxiety; use of an adult population; and no comorbid effects of substance use on PEP. Any articles retrieved that investigated anticipatory processing (AP) in social anxiety were not included as these were comprehensively reviewed in the first paper of this two-part review. The references section of each article retrieved was also examined to locate other related articles that were not located
in the original search. This yielded a total of 17 articles which met the inclusion criteria.

**Repetitive Negative Thinking**

RNT can be described as a maladaptive, repetitive, and perseverative pattern of thinking, which is negatively valenced and perceived to be intrusive or unwanted (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Rachman, 1981). Such thinking is typically observed across a range of psychopathologies, including depression and anxiety (American Psychiatric Association, 2013), and is believed to consume cognitive resources that limits availability for the effective operation of other cognitive functions (Linville, 1996).

While RNT is considered a transdiagnostic process that is characteristic of various psychopathologies (Harvey, Watkins, Mansell, & Shafran, 2004), there appear to be functional differences between these modes of thought for different disorders. For example, differences in valence (i.e., positive versus negative content), temporal orientation (i.e., past, present, or future), and discrepancy (i.e., an incomplete versus a completed task) can be used to specify different modes of RNT (Martin & Tesser, 1996). *Depressive rumination*, has been described as “behaviour and thoughts that focus one’s attention on one’s depressive symptoms and on the implications of these symptoms” (Nolen-Hoeksema, 1991, p. 569) and is primarily a feature of major depression (Nolen-Hoeksema, 1991; Nolen-Hoeksema, 2000). PEP occurs when a person with social phobia leaves a social event and experiences RNT centred on perceived social failure (Clark & Wells, 1995). While both depressive rumination and PEP are overlapping constructs (McEvoy, Mahoney, & Moulds, 2010), slight differences regarding content and unattained goals ruminated about vary. For example, depressed patients tend to ruminate on their depressive symptoms and consequences
(Nolen-Hoeksema, 1991), while individuals with social anxiety disorder (SAD) focus on rumination related to perceived social failure (Clark & Wells, 1995).

**Cognitive-Behavioural Models of Social Anxiety**

Given that social anxiety disorder (SAD) is one of the most prevalent lifetime disorders (Kessler et al., 2005), identifying the processes implicated in the maintenance of social anxiety is important. Two of the most prominent cognitive-behavioural models of social anxiety provide useful frameworks for understanding the role of PEP in social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). Both models are similar in that they propose that individuals with social anxiety engage in PEP following social-evaluative events. A more detailed account of these models has been given previously (Sluis et al., 2017a), consequently this section will review mainly PEP.

Rapee and Heimberg (1997) suggest that the processes maintaining social anxiety are the same regardless of whether a social-evaluative situation is encountered, anticipated, or retrospectively brooded over. However, they do not explicitly emphasise PEP as a distinct and important maintaining factor of social anxiety. In contrast, Clark and Wells (1995) specifically note the significance of PEP after leaving a social-evaluative situation and describe this as a unique maintaining factor for socially anxious individuals. Due to their explicit account of PEP, much of the literature has employed the Clark and Wells (1995) model. Thus, the following review focuses on PEP and how it relates to this model.

**Post-Event Processing and Social Anxiety**

Tables 2.1 and 2.2 provide a detailed description of the study details, measures used, and a summary of findings for each study included in this review. The effects of PEP in social anxiety are better understood than AP given the larger literature base on the former (Sluis et al., 2017a; see Table 2.1). The first measure of PEP (PEPQ; Post-Event Processing Questionnaire) was developed by Rachman, Grüter-Andrew and
### Table 2.1. **Characteristics of Post-Event Processing in Social Anxiety**

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Social-evaluative threat induction</th>
<th>Follow-up</th>
<th>PEP measure (additional measures)</th>
<th>Summary of findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rachman et al. (2000)</td>
<td>130 undergraduates (high and low SA)</td>
<td>No</td>
<td>No</td>
<td>PEPQ (scale development; BDI II, SPAI)</td>
<td>High and low SA differ significantly on PEP for social events. High SA report PEP to make matters worse.</td>
</tr>
<tr>
<td>McEvoy and Kingsep (2006)</td>
<td>117 SAD</td>
<td>No</td>
<td>No</td>
<td>PEPQ (SPS, SIAS, BDI II, DASS)</td>
<td>PEP did not relate significantly with measures of performance or social interaction anxiety. PEP related most strongly to state anxiety.</td>
</tr>
<tr>
<td>Wong (2015)</td>
<td>560 undergraduates</td>
<td>No</td>
<td>No</td>
<td>E-PEPQ (SPS, DASS)</td>
<td>The E-PEPQ-15 demonstrated good internal consistency</td>
</tr>
<tr>
<td>Fehm et al. (2008)</td>
<td>130 undergraduates</td>
<td>No</td>
<td>No</td>
<td>PEPQ (German)</td>
<td>Revised PEPQ showed excellent internal consistency</td>
</tr>
<tr>
<td>Fehm et al. (2007)</td>
<td>217 undergraduates</td>
<td>No</td>
<td>No</td>
<td>PEPQ (German)</td>
<td>Social events were followed more often and by more intense PEP. FNE was significantly associated with PEP for social but not for general phobic situations (specificity). PEP was particularly elevated for social interactions, as opposed to performance situations.</td>
</tr>
<tr>
<td>Kocovski and Rector (2007)</td>
<td>439 undergraduates</td>
<td>No</td>
<td>No</td>
<td>PEPQ, ARQ (SPS, ASI)</td>
<td>High SA associated with higher levels of PEP relating to social events. High levels of trait anxious rumination associated with higher PEP. SA and anxious rumination accounted for 25% of variance in PEP.</td>
</tr>
<tr>
<td>Lundh and Sperling (2002)</td>
<td>55 undergraduates</td>
<td>No</td>
<td>1-week</td>
<td>PEPR (SPS)</td>
<td>SA was associated with the degree of negative PEP following negative-evaluational events. Negative PEP was highly stable over two consecutive days.</td>
</tr>
<tr>
<td>Campbell, Bierman and Molenaar (2016)</td>
<td>10 undergraduates</td>
<td>No</td>
<td>13-week daily follow-ups 1-week</td>
<td>PEPQ (SADS, BFNE, ASBQ)</td>
<td>Same-day fear of negative evaluation was associated with maladaptive post-event rumination which influenced social withdrawal behaviours</td>
</tr>
<tr>
<td>Laposa and Rector (2011)</td>
<td>75 SAD</td>
<td>No (video-taped exposure during treatment)</td>
<td>No (video-taped exposure during treatment)</td>
<td>PEPQ, ARQ (SIAS, SADOS, IPES)</td>
<td>PEP was positively associated with baseline SA symptoms, state anxiety during videotaping, anxious rumination, fear of causing discomfort to others, and negative interpretation of positive social events.</td>
</tr>
<tr>
<td>Mitchell and Schmidt (2014)</td>
<td>42 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>Four-days</td>
<td>PEPQ-R (BDI II, SIAS, SAFE)</td>
<td>In-situation safety behaviours uniquely associated with greater PEP. State anxiety not uniquely associated with PEP. Restricting and active subtypes of in-situation safety behaviours showed specificity to PEP.</td>
</tr>
<tr>
<td>Holzman et al. (2014)</td>
<td>101 undergraduates</td>
<td>No</td>
<td>No</td>
<td>PEPQ-R (SFA, SBSA, SPS, SIAS)</td>
<td>SFA and PEP predicted social performance anxiety after controlling for social interaction anxiety. Associations with social interaction anxiety were non-significant when controlling for performance anxiety.</td>
</tr>
<tr>
<td>Fisak &amp; Hammond (2013)</td>
<td>300 undergraduates</td>
<td>No</td>
<td>No</td>
<td>PEPQ</td>
<td>Positive beliefs about PEP positively associated with PEP and SA.</td>
</tr>
<tr>
<td>Wong and Moulds (2010)</td>
<td>124 undergraduates</td>
<td>No</td>
<td>No</td>
<td>RTQ (FNE, DASS, PBRS)</td>
<td>SA was positively associated with positive metacognitive beliefs about rumination.</td>
</tr>
</tbody>
</table>
EXECUTIVE FUNCTION AND REPETITIVE NEGATIVE THINKING

Mellingings and Alden (2000) 116 undergraduates (high and low SA) Interaction 1-day RQ (SADS; FAQ; STAI; RSQ; BDI) High SA showed more selective attention to negative self-related information than low SA. High SA also engaged in more PEP the day following the interaction.

Dannahy and Stopa (2007) 50 undergraduates (high and low SA) Interaction 1-week TQ, DTQ (FNE, SPRS, BDI) High SA engaged in more PEP, and reported more negative PEP than low SA.

Kashdan and Roberts (2007) 83 undergraduates Interaction 1-day RQ (SIAS, PANAS, BDI-II) High SA associated with greater negative PEP following interactions with strangers (largely limited to those with high depressive symptoms). High SA and PEP associated with increased negative affect following personal disclosure interactions.

Edwards et al. (2003) 53 undergraduates (high and low SA) Speech 1-week TQ (BFNE; SADS; APPQ-S; DASS) High SA showed greater memory biases, spent more time ruminating over perceived negative aspects of speech, and engaged in greater levels of overall rumination.

Kocovski et al. (2005) 112 undergraduates (high and low SA) No CHIP (EMAS) High SA were more likely to ruminate and less likely to distract when faced with social stressors. High SA also recorded more negative thoughts and more upward counterfactual thoughts (i.e., if only).

Edwards et al. (2003) 53 undergraduates (high and low SA) Speech 1-week TQ (BFNE; SADS; APPQ-S; DASS) High SA showed greater memory biases, spent more time ruminating over perceived negative aspects of speech, and engaged in greater levels of overall rumination.

Kocovski et al. (2005) 112 undergraduates (high and low SA) No CHIP (EMAS) High SA were more likely to ruminate and less likely to distract when faced with social stressors. High SA also recorded more negative thoughts and more upward counterfactual thoughts (i.e., if only).

Cody and Teachman (2010) 81 undergraduates (high and low SA) Speech 2-days PEPQ, RSQ (SIAS; BFNE; PANAS; STAI) High SA remembered confederates feedback more positively than their own and remembered their negative feedback as worse than the low SA group.

Kiko et al. (2012) 91 SAD and 20 NC Speech and interaction 1-day PEPQ (SIAS; SPS; CES-D; SCQ; SBQ; FAQ TQ (SPS; SIAS; SPQ) The speech triggered significantly more intense PEP in SAD. Regardless of the social situation, PEP was best predicted by situational anxiety and dysfunctional cognitions.

Chen et al. (2013) 121 SAD Speech 1-week PEPQ (SIAS; SPS; BFNE; DASS) A direct path from trait social anxiety and PEP was found. Also, indirect paths from trait social anxiety to PEP via inappropriate attentional focus and self-evaluation of performance.

Abbott and Rapee (2004) 43 SAD and 30 NC Speech 1-week PERQ (SIAS; SPS; BFNE; DASS) SAD engaged in more negative PEP about speech than NC. SAD maintained negative self-appraisals of performance over 1 week. Following successful CBT, negative PEP was reduced.

Perini et al. (2006) 40 SAD and 20 NC Speech 1-week PERQ (SIAS; SPS; DASS; RSQ) SAD engaged in more negative rumination, experienced these thoughts as more distressing, perceived they had less control over these thoughts, and perceived their performance as worse than NC.

Makkar and Grisham (2011a) 40 undergraduates Speech and interaction 1-day PEPQ (FNE; SIAS; SPS; BDI-II; STAI; SBQ; SCQ; FAQ; SBSA) Higher levels of SA were associated with experiencing more negative self-perceptions and regret-based cognitions during PEP. PEP was greater following the speech than the interaction.

Coles et al. (2002) 22 SAD and 30 NC Speech and cocktail party interaction 3-weeks Memory perspective scale (SIAS; SPS; BDI) SAD group recalled role-plays from more of an observer perspective than NC over 3-week interval. SAD group made more dispositional attributions for their nervousness particularly 3 weeks later.

Kocovski and Rector (2008) 76 SAD No (exposure therapy tasks) 1-week PEPQ, RSQ (SPS; SIAS; LSAS; BDI-II) Significant PEP occurred after both exposure tasks. Anxiety ratings were positively correlated with the severity of subsequent PEP related to exposure task.

Laposa, Collimore and Rector (2014) 233 Individuals with varying anxiety No (CBGT) 1-week PEPQ (SIAS, PSWQ) All anxiety disorders showed heightened and equivalent post-event processing ratings and that peak state anxiety during the first CBGT session predicted subsequent level of post-event
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Size</th>
<th>Type of Intervention</th>
<th>Duration</th>
<th>Measures Used</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>McEvoy et al. (2009)</td>
<td>61 SAD</td>
<td>No (CBGT)</td>
<td>7-weeks</td>
<td>YBOCS-SR, PDSS-SR, PEPQ-R (SPS, SIAS, BDI-II, MCQ)</td>
<td>Reduced PEP was associated with reduced SA, but not depression.</td>
</tr>
<tr>
<td>Price and Anderson (2011)</td>
<td>91 SAD</td>
<td>No (CBGT)</td>
<td>8-sessions</td>
<td>RQ (FNE)</td>
<td>PEP reduced as a result of treatment</td>
</tr>
<tr>
<td>Hedman et al. (2013)</td>
<td>94 SAD</td>
<td>No (ICT and CBGT)</td>
<td>ICT (16-sessions) CBGT (15-sessions)</td>
<td>SPWSS</td>
<td>ICT was mainly mediated by reductions in avoidance and self-focused attention, whereas improvement in CBGT was mediated by changes in self-focused attention, and anticipatory and post-event processing.</td>
</tr>
<tr>
<td>McEvoy and Perini (2009)</td>
<td>81 SAD</td>
<td>No (CBGT and ATT)</td>
<td>7-weeks</td>
<td>Single-item measure of PEP and AP (SPS, SIAS, BDI-II, MCQ)</td>
<td>PEP improved significantly following both CBGT and ATT.</td>
</tr>
</tbody>
</table>

Note: PEP = post-event processing; SA = social anxiety; SAD = social anxiety disorder; NC = normal controls; AP = Anticipatory Processing; FNE = Fear of Negative Evaluation; BFNE = Brief Fear of Negative Evaluation Scale; SADS = Social Avoidance and Distress Scale; BDI II = Beck Depression Inventory II; SPAI = Social Phobia and Anxiety Inventory; DASS = Depression, Anxiety and Stress Scale; SFA = self-focused attention; CBT = cognitive-behavioural therapy; CBGT = cognitive-behavioural group therapy; ICT = Individual Cognitive Therapy; ASI = Anxiety Sensitivity Index; ATT = Attention Training; PEPQ = Post-Event Processing Questionnaire; PEPQ-R = Post-Event Processing Questionnaire Revised; E-PEPQ = Extended Post-Event Processing Questionnaire; ARQ = Anxious Rumination Questionnaire; PEPR = Post-Event Processing Record; RTQ = Repetitive Thinking Questionnaire; RQ = Rumination Questionnaire; SPS = Social Phobia Questionnaire; SIAS = Social Interaction Anxiety Scale; TQ = Thoughts Questionnaire; DTQ = Daily Thoughts Questionnaire; CHIP = Coping with Health Injuries and Problems; PERQ = Post-Event Rumination Questionnaire; SADOS = Social Anxiety and the Fear of Cauing Discomfort to Others; IPES = Interpretation of Positive Events Scale; SAFE = Subtle Avoidance Frequency Examination; SBSA = Self-Beliefs Related to Social Anxiety Scale; PBRS = Positive Beliefs about Rumination Scale; SPRS = Social Performance Rating Scale; PANAS = Positive and Negative Affect Scales; BSQ = Body Sensations Questionnaire; STAI = State Trait Anxiety Inventory; FAQ = Focus of Attention Questionnaire; RSQ = Response Style Questionnaire; APPQ-S = Albany Panic and Phobia Scale; EMAS = Endler Multidimensional Anxiety Scale; CES = Center of Epidemiological Studies; DFS = Dysfunctional and Functional Self-Consciousness Questionnaire; SCQ = Social Cognitions Questionnaire; SBQ = Social Behaviours Questionnaire; SPQ = Speech Performance Questionnaire; LSAS = Liebowitz Social Anxiety Scale; MCQ = Meta-Cognitions Questionnaire; ACS = Attentional Control Scale; SPWSS = Social Phobia Weekly Summary Scale; ASBQ = Anticipatory Social Behaviours Questionnaire; PSWQ = Penn State Worry Questionnaire; YBOCS-SR = Yale-Brown Obsessive Compulsive Scale-Self Report; PDSS-SR = Panic Disorder Severity Scale-Self Report |
### Table 2.2.

**Causes and Consequences of Post-Event Processing in Social Anxiety**

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Social-evaluative threat induction</th>
<th>Follow-up</th>
<th>PEP measure</th>
<th>Summary of findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wong and Moulds (2009)</td>
<td>93 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>No</td>
<td>VAS (FNE; DASS; SBSA; VAS; PEPQ-R (SPIN))</td>
<td>Relative to distraction, rumination maintained anxiety in both high and low SA groups.</td>
</tr>
<tr>
<td>Rowa et al. (2014)</td>
<td>41 SAD</td>
<td>Speech</td>
<td>1-day</td>
<td>PEPQ, TQ (SPS; BDI-II)</td>
<td>Compared to the focus (PEP) condition, those in the distraction condition reported decreased anxiety.</td>
</tr>
<tr>
<td>Kocovski et al. (2011)</td>
<td>114 undergraduates</td>
<td>Speech</td>
<td>1-week</td>
<td>PEPQ (SPAI)</td>
<td>High SA group in distraction condition reported more positive thoughts compared with high SA group who ruminated. Both SA and depression predicted greater PEP and negative thoughts 1 week later.</td>
</tr>
<tr>
<td>Field and Morgan (2004)</td>
<td>66 students (high and low SA)</td>
<td>No</td>
<td>No</td>
<td>PEPQ (SPAI)</td>
<td>High SA recalled memories rated as significantly more negative and shameful regardless of whether they engaged in positive or negative PEP. High SA group engaged in negative PEP recalled memories as anxious and shameful but rated as more calming.</td>
</tr>
<tr>
<td>Morgan and Banerjee (2008)</td>
<td>50 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>No</td>
<td>AMQ (SPAI; BDI)</td>
<td>Negative feedback led to recall of memories with a greater average anxiety rating in high SA group. High SA who engaged in a ruminative response style recalled memories with the highest average anxiety rating.</td>
</tr>
<tr>
<td>Chiupka et al. (2012)</td>
<td>85 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>No</td>
<td>PANAS (SPIN; DASS; NSPS)</td>
<td>PEP images and memories were associated with greater reported negative impact on participants’ perceptions of self and others.</td>
</tr>
<tr>
<td>Brozovich and Heimberg (2011)</td>
<td>64 undergraduates (high and low SA)</td>
<td>Interaction</td>
<td>1-week</td>
<td>PEPQ (SIAS; BDI-II; BFNE; BSAM; SPQ)</td>
<td>High SA group evaluated their performance more poorly than low SA group both immediately after and 1 week following the interaction. High SA assigned to self-focused PEP displayed fewer positive feelings about performance compared to high SA in other-focused PEP condition.</td>
</tr>
<tr>
<td>Gaydukevych and Kocovski (2012)</td>
<td>82 undergraduates (high and low SA)</td>
<td>Interaction</td>
<td>1-day</td>
<td>TQ, PEPQ (SIAS; BDI-II; TFAQ; RRQ; FAQ)</td>
<td>The high self-focused attention group reported more frequent negative PEP over the 24-hour period compared to the low self-focused group.</td>
</tr>
<tr>
<td>Holzman and Valentiner (2016)</td>
<td>137 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>1-day</td>
<td>TQ (SPS, SIAS, CES-D, FAQ, BQ)</td>
<td>High levels of self-focused attention led to a stronger, inverse relationship between immediate positive performance appraisals and subsequent negative PEP. High levels of self-focused attention led to a stronger, inverse relationship between negative PEP and changes in positive performance appraisals</td>
</tr>
<tr>
<td>Makkar and Grisham (2013)</td>
<td>80 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>1-day</td>
<td>TQ (BFNE; SPS; DASS; PANAS; BQ; FAQ; SCQ)</td>
<td>Participants who observed a false increased heart rate reported higher levels of negative affect, more negative performance appraisals, and more frequent negative ruminative thoughts (not specific to high SA’s).</td>
</tr>
<tr>
<td>Brown and Kocovski (2014)</td>
<td>104 undergraduates</td>
<td>Speech</td>
<td>2-days</td>
<td>PEPQ, TQ, RRQ (SIAS, LSAS, FMPS,</td>
<td>Both state and trait perfectionism was a significant predictor of post-event processing two days following the speech while controlling for baseline social anxiety, depression and state anxiety</td>
</tr>
<tr>
<td>Study / Authors (Year)</td>
<td>Participants / Conditions</td>
<td>Task / Manipulation</td>
<td>Time</td>
<td>Measures</td>
<td>Outcomes</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------</td>
<td>--------------------</td>
<td>------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Cek, Sánchez, and Timpano (2016)</td>
<td>55 undergraduates</td>
<td>Speech</td>
<td>30-minutes</td>
<td>BDI-II, TQ (SIAS)</td>
<td>The association between social anxiety and post-event processing was partially accounted for by attention bias to disgust.</td>
</tr>
<tr>
<td>Vassilopoulos (2008)</td>
<td>58 undergraduates (high and low SA)</td>
<td>No</td>
<td>No</td>
<td>Thought-listing exercise (FNE; BDI-II)</td>
<td>High SA in the experiential self-focus condition showed decreased anxiety from pre to post manipulation and was associated with more positive thoughts on the thought-listing exercise.</td>
</tr>
<tr>
<td>Nilsson et al. (2012)</td>
<td>12 SAD</td>
<td>Speech</td>
<td>No</td>
<td>Thought listing exercise (FNE; SPS; SIAS; BDI-II; VEQ)</td>
<td>An experiential self-focused mode led to a decreased proportion of negative thoughts, whereas an analytical self-focused mode led to a decreased proportion of neutral thoughts.</td>
</tr>
<tr>
<td>Wong and Moulds (2012)</td>
<td>74 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>No</td>
<td>VAS (FNE; DASS; SBSA; SPORS)</td>
<td>An experiential processing mode led to stronger unconditional beliefs during PEP.</td>
</tr>
<tr>
<td>Wong, McEvoy and Rapee (2016)</td>
<td>331 undergraduates (high and low SA)</td>
<td>No</td>
<td>1-week</td>
<td>RTQ (E-PEPQ, SPS, DASS, SBSA)</td>
<td>A higher number of recent social stressors predicted an increasing trajectory of conditional and unconditional beliefs but only within the context of participants with high levels of SA and low levels of thoughts about the past.</td>
</tr>
<tr>
<td>Cody and Teachman (2011)</td>
<td>97 undergraduates (high and low SA)</td>
<td>4 Speeches</td>
<td>3-days</td>
<td>PEPQ (SIAS, SPS, BFNE, MPSP)</td>
<td>Post-event processing fully mediated the relationship between social anxiety group status and worsening global performance evaluations.</td>
</tr>
<tr>
<td>Makkar and Grisham (2011b)</td>
<td>77 participants (high and low SA)</td>
<td>Speech</td>
<td>1-day</td>
<td>TQ, SCQ (BFNE; SIAS; SPS; BDI-II; STAI; BQ; FAQ)</td>
<td>Regardless of SA group, those who held a negative self-image experienced higher levels of anxiety and engaged in more negative PEP.</td>
</tr>
<tr>
<td>Brozovich and Heimberg (2013)</td>
<td>114 undergraduates (high and low SA)</td>
<td>Speech</td>
<td>No</td>
<td>PEPQ (PRCA; BDI-II; SIAS; BSAM)</td>
<td>High SA in the PEP-imagery condition displayed greater anxiety than those in the PEP-semantic or control conditions.</td>
</tr>
<tr>
<td>Zou and Abbott (2012)</td>
<td>40 SAD and 40 NC</td>
<td>Interaction</td>
<td>No</td>
<td>TQ (SIAS; SPS: BFNE; DASS; PANAS; SAR; PQ)</td>
<td>The moderate score condition (of false feedback) was detrimental for socially anxious individuals self-appraisal’s and PEP (whereas controls did not show this effect)</td>
</tr>
<tr>
<td>Gramer, Schild and Lurz, 2012</td>
<td>70 female undergraduates</td>
<td>Speech</td>
<td>1-week</td>
<td>TQ (SAP, PANAS, DASS)</td>
<td>Socially anxious individuals displayed higher levels of negative rumination, and post-event rumination during recovery was significantly related to post-task reappraisals. Group differences in rumination were also mediated by cognitive appraisals.</td>
</tr>
<tr>
<td>Makkar and Grisham (2012)</td>
<td>81 undergraduates (high and low SA)</td>
<td>2 Speeches</td>
<td>No</td>
<td>Response task manipulation (BFNE; SPS; BDI-II; STAI; BQ; SCQ)</td>
<td>Engaging in PEP compared to distraction led to increased willingness to give a second speech, reduction in negative performance appraisals, and better perceived speech quality.</td>
</tr>
<tr>
<td>Blackie and Kocovski (2016)</td>
<td>77 undergraduates</td>
<td>2 Speeches</td>
<td>1-day</td>
<td>PEPQ, TQ, SARQ (SIAS, SIBS, BDI-II)</td>
<td>They found that those in the distraction condition reported less post-event processing than those in the rumination and control conditions.</td>
</tr>
</tbody>
</table>
Non-verbal intelligence was a unique negative predictor of post-event processing, however no relationship was found between social anxiety symptoms and verbal or non-verbal intelligence.

Note: SA = social anxiety; NC = normal controls; PEP = post-event processing; PEPQ = Post-Event Processing Questionnaire; AMQ = Autobiographical Memory Questionnaire; VAS = Visual Analogue Scales; TQ = Thoughts Questionnaire; SCQ = Social Cognitions Questionnaire; PANAS = Positive and Negative Affect Scale; PEPQ-R = Post-Event Processing Questionnaire Revised; E-PEPQ = Extended Post-Event Processing Questionnaire; FNE = Fear of Negative Evaluation Scale; DASS = Depression, Anxiety, and Stress Scale; SBSA = Self-Beliefs Related to Social Anxiety Scale; VAS = Visual Analogue Scale; SPIN = Social Phobia Inventory; SPS = Social Phobia Scale; BDI-II = Beck Depression Inventory; SPAI = Social Phobia and Anxiety Inventory; NSPS = Negative Self Portrayal Scale; BSAM = Brief State Anxiety Measure; BFNE = Brief Fear of Negative Evaluation Scale; SPQ = Speech Performance Questionnaire; TSFAQ = Trait Self-Focused Attention Questionnaire; RRQ = Ruminative Reflection Questionnaire; FAQ = Focus of Attention Questionnaire; BQ = Behaviour Questionnaire; VEQ = Voice Evaluation Questionnaire; SPORS = Speech Performance Observer Rating Scale; PRCA = Personal Report of Communication Apprehension; SAR = State Anxiety Rating; PQ = Performance Questionnaire; STAI = State Trait Anxiety Inventory; CES-D = Center for Epidemiological Studies Depression Scale; RTQ = Repetitive Thinking Questionnaire; SARQ = Social Anxiety Rumination Questionnaire; SIBS = Social Interaction Phobia Scale; LSAS = Liebowitz Social Anxiety Scale; FMPS = Frost Multidimensional Perfectionism Scale; SAP = Social Anxiety Scale; RRS = Ruminative Response Scale; PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire-IV; MPSP = Modified Perception of Speech Performance
Shafran (2000). The authors employed an analogue sample of 130 high and low socially anxious undergraduates to develop the 13-item measure that assesses the intensity and frequency of engaging in PEP following a social-evaluative situation. They found that socially anxious individuals reported higher levels of PEP on the PEPQ than low socially anxious individuals. The authors also conducted a principal components analysis and found that all items except three loaded significantly on one factor, accounting for 42.8% of the variance. Moreover, PEP in high socially anxious individuals was positively associated with: (1) more frequent recall of negative events; (2) avoidance of similar social situations; and (3) memories rated as intrusive and interfering.

In an attempt to replicate and extend the findings of Rachman et al. (2000), McEvoy and Kingsep (2006) employed a clinical sample of 117 participants with a primary diagnosis of social phobia. These authors replicated the single factor solution of Rachman et al. (2000) with the exception of one item, demonstrating the robustness of the factor structure across different samples. Interestingly, they found that the PEPQ was not significantly correlated with measures of performance or social interaction anxiety, but it was independently and strongly related to state anxiety (after controlling for depression, trait anxiety and stress; \( r = .26 \)). While the authors suggest that PEP may be a function of situational, transient anxiety in general rather than being specific to social anxiety, the state anxiety experienced by this sample was observed within a social context. The PEPQ has also shown good psychometric properties in a German version of the PEPQ (Fehm, Hoyer, Schneider, Lindemann, & Klusmann, 2008) and has since been further developed into the Extended Post-Event Processing Questionnaire (E-PEPQ; Wong, 2015). A 15-item version of the E-PEPQ demonstrated good internal consistency and two of its three subscales had significantly stronger positive associations with social anxiety than with depression (Wong, 2015).
Researchers have also begun to explore the characteristics and stability of PEP in the context of social anxiety. Correlational evidence suggests that social situations elicit significantly more PEP than do non-social phobic situations (Fehm, Schneider, & Hoyer, 2007). Kocovski and Rector (2007) recruited a sample of 439 college students who completed a number of anxiety and PEP self-report questionnaires (see Table 2.1 for measures). They found that higher levels of social anxiety (measured by the Social Phobia Scale [SPS]; Mattick & Clark, 1998) and trait anxious rumination were associated with higher levels of PEP in relation to a social event (β = 0.15). Furthermore, social anxiety and trait anxious rumination accounted for approximately 25% of the variance in PEP (Kocovski & Rector, 2007). Thus, emphasizing the relevance of the PEP construct for models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). Employing a more ecologically valid methodology, Lundh and Sperling (2002) employed a sample of 62 undergraduate students who were required to recall a social anxiety provoking event and use a diary method to record their thoughts while they engaged in PEP. Findings showed that social anxiety was significantly associated with the degree of PEP after a negative-evaluational event (r = .51), and that PEP was highly stable over two consecutive days (r = .75). However, it should be noted that only one measure of social anxiety was used (SPS; Mattick & Clark, 1998) which may not entirely capture each dimension of social anxiety. Furthermore, it is possible that the diary method recording itself may have facilitated more frequent and intense PEP than otherwise may have been experienced. Similarly, Campbell, Bierman, and Molenaar (2016) employed a sample of 10 new undergraduate students starting their first semester at university to investigate how day-to-day processes of social anxiety influenced future social anxiety and social withdrawal. Participants were required to complete brief online daily diaries throughout the 13 weeks of their first semester by outlining salient anxiety-provoking social interactions
and completing several brief measures. They found that for most individuals, same-day fear of negative evaluation was associated with maladaptive PEP ($\beta = .72$) which influenced social withdrawal behaviours. While their findings provide important idiographic information based on more ecologically valid experiences, the sample size was small. Further support for the stability of PEP has also been evidenced by Laposa and Rector (2011) who employed a sample of 75 individuals with a primary diagnosis of social phobia. Participants completed several self-report measures before engaging in cognitive-behavioural group therapy (CBGT). They demonstrated that PEP was stable over four weeks in the context of videotaped exposures during treatment ($r = .68$). While these studies provide preliminary support for the stability and pervasiveness of PEP, it should be noted that the aforementioned studies did not control for depression which limits the ability to determine specificity of the PEP construct to social anxiety (Campbell, Bierman, & Molenaar, 2016; Laposa & Rector, 2011; Lundh & Sperling, 2002).

Further support for the Clark and Wells (1995) model of social anxiety has been obtained by research showing that in-situation safety behaviours are uniquely associated with higher levels of PEP (Mitchell & Schmidt, 2014), and that interoceptive self-focused attention and PEP uniquely predict social performance anxiety, but not social interaction anxiety (Holzman, Valentiner, & McCraw, 2014). Other researchers have investigated underlying metacognitive processes that may maintain PEP. In line with the metacognitive model of GAD (Wells, 1995), several studies have revealed associations between social anxiety and positive metacognitive beliefs about rumination, even after controlling for gender, depression, level of rumination, and other metacognitive variables (Fisak & Hammond, 2013; Wong & Moulds, 2010). Taken together, these studies highlight that PEP may be a unique and adverse maintaining factor of social anxiety that is relatively stable over time, however it is important for
researchers to consistently include measures of depression into study designs in order to further elucidate specificity of PEP to social anxiety. Furthermore, the vast majority of these studies have employed analogue samples, thus study designs need to be replicated with clinical samples in order to generalise the findings.

**Post-Event Processing in Response to a Social Interaction**

Researchers have examined cognitive processes in response to social-evaluative threats. These types of social stressors typically elicit PEP using either a social interaction or a speech task. In a social interaction, it is believed that the ambiguity of the situation is primarily responsible for the anxiety-induced effects. In other words, the more ambiguous a situation is perceived to be, the more likely a socially anxious individual will experience anxiety. Mellings and Alden (2000) used the Fear of Negative Evaluation scale (FNE; Watson & Friend, 1969) to distinguish undergraduates into high and low social anxiety groups. Participants were required to engage in a social interaction with a confederate of the opposite sex and then they measured the frequency of PEP the following day. They found that high socially anxious individuals, compared to low socially anxious, showed more selective attention to negative self-related information which was associated with more biased judgments about recollections of the event ($r = .37$). Furthermore, high socially anxious individuals engaged in more PEP the day after the interaction, and the frequency of PEP predicted recall of negative self-related information ($r = .20$). Dannahy and Stopa (2007) also used an interaction task employing 132 high and low socially anxious undergraduates and found that high socially anxious individuals engaged in more PEP, experienced more anxiety, predicted worse performance, and underestimated their actual performance than low socially anxious individuals. The degree of PEP was also linked to the extent of social anxiety and negative appraisals of performance both immediately following the interaction ($r = -.26$) and one week later ($r = -.40$; Dannahy
Kashdan and Roberts (2007) employed 83 college students and also found that social anxiety was associated with greater PEP following a social interaction, although this finding was largely limited to those with elevated depressive symptoms ($r = 0.42$).

**Post-Event Processing in Response to a Speech Performance**

Similar findings to social interactions have also been reported by studies inducing social-evaluative threat following a speech task. In studies employing analogue samples, it has been found that in response to a speech task high socially anxious individuals engage in greater and more negative levels of PEP (Edwards, Rapee, & Franklin, 2003); are more likely to use ruminative coping strategies than distraction strategies (Kocovski, Endler, Rector, & Flett, 2005); and show greater memory biases for negative feedback regarding speech performance (Cody & Teachman, 2010). Furthermore, for speech tasks, consistently the results reveal that social anxiety is a unique predictor of PEP over and above that of depression and trait anxiety (Abbott & Rapee, 2004; Edwards et al., 2003; Makkar & Grisham, 2011a).

Comparable outcomes have also been established for clinical samples of socially phobic individuals. Studies employing patients with a principal diagnosis of SAD have found that speech tasks trigger significantly more intense PEP than social interactions (Kiko et al., 2012), and that trait social anxiety accounts for significant and unique variance in PEP following a speech task (Chen, Rapee, & Abbott, 2013). Abbott and Rapee (2004) and Perini, Abbott and Rapee (2006) found that, individuals with social phobia compared to non-anxious controls (43 individuals with social phobia and 30 controls, and 40 individuals with social phobia and 20 controls, respectively), engaged in more negative PEP in the week following a speech task ($r = .64$). Furthermore, individuals with social phobia reported experiencing these thoughts as more distressing ($r = .56$), and perceived they had less control over these thoughts ($r = -.44$; Perini,
Executive Function and Repetitive Negative Thinking

Abbott, & Rapee, 2006). Investigations regarding memory perspective of PEP have yielded analogous results to that obtained for AP (Hinrichsen & Clark, 2003). For example, Coles, Turk and Heimberg (2002) examined a clinical sample of 22 individuals who completed two role-plays which involved a speech and a party interaction situation. They found that memories following a role-play tended to be from more of an observer perspective than a field perspective following both a speech performance and a social interaction situation. They concluded that the importance of memory perspective rests on the idea that negative beliefs are further maintained due to the negatively skewed representation of the self.

Post-Event Processing as Disorder-Specific or Transdiagnostic

While some researchers suggest that PEP may be indistinguishable from other forms of RNT (e.g., depressive rumination; McEvoy et al., 2010; McEvoy et al., 2013), others have sought to differentiate PEP from depressive rumination. Kocovski and Rector (2008) had 76 patients with SAD complete 2 assessments of PEP following exposure to anxiety provoking tasks in CBGT. The first task involved attending a group therapy session, one of which was common to all patients. The second task was an idiosyncratically defined exposure task. Patients with higher social anxiety levels reported higher levels of PEP related to these anxiety provoking social events ($R^2 = .34$ and $R^2 = .23$, respectively; results which were consistent across multiple measures of social anxiety). Importantly, depressive rumination was not a significant predictor of PEP, and depressive rumination was not correlated with PEP or social anxiety. These findings imply that thought content focused upon during PEP, is specific to social anxiety and not confounded with depressive rumination (Kocovski & Rector, 2008). The authors concluded that while there is significant comorbidity between SAD and depression, there are important conceptual differences between these maintaining constructs which have diagnostic specificity (e.g., depressive rumination and PEP;
Kocovski & Rector, 2008). While depressed patients tend to ruminate on their depressive symptoms and consequences (Nolen-Hoeksema, 1991), individuals with SAD focus on rumination related to perceived social failure (Clark & Wells, 1995).

Conversely, other researchers have found that PEP may not be specific to social anxiety, but rather a transdiagnostic process observed across a range of disorders (Laposa, Collimore, & Rector, 2014). For example, Laposa, Collimore, and Rector (2014) employed a clinical sample of 233 individuals with a primary diagnosis of either: SAD ($n = 45$), obsessive-compulsive disorder ($n = 61$), generalised anxiety disorder ($n = 65$), or panic disorder with/without agoraphobia ($n = 62$) who attended CBGT specific to their diagnosis. The authors found that all anxiety disorders showed heightened and equivalent PEP ratings and that peak state anxiety during the first CBGT session predicted subsequent level of PEP, regardless of anxiety group. These findings provide preliminary support that PEP may be a transdiagnostic process that is observed across a range of anxiety disorders. While there is a strong empirical basis for PEP as a maintaining feature of social anxiety, future research is needed to further elucidate and disentangle whether PEP is indeed disorder-specific or transdiagnostic.

**Changes in Post-Event Processing in Response to Treatment**

The authors are aware of only four studies to date that have examined changes in PEP following interventions. McEvoy, Mahoney, Perini and Kingsep (2009) examined changes in PEP in a sample of 61 individuals diagnosed with social phobia following a seven week course of CBGT. They found that reductions in PEP following treatment were associated with reductions in social anxiety as measured by the SPS and Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998; SPS, $r = .39$ and SIAS, $r = .34$), but not depression. Furthermore, metacognitions were less strongly endorsed following treatment, except for positive metacognitions about PEP. These findings further validate the inclusion of PEP as a maintaining factor in models of social anxiety
(Clark & Wells, 1995; Rapee & Heimberg, 1997), and add to the literature highlighting the unique association of PEP to social anxiety. However, given the correlational nature of the study, causation is unable to be established.

Price and Anderson (2011) examined the extent that PEP is impacted by cognitive-behavioural therapy (CBT), and the relationship between PEP and change during treatment. Participants were a clinical sample of 91 individuals diagnosed with SAD, who were randomly assigned to either CBGT or an individually based virtual reality exposure. While both treatment conditions targeted several processes shown to maintain social anxiety, PEP was not specifically focused upon during treatment. However, PEP decreased as a result of treatment ($\beta_{10} = -8.82$, $p < .01$), and for individuals reporting higher levels of PEP prior to treatment, social anxiety symptoms improved at a slower rate than those with lower levels of PEP. These findings are interesting given that none of the treatment packages focused explicitly on PEP. However, the authors were unable to determine which components of the treatment packages contributed to reductions in PEP.

In a study of a clinical sample of 81 participants with a primary diagnosis of social phobia, McEvoy and Perini (2009) examined whether or not supplementing CBGT with Attention Training (ATT; Wells, 1990) could produce greater changes in AP and PEP. McEvoy and Perini (2009) found that both the CBGT group and the ATT group significantly improved on both AP ($r = .39$ and SIAS, $r = .38$) and PEP ($SPS, r = .42$ and SIAS, $r = .34$). Furthermore, increased attentional control during treatment was associated with reductions in both AP ($r = -.36$) and PEP ($r = -.44$). Accordingly, these findings provide support for the importance of increased attentional control in regards to reducing engagement in maladaptive RNT processes.

Employing a clinical sample of 94 individuals with social anxiety disorder, Hedman et al. (2013) investigated whether changes in four maintenance processes of
social anxiety (i.e., avoidance, self-focused attention, AP, and PEP) mediate clinical improvement in either individual cognitive therapy (ICT) or CBGT. They found significant between-treatment differences whereby improvement in ICT was mainly mediated by reductions in avoidance and self-focused attention, whereas improvement in CBGT was mediated by changes in self-focused attention, and AP and PEP. These results suggest that it is of greater importance to reduce AP and PEP in CBGT than it is in ICT, however it should be noted that the participants were collected from two separate randomised controlled trials so the results are not based on random allocation of a single cohort to ICT or CBGT.

**Causes and Consequences of Post-Event Processing**

Experimental studies that manipulate PEP or related constructs are beginning to accumulate (see Table 2.2 for study details). Such studies typically manipulate PEP following social-evaluative threat (e.g., speech task, social interaction) to examine the cognitive, affective, and behavioural consequences for socially anxious individuals. Researchers have shown that PEP maintains anxiety (Wong & Moulds, 2009), social anxiety predicts greater PEP and negative thoughts over the course of one week, and distraction leads to decreased anxiety (Rowa, Antony, Swinson, & McCabe, 2014) and more positive thoughts compared to RNT for high socially anxious individuals (Kocovski, MacKenzie, & Rector, 2011).

**Post-Event Processing and Memory**

Based on Clark and Wells’ (1995) suggestion that PEP may heighten the availability of previous social failures, several studies have examined autobiographical memories associated with PEP. For example, Field and Morgan (2004) compared a student sample of 66 high and low socially anxious participants to determine whether PEP affects retrieval of autobiographical memories. Participants were instructed to describe a recent ambiguous social event or interaction and were subsequently allocated
to one of three conditions, positive PEP, negative PEP, or a distraction condition. Compared to the low socially anxious group, high socially anxious participants recalled memories that were rated as significantly more negative ($\beta = -1.33$) and shameful ($\beta = 1.93$), regardless of the type of PEP they engaged in. Unexpectedly, it also found that after negative PEP, the high socially anxious group, recalled memories that were anxious and shameful but rated as more calming compared to the other conditions. The researchers suggested this may have some adaptive benefit of PEP. However given that PEP was assessed based on the recall of a recent ambiguous social event, ecological validity of the task is low.

Morgan and Banerjee (2008) also examined autobiographical memories associated with PEP following negative feedback in response to a real or imagined social task. Participants were a sample of 50 undergraduates of high and low socially anxious individuals. It was found that negative feedback in response to a speech task, led to the recall of memories with a significantly greater average anxiety rating in the high socially anxious group than the low socially anxious group ($\eta^2 = .11$). Furthermore, high socially anxious individuals who engaged in a ruminative response style (compared to a reflective response style) following an imagined social encounter, recalled memories with the highest average anxiety rating ($\beta = .33$). Similarly, Chiupka, Moscovitch, and Bielak. (2012) employed a sample of 85 undergraduates and found that images and memories during PEP were associated with greater reported negative impact on participants’ perception of themselves ($\eta_p^2 = .06$) and others ($\eta_p^2 = .09$). Nonetheless, results from studies assessing retrieval of autobiographical memories may be prone to recall bias.

**Post-Event Processing, Self-Focused Attention and Attention Bias**

The process of directing attention towards internal stimuli during social events has been implicated in the maintenance of social anxiety (Clark & Wells, 1995). Thus
researchers have begun to examine the role of self-focused attention during PEP. Brozovich and Heimberg (2011) employed an analogue sample of 64 high and low socially anxious individuals and randomly assigned participants to either a self-focused PEP condition or an other-focused PEP condition. Following a social interaction with a confederate, socially anxious individuals in the self-focused condition displayed fewer positive feelings about their performance than did socially anxious individuals in the other-focused condition as well as low socially anxious individuals in either condition ($\eta^2 = 10$).

Gaydukevych and Kocovski (2012) used a sample of 82 high and low socially anxious undergraduates to investigate the relationship between self-focused attention and PEP. Participants were randomly assigned to either a high or a low self-focused attention condition and then engaged in a five minute unstructured conversation with a confederate. PEP was assessed the following day online. They found that those in the high self-focused attention group reported a similar amount of positive PEP but more negative PEP over the 24-hour period compared to the low self-focused attention group.

Extending the work of Gaydukevych and Kocovski (2012), Holzman and Valentiner (2016) examined whether self-focused attention affects the relationships between performance appraisals and PEP following a social event that involved reading a book for 5 minutes to an audience of three research assistants. They employed a sample of 137 undergraduates who were distinguished into high and low social anxiety groups and then further randomly assigned into either a high self-focused or low self-focused attention condition. They found that high levels of self-focused attention led to a stronger, inverse relationship between immediate positive performance appraisals and subsequent negative PEP (partial $r = -.43$), however this finding was not specific to high social anxiety. They also found that high levels of self-focused attention led to a stronger, inverse relationship between negative PEP and changes in positive performance appraisals (partial $r = -.23$). These findings suggest that self-focused
attention is important for understanding how negative PEP undermines positive performance appraisals. Taken together, these findings provide support for a causal relationship between self-focused attention and PEP in support of Clark and Wells (1995) assertion of a self-focused processing mode during this form of RNT.

Using a different design, Makkar and Grisham (2013) employed 80 high and low socially anxious individuals who were shown false physiological feedback regarding an increase or decrease in their heart rate both prior to and during a speech task. Given that socially anxious individuals tend to become self-focused and hyper-vigilant to internal interoceptive cues, a shift to detailed monitoring of internal information was expected. Compared to those who observed a false decreased heart rate, those who observed a false increased heart rate reported higher levels of negative affect ($\eta_p^2 = .10$), more negative performance appraisals ($\eta_p^2 = .17$), and more frequent negative PEP ($\eta_p^2 = .11$). These effects were also mediated by an increase in self-focused attention. However, it should be noted that these effects were not specific to high socially anxious participants. These findings suggest that both high and low socially anxious individuals tend to negatively appraise their anxiety symptoms and use this information to erroneously assess their social performance. It may not be surprising that both high and low socially anxious individuals reported similar outcomes because the somatic information was probably sufficiently salient and attention engaging even for low socially anxious individuals (Makkar & Grisham, 2013).

Perfectionism has also been found to be comorbid with SAD (Bieling, Summerfeldt, Israeli, & Antony, 2014). On this basis, Brown and Kocovski (2014) examined perfectionism, in both state and trait forms, as a predictor of PEP in a sample of 104 socially anxious undergraduates. Following the administration of several measures, participants delivered an impromptu speech and were then assessed for PEP two days later online. They found that both state ($\beta = .39$) and trait ($\beta = .21$)
perfectionism was a significant predictor of PEP two days following the speech while controlling for baseline social anxiety, depression and state anxiety. These findings suggest that it may be beneficial to use strategies that target perfectionism as a way of reducing PEP for socially anxious individuals, however the present study observed these findings within the context of an undergraduate sample, thus replication with a clinical sample is needed.

Given that models of social anxiety propose that biased attention to threat signals plays a key role in symptom development and maintenance, Cek, Sánchez, and Timpano (2016) employed a sample of 55 undergraduates to assess the associations between social anxiety, attention bias to disgust, subjective emotional and physiological reactivity to a social stressor, and subsequent PEP. Participants completed an attention task with facial stimuli which was measured using an eye-tracking device, followed by the delivery of an impromptu speech which was later utilised to assess PEP. They found that the association between social anxiety and PEP was partially accounted for by attention bias to disgust, however this effect was quite modest which limits the generalizability of the findings to clinical samples. Moreover, it should be noted that only one measure of social anxiety was used (SIAS) and they neglected to control for depression.

**Modes of Post-Event Processing**

Several researchers have investigated the distinct modes of self-focused attention that are thought to underlie PEP. An experiential processing mode is considered adaptive (i.e., focusing on the direct experience of one’s feelings, symptoms and experiences), while an analytical processing mode is deemed maladaptive (i.e., thinking analytically about the meanings of one’s feelings, symptoms and experiences; Watkins & Teasdale, 2004). Vassilopoulos (2008) randomly assigned 58 high and low socially anxious undergraduates to either an analytic or experiential self-focus task.
Vassilopoulous found that high socially anxious individuals in the experiential self-focus condition had decreased anxious mood ratings from pre to post manipulation which was associated with more positive thoughts. Those in the analytical self-focus condition showed no significant changes in mood and cognition. Nilsson, Lundh and Viborg (2012) replicated these effects with a clinical sample of 12 outpatients with a diagnosis of SAD. Following a speech task, they found that an experiential self-focus mode disrupted the RNT process while an analytical self-focus mode strengthened the relationship between negative self-evaluation and PEP across three time points ($r = .83$, $r = .97$, $r = .91$, respectively). Furthermore, adopting an experiential self-focus mode tended to decrease negative thoughts, whereas an analytical mode was inclined to reduce neutral thoughts, although the effects were weak. Wong and Moulds (2012) also examined the impact of adopting an analytical versus an experiential processing mode during RNT in 74 high and low socially anxious undergraduates following a speech task. Unexpectedly, they found that an experiential mode (compared to an analytical mode) led to stronger maladaptive high standard ($\eta_p^2 = .08$) and conditional beliefs ($\eta_p^2 = .07$) during AP, and stronger maladaptive unconditional beliefs during PEP ($\eta_p^2 = .10$). While this outcome contrasts with previous findings, the authors suggest that the analytical processing mode may have assisted participants to rationalise their performance thus allowing for disconfirmation of negative beliefs regarding the social situation. Extending the work of Wong and Moulds (2012), Wong, McEvoy, and Rapee (2016) examined the prediction of the trajectory of maladaptive social-evaluative beliefs over time from trait RNT and trait-PEP, as well as their interactions with the frequency of recent social stressors and social anxiety levels. Employing a sample of 331 undergraduates, participants were administered a number of online measures (see Table 2) and then given another online measure of self-beliefs related to social anxiety (SBSA; Wong & Moulds, 2009) one week later. They found that a higher number of
recent social stressors predicted an increasing trajectory of conditional and
unconditional beliefs but only within the context of participants with high levels of
social anxiety and low levels of thoughts about the past. This was an unexpected
finding which the authors suggested might indicate that the tendency to engage in PEP
may have adaptive effects, which is consistent with other previous research indicating
an adaptive component of PEP (Blackie & Kocovski, 2016; Field & Morgan, 2004;
Makkar & Grisham, 2012).

Cody and Teachman (2011) employed a sample of 97 high and low socially
anxious undergraduates to examine differences in the use of global and local evaluations
(e.g., seeing the forest vs. the trees) of public speaking performance. Participants were
required to give a series of four brief speeches, and then self-rated their performance on
items reflecting global and local performance indicators along with a measure asking
how they thought the experimenter would rate their performance. After three days,
participants completed the performance assessments again along with a measure of
PEP. As expected, they found that PEP fully mediated the relationship between social
anxiety group status and worsening global performance evaluations, suggesting that
PEP may be an important mechanism by which social anxiety leads to worsening self-
perceptions over time. The authors suggest that processing of negative global
information during PEP is analogous to analytical self-focus in terms of leading to
more negative over-generalisations about one’s social performance, findings which are
consistent with previous research in the area (Nilsson et al., 2012; Vassilopoulos, 2008).
While these findings are generally consistent, it is important to note that the
aforementioned studies used a variety of measures to assess PEP (e.g., thought listing
exercise, visual analogue scales, repetitive thinking questionnaire, and the PEPQ; Cody
& Teachman, 2011; Nilsson et al., 2012; Vassilopoulos, 2008; Wong & Moulds, 2012;
Wong et al., 2016). Given that different measures may be measuring slightly different aspects of PEP, comparison of findings between studies may be difficult.

**Post-Event Processing and Imagery**

The relationship between imagery and PEP has also been investigated. Compared to verbal thought, imagery is more likely to activate emotional arousal in addition to triggering distorted beliefs about feared social situations (Holmes & Mathews, 2005). Makkar and Grisham (2011b) had 77 high and low socially anxious participants hold either a negative or a control self-image in mind as they engaged in a speech task. They found that participants who held a negative self-image in mind experienced higher anxiety levels and more negative thoughts, were more self-focused, rated their anxiety as more visible, appraised their performance more negatively, and engaged in more negative and less positive PEP, regardless of social anxiety level or depression.

Brozovich and Heimberg (2013) investigated whether PEP involving mental imagery is particularly detrimental for social anxiety by employing 114 high and low socially anxious undergraduates. Following a threat of a speech task, participants were randomly assigned to one of three conditions about a past speech: PEP involving imagery; PEP involving semantics; and a control condition with no PEP. They found that high socially anxious individuals in the PEP imagery condition experienced greater anxiety than those in the other conditions both immediately following the induction ($\eta^2_p = .25$) and before the anticipated speech task ($\eta^2_p = 19$). Their participants also interpreted ambiguous social scenarios more anxiously than socially anxious individuals in the control condition. Moreover, high socially anxious individuals made more negative predictions regarding their upcoming speech performance than low anxious participants in all conditions ($\eta^2_p = .62$). Findings from these studies provide further
support for the interaction of cognitive biases (Hirsch, Clark, & Mathews, 2006) highlighting the detrimental effects of imagery during perseverative modes of thought.

**Post-Event Processing and Self-Appraisal**

According to the Clark and Wells (1995) model, negative perceptions of performance and PEP should have a positive relationship. In an attempt to examine this relationship, Zou and Abbott (2012) employed a clinical sample and had 40 socially phobic individuals and 40 controls engage in a structured five-minute conversation in groups of four people. Following the interaction, participants were randomly assigned to a false feedback condition, receiving either high scores or moderate scores based on performance. Socially anxious participants who received moderate scores exhibited poorer self-appraisals and a higher degree of RNT ($\eta_p^2 = .09$) compared to those in the high score condition. Controls did not show this effect in either condition. The authors noted that given the subjectivity of the false feedback in the moderate condition (scores of 5/10), it is possible that the situation may have been interpreted as more ambiguous as this score is neither positive nor negative. This finding highlights the prominence of ambiguity as a distinct trigger of distorted beliefs relating to performance in social-evaluative situations.

Gramer, Schild, and Lurz (2012) examined the influence of trait social anxiety on subjective and physiological responses to an anticipated stressor employing 70 undergraduate female students who were split into high and low social anxiety groups. Participants engaged in a five minute speech task after a one week anticipation period to prepare the task. They found that socially anxious individuals displayed higher levels of negative PEP, and that PEP during recovery was significantly related to post-task reappraisals ($r = -.59$). Group differences PEP were also mediated by cognitive appraisals. While these findings provide further support for the notion that self-evaluations are an important determinant of PEP, the study was conducted with a non-
clinical female sample and only one measure of social anxiety was used (Social Anxiety Scale [SAP]; Lück, 1971).

**Adaptive Effects of Post-Event Processing**

In contrast to the reviewed research supporting PEP as a maladaptive maintaining process in social anxiety, several studies have revealed some adaptive properties of PEP. Makkar and Grisham (2012) had 81 high and low socially anxious participants engage in two speech tasks. After concluding the first speech, participants were randomly assigned to engage in either PEP or a distraction task. It was found that engaging in PEP as opposed to distraction led to some positive outcomes including increased willingness among low socially anxious individuals to give a second speech ($\eta^2_p = .20$), and improved overall perception of speech quality in high and low socially anxious individuals ($\eta^2_p = .07$). While the observed positive effects imply that PEP may have some adaptive qualities, the authors do acknowledge the possibility that their PEP manipulation may have acted as a form of imaginal exposure. Exposure sessions that facilitate emotional processing have shown positive effects (Foa & Kozak, 1986). Thus the positive effects found may be a consequence of instructions given by the experimenter. Furthermore, the second speech may have been less anxiety-provoking due to habituation (Makkar & Grisham, 2012).

Blackie and Kocovski (2016) examined whether a brief distraction period immediately following a speech would lead to less PEP the following day employing a sample of 77 undergraduates with elevated social anxiety. Following the delivery of a speech, participants were randomly assigned to a distraction, PEP, or control condition and then reported levels of PEP in relation to the speech. They found that those in the distraction condition reported less PEP ($\eta^2_p = .12$) than those in the PEP and control conditions, suggesting that distraction may be a potentially useful strategy for reducing PEP. Furthermore, Penney, Miedema, and Mazmanian (2015) used a sample of 126
undergraduates to assess the relationship between intelligence and rumination among a range of emotional disorders and found that non-verbal intelligence was a unique negative predictor of PEP, however no relationship was found between social anxiety symptoms and verbal or non-verbal intelligence. Interestingly, these findings indicate that intelligence may be linked to the cognitive processes that underlie emotional disorders, such as PEP, rather than to the symptoms of emotional disorders per se.

Limitations of Existing Evidence in Post-Event Processing

The PEP literature in social anxiety has been more extensively researched than that of AP (Sluis et al., 2017a). While more is known about PEP, there are notable limitations. Firstly, while many studies have examined PEP in clinical samples of patients with a primary diagnosis of SAD (16 studies), a larger proportion of these studies have employed undergraduates as analogues to those diagnosed with SAD (39 studies). Although it is accepted that social anxiety is continuously distributed in the general population (Stopa & Clark, 2001), studies utilising social anxiety analogue samples have used various measures to categorise high and low social anxiety groups. For example, some studies have split their groups using the Social Phobia and Anxiety Inventory (SPAI; Turner, Biedel, & Dancu, 1996), the Fear of Negative Evaluation scale (FNE; Watson & Friend, 1969), or the Social Avoidance and Distress Scale (SADS; Watson & Friend, 1969). Although these measures are often highly correlated with SAD diagnoses (Watson & Friend, 1969), each measure assesses distinct aspects of social anxiety and on their own may not adequately capture the full range of social anxiety symptoms.

Secondly, studies have used various measures to assess PEP. For example, PEP has been assessed using the PEPQ (Rachman et al., 2000), the Rumination Questionnaire (RQ; Mellings & Alden, 2000), the Thoughts Questionnaire (TQ; Edwards et al., 2003), the Post-Event Rumination Questionnaire (PERQ; Abbott &
Rapee, 2004), the Anxious Rumination Questionnaire (ARQ; Kocovski & Rector, 2007), and the Repetitive Thinking Questionnaire (RTQ; McEvoy et al., 2010). While these measures are similar, each measure may assess slightly different aspects of PEP in social anxiety. For example, the PEPQ (Rachman et al., 2000) was specifically developed to measure PEP for socially anxious individuals following a social-evaluative event. More recent measures assessing PEP have modified previous measures tailored for specific research designs. One such measure, the ARQ (Kocovski & Rector, 2007) was formatted according to Nolen-Hoeksema’s (1991) Response Style Theory (i.e., a theory developed to explain ruminative responses to depressive symptoms). Given that some of these measures have been modified based on theories of depression, it is conceivable that specificity relating to PEP, as opposed to depressive rumination, is lacking. One possible avenue for researchers to overcome this hurdle may be to include assessments of both constructs, using measures that clearly employ items pertaining to either mode of RNT. In this manner, researchers are able to more accurately interpret outcomes in relation to an anxiety-provoking social event for those with SAD, and further elucidate whether or not depressive rumination and PEP are indeed one in the same or separate constructs. Nonetheless, although the outcomes relating to PEP are relatively stable, consistent use of PEP measures relative to social-evaluative events would allow for greater ease of comparison between studies.

Thirdly, another methodological concern regarding social anxiety and depression measures is their high correlation. For example, although many studies have measured depression to control for this confound, there are numerous studies that have neglected to control for depression (Campbell et al., 2016; Chen et al., 2013; Fisak & Hammond, 2013; Holzman et al., 2014; Kocovski et al., 2005; Kocovski & Rector, 2007; Laposa & Rector, 2011; Lundh & Sperling, 2002; Price & Anderson, 2011; Rowa et al., 2014). Given that depression and anxiety are highly comorbid, and that RNT is
also a primary attribute of depression, it is crucial to control for the effects of depression when examining PEP in social anxiety in order to determine specificity of this construct to social anxiety. Furthermore, measures of social anxiety used across studies are also inconsistent, varying, or inadequate. In some instances, only one measure of social anxiety has been assessed. Given that social anxiety is multifaceted (i.e., social performance fears, social interaction fears, fear of negative evaluation), multiple measures of social anxiety assessing fears associated with each dimension, or even a single measure that captures the full spectrum of social anxiety is essential. Using a measure of social anxiety that captures the full spectrum across studies would allow for more accurate interpretation of results by indicating which dimension of social anxiety a construct is most closely associated with.

Lastly, self-report measures have largely been relied upon to investigate PEP and how this construct relates to other features of social anxiety. Given that models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997) elucidate the cognitive, affective, behavioural, and physiological consequences of PEP, it would be beneficial to measure such constructs using multi-method paradigms.

**A Theory of Attentional Control**

As PEP involves repetitive and persistent thoughts that centre on a reduced ability to inhibit or shift attention away from one’s current stream of thought, researchers have begun to theorise about the attentional mechanisms thought to underlie this phenomenon (Linville, 1996). A weakened attentional control system is thought to be responsible for the cognitive impairments (Linville, 1996) observed in maladaptive thought processes, such as PEP, which are the result of anxiety and stress. Attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007), proposes an explanation as to the higher order cognitive functions that
underlie PEP which may explain the relationship between social anxiety and cognitive performance.

Attentional control theory has two main tenents: (1) anxiety is associated with deficits in cognitive efficiency, resulting in a decreased ability to inhibit task-irrelevant information, shift attention between tasks, and update working memory; and (2) these deficits are predominantly assumed to affect processing efficiency (i.e., the way cognitive resources are used to achieve desired outcomes), while not negatively impacting performance effectiveness (i.e., ability to perform a task).

This theory emphasises two prominent executive functions thought to be primarily responsible for a reduction in attentional control. The inhibition function uses attentional control to inhibit the allocation of attentional resources to irrelevant stimuli or maladaptive thought processes. The shifting function uses attentional control to shift the allocation of attentional resources to task-relevant stimuli or adaptive thought processes (Eysenck et al., 2007; Miyake et al., 2000). A more detailed description of attentional control theory has been outlined previously (Sluis et al., 2017a). Given the perseverative nature of PEP, attentional control theory appears to be one likely theoretical explanation as to why socially anxious individuals find it so difficult to disengage from this mode of thinking. However it is important to note that multiple factors may contribute to the explanation of why socially anxious individuals find it difficult to disengage from PEP and only one potential explanation outlining attentional control has been provided in this paper. For example, the role of motivation (Kouniher, Charron, & Koechlin, 2009), cognitive load of task demands (Gazzaley, 2011), threat load of the task (Van Dillen & Koole, 2009), and emotion regulation (McRae et al., 2010; Kanske, Heissler, Schönfelder, Bongers, & Wessa, 2011) may all partially account for and provide differential explanations as to why socially anxious individuals find it difficult to disengage from this mode of RNT.
Conclusions and Future Directions

This paper has provided a review of the available and relevant literature supporting the maintaining role of PEP, consistent with cognitive-behavioural models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). While there is a substantial amount of empirical evidence investigating the characteristics, causes, and consequences of PEP in social anxiety, future research that addresses the methodological limitations of previous research should enhance interpretation of important findings and provide more accurate results in a more holistic manner.

Current evidence suggests a number of maladaptive cognitive processes that contribute to the negative impact of PEP, such as negative memory and interpretation biases, negative self-imagery, negative self-appraisals, and increased self-focused attention. The prevalence of these cognitive processes involved in PEP highlights the importance of attentional control regarding an inability to shift attention to more adaptive cognitive processes or inhibit negative thought processes. However, this hypothesis remains to be empirically assessed. Previous research examining the impact of attention training on PEP identified that attentional control during treatment was associated with reductions in PEP (McEvoy & Perini, 2009). This finding highlights the relevance of attentional control when studying the maintaining processes of social anxiety and is an important area of future research that triggers a number of additional research questions. For example, does a weakened attentional control system lead to symptoms of social anxiety, such as PEP? Or, do symptoms of social anxiety lead to a weakened attentional control system?

Future research examining the underlying functions of PEP will provide a thorough understanding of these thought processes, and may also elucidate other cognitive processes involved in the maintenance of social anxiety. Moreover, given the contradictory findings regarding PEP as being disorder-specific compared to
transdiagnostic, future research would benefit from exploring the theoretical underpinnings in more depth to gain a better understanding of this thought process across disorders. This line of research would further contribute to informing theoretical models and treatment protocols for those with SAD, or indeed other emotional disorders.
Chapter 2 Conclusion

Similar to chapter 1, chapter 2 provided a comprehensive review of the available and relevant literature on PEP in social anxiety. In particular, the chapter highlighted how PEP contributes to the maintenance of SAD by outlining the maladaptive characteristics of this RNT process. Further to this, the chapter also reviewed the literature on PEP illustrating the behavioural, physiological, cognitive, and affective consequences in socially anxious individuals. While the literature reviewed in this chapter supports models of social anxiety proposing PEP as a core feature (Clark & Wells, 1995; Rapee & Heimberg, 1997), the literature on PEP is also limited in terms of exploring the potential underlying mechanisms of this RNT process. Likewise, chapter 2 complimented chapter 1 by providing the same theoretical explanation of attentional control theory to be used as a guide in the program of research to explore the underlying cognitive processes of PEP, in addition to AP.

Aims of the Program of Research

Given the limitations in the social anxiety literature outlined in chapters 1 and 2, along with the lack of research investigating the underlying cognitive functions of AP and PEP, the current program of research had two main aims. The first phase of the PhD research program aimed to explore the correlational relationships between attentional control, social anxiety, and AP and PEP. An investigation using subjective self-report measures was considered a necessary starting point for the current PhD research program in order to reveal the nature of these associations and provide justification for the following experimental studies which used objective, behavioural measures to explore causal relationships.

The second phase of the research program aimed to experimentally manipulate AP and PEP in order to investigate attentional control using an objective behavioural paradigm (i.e., mixed emotional saccade task). The second phase also aimed to address
limitations of the current social anxiety literature by employing a multi-method approach (e.g., self-report, behavioural), as well as control for potential confounding effects of depression and trait anxiety. Additionally, social anxiety analogue samples were employed throughout the PhD research program given the novelty of these investigations. As previously mentioned in chapters 1 and 2, it is generally accepted that social anxiety is continuously distributed in the general population (Stopa & Clark, 2001) and use of analogue samples for identifying processes in SAD has been justified by existing research that supports the validity of this sampling strategy (i.e., results obtained using an analogue sample are largely similar to results found using a clinical sample; Stopa & Clark, 2001).

The following chapter, chapter 3, is the first empirical paper in the program of research which explores the correlational relationships between attentional control, social anxiety and AP (Study 1A) and PEP (Study 1B).
CHAPTER 3 (STUDIES 1A AND 1B): ATTENTIONAL CONTROL ASSOCIATED WITH CORE COGNITIVE SYMPTOMS OF SOCIAL ANXIETY

Paper submitted for publication:


Abstract ............................................................................................................................ 78
Introduction ..................................................................................................................... 79
Aims, Overview and Hypotheses .................................................................................... 80
Method ............................................................................................................................. 81
  Participants .................................................................................................................. 81
  Measures ...................................................................................................................... 82
  Procedure ..................................................................................................................... 84
Results ............................................................................................................................. 84
  Study 1A ...................................................................................................................... 84
  Study 1B ...................................................................................................................... 85
Mediation Analyses of PEP and Attentional Shifting with Trait Anxiety .................. 87
Mediation Analyses of PEP and Attentional Control with Positive Affect ................. 88
Discussion ........................................................................................................................ 90
Implications ................................................................................................................. 93
Limitations and Future Directions ............................................................................... 93
Chapter 3 Conclusion .................................................................................................. 95
Abstract

Models of social anxiety emphasize anticipatory processing (AP) and post-event processing (PEP) as repetitive negative thinking processes that occur before and after social-evaluative events, respectively. Both AP and PEP have been implicated as maladaptive processes which maintain social anxiety. Accordingly, a common vulnerability, such as poor attentional control, may serve to maintain both. The present research included two studies to investigate the relationship between attentional control and AP (study 1A) and PEP (study 1B). Participants \( n = 50 \) for study 1; \( n = 43 \) for study 2) completed self-report measures of social anxiety, AP or PEP, attentional control, trait anxiety, and positive and negative affect. Poorer total attentional control was associated with social anxiety in both studies. However, diminished attentional shifting was associated with increased levels of PEP, and not AP. Mediation modelling suggested that trait anxiety mediated the relationship between attentional shifting and PEP. Furthermore, positive affect mediated the relationship between total attentional control and PEP. The findings suggest that attentional control plays a role in emotion regulation and repetitive negative thinking (RNT) processes, such as PEP, but not AP.

Keywords: Social Anxiety, Anticipatory Processing, Post-Event Processing, Attentional Control, Repetitive Negative Thinking.
Attentional Control Associated with Core Cognitive Symptoms of Social Anxiety

Introduction

Social anxiety disorder (SAD) is one of the most commonly occurring (Slade, Johnston, Oakley, Browne, Andrews, & Whiteford, 2009) and researched (Boschen, 2008) anxiety disorders. It is characterised by excessive fear about one or more social situations, potentially exposing an individual to real or anticipated negative evaluations by others (APA, 2013; Boschen & Curtis, 2008). Two of the core cognitive symptoms of SAD include: anticipatory processing (AP), which occurs prior to a social/performance event and is a form of repetitive negative thinking (RNT) that is dominated by predictions of poor performance, previous failures, negative images of oneself and rejection; and post-event processing (PEP) which occurs after a social/performance event and is a form of RNT focused on perceived social failure (Clark & Wells, 1995). While AP and PEP are both considered forms of RNT with some degree of overlap (McEvoy, Mahoney, & Moulds, 2010; McEvoy, Watson, Watkins, & Nathan, 2013), there appears to be functional differences between them that supports their diagnostic specificity (for a review of AP see Sluis, Boschen, Neumann, & Murphy, 2017a; for a review of PEP see Sluis, Boschen, Neumann, & Murphy, 2017b). Indeed, the most distinct aspect is temporal orientation (i.e., prior to an event and post-event), however the association between these cognitive constructs suggests that they may result from a common cognitive cause, such as attentional control deficits (Derryberry & Reed, 2002).

Attentional control is deemed necessary for the flexible regulation of cognitive resources and involves top-down control over various dimensions of attention (Armstrong, Zald, & Olatunji, 2011). Accordingly, it is thought that cognitive performance may be adversely affected by high levels of anxiety due to poor top-down attentional control (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011);
Eysenck, Derakshan, Santos, & Calvo, 2007). While attentional control can be voluntary or involuntary, the voluntary control system of attentional focus and shifting has been identified as an important source of individual differences (Derryberry & Reed, 2002). The attentional focusing dimension refers to the ability to maintain attentional engagement when faced with task-irrelevant distractions, while attentional shifting refers to the ability to allocate attention away from irrelevant distractions towards new or relevant tasks (Derryberry & Reed, 2002). A weakened attentional control system may facilitate RNT processes, such as AP and PEP, by allowing maladaptive thoughts to take precedence over adaptive cognitions thereby fostering an inability to disengage attention away from the RNT. While there is no prior research to date directly examining the association between attentional control, AP, and PEP, previous clinical research has demonstrated that deficits in attentional control are related to similar RNT processes in other anxiety disorders (Armstrong et al., 2011). For example, Armstrong, Zald and Olatunji (2011) examined deficits in attentional control that may contribute to obsessional thoughts in patients with obsessive-compulsive disorder (OCD) or perseverative worry in patients with generalised anxiety disorder (GAD). They found that diminished attentional control was associated with both OCD and GAD relative to non-clinical controls. Furthermore, they demonstrated that deficits in attentional control were related to increased worry in GAD, but not with increased obsessional thoughts in OCD. Given that worry is also considered a RNT process similar to that of AP and PEP, an examination of diminished attentional control relative to cognitive symptoms in social anxiety is worthy of investigation.

Aims, Overview and Hypotheses

The current study examined the relationship between RNT processes characteristic of social anxiety (AP and PEP) and dimensions of self-reported attentional control (i.e., total scores of attentional control, attentional focusing and
attentional shifting). In addition, given the multi-dimensional nature of SAD, multiple self-report measures of social anxiety were used including the Social Interaction Anxiety Scale, The Social Phobia Scale, and the Brief Fear of Negative Evaluation Scale (Mattick & Clarke, 1998; Leary, 1983). It was predicted that deficits in attentional control would be highly correlated with core cognitive symptoms of SAD, including both AP and PEP. Furthermore, it was expected that self-reported social anxiety would be associated with deficits in attentional control. Lastly, given that trait anxiety, positive affect, and negative affect have been found to be associated with attentional control and are highly correlated with multiple measures of SAD (Derryberry & Reed, 2002; Mattick & Clarke, 1998), trait anxiety, positive affect and negative affect were assessed to gain further insight into the relationship between attentional control and cognitive symptoms of SAD. Accordingly, mediation models were used to explore the relationship between these constructs.

Method

Participants

A total of 160 (study 1A) and 122 (study 1B) undergraduate participants completed an online screening measure of the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) to select individuals scoring higher than non-anxious samples on social anxiety. Participants for the current studies were selected by choosing those who scored one standard deviation above the mean on the SIAS (≥ 30) reported for a college sample by Mattick and Clarke (1998; Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992; Judah, Grant, Lechner, & Mills, 2013; Mills, Grant, Judah, & Lechner, 2014a). The use of analogue samples in social anxiety has been justified by previous research whereby results obtained are largely similar to that of clinical samples (Stopa & Clark, 2001). Study 1A consisted of 50 undergraduate participants (11 males, 39 females) with an age range of 17-48 years (M = 21.74, SD = 6.65). Study 1B consisted
of 43 undergraduate participants (11 Males, 32 Females) with an age range of 17-29 years ($M = 20.29$, $SD = 3.54$).

**Measures**

**The Social Interaction Anxiety Scale and Social Phobia Scale.** (SIAS; SPS; Mattick & Clarke, 1998) The SIAS and SPS are companion scales designed to measure fear of social interaction in groups, and the fear of being observed, respectively. Each measure comprises 20 items with participants indicating the extent to which the statement is characteristic of them (e.g., SIAS; *I have difficulty talking with other people*; e.g., SPS; *I fear that I may blush when I am with others*) using a response scale ranging from 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*). The SIAS has strong psychometric properties and good screening utility for both clinical and research purposes (Rodebaugh, Woods, Heimberg, Liebowitz, & Schneier, 2006). The SIAS and SPS demonstrated excellent internal consistency in study 1A ($\alpha = .95$, $\alpha = .92$, respectively) and study 1B ($\alpha = .95$, $\alpha = .94$, respectively).

**Brief Fear of Negative Evaluation Scale.** (BFNE; Leary, 1983) is a 12-item measure used to assess fear of negative evaluation from others. Participants are asked to indicate the extent to which each statement is characteristic or true of them (e.g., *I am afraid that others will not approve of me*) using a response scale ranging from 0 (*not at all like me*) to 4 (*extremely like me*). The BFNE demonstrated good internal consistency in study 1A ($\alpha = .89$) and study 1B ($\alpha = .94$).

**State-Trait Anxiety Inventory- Trait Version.** (STAI; Spielberger, 1983) The STAI-T is a 20-item scale that measures pervasive or chronic symptoms of anxiety (e.g., *I lack self-confidence*). Each item is measured on a 4-point Likert-type scale ranging from 0 (*almost never*) to 3 (*almost always*). The STAI-T had excellent internal consistency in study 1A ($\alpha = .92$) and study 1B ($\alpha = .93$).
**Attentional Control Scale.** (ACS; Derryberry & Reed, 2002) is a 20-item measure of general capacity to control attention across two domains including the ability to focus (e.g., *When I need to concentrate and solve a problem, I have trouble focusing my attention*) and shift attention when necessary (e.g., *I can quickly switch from one task to another*). The ACS is rated on a 4-point scale from 1 (*almost never*) to 4 (*always*) with participants indicating the extent to which the statement is characteristic of them. Higher scores on the ACS indicate greater attentional control. The ACS had adequate internal consistency in study 1A ($\alpha = .70$) and study 1B ($\alpha = .85$).

**Positive and Negative Affect Scales.** (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item scale consisting of two 10-item subscales designed to measure positive and negative affect. On a 5-point Likert-type scale from 1 (*very slightly, or not at all*) to 5 (*extremely*), participants indicate the extent to which they feel a given affect state (e.g., *Jittery*). The PANAS-Positive Affect and PANAS-Negative Affect subscales demonstrated good internal consistency in study 1A ($\alpha = .91$; $\alpha = .83$, respectively) and study 1B ($\alpha = .87$; $\alpha = .85$, respectively).

**Anticipatory Social Behaviours Questionnaire.** (ASBQ; Hinrichsen & Clark, 2003) is a 12-item questionnaire which measures trait levels of anticipatory processing behaviours prior to a social-evaluative situation (e.g., imagining past failures, negative predictions). Items are measured using a 4-point Likert-type scale from 1 (*never*) to 4 (*always*). The ASBQ had good internal consistency in study 1A ($\alpha = .83$).

**Post-Event Processing Questionnaire-Revised.** (PEPQ-R; McEvoy & Kingsep, 2006) is a 9-item scale assessing state levels of how much and how often individuals engaged in post-event processing after a social situation in the past 2 weeks using 0-100 visual analogue scales. The PEPQ-R had excellent internal consistency in study 1B ($\alpha = .91$).
**Procedure**

Participants provided informed written consent and demographic information and were then administered all self-report questionnaires in-person. Participants completed the same questionnaire measures for each study, although participants in study 1A also completed the ASBQ (which was not administered in study 1B) and participants in study 1B completed the PEPQ-R (which was not administered in study 1A). Participants were debriefed about the nature of the study upon completion of the study.

**Results**

**Study 1A**

The means, standard deviations, and ranges of all self-report measures are presented in Table 3.1. Correlations between SAD, AP, and attentional control are presented in Table 3.2.

**Table 3.1**

*Means, standard deviations, and range of scores for the primary measures (N = 50).*

<table>
<thead>
<tr>
<th>Measure</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIAS</td>
<td>48.76</td>
<td>10.61</td>
<td>30</td>
<td>77</td>
</tr>
<tr>
<td>SPS</td>
<td>39.46</td>
<td>14.88</td>
<td>13</td>
<td>72</td>
</tr>
<tr>
<td>BFNE</td>
<td>32.44</td>
<td>8.49</td>
<td>13</td>
<td>47</td>
</tr>
<tr>
<td>STAI-T</td>
<td>30.84</td>
<td>10.28</td>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>ASBQ</td>
<td>33.68</td>
<td>5.64</td>
<td>18</td>
<td>47</td>
</tr>
<tr>
<td>ACS - Total</td>
<td>45.70</td>
<td>6.14</td>
<td>32</td>
<td>60</td>
</tr>
<tr>
<td>ACS – Focus</td>
<td>16.60</td>
<td>3.47</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>ACS – Shift</td>
<td>11.00</td>
<td>1.78</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>PANAS - NA</td>
<td>21.60</td>
<td>6.67</td>
<td>11</td>
<td>38</td>
</tr>
<tr>
<td>PANAS - PA</td>
<td>26.84</td>
<td>7.79</td>
<td>11</td>
<td>45</td>
</tr>
</tbody>
</table>

*Note:* SIAS = Social Interaction Anxiety Inventory; SPS = Social Phobia Scale; BFNE = Brief Fear of Negative Evaluation Scale; STAI-T = State Trait Anxiety Inventory-Trait version; ASBQ = Anticipatory Social Behaviours Questionnaire; ACS = Attentional Control Scale (Focus or Shift Subscales); PANAS – Positive and Negative Affect Scale (Positive or Negative subscale).
As predicted, total scores for attentional control were negatively correlated with social anxiety as measured by total SIAS scores. There was also a negative correlation between SIAS scores and the attentional shifting component. However, the predicted correlations between attentional control total, shifting or focus and AP were not found. Given the absence of associations between AP and attentional control, mediation models were not explored for AP.

**Study 1B**

The means, standard deviations and ranges of all self-report measures are presented in Table 3.3. Correlations between SAD, PEP, and attentional control are presented in Table 3.4.

---

**Table 3.2**

*Correlations between SAD, AP, and attentional control (N = 50).*

<table>
<thead>
<tr>
<th>Measure</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SIAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. SPS</td>
<td></td>
<td>.65**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. BFNE</td>
<td></td>
<td>.51**</td>
<td>.60**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. STAI-T</td>
<td></td>
<td>.61**</td>
<td>.66*</td>
<td>.62**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. ASBQ</td>
<td></td>
<td>.57**</td>
<td>.71**</td>
<td>.58**</td>
<td>.78**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ACS - Total</td>
<td>-.32*</td>
<td>-.21</td>
<td>-.11</td>
<td>-.14</td>
<td>-.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. ACS - Focus</td>
<td>-.24</td>
<td>-.22</td>
<td>-.10</td>
<td>-.28</td>
<td>-.19</td>
<td>.72**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. ACS - Shift</td>
<td>-.31*</td>
<td>-.06</td>
<td>-.15</td>
<td>.02</td>
<td>-.08</td>
<td>.73**</td>
<td>.32*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. PANAS - NA</td>
<td>.37**</td>
<td>.61**</td>
<td>.40**</td>
<td>.74**</td>
<td>.68**</td>
<td>-.05</td>
<td>-.16</td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>10. PANAS - PA</td>
<td>-.09</td>
<td>.11</td>
<td>-.01</td>
<td>-.29*</td>
<td>-.17</td>
<td>.11</td>
<td>.07</td>
<td>.09</td>
<td>-.27</td>
</tr>
</tbody>
</table>

*Note:* *p < .05, **p < .01. SIAS = Social Interaction Anxiety Inventory; SPS = Social Phobia Scale; BFNE = Brief Fear of Negative Evaluation Scale; STAI-T = State Trait Anxiety Inventory-Trait version; ASBQ = Anticipatory Social Behaviours Questionnaire; ACS = Attentional Control Scale (Focus or Shift Subscales); PANAS = Positive and Negative Affect Scale (Positive or Negative subscale).
Table 3.3
Means, standard deviations, and range of scores for the primary measures (N = 43).

<table>
<thead>
<tr>
<th>Measure</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIAS</td>
<td>48.49</td>
<td>11.70</td>
<td>30</td>
<td>74</td>
</tr>
<tr>
<td>SPS</td>
<td>42.51</td>
<td>17.98</td>
<td>12</td>
<td>78</td>
</tr>
<tr>
<td>BFNE</td>
<td>34.65</td>
<td>10.47</td>
<td>9</td>
<td>48</td>
</tr>
<tr>
<td>STAI-T</td>
<td>33.40</td>
<td>11.04</td>
<td>12</td>
<td>55</td>
</tr>
<tr>
<td>PEPQ-R</td>
<td>58.84</td>
<td>18.91</td>
<td>14</td>
<td>90</td>
</tr>
<tr>
<td>ACS – Total</td>
<td>45.26</td>
<td>8.81</td>
<td>26</td>
<td>66</td>
</tr>
<tr>
<td>ACS – Focus</td>
<td>16.02</td>
<td>4.35</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>ACS – Shift</td>
<td>11.49</td>
<td>2.46</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>PANAS – NA</td>
<td>24.21</td>
<td>7.59</td>
<td>13</td>
<td>45</td>
</tr>
<tr>
<td>PANAS – PA</td>
<td>25.77</td>
<td>7.02</td>
<td>10</td>
<td>39</td>
</tr>
</tbody>
</table>

Note: SIAS = Social Interaction Anxiety Inventory; SPS = Social Phobia Scale; BFNE = Brief Fear of Negative Evaluation Scale; STAI-T = State Trait Anxiety Inventory-Trait version; PEPQ-R = Post-Event Processing Questionnaire Revised; ACS = Attentional Control Scale (Focus or Shift Subscales); PANAS = Positive and Negative Affect Scale (Positive or Negative subscale).

Table 3.4
Correlations between SAD, PEP, and attentional control (N = 43).

<table>
<thead>
<tr>
<th>Measure</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SIAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. SPS</td>
<td>.72**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. BFNE</td>
<td>.75**</td>
<td>.69**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. STAI-T</td>
<td>.67**</td>
<td>.67**</td>
<td>.67**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. PEPQ-R</td>
<td>.39**</td>
<td>.36*</td>
<td>.32*</td>
<td>.67**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ACS - Total</td>
<td>-.30*</td>
<td>- .31*</td>
<td>-.24</td>
<td>-.40**</td>
<td>-.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. ACS - Focus</td>
<td>-.36*</td>
<td>-.41**</td>
<td>-.38*</td>
<td>-.39**</td>
<td>-.17</td>
<td>.85**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. ACS - Shift</td>
<td>-.17</td>
<td>-.15</td>
<td>-.05</td>
<td>-.34*</td>
<td>-.42**</td>
<td>-.72**</td>
<td>-.34*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. PANAS - NA</td>
<td>.63**</td>
<td>.61**</td>
<td>.63**</td>
<td>.79**</td>
<td>.58**</td>
<td>-.14</td>
<td>.26</td>
<td>-.13</td>
<td></td>
</tr>
<tr>
<td>10. PANAS - PA</td>
<td>-.42**</td>
<td>-.33*</td>
<td>-.38*</td>
<td>-.75**</td>
<td>-.46**</td>
<td>-.40**</td>
<td>-.30*</td>
<td>-.38*</td>
<td>-.50**</td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01. SIAS = Social Interaction Anxiety Inventory; SPS = Social Phobia Scale; BFNE = Brief Fear of Negative Evaluation Scale; STAI-T = State Trait Anxiety Inventory-Trait version; PEPQ-R = Post-Event Processing Questionnaire - Revised; ACS = Attentional Control Scale (Focus or Shift Subscales); PANAS = Positive and Negative Affect Scale (Positive or Negative subscale).
As predicted, attentional control total was negatively correlated with social anxiety as measured by the SIAS and SPS. The attentional focusing component was also significantly negatively correlated with SIAS, SPS and BFNE scores. Furthermore, poorer attentional shifting was related to increased PEP as predicted. While measures of social anxiety were not correlated with the attentional shifting component, trait anxiety was significantly negatively correlated with attentional shifting, allowing further examination of a mediation model between attentional shifting, trait anxiety, and PEP.

Mediation Analyses of PEP and Attentional Shifting with Trait Anxiety

Prior research suggests that trait anxiety may largely account for various forms of RNT, including PEP (McEvoy et al., 2010). Therefore, trait anxiety (STAI-T) was examined as a mediator of the association between attentional shifting and PEP. Baron and Kenny’s (1986) conditions required to statistically test mediation were employed. Bootstrapping methods were used because this is a non-parametric test that provides a sensitive way to determine whether the indirect effect of the independent variable (attentional shifting) on the dependent variable (PEP) through the mediator (trait anxiety) is statistically significant in smaller samples. Mediation modelling using bootstrapping methods with smaller samples has been used in previous research (Fritz & MacKinnon, 2007; Sluis & Boschen, 2014). Figure 3.1 presents results of the mediating model for the 95% confidence interval of the indirect path (ab) obtained using 5000 resamples.

Attentional shifting and trait anxiety accounted for significant variance in PEP, $R^2 = .49$, $F(2, 40) = 19.44$, $p < .001$. Poorer attentional shifting was associated with higher levels of PEP when attentional shifting was entered alone in the regression model, $\beta = -3.24$, $t(41) = -2.98$, $p < .001$ (path $c$) and attentional shifting was negatively associated with trait anxiety, $\beta = -1.53$, $t(41) = -2.33$, $p = .02$ (path $a$). Higher levels of
trait anxiety predicted higher levels of PEP while controlling for attentional shifting, $\beta = 1.02$, $t(40) = 4.98$, $p < .001$ (path $b$). The indirect effect ($ab$) of attentional shifting through trait anxiety on PEP was significant such that the 95% confidence interval did not overlap with zero (lower limit = -3.3813, upper limit = -.3154). The direct effect of attentional shifting on PEP was no longer significant when controlling for trait anxiety, supporting full mediation, $\beta = -1.67$, $t(40) = -1.82$, $p = .08$ (path $c'$).

Figure 3.1 Mediation model for trait anxiety as a mediator between attentional shifting and post-event processing with standardised regression coefficients (*$p < .05$, **$p < .001$). The indirect effect ($ab$) was significant at the 95% confidence interval (lower limit = -3.3813, upper limit = -.3154).

**Mediation Analyses of PEP and Attentional Control with Positive Affect**

As shown in Table 3.4, positive affect was significantly positively correlated with total scores of attentional control, allowing further examination of a mediation model between attentional control total, positive affect, and PEP. Given that previous research has demonstrated that positive affect accounts for higher levels of attentional control (Derryberry & Reed, 2002), positive affect (PANAS-PA) was also examined as a mediator of the association between attentional control total and PEP. Figure 3.2
presents results of the mediating model for the 95% confidence interval of the indirect path \((ab)\) obtained using 5000 resamples. Attentional control total and positive affect accounted for significant variance in PEP, \(R^2 = .23, F(2, 40) = 5.90, p < .01\). Poorer attentional control was associated with higher levels of PEP when attentional control total was entered alone in the regression model, \(\beta = -.64, t(41) = -2.01, p < .05\) (path \(c\)) and better attentional control was positively associated with positive affect, \(\beta = .32, t(41) = 2.80, p < .01\) (path \(a\)). Furthermore, higher levels of positive affect predicted lower levels of PEP while controlling for attentional control, \(\beta = -1.09, t(40) = -2.67, p = .01\) (path \(b\)). The indirect effect \((ab)\) of attentional control through positive affect on PEP was significant such that the 95% confidence interval did not overlap with zero (lower limit = -.8705, upper limit = -.0648). The direct effect of attentional control on PEP was no longer significant when controlling for positive affect, supporting full mediation, \(\beta = -.29, t(40) = -.91, p = .37\) (path \(c'\)).

\[\text{Figure 3.2} \quad \text{Mediation model for positive affect as a mediator between attentional control and post-event processing with standardised regression coefficients } (*p < .05, **p < .01). \text{ The indirect effect } (ab) \text{ was significant at the 95% confidence interval} \text{ (lower limit = -.8705, upper limit = -.0648).} \]
Discussion

The current research aimed to elucidate the associations between RNT processes of social anxiety, including both AP and PEP, and attentional control in an attempt to determine whether a poorer attentional control system accounts for increased levels of RNT in social anxiety. Given the paucity of research examining these associations within the context of social anxiety, the current study also aimed to explore potential mediating effects using additional constructs highly correlated with both attentional control and symptoms of social anxiety, including trait anxiety and positive and negative affect (Derryberry & Reed, 2002; Mattick & Clarke, 1998; McEvoy et al., 2010). Therefore, it was expected that deficits in attentional control would predispose socially anxious individuals to engage in higher levels of AP and PEP.

As predicted, higher levels of social anxiety were associated with poorer attentional control scores, and poorer attentional shifting scores (study 1A) and decreased attentional focus (study 1B). These findings are consistent with previous research demonstrating that top-down attentional control is adversely affected by high levels of anxiety (Derakshan & Eysenck, 2009; Derryberry & Reed, 2002; Eysenck & Derakshan, 2011; Eysenck, Derakshan, Santos, & Calvo, 2007). In terms of the association between attentional control and RNT processes of social anxiety (e.g., AP and PEP), the present findings were partially consistent with predictions. In study 1B, higher levels of PEP were associated with poorer attentional shifting. This finding is consistent with previous research highlighting the role of attentional control in anxiety disorders (Berggren & Derakshan, 2013; Derryberry & Reed, 2002; Moriya & Tanno, 2008), and in particular, similar RNT processes such as worry (Armstrong et al., 2011). Furthermore, research within the field of attention training in anxiety disorders suggests that increased attentional control reduces symptoms of anxiety (Wells, 1990; Wells, White, & Carter, 1997). For example, McEvoy and Perini (2009) conducted attention
training for a clinical sample of participants with social phobia and found that increased attentional control during treatment was associated with reductions in both AP and PEP.

Conversely, AP was not associated with any aspect of attentional control (i.e., total, focus, or shifting) suggesting that increased AP is not related to poorer attentional control. While this finding is in direct contrast with previous research on attention training demonstrating a relationship between attentional control and AP (McEvoy & Perini, 2009), it is consistent with other research that did not find an association between attentional control and similar RNT processes such as rumination or obsessional thoughts (Armstrong et al., 2011). It is possible that increased levels of AP may be underpinned by other factors not examined in study 1A, such as motivation, or may even have an adaptive component that is not affected by attentional control (Sluis, Boschen, Neumann, & Murphy, 2017c). The different associations between AP and PEP with attentional control found in studies 1A and 1B are an important finding that highlights a distinguishing factor between both AP and PEP in social anxiety. However, it is also important to note that the content and timeframes to which social situation responses are anchored to (on the measures employed for AP and PEP) are somewhat diverse. For example, the ASBQ (i.e., measure for AP used) assesses trait AP related to social situations in general with no specified timeframe, whereas the PEPQ-R (i.e., measure for PEP used) assesses PEP related to a social situation occurring in the past two weeks. Accordingly, the discrepancy of the findings relative to attentional control with AP and PEP may in fact be due to differences in the variety of social situations recalled (i.e., social performance versus a social interaction), or biases related to the timeframes of recalled social situations. In addition, the PEPQ-R incorporates more items focused on RNT than the ASBQ. As such, it is probably not surprising that the PEPQ-R is more highly correlated with attentional control than the ASBQ. In order to make any firm conclusions regarding attentional control being more
involved in PEP than AP, future research would need to replicate the findings with more comparable measures of AP and PEP. Therefore, caution should be ensured when interpreting and comparing the findings for studies 1A and 1B relative to AP and PEP findings.

While an association between attentional shifting and PEP was evident in study 1B, it appears that the pathway of this relationship is mediated by trait anxiety and not social anxiety. This mediated outcome is consistent with Armstrong et al. (2011), who found that reduced attentional control was associated with increased levels of worry that was also mediated by trait anxiety. These mediated relationships suggest that regulating a negative emotion, such as anxiety, is a key factor in determining attentional control abilities that affect RNT processes. While some researchers suggest that similar RNT processes observed across disorders have diagnostic specificity (Kocovski & Rector, 2008), the mediated relationship evident in this research supports a transdiagnostic view whereby a subset of RNT processes are the result of anxiety rather than a spectrum of disorders (Laposa, Collimore, & Rector, 2014; McEvoy et al., 2010; McEvoy et al., 2013).

Given that trait anxiety, mediated the relationship between attentional shifting and PEP, it is not surprising that study 1B also found a mediated pathway through positive affect. More specifically, the relationship between increased attentional control and lower levels of PEP was mediated by increased levels of positive affect. This mediated outcome supports the importance of positive emotion regulation as a key factor in determining the relationship between attentional control abilities and PEP (Derryberry & Rothbart, 1988). Both mediated models suggest that when attentional control abilities are increased, disengagement from distressing thoughts or stimuli is promoted, leading to increased feelings of positivity, which in turn decreases maladaptive thought processes such as PEP. However, when attentional control
abilities are diminished, disengagement from distressing thoughts and stimuli becomes challenging, leading to elevated feelings of anxiety, thus increasing thought processes centred on anxiety, such as PEP.

**Implications**

The findings of the current studies have several implications for understanding the association between attentional control and the cognitive symptoms of social anxiety. For example, research within the field of attention training has demonstrated that improved attentional control attenuates not only anxiety, but also the cognitive symptoms associated with anxiety, such as AP and PEP (McEvoy & Perini, 2009). Findings from the current study corroborate the notion that attention training may be a useful intervention, particularly with regards to PEP, that targets the underlying mechanism of attentional control responsible for maladaptive processes. This study also provides preliminary support for the importance of assessing for attentional control when treating individuals with social anxiety, or other anxiety disorders, in order to design appropriate, individualised interventions. Accordingly, cognitive-behavioural interventions incorporating strategies designed to increase attentional control, such as mindfulness exercises or tasks designed to improve executive functioning or working memory capacity, may reduce preoccupations with anxiety related fears, ultimately alleviating maladaptive RNT processes.

**Limitations and Future Directions**

Despite the novel findings from the current research, several limitations and ideas for future research should be mentioned. First, the findings from the research were collected from two different samples to assess AP and PEP rather than examining both processes in a single cohort of participants. Furthermore, the inclusion of only one measure of RNT in each sample (e.g., AP and PEP) negates the ability to examine the relationship between both AP and PEP within a single sample. Accordingly, the
differences in the findings across samples may have been due to differences in the samples as opposed to differences in AP and PEP. Therefore, future research examining both of these RNT processes within the same sample is necessary to distinguish whether differences in the findings did indeed occur due to AP and PEP differences.

Second, although the findings from the mediation modelling provide important insight into the relationships between attentional control and RNT processes, causal relationships are unable to be inferred due to the correlational nature of the research. Thus, longitudinal designs are necessary in future research before more definitive inferences can be made. Third, a sample of undergraduate students were employed in both studies limiting the generalizability of the findings to clinical or community samples. However, it is important to note that the participants in both studies were individuals scoring one standard deviation or more higher than non-anxious samples on mean levels of social anxiety and were not random samples of undergraduate students with all levels of anxiety.

Lastly, both studies exclusively used self-report measures to examine associations between attentional control, AP and PEP in social anxiety. While self-report measures provide useful insight into these constructs, it would be beneficial to incorporate behavioural measures of attentional control in order to corroborate the current findings. Future research addressing these limitations would further elucidate the role of attentional control as an underlying mechanism of RNT processes in the context of social anxiety.
Chapter 3 Conclusion

Chapter 3 explored the correlational relationships between social anxiety, attentional control, AP and PEP as an initial step in the PhD research program. The findings from studies 1A and 1B in this chapter partially supported the notion that attentional control plays a role in social anxiety, AP and PEP. However, the findings are limited in that causation is unable to be established from correlational studies and the studies made exclusive use of self-report measures. For these reasons, multi-method (e.g., self-report, behavioural) experimental studies were conducted to extend the research program. Chapter 4 extends upon study 1A by experimentally manipulating AP prior to the threat of a speech task in order to investigate attentional control (i.e., the inhibition and shifting executive functions) using an objective behavioural paradigm (i.e., mixed emotional saccade task).
CHAPTER 4 (STUDY 2): ANTICIPATORY PROCESSING IN SOCIAL ANXIETY: INVESTIGATION USING ATTENTIONAL CONTROL THEORY

Abstract ............................................................................................................................ 99

Introduction ................................................................................................................... 101
  Anxiety and the Inhibition Function ........................................................................ 102
  Anxiety and the Shifting Function .......................................................................... 103

Aims, Overview and Hypotheses .................................................................................. 104

Method ........................................................................................................................... 105
  Participants ................................................................................................................ 105
  Questionnaire Measures ........................................................................................... 106
  Mixed emotional saccade task ................................................................................ 107
  Procedure ................................................................................................................... 109
  Data Preparation and Preliminary Analyses .............................................................. 110

Results ........................................................................................................................... 110
  Analyses of the Inhibition Function ...................................................................... 111
  Analyses of the Shifting Function .......................................................................... 114

Discussion ...................................................................................................................... 116

Chapter 4 Conclusion .................................................................................................... 122
Notes

Paper Published:

The candidate is first author on this paper and accepts responsibility of its publication. All co-authors meet the criteria for authorship and take responsibility for their part in the publication. The candidate was responsible for manuscript preparation including literature review, study concept and design, data collection, analysis and interpretation, and writing the manuscript. All co-authors are members of the candidate’s supervisory team and their contribution to the paper was supervisory in nature.

Elsevier Publishing permits the use of The Contribution for inclusion in a thesis or dissertation as long as full acknowledgement of The Contribution’s published source is given.

(Signed)                                                (Date): 17/02/2018
Rachel A. Sluis

(Countersigned)                                         (Date): 17/02/2018
Primary Supervisor: Mark J. Boschen

(Countersigned)                                         (Date): 17/02/2018
Associate Supervisor: David L. Neumann
(Countersigned)                      (Date): 17/02/2018

Associate Supervisor: Karen Murphy
Abstract

Background and Objectives: Cognitive models of social anxiety disorder (SAD) emphasize anticipatory processing (AP) as a prominent maintaining factor occurring before social-evaluative events. While AP is a maladaptive process, the cognitive mechanisms that underlie ineffective control of attention are still unclear. The present study tested predictions derived from attentional control theory in a sample of undergraduate students high and low on social anxiety symptoms.

Methods: Participants were randomly assigned to either engage in AP prior to a threat of a speech task or a control condition with no social evaluative threat. After completing a series of questionnaires, participants performed pro-saccades and antisaccades in response to peripherally presented facial expressions presented in either single-task or mixed-task blocks.

Results: Correct antisaccade latencies were longer than correct pro-saccade latencies in-line with attentional control theory. High socially anxious individuals who anticipated did not exhibit impairment on the inhibition and shifting functions compared to high socially anxious individuals who did not anticipate or low socially anxious individuals in either the anticipatory or control condition. Low socially anxious individuals who anticipated exhibited shorter antisaccade latencies and a switch benefit compared to low socially anxious individuals in the control condition.

Limitations: The study used an analogue sample; however findings from analogue samples are generally consistent with clinical samples.

Conclusions: The findings suggest that social threat induced AP facilitates executive functioning for low socially anxious individuals when anticipating a social-evaluative situation.
Keywords: Social Anxiety Disorder, Social Phobia, Anticipatory Processing, Inhibition, Shifting, Attentional Control Theory, Antisaccade.
Anticipatory Processing in Social Anxiety: Investigation Using Attentional Control Theory

Introduction

Anticipatory processing (AP) occurs when a socially anxious individual anticipates a social/performance event and engages in repetitive negative thinking (RNT) that is dominated by past failures, negative images of oneself, predictions of poor performance, and rejection (Clark & Wells, 1995; Rapee & Heimberg, 1997). Several studies have demonstrated an association between self-reported engagement in AP and social anxiety. For example, Vassilopoulos (2004) found that high socially anxious (HSA) individuals reported anticipatory thoughts prior to a social-evaluative event to be intrusive, persistent, and interfering. Research has shown that compared to low socially anxious (LSA) people, HSA individuals recall more past perceived failures and fewer past positive events, have more catastrophic thoughts and thoughts about escape or avoidance of the stressful situation, experience more negative bodily sensations, and have fewer thoughts concerning improvement of in-situation performance behaviours (Hinrichsen & Clark, 2003; Vassilopoulos, 2008).

Experimental studies investigating AP in social anxiety have highlighted the maladaptive consequences of this mode of self-focused thinking (for a review see Sluis, Boschen, Neumann, & Murphy, 2017a). Typically, experimental studies induce HSA and LSA individuals to engage in either AP or distraction prior to social-evaluative threat (e.g., threat of a speech task or social interaction; Hinrichsen & Clark, 2003; Vassilopoulos, 2005; Wong & Moulds, 2011). Research shows that HSA individuals who engage in AP versus distraction, prior to the threat of a speech task, report stronger feelings of anxiety (Hinrichsen & Clark, 2003; Vassilopoulos, 2005; Wong & Moulds, 2011), a more negative overall appearance of themselves in the upcoming speech (Vassilopoulos, 2005), and show increased relative skin conductance (Wong & Moulds,
In contrast, distraction tends to significantly decrease self-reported anxiety prior to the threat of a speech task (Hinrichsen & Clark, 2003; Vassilopoulos, 2005). Attentional control theory offers a potential explanation for these dysfunctional outcomes which proposes that performance on cognitive tasks, especially those with a high cognitive load, are adversely affected by high levels of anxiety due to poor top-down attentional control (see Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck, Derakshan, Santos, & Calvo, 2007 for a review). As such, enhanced ability to inhibit a prepotent response or shift attention may benefit socially anxious individuals by allowing them to reduce their engagement in dysfunctional modes of thought, such as AP, which subsequently increases their anxiety and maintains maladaptive cognitive processes.

**Anxiety and the Inhibition Function**

To assess individual differences in attentional control, the antisaccade paradigm may be used (Ainsworth & Garner, 2013). The antisaccade task requires participants to make an eye movement to the opposite side of the screen after being presented with a visual cue appearing to the left or right of fixation. As this requires participants to inhibit an automatic eye-movement to the target location, the antisaccade task utilises top-down attentional control (inhibition). The pro-saccade task, which involves fixating on the cue location, is typically used as a control measure in this paradigm. Two performance measures of the antisaccade task are processing efficiency (i.e., latency to make a correct saccade) and performance effectiveness (i.e., errors). According to attentional control theory, adverse effects of anxiety pose greater impairment on processing efficiency than on performance effectiveness (Eysenck & Derakshan, 2011). Thus, anxiety should affect the antisaccade task, but not the pro-saccade task.

Individuals with high levels of trait anxiety display slower antisaccades than low anxious controls (Ansari & Derakshan, 2010; Ansari & Derakshan, 2011; Ansari,
Furthermore, trait anxious individuals find it difficult to efficiently inhibit responses on the antisaccade task when using facial expressions as emotional cues (Derakshan et al., 2009; Garner, Ainsworth, Gould, Gardner, & Baldwin, 2009; Reinholdt-Dunne et al., 2012; Wieser, Pauli, & Mühlberger, 2009). Wieser et al. (2009) used happy, angry, fearful, sad, and neutral facial expressions as emotional cues with HSA and LSA individuals to examine the predictions of attentional control theory with socially anxious individuals. Although socially anxious individuals displayed diminished effectiveness (more errors), there were no differences between HSA and LSA individuals in pro-saccade and antisaccade latencies (processing efficiency). The authors suggest this finding may be due to the salience of human faces attracting attention for socially anxious individuals and thereby reducing their latencies but increasing errors. This finding is surprising given that attentional control theory assumes that anxiety impairs processing efficiency more than performance effectiveness. However, Wieser et al. (2009) employed this paradigm with socially anxious individuals in the absence of any social-evaluative threat. Given that socially anxious individuals often only experience anxiety when faced with social-evaluative threat (e.g., speech task, social interaction), attentional control deficits may be more readily observed in the context of their feared stimulus (Mills, Grant, Judah, & White, 2014b).

**Anxiety and the Shifting Function**

The task-switching paradigm is commonly used to assess the executive function of switching (Diamond, 2013; Miyake et al. 2000; Rogers & Monsell, 1995; Monsell, 2003). A typical task-switching paradigm involves two tasks or decisions (A and B). In the no-switch task participants only perform one task within a block of trials. In the switch trials a mixture of task A and B trials are completed within a single block.
Typically performance is slower or less accurate for the mixed than single task blocks of trials, thus demonstrating a switch-cost (Rogers & Monsell, 1995; Monsell, 2003). However, a protocol that mixed antisaccade and pro-saccade trials showed an improvement in antisaccade performance relative to the single task block of trials (Ansari, Derakshan, & Richards, 2008).

Ansari et al. (2008) compared the performance of high and low trait anxious individuals for the single-task block and the mixed-task block of antisaccade and pro-saccade tasks using emotionally neutral cues. They found a reduced switch-cost for correct antisaccade latencies for the low-anxious participants, but not for high-anxious participants and no group difference in switch-costs for the pro-saccade task. There were no group differences on saccade accuracy which supports the prediction that anxiety affects performance efficiency more than performance effectiveness. The authors interpreted these results as showing that high anxious individuals exhibit diminished “top-down” control of attention when shifting. The findings of Ansari et al. (2008) with neutral task cues are encouraging as the adverse effects of anxiety on task performance would be greater in the presence of threat-related material, an issue that was examined in the current study.

**Aims, Overview and Hypotheses**

The present study examined attentional control in high and low socially anxious individuals that engaged in AP prior to the threat of a speech task or a control condition. An undergraduate sample of non-clinical participants was sampled on the basis that social anxiety is continuously distributed in the general population and results obtained with an analogue sample are largely similar to results found using a clinical sample (Stopa & Clark, 2001). The mixed saccade paradigm was employed as a valid and reliable measure of attentional control that is not reliant on manual reaction times (Ainsworth & Garner, 2013). Emotional faces (cues) were used for the stimuli as this is
more meaningful for socially anxious individuals and should significantly impact on saccadic responses. In order to assess attentional control during AP; some participants were tested under conditions of social-evaluative threat (e.g., speech task). Finally, measures of depression, trait anxiety, and self-reported attentional control were taken in order to control for any potential confounding effects.

Based on attentional control theory and previous literature, the following hypotheses were examined. It was expected that correct antisaccade latencies would be longer than correct pro-saccade latencies, along with more errors in the antisaccade than in the pro-saccade task, regardless of group or condition. Additionally, it was predicted that HSA individuals would exhibit greater impairment on executive functioning than LSA individuals, regardless of condition, and that HSA individuals in the anticipate condition would exhibit more impairment on executive functioning than HSA individuals in the control condition, or LSA individuals in either condition. Furthermore, it was expected that these effects would be greater on performance efficiency (i.e., response latency) than performance effectiveness (i.e., response accuracy).

**Method**

**Participants**

A total of 326 undergraduate volunteers completed an online screening measure of the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) and one public speaking item from the Social Phobia Scale (SPS; Mattick & Clarke, 1998) in exchange for partial course credit. The SIAS has strong psychometric properties and good screening utility for both clinical and research purposes (Rodebaugh, Woods, Heimberg, Liebowitz, & Schneier, 2006). The anxiety groups were selected by choosing those who scored one standard deviation above the mean (HSA group) and less than the mean (LSA group) on the SIAS ($M = 19.5$, $SD = 10.9$; Heimberg, Mueller, Holt, Hope, &
Liebowitz, 1992; Judah, Grant, Lechner, & Mills, 2013; Mills, Grant, Judah, & Lechner, 2014a). Thus, participants were classified into the LSA group if they scored (≤ 19) on the SIAS and rated the public speaking item as 0 (not at all), 1 (slightly), or 2 (moderately). Participants who scored (≥ 30) on the SIAS and rated the public speaking item as 3 (very), or 4 (extremely) were classified into the HSA group (Cody & Teachman, 2011). The final sample consisted of 81 participants. The participants’ ages ranged from 17 to 48 years (M = 24.09, SD = 8.21), and 56 (69.1%) of them were female. All participants indicated they had normal or corrected-to-normal vision. Participants did not differ on each measure as a function of condition ensuring the validity of random assignment (all ps > .51). However, as expected the high and low social anxiety groups differed on each questionnaire measure (see Table 4.1).

Table 4.1. Means and standard deviations for each measure for both high and low social anxiety groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low Social Anxiety</th>
<th>High Social Anxiety</th>
<th>F(1,74)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIAS</td>
<td>9.15</td>
<td>48.03</td>
<td>11.04</td>
<td>426.73</td>
</tr>
<tr>
<td>SPS</td>
<td>9.51</td>
<td>38.03</td>
<td>14.17</td>
<td>119.48</td>
</tr>
<tr>
<td>BFNE</td>
<td>13.44</td>
<td>31.75</td>
<td>8.74</td>
<td>92.17</td>
</tr>
<tr>
<td>STAI-T</td>
<td>11.49</td>
<td>29.88</td>
<td>10.20</td>
<td>87.02</td>
</tr>
<tr>
<td>ACS</td>
<td>41.39</td>
<td>54.50</td>
<td>6.27</td>
<td>67.70</td>
</tr>
<tr>
<td>BDI</td>
<td>12.37</td>
<td>26.28</td>
<td>12.52</td>
<td>39.79</td>
</tr>
</tbody>
</table>

Note: SIAS, Social Interaction and Anxiety Scale; SPS, Social Phobia Scale; BFNE, Brief Fear of Negative Evaluation Scale; STAI-T, State-Trait Anxiety Inventory-Trait; ACS, Attentional Control Scale; BDI, Beck Depression Inventory.

**Questionnaire Measures**

All questionnaire measures use a Likert-type scale with participants asked to indicate the extent to which each statement is characteristic or true of them.

**Brief Fear of Negative Evaluation Scale.** (BFNE; Leary, 1983) is a 12-item measure assessing fear of negative evaluation from others. The BFNE has shown good
four-week test-retest reliability \( r = .75; \) Leary, 1983), along with excellent internal consistency in the current study \( (\alpha = .95) \).

**The Social Interaction Anxiety Scale and Social Phobia Scale.** (SIAS; SPS; Mattick & Clarke, 1998) The SIAS and SPS are companion scales that measure fear of social interaction in dyads or groups, and the fear of being observed, respectively. Each questionnaire is a 20-item measure. Excellent internal consistency was shown for both the SIAS and SPS in the current study \( (\alpha = .95, \alpha = .96, \text{respectively}) \).

**State-Trait Anxiety Inventory.** (STAI; Spielberger, 1983) Comprising two 20-item measures of general anxiety, the STAI State assesses how participants currently feel, and the STAI Trait assesses how they generally feel. Internal consistency in the current study was excellent for both the STAI-S \( (\alpha = .94) \), and the STAI-T \( (\alpha = .96) \).

**Attentional Control Scale.** (ACS; Derryberry & Reed, 2002) is a 20-item measure of general capacity to control attention including an assessment of attention focusing, flexible control of thoughts, and breadth of attention. The ACS demonstrated good internal consistency in the current study \( (\alpha = .88) \).

**Beck Depression Inventory II.** (BDI II; Beck, Steer, & Brown, 1996) is a revised 21-item measure used to assess the severity of depression during the past two weeks. Excellent internal consistency was demonstrated in the current study \( (\alpha = .93) \).

**Mixed emotional saccade task**

A modified version of the mixed emotional saccade task (Ansari et al., 2008; Wieser et al., 2009) was used. Facial stimuli were taken from the NimStim Faces Set (Tottenham et al., 2009) and included male and female facial expressions of anger, fear, sadness, happiness, and neutral. Participants were required to perform antisaccade and pro-saccade tasks in response to the faces which were presented in two blocks: single task (i.e., participants completed trials of the same task consecutively in different blocks, either antisaccade or pro-saccade) and mixed task (i.e., antisaccade and pro-
saccade trials were presented randomly where participants were required to switch between tasks). The order of the trials and blocks was counterbalanced (see Wieser et al., 2009 for stimuli visual angle specifications).

The OpenSesame software package (Dalmaijer, Mathôt, & Van der Stigchel, 2013) was used to present the mixed emotional saccade task on a Tobii TX300 eye-tracker 23-in wide screen TFT monitor with a resolution of 1,920 × 1,080 pixels (see Figure 4.1). After 24 practice trials, the ten facial images were presented 16 times each on the right side and 16 times on the left of the screen, resulting in 320 experimental trials in total. Participants completed 4 blocks of 40 trials for the two single tasks (80 trials each) and 4 blocks of 40 trials for the mixed task.

Eye-movements were measured at a sampling rate of 300 Hz using the Tobii TX300 eye-tracker and Tobii studio software 3.2 (Tobii Technology AB, 2011). The eye-tracker was calibrated using nine fixation points equally spaced. Participants were seated with their eyes at a distance of 60 cm from the centre of the screen.
**Figure 4.2.** Antisaccade and pro-saccade experimental tasks (mixed task block requires randomly switching between tasks). Inter-trial interval varied randomly between 750-1250 ms.

**Procedure**

Participants were randomly assigned to either an AP condition or a control condition for their corresponding group (HSA or LSA) and tested individually (20 HSA anticipate condition, 20 HSA control condition, 20 LSA anticipate condition, and 21 LSA control condition). After obtaining written consent, demographics and baseline levels of state anxiety were measured using the STAI-S, along with measures of social anxiety (SPS, BFNE), depression (BDI II), trait anxiety (STAI-T), and attentional control (ACS). Those in the AP conditions were informed that they would be required to deliver an impromptu three-minute speech about one of two designated topics that would be video recorded and rated for its quality. To induce anticipatory anxiety, these participants were given a social threat induction as adapted from Vassilopoulos (2005). Participants in the AP conditions were then shown a short video of another student giving a speech in order to ensure further anticipatory anxiety. Following the video, participants were instructed to sit for five minutes and think about the speech task they
were about to make. Anxiety levels were re-assessed following five-minutes of AP using the STAI-S. Participants in the control condition were not given the social-evaluative threat induction and all participants were then instructed to complete the questionnaires and the mixed emotional saccade task, which took approximately 20 minutes. In order to ensure time equivalency for those in the control and AP conditions, those in the control condition were instructed to sit quietly once they had completed the questionnaire measures while the experimenter organised some papers and equipment for the next part of the experiment (Mansell & Clark, 1999).

After the mixed emotional saccade task, those in the AP conditions were advised that they would not perform their impromptu speech and all participants were debriefed about the purpose of the study. Participants were also advised to keep details of the study confidential to minimise diffusion effects.

Data Preparation and Preliminary Analyses

Data from the mixed emotional saccade task was prepared according to previous research (see Ansari et al., 2008). Given that the groups differed in their scores on depression, trait anxiety, and self-reported attentional control, ANCOVA analyses were conducted using these measures as covariates.

Results

To examine the effectiveness of the anxiety manipulation for those in the anticipate conditions, a 2 × 2 Group (HSA, LSA) × Time (Pre, Post) ANOVA was conducted on STAI-S scores. The ANOVA revealed a statistically significant group × time interaction \( F(1,37)=18.91, p=.001, n_p^2 = .34 \). There was a statistically significant increase in STAI-S baseline and STAI-S post induction scores for both high (Pre STAI-S, \( M = 19.32, SD = 8.23 \); Post STAI-S, \( M = 41.42, SD = 7.18 \)) \( t(18) = -8.56, p < .001 \) and low (Pre STAI-S, \( M = 5.10, SD = 6.10 \); Post STAI-S, \( M = 13.65, SD = 9.48 \)) \( t(19) = -4.77, p < .001 \) socially anxious participants in the anticipate conditions indicating that the
social threat induction increased participant’s state anxiety prior to performing the mixed emotional saccade task. As expected, this increase was greater for those in the HSA anticipate condition compared to those in the LSA anticipate condition (Pre STAI-S, \( t(38) = 6.25, p < .001 \); Post STAI-S, \( t(37) = 10.28, p < .001 \)).

**Analyses of the Inhibition Function**

**Correct response latencies of pro-saccades and antisaccades in the mixed-task block.** Figure 4.2 shows the mean correct saccade latencies for each of the anti- and pro-saccade tasks according to group and condition. Analyses revealed a significant main effect of task [\( F(1, 66) = 19.43, p < .001, n_p^2 = .23 \)] and a significant three-way interaction [\( F(1, 66) = 5.43, p = .02, n_p^2 = .08 \)]. The main effect of task showed that correct latencies were significantly shorter for pro-saccade (\( M = 180.63, SD = 16.03 \)) than for antisaccade (\( M = 243.49, SD = 26.81 \)) trials, regardless of condition or group. The group × task and condition × task interactions were not significant. Furthermore, the main effects of group and condition were also non-significant (\( Fs < 0.79, ps > .37 \)).
To follow up the significant three-way interaction simple effects analysis for each group and each condition were conducted. In the HSA group, the simple main effect of task \(F(1,33)=10.47, p < .01, \eta^2_p = .24\) revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials, but this did not differ as a function of condition \([\text{task} \times \text{condition} \text{interaction and main effect of condition were non-significant;}\ F(1,33)=1.50, p = .23, \eta^2_p = .04;\ F(1,33)=0.31, p = .58, \eta^2_p = .01]\). In the LSA group, the simple main effect of task \([F(1,30)=9.04, p < .01, \eta^2_p = .23]\) revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials, however the interaction between condition \(\times\) task was non-significant \([F(1,30)=2.16, p=.15, \eta^2_p = .07]\) as was the main effect of condition \([F(1,30)=0.15, p = .71, \eta^2_p = .01]\).

In the anticipate conditions, the simple main effect of task \([F(1,31)=7.82, p< .01, \eta^2_p = .20]\) revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials. The group \(\times\) task interaction \([F(1,31)=2.15, p=.15, \eta^2_p = .07]\) revealed...
.07] and main effect of group \[F(1,31)=0.22, p = .65, \eta^2_p = .01\] were not significant. In the control condition, the simple main effect of task \[F(1,32)=11.53, p < .01, \eta^2_p = .27\] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade latencies, but this did not differ as a function of group \[\text{task} \times \text{group interaction and main effect of group were non-significant; } F(1,32)=0.002, p = .97, \eta^2_p = .00; F(1,32)=0.87, p = .36, \eta^2_p = .03\].

**Errors for pro- and antisaccades in the mixed-task block.** Figure 4.3 shows the mean percentage of saccade errors for each of the anti- and pro-saccade tasks according to group and condition. Analyses revealed a significant main effect of task \[F(1,66)=4.71, p = .03, \eta^2_p = .07\] reflecting that errors were significantly higher for antisaccade \((M = 4.30, SD = 2.23)\) than for pro-saccade \((M = .90, SD = .55)\) trials. However, neither the two-way interaction of group \(\times\) task, the two-way interaction of condition \(\times\) task, nor the three-way interaction of group \(\times\) condition \(\times\) task were significant. Furthermore, the main effects of group and condition were also non-significant \((Fs < 1.24, ps > .26)\).

![Figure 4.3. Mean percentage of errors (with standard errors) of task by group in the anticipate and control conditions.](image_url)
Analyses of the Shifting Function

Correct anti- and pro-saccade latencies in the single-task versus mixed-task block (switch-costs effects). Analyses for the shifting function were conducted for the switch-costs data (difference in saccade mean latency between the single-task and mixed-task blocks). Analyses revealed a significant three-way interaction $[F(1,72)=3.83, p = .05, \eta^2_p = .05]$; see Figure 4.4. The two-way interactions of group × task, and condition × task were non-significant, and the main effect of task was non-significant ($F_s < 1.84, ps > .17$). The significant main effect of group $[F(1,72)=3.89, p = .05, \eta^2_p = .05]$, revealed that the HSA group had a switch benefit ($M = -4.22, SE = 2.17$) compared to the LSA group ($M = 2.97, SE = 2.13$) who demonstrated a switch-cost.

![Figure 4.4](image.png)

*Figure 4.4.* Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition.

Follow-up analysis for the three-way interaction showed that for the LSA group, the main effect of task was not significant $[F(1,35)=0.50, p=.49, \eta^2_p = .01]$, although the interaction between condition × task was significant $[F(1,35)=4.50, p=.04, \eta^2_p = .11]$. This significant interaction indicated a switch benefit in antisaccades for LSA individuals in the anticipate condition compared to the LSA control group who showed
Executive function and repetitive negative thinking  115

a switch-cost \( t(38) = 2.99, p = .006 \), whereas the opposite effect was seen in switch-cost for the LSA group in pro-saccades with controls performing faster than those who anticipated, however this effect was non-significant \( t(38) = 1.62, p = .11 \). In the HSA group, the condition \( \times \) task interaction was non-significant \( F(1,34)=0.20, p = .66, n_p^2 = .01 \) as was the main effect of task \( F(1,34)=0.48, p = .49, n_p^2 = .01 \).

In the control condition, neither the two-way interaction of group \( \times \) task \( F(1,35)=0.35, p = .56, n_p^2 = .01 \) nor the main effect of task \( F(1,35)=0.87, p = .36, n_p^2 = .02 \) were significant, however the main effect of group was significant \( F(1,35)=3.82, p=.05, n_p^2 = .10 \) indicating a switch benefit for HSA individuals \( (M = -3.58, SE = 2.77) \) compared to LSA individuals who were slower \( (M = 5.50, SE = 2.77) \). In the anticipate condition, the group \( \times \) task interaction was non-significant \( F(1,34)=2.68, p = .11, n_p^2 = .07 \) as was the main effect of task \( F(1,34)=0.17, p = .68, n_p^2 = .01 \).

**Errors for the anti- and pro-saccades in the single-task block versus the mixed-task block (switch-cost).** Analyses revealed a non-significant main effect of task. Furthermore, the two-way interaction of condition \( \times \) task and the three-way interaction of group \( \times \) condition \( \times \) task were non-significant \( (F_s < 0.81, p_s > .36) \). However, the two-way interaction of group \( \times \) task was significant \( F(1,70)=3.96, p = .05, n_p^2 = .05 \) which indicated a switch benefit in pro-saccades for HSA \( (M = -.33, SD = 1.31) \) compared to LSA \( (M = .28, SD = .69) \) individuals \( t(75) = -2.55, p = .01 \).

**Switch-cost for correct anti and pro-saccade latencies of the switch versus repeat trials in the mixed-task block.** Analyses revealed a non-significant main effect of task and neither the three-way interaction, the two-way interaction of group \( \times \) task nor the two-way interaction of condition \( \times \) task approached significance \( (F_s < 1.64, p_s > .20; \text{ see Figure 4.5}) \). Furthermore, there were no significant effects of error rates for switch-cost for anti and pro-saccades of the switch versus repeat trials in the mixed-task block.
Figure 4.5. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition for switch versus repeat trials in the mixed-task block.

Discussion

The aim of the current study was to examine the underlying mechanisms thought to be responsible for AP in social anxiety using attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007). The current study also aimed to extend previous work in the area by manipulating AP and employing the mixed emotional saccade paradigm in order to assess the main tenets of attentional control theory. Thus, it was expected that HSA individuals (compared to LSA individuals) who anticipated would exhibit deficits in two basic functions of the central executive, including the inhibition and shifting functions.

As predicted, findings showed that correct antisaccade latencies were longer than correct pro-saccade latencies, along with higher error rates, which is consistent with previous research (Ansari et al., 2008; Wieser et al., 2009). Furthermore, this effect was also greater for performance efficiency than for performance effectiveness as evidenced by the lack of anxiety-related effects on saccade accuracy. Conversely, the hypothesised effects of group or condition were not found as expected. More specifically, the HSA group who anticipated did not exhibit impairment on the inhibition and shifting functions compared to the HSA group who did not anticipate or
the LSA groups in either condition. Interestingly however, the predominant findings were for the LSA group only. For example, LSA individuals who anticipated demonstrated a switch benefit, compared to LSA individuals in the control condition who exhibited a switch-cost. These findings suggest that AP facilitates the ability to shift attention for LSA individuals when anticipating a social-evaluative situation. This was an unexpected finding that warrants further explanation. The improved executive functions performance observed by LSA individuals when anticipating may be a consequence of increased motivation to perform the speech task. For example, given that these individuals do not experience incapacitating levels of anxiety prior to a social-evaluative event, their alertness and arousal to perform the task as a result of threat experienced may be increased which in turn may have benefited their performance and facilitated their attentional control abilities. Indeed, the effects of impaired performance for LSA individuals in the control condition are somewhat more unexpected. Thus, it appears that engaging in AP prior to the threat of a speech task is beneficial and adaptive compared to not engaging in this thought process for LSA individuals.

The absence of an impairment in the HSA group was also surprising, along with the lack of impairment on attentional control for AP. While it was expected that AP would impair executive functioning for HSA individuals, these findings are generally consistent with that of Wieser et al. (2009). For example, Wieser and colleagues found that HSA individuals made more antisaccade errors in response to all facial expressions, but no group differences between HSA and LSA individuals were observed in terms of pro-saccade and antisaccade latencies. Wieser et al. (2009) concluded that this may be due to the salience of human facial stimuli which may attract attention for socially anxious individuals, thus reducing response times. A similar conclusion may apply to the current findings and suggest that multiple factors may contribute to the lack of anxiety induced effects observed, such as the role of motivation (Kouneiher, Charron, &
Koechlin, 2009), or the cognitive load of task demands (Gazzaley, 2011), which may partially contribute to the underlying mechanisms responsible for AP in social anxiety.

Motivation appears to play a vital role in socially anxious individual’s ability to perform a difficult task effectively. For example, Kouneiher et al., (2009) showed that motivation can integrate with cognitive control, such that when HSA individuals are motivated, perhaps due to perceived negative evaluations associated with poor performance, compensatory strategies are more likely to be employed in order to maintain task performance with LSA individuals. This explanation also appears likely in describing the current findings of the lack of impaired performance in HSA individuals which was analogous to that of LSA individuals. Thus it seems that the anxiety experienced by HSA individuals when anticipating a social-evaluative situation may have adaptive benefits in terms of their executive functioning, however this may only be true for HSA individuals with high levels of motivation. The role of motivation and how this interacts with anxiety on cognitive functioning is an important area worthy of future investigations.

Conversely, findings for the switching function from the current study are inconsistent with that of previous research. For example, Ansari and colleagues (2008) found an improvement in the mixed-task block for low-anxious participants, but not for high-anxious participants, whereas the current study failed to demonstrate this effect. Given that Ansari et al. (2008) used neutral stimuli, it was expected that the emotional cues in the present study would yield greater attentional control deficits due to their threat-relevance for HSA individuals. Nevertheless, as suggested by Wieser et al. (2009), the salience of human facial stimuli may have increased an attentional avoidance response for socially anxious individuals, thus reducing response times and improving their switching performance.
While the current findings show some support for the predictions of attentional control theory, there are several limitations to note. First, the data obtained in the current study was acquired from an undergraduate sample. Nonetheless, the final sample consisted of individuals categorised into high and low social anxiety groups and results obtained using an analogue sample are largely similar to results found using a clinical sample (Stopa & Clark, 2001). Second, given that the social threat induction was not delivered to those in the control condition followed by a distraction task (as opposed to facilitated AP), caution should be ensured when interpreting the current findings. As such, it is difficult to determine whether the outcomes observed were due to the effects of the social threat induction, AP, or indeed a combination of both. Nonetheless, previous research within the field of AP has demonstrated that participants given a social threat induction followed by a distraction task still engaged in AP, despite engaging in a distractor task (Vassilopoulos, 2005). This finding by Vassilopoulos (2005) formed the basis for exclusion of the social threat induction followed by a distractor task to control participants in the current study. Third, while the cue offset and target onset duration of 500 ms used in the current study is the most commonly applied duration to detect attentional control deficits (Sluis & Boschen, 2014), manipulating different interval durations may yield diverse anxiety effects worthy of future investigation. For example, Ansari and Derakshan (2011) manipulated the interval between offset of instructional cue and onset of target (CTI) and found that high anxious individuals showed comparable saccade latencies to that of low anxious individuals when the CTI was medium (400 ms) compared to when it was short (0 ms; which resulted in poorer performance). Given that the current study used a CTI comparable to Ansari and Derakshan’s medium interval duration, the improved performance observed by HSA individuals in the current study may be reflective of their findings suggesting that medium CTI’s may result in greater investment of
attentional resources in preparation for the task goal, thus improving their performance. Lastly, the current study neglected to assess for other potential contributing factors that underlie AP including the role of motivation, or manipulating the cognitive load of the task.

If the aforementioned compensatory strategies relative to the role of motivation are indeed employed by HSA individuals when performing cognitive tasks, then compromising compensatory strategies by increasing cognitive load may reveal clearer attentional control deficits. For example, attentional control theory posits that under conditions of high task demands, such as attenuating cognitive resources between two tasks, HSA individuals may be more easily overloaded than LSA individuals which may in turn detract from their ability to strengthen cognitive efficiency on the main task. The role of cognitive load has been investigated by previous researchers who have demonstrated that high anxious participants showed longer latencies compared to low anxious peers under conditions of ‘high’ cognitive load (Derakshan & Eysenck, 1998; Eysenck, Payne, & Derakshan, 2005; MacLeod & Donnellan, 1993). The current study neglected to manipulate cognitive load of the task, thus future research would benefit from replicating the present findings by investigating the role of cognitive load in order to elucidate whether this does indeed reveal clearer deficits in attentional control for AP between HSA and LSA individuals. In terms of the current findings, it is possible that there may actually be a threshold point of cognitive load whereby AP may facilitate performance and have an adaptive component for HSA individuals when the cognitive load is low to moderate, such as that in the current study. However, AP may be maladaptive and impair executive functioning when the cognitive load is high (e.g. concurrently performing two tasks). Nevertheless, this is only conjecture and still needs to be tested empirically in future research.
The present findings have several implications for understanding the role of AP in social anxiety and how this interacts with attentional control. Models of SAD highlight AP as a feature of social anxiety that contributes to dysfunctional outcomes associated with this clinical condition. According to the current findings, there appear to be multiple underlying mechanisms associated with the maladaptive effects of AP which are complex and interacting. Furthermore, some of the premises of attentional control theory were not supported by the current findings, which provide justification for the expansion of theoretical models of attentional control to gain a greater understanding of this construct in relation to SAD and indeed other anxiety disorders.

In conclusion, the current study adds to the growing literature on social anxiety and attentional control and provides insight into the complexities of the underlying mechanisms of AP in social anxiety. It is evident that more research is needed to determine the exact mechanisms by which AP is dysfunctional and beneficial for HSA individuals. Future research addressing the interacting effects of motivation and cognitive/emotional load with attentional control during AP should provide greater understanding in this area. In turn, future studies will have the potential to inform the development of interventions for those with SAD.
Chapter 4 Conclusion

Chapter 4 experimentally examined whether impairments in attentional control (i.e., inhibition and shifting functions of the central executive) underlie AP in social anxiety. Thus, the study in chapter 4 manipulated AP prior to the threat of a speech task using an objective behavioural paradigm (i.e., mixed emotional saccade task) to measure attentional control. While the predictions of an anxiety-related effect on impaired task performance was not observed, this chapter revealed novel findings for LSA individuals. Specifically, LSA individuals in the anticipate condition exhibited a switch benefit compared to LSA individuals in the control condition, who demonstrated a switch-cost, revealing that AP may indeed facilitate attentional control abilities for LSA individuals.

Similar to chapter 4, chapter 5 extends upon study 1B by experimentally manipulating PEP following delivery of a speech task to investigate whether impairments in attentional control (i.e., inhibition and shifting) underlie PEP by employing the same behavioural paradigm as that used in chapter 4.
CHAPTER 5 (STUDY 3): POST-EVENT PROCESSING IN SOCIAL ANXIETY: INVESTIGATION USING ATTENTIONAL CONTROL THEORY

Paper submitted for publication:


Abstract ......................................................................................................................... 124
Introduction ................................................................................................................... 125
Attentional Control Theory ........................................................................................... 126
Aims, Overview and Hypotheses .................................................................................. 128
Method .......................................................................................................................... 129
Participants .................................................................................................................. 129
Questionnaire Measures ............................................................................................ 130
Mixed emotional saccade task .................................................................................. 132
Procedure .................................................................................................................. 132
Results ........................................................................................................................... 133
Analyses of the Inhibition Function .......................................................................... 134
Analyses of the Shifting Function ............................................................................. 137
Discussion ..................................................................................................................... 140
Chapter 5 Conclusion .................................................................................................... 145
Abstract

Background and Objectives: Post-event processing (PEP) is a possible maintaining factor of social anxiety occurring after a social-evaluative event. Prior research demonstrates that PEP is a repetitive negative thinking (RNT) process that has maladaptive outcomes; however, the cognitive mechanisms thought to underlie PEP are still unclear. Accordingly, poor attentional control may serve to maintain this thought process in social anxiety disorder.

Method: Undergraduate students high and low on symptoms of social anxiety were randomly assigned to engage in either PEP following a speech task or a control condition. Participants completed a series of self-report questionnaires and then performed pro-saccades and antisaccades in response to facial expressions presented peripherally in either single-task or mixed-task blocks. Results: Consistent with attentional control theory, correct antisaccades were longer than correct pro-saccades. High socially anxious participants in the PEP condition did not display impairment on the inhibition and shifting functions compared to high socially anxious participants in the control condition or low socially anxious participants in either condition. Low socially anxious participants in the PEP condition displayed shorter antisaccade latencies and a switch benefit compared to low socially anxious participants in the control condition. Limitations: While the study used an analogue sample, findings from analogue samples are generally applicable to clinical samples. Conclusions: PEP may facilitate executive functioning for low socially anxious individuals and have an adaptive component following social-evaluative events.

Keywords: Social anxiety disorder, Post-event processing, Attentional Control Theory, Antisaccade, Inhibition, Shifting.
Post-Event Processing in Social Anxiety: Investigation Using Attentional Control Theory

Introduction

Cognitive theories of social anxiety disorder (SAD) emphasize the relevance of cognitive processes, such as attention, interpretation and memory which shape and maintain social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). Post-event processing (PEP) occurs when a person leaves a social event, and is a repetitive negative thought process centred on perceived social failure (Clark & Wells, 1995). Much of the research on PEP illustrates the dysfunctional outcomes associated with this style of repetitive negative thinking (RNT). For example, correlational studies have shown that PEP in high socially anxious individuals (HSA) is positively associated with more frequent recall of negative social events, memories rated as intrusive and interfering, withdrawal behaviours and avoidance of similar social events (Campbell, Bierman, & Molenaar, 2016; Lundh & Sperling, 2002; Rachman, Grüter-Andrew & Shafran, 2000). PEP is also a pervasive and stable construct over several weeks (Laposa & Rector, 2011).

Experimental studies that manipulate PEP in social anxiety have used social-evaluative threat tasks, such as a speech or a social interaction, to highlight the maladaptive outcomes of this, and similar, modes of thought (for a review of anticipatory processing [AP] see Sluis, Boschen, Neumann, & Murphy, 2017a; for a review of PEP see Sluis, Boschen, Neumann, & Murphy, 2017b). For example, research shows that compared to low socially anxious individuals (LSA), HSA individuals who engage in PEP recall memories that are more negative and shameful (Field & Morgan, 2004), experience greater anxiety (Morgan & Banerjee, 2008), and have more of a negative perception of themselves and others (Chiupka, Moscovitch, & Bielak., 2012). A speech task is a valid and reliable technique used to elicit PEP.
Studies using a speech task have found that HSA individuals engage in greater and more negative levels of PEP (Edwards, Rapee, & Franklin, 2003), are more likely to use ruminative coping strategies than distraction strategies (Kocovski, Endler, Rector, & Flett, 2005); and show greater memory biases for negative feedback regarding speech performance (Cody & Teachman, 2010). Furthermore, in terms of a speech task, social anxiety has consistently been found to be a unique predictor of PEP over and above that of depression and trait anxiety (Abbott & Rapee, 2004; Edwards et al., 2003; Makkar & Grisham, 2011a). Taken together, these studies highlight the maladaptive consequences of PEP in social anxiety.

**Attentional Control Theory**

Attentional control theory is a framework for understanding attentional control in the context of anxiety and cognitive performance. The first tenet of attentional control theory predicts that anxiety is associated with deficits in cognitive efficiency, resulting in a decreased ability to inhibit task-irrelevant information, shift attention between tasks, and update working memory. The second tenet predicts that these deficits are predominantly assumed to affect processing efficiency while not negatively impacting performance effectiveness (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck, Derakshan, Santos, & Calvo, 2007).

Central to the theoretical assumption that anxiety impairs attentional control, two attentional systems have been distinguished - the goal-directed attentional system and the stimulus-driven attentional system (Corbetta & Shulman, 2002; Posner & Petersen, 1990). Anxiety is proposed to disrupt the relative balance of these two attentional systems whereby the stimulus-driven attentional system increases and the goal-directed attentional system decreases activation (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007). Three executive functions underlie ineffective control of attention in anxiety and these are inhibition, shifting and updating
The presence of threat-related stimuli triggers anxiety thus impairing processing efficiency which reduces attentional control. While each executive function uniquely influences attentional control, the effects of anxiety is less on the updating than the inhibition and shifting functions (Derakshan & Eysenck, 2009). Given that these functions are all part of the goal directed attentional system, if the demands on one function are excessive then processing resources available for other executive functions will be limited (Eysenck et al., 2007).

The mixed saccade paradigm can be used to test the main tenets of attentional control theory. The paradigm provides an overt assessment of attention that is sensitive to individual differences and is not reliant on manual responses (Ainsworth & Garner, 2013; Sluis, Boschen, Neumann, & Murphy, 2017c). Moreover, it simultaneously assesses both the inhibition and shifting executive functions as participants are required to inhibit an automatic response and switch attention between blocks of trials (for a more detailed description of the mixed saccade task see Sluis et al., 2017c).

While there is limited research applying attentional control theory using the antisaccade task, the available literature has examined attentional control in those with trait anxiety and social anxiety, however these findings are diverse (Ansari, Derakshan, & Richards, 2008; Sluis et al., 2017c; Wieser, Pauli, & Mühlberger, 2009). For example, some researchers have found that high trait anxious individuals (compared to low trait anxious) have difficulty inhibiting responses or shifting attention on the antisaccade task as demonstrated by slower antisaccade latencies (Ansari & Derakshan, 2010; Ansari et al., 2008). Conversely, other researchers examining attentional control in those with social anxiety have not found an inhibition or shifting deficit for HSA individuals (Sluis et al., 2017c; Wieser et al., 2009). Despite these disparate findings, the authors are aware of only one study to date which has applied attentional control theory to specifically examine the mechanisms responsible for particular maladaptive
thought processes that are characteristic of social anxiety. For example, Sluis et al. (2017c) applied attentional control theory to examine the underlying mechanisms of AP, a dysfunctional mode of thought characteristic of SAD. While they found some support for attentional control theory in terms of slower latencies and more errors in antisaccades compared to pro-saccades, they did not find inhibition and shifting impairments for HSA individuals who anticipated a social-evaluative event. Instead, they found that AP appeared to facilitate performance for LSA individuals, indicating an adaptive component of this thought process. While PEP is also considered a RNT process similar to that of AP, there appear to be functional differences that distinguish PEP from AP (Martin & Tesser, 1996). For example, temporal orientation and goal-discrepancy tend to differentiate AP from PEP such that AP is future focused on an incomplete task, whereas PEP is past-focused and centred on a completed task. Thus, an examination of the underlying mechanisms potentially responsible for PEP in the current study is warranted.

Aims, Overview and Hypotheses

The current study examined attentional control in high and low socially anxious individuals who engaged in PEP following a speech task or a control condition. As social anxiety is continuously distributed in the general population and results obtained with an analogue sample are largely similar to those obtained for clinical samples (Stopa & Clark, 2001), an undergraduate sample of non-clinical participants was sought. The mixed saccade paradigm using emotional faces was employed to measure attentional control. In order to assess attentional control during PEP; some participants were tested under conditions of social-evaluative threat (e.g., speech task) and others were a control group. Measures of depression and trait anxiety were taken to control for comorbidities.
Based on attentional control theory and previous literature, the following hypotheses were examined. It was expected that correct antisaccade latencies would be longer than correct pro-saccade latencies, along with more errors in the antisaccade than in the pro-saccade task, regardless of social anxiety group or PEP and control condition. Additionally, it was predicted that HSA individuals would exhibit greater executive functioning impairment than LSA individuals, regardless of condition. Furthermore, it was expected that HSA individuals in the PEP condition would exhibit more executive functioning impairment than HSA individuals in the control condition, or LSA individuals in either condition. It was also expected that the impaired executive functioning effects would be greater on performance efficiency (i.e., response latency) than performance effectiveness (i.e., response accuracy).

Method

Participants

A total of 392 undergraduate volunteers completed an online screening measure of the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) and one public speaking item from the Social Phobia Scale (SPS; Mattick & Clarke, 1998) in order to select high and low social anxiety groups. Undergraduate volunteers received partial course credit for participation. Groups were selected by choosing those who scored one standard deviation above the mean and those who scored equal to or less than the undergraduate sample mean on the SIAS (Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992; Judah, Grant, Lechner, & Mills, 2013; Mills, Grant, Judah, & Lechner, 2014a). The SIAS has good screening utility for both clinical and research purposes and strong psychometric properties (Rodebaugh, Woods, Heimberg, Liebowitz, & Schneier, 2006). Participants were categorised into the LSA group if they scored (≤ 19) on the SIAS and who rated the public speaking item as 0 (not at all), 1 (slightly), or 2 (moderately). Participants who scored (≥ 30) on the SIAS and who rated the public speaking item as 3
(very), or 4 (extremely) were categorised into the HSA group. The final sample consisted of 92 participants. The participants’ ages ranged from 17 to 63 years ($M = 22.44$, $SD = 6.89$), and 63 (68.5%) were female. All participants indicated they had normal or corrected-to-normal vision. High and low social anxiety groups differed on scores for a range of anxiety, attentional control, and PEP, as expected (see Table 5.1).

Table 5.1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low Social Anxiety</th>
<th>High Social Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIAS</td>
<td>12.29</td>
<td>49.40</td>
</tr>
<tr>
<td>SPS</td>
<td>10.98</td>
<td>42.83</td>
</tr>
<tr>
<td>BFNE</td>
<td>17.33</td>
<td>34.32</td>
</tr>
<tr>
<td>PEPQ-R</td>
<td>23.71</td>
<td>59.67</td>
</tr>
<tr>
<td>STAI-T</td>
<td>16.51</td>
<td>33.45</td>
</tr>
<tr>
<td>ACS</td>
<td>56.49</td>
<td>44.62</td>
</tr>
<tr>
<td>BDI II</td>
<td>16.91</td>
<td>30.43</td>
</tr>
</tbody>
</table>

Note: SIAS, Social Interaction and Anxiety Scale; SPS, Social Phobia Scale; BFNE, Brief Fear of Negative Evaluation Scale; PEPQ-R, Post Event Processing Questionnaire – Revised; STAI-T, State-Trait Anxiety Inventory-Trait; ACS, Attentional Control Scale; BDI II, Beck Depression Inventory II.

**Questionnaire Measures**

The Social Interaction Anxiety Scale and Social Phobia Scale. (SIAS; SPS; Mattick & Clarke, 1998) The SIAS is designed to measure fear of social interaction in groups, and the SPS measures fear of being observed. Each measure comprises 20-items using a response scale ranging from 0 (not at all characteristic or true of me) to 4 (extremely characteristic or true of me) for each item (e.g., SIAS; I have difficulty talking with other people; e.g., SPS; I fear that I may blush when I am with others).

Following the pre-screening, the SPS was administered in its entirety to validate the categorisation into high and low social anxiety groups. Excellent internal consistency
was demonstrated for both the SIAS and SPS in the current study ($\alpha = .96$, $\alpha = .97$, respectively).

**Brief Fear of Negative Evaluation Scale.** (BFNE; Leary, 1983) measures fear of negative evaluation from others and comprises 12 items using a response scale ranging from 0 (*not at all like me*) to 4 (*extremely like me*) for each item (e.g., *I am afraid that others will not approve of me*). The BFNE had excellent internal consistency in the current study ($\alpha = .95$).

**State-Trait Anxiety Inventory.** (STAI; Spielberger, 1983) are two 20-item measures. The STAI State assesses how participants currently feel (e.g., *I feel nervous*), and the STAI Trait assesses how they generally feel (e.g., *I lack self-confidence*). Each item is measured on a 4-point Likert-type scale ranging from 0 (*not at all*) to 3 (*very much so*) for the STAI State and from 0 (*almost never*) to 3 (*almost always*) for the STAI Trait. Both the STAI-S ($\alpha = .96$), and the STAI-T ($\alpha = .96$) demonstrated excellent internal consistency in the current study.

**Attentional Control Scale.** (ACS; Derryberry & Reed, 2002) measures control of attention including attentional focusing, flexible control of thoughts, and breadth of attention. The ACS is a 20 item measure rated on a 4-point scale from 1 (*almost never*) to 4 (*always*) for each item (e.g., *When I need to concentrate and solve a problem, I have trouble focusing my attention*). Good internal consistency was shown for the ACS in the current study ($\alpha = .90$).

**Beck Depression Inventory II.** (BDI II; Beck, Steer, & Brown, 1996) measures levels of depression during the past two weeks and is a 21-item measure rated on a 4-point scale ranging from 0 (*not at all*) to 3 (*severely*). The BDI-II demonstrated excellent internal consistency in the current study ($\alpha = .94$).

**Post-Event Processing Questionnaire-Revised.** (PEPQ-R; McEvoy & Kingsep, 2006) is a 9-item scale used to assess how much and how often individuals
engage in post-event processing after a social situation in the past two weeks using 0-100 visual analogue scales. Participants in the current study responded to items relative to the speech performance given during the experiment. The nine items were obtained from the original 14-item PEPQ (Rachman et al., 2000) and has shown good internal consistency among those with SAD ($\alpha = .93$; Kiko et al., 2012) and those with high social anxiety ($\alpha = .90$; Mitchell & Schmidt, 2014). Excellent internal consistency was demonstrated in the current study ($\alpha = .95$).

**Mixed emotional saccade task**

The mixed emotional saccade task was the same as that used in previous research (for a detailed description of the stimuli, task and hardware see Sluis et al., 2017c). Data reported in the current study was from a different cohort of participants to that reported in Sluis et al., 2017c.

**Procedure**

High and low socially anxious participants were randomly assigned to either a PEP condition or a control condition. Participants were tested individually with the following numbers in each condition: 24 HSA PEP condition, 23 HSA control condition, 24 LSA PEP condition, and 21 LSA control condition.

Initially, written consent was obtained. Subsequently, baseline levels of state anxiety were taken for all participants using the STAI-S, in conjunction with measures of social anxiety (SPS, BFNE), attentional control (ACS), trait anxiety (STAI-T), and depression (BDI II). Participants in the PEP conditions were informed that they would be required to deliver an impromptu three-minute speech that would be video recorded and rated on quality and were given the option to speak about one of two topics including “the Advantages and Disadvantages of the Death Penalty” or “the Advantages and Disadvantages of Animal Testing”. In order to induce PEP, these participants were given the following social threat induction: “The next part of this experiment is an
assessment of your social skills and public speaking ability. I will stay here to watch you give the speech and rate you on several different measures of the effectiveness of your presentation. You will also be video-recorded so that some expert psychologists can rate your ability also. You now have one minute to prepare your speech before I start the camera and you begin your speech.” Concluding the speech, participants in the PEP conditions were given 10 minutes where they were instructed to: (1) think about the speech they had just given, (2) think about how well they performed, and (3) think about how they felt or may have appeared during the speech. The 10 minute timeframe was chosen as the literature suggests that PEP is a relatively stable phenomenon, where socially anxious individuals experience increases in negative evaluative thoughts following social-evaluative events (Lundh & Sperling, 2002; Zou & Abbott, 2012). A further assessment of the STAI-S along with the PEPQ-R was taken at the end of the 10 minute PEP time. Those in the control conditions were not required to perform a speech or engage in 10 minutes of PEP. Participants in the control condition were instructed to sit quietly on completion of questionnaire measures while the experimenter organised equipment to ensure time equivalency between conditions (Mansell & Clark, 1999; Sluis et al., 2017c).

On completion of these measures, participants in all conditions were required to perform an emotional saccade task in two blocks (i.e., single task, mixed task) after instructions had been given. This took approximately 20 minutes. Finally, all participants were debriefed.

**Results**

Data from the mixed emotional saccade task was prepared according to previous research (see Ansari et al., 2008). ANCOVAs were conducted using depression and trait anxiety as covariates given high comorbidity between these measures and social anxiety.
To examine the effectiveness of the anxiety manipulation for those in the PEP conditions, a $2 \times 2$ Group (HSA, LSA) $\times$ Time (Pre, Post) ANOVA was conducted on STAI-S scores. The ANOVA revealed a statistically significant Group $\times$ Time interaction [$F(1,46) = 11.22, p = 0.002, n_p^2 = 0.20$]. As expected, there was a statistically significant increase in STAI-S baseline and STAI-S post induction scores for HSA participants in the PEP condition (Pre STAI-S, $M = 26.71, SD = 13.31$; Post STAI-S, $M = 37.29, SD = 11.42$) [$t(23) = -6.83, p < 0.001$], but not for LSA participants in the PEP condition (Pre STAI-S, $M = 11.33, SD = 11.98$; Post STAI-S, $M = 13.83, SD = 11.70$) [$t(23) = -1.35, p = 0.190$]. The post PEPQ-R was also completed by participants in the PEP condition. As expected, HSA participants engaged in PEP following the speech task (Post PEPQ-R, $M = 59.67, SD = 21.13$) to a significantly greater degree than LSA participants (Post PEPQ-R, $M = 23.71, SD = 19.50$) [$t(46) = 6.13, p < 0.001$].

**Analyses of the Inhibition Function**

Correct response latencies of pro-saccades and antisaccades in the mixed-task block. Analyses revealed a significant main effect of task [$F(1,86)=49.05, p < .001, n_p^2 = 0.36$], showing that correct latencies were significantly shorter for pro-saccade ($M = 188.75, SD = 24.90$) than for antisaccade ($M = 247.85, SD = 37.44$) trials. The Group $\times$ Task and Condition $\times$ Task interactions and the main effects of group and condition were all non-significant ($F$s $< 1.13, p$s $> 0.29$).
Figure 5.1 shows the mean correct saccade latencies for each of the anti- and pro-saccade tasks according to group and condition. There was a significant three-way interaction between group, task and condition \(F(1,86)=12.05, p = .001, \eta^2_p = 0.12\). To further examine this interaction simple effects analysis for each group and condition were conducted. In the HSA group, the simple main effect of task \(F(1,43) = 15.50, p < 0.001, \eta^2_p = 0.27\) revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials. The Task × Condition interaction was significant \(F(1,43) = 6.31, p = 0.016, \eta^2_p = 0.13\) such that antisaccade latencies in the PEP condition were
significantly shorter than antisaccade latencies in the control condition \[ t(43) = -2.14, p = 0.038 \]. The simple main effect of condition was non-significant \[ F(1,41) = 2.00, p = 0.165, n_p^2 = 0.05 \].

In the PEP condition, the simple main effect of task \[ F(1,44) = 48.09, p < 0.001, n_p^2 = 0.52 \] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials. The Group × Task interaction was significant \[ F(1,44) = 8.51, p = 0.006, n_p^2 = 0.16 \], however follow-up analyses for the interaction were non-significant \( ps > 0.13 \) as was the main effect of group \[ F(1,44) = 0.005, p = 0.944, n_p^2 = 0.00 \].

In the control condition, the simple main effect of task \[ F(1,40) = 10.27, p = 0.003, n_p^2 = 0.20 \] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade latencies. The Group × Task interaction was also significant \[ F(1,40) = 5.93, p = 0.019, n_p^2 = 0.13 \], however follow-up analyses for the interaction were non-significant \( ps > 0.06 \). The simple main effect of group \[ F(1,40) = 4.76, p = 0.035, n_p^2 = 0.11 \] revealed that saccade latencies were significantly shorter for the HSA group compared to the LSA group.

**Errors for pro- and antisaccades in the mixed task block.** Figure 5.2 shows the mean percentage of saccade errors for each of the anti- and pro-saccade tasks according to group and condition. Analyses revealed a significant main effect of task \[ F(1,86) = 14.45, p < 0.001, n_p^2 = 0.14 \] with significantly more errors for antisaccade \( M = 3.49, SD = 2.24 \) than for pro-saccade \( M = 0.83, SD = 0.57 \) trials. Neither the two-way interaction of Task × Group, the two-way interaction of Task × Condition, nor the three-way interaction of Task × Group × Condition was significant. The main effects of group and condition were non-significant \( Fs < 0.27, ps > 0.60 \).
**Analyses of the Shifting Function**

**Correct anti- and pro-saccade latencies in the single-task versus mixed-task block (switch-costs effects).** Analyses for the shifting function were conducted for the switch-costs data (difference in saccade mean latency between single-task and mixed-task blocks; see Figure 5.3). The two-way interaction of Task × Group was non-significant, and neither were the main effects of task, group or condition ($F$s < 0.11, $p$s > 0.14).
Figure 5.3. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition.

There was a significant three-way interaction \([F(1,86) = 9.84, p = 0.002, \eta^2_p = 0.10]\) and a significant Task × Condition interaction \([F(1,86) = 7.13, p = 0.009, \eta^2_p = 0.08]\). Follow-up analysis for the three-way interaction showed that for the LSA group, the main effects of task and condition were non-significant \([F < 2.86, p > 0.10]\), however the interaction between Task × Condition was significant \([F(1,41) = 9.60, p = 0.004, \eta^2_p = 0.19]\). This significant interaction revealed a switch benefit in antisaccades for LSA individuals in the PEP condition compared to the LSA group in the control condition who showed a switch-cost \([t(43) = -3.25, p = 0.002]\). However, the opposite effect was seen in pro-saccades for LSA individuals in the control condition who showed a switch benefit compared to LSA individuals in the PEP condition who showed a switch-cost \([t(24) = 2.49, p = 0.020]\). In the HSA group, the Task × Condition interaction and main effects of task and condition were non-significant \([F < 0.34, p > 0.57]\).

In the PEP condition, the main effects of task and group were non-significant \([F < 2.32, p > 0.14]\), however the Task × Group interaction was significant \([F(1,44) =\)
10.23, \( p = 0.003, n_p^2 = 0.19 \). This significant interaction revealed a greater switch benefit in antisaccades for LSA individuals (\( M = -22.57, SD = 28.85 \)) compared to HSA individuals (\( M = -5.51, SD = 30.89 \)) \([t(46) = 1.98, p = 0.054]\). In the control condition, the main effects of task and group were non-significant \((F_s < 2.79, ps > 0.10)\), however the Task × Group interaction was significant \([F(1,40) = 6.23, p = 0.017, n_p^2 = 0.14]\). This significant interaction revealed a switch benefit in pro-saccades for LSA individuals in the control condition compared to HSA individuals in the control condition who showed a switch-cost \([t(31) = 2.18, p = 0.037]\), whereas the opposite effect was seen for antisaccades with LSA individuals showing a switch-cost compared to HSA individuals who showed a switch benefit \([t(25) = -1.94, p = 0.064]\), with a trend toward significance.

**Errors for the anti- and pro-saccades in the single-task block versus the mixed-task block (switch-cost).** Analyses revealed non-significant main effects of task and group \((F_s < 0.43, ps > 0.51)\), in addition to a non-significant three-way interaction, and non-significant two-way interactions \((F_s < 2.69, ps > 0.11)\). The main effect of condition was significant \([F(1,86) = 5.92, p = 0.017, n_p^2 = 0.06]\) such that individuals in the PEP condition showed a greater switch-cost (\( M = -1.26, SD = 0.25 \)) compared to individuals in the control condition (\( M = -0.37, SD = 0.26 \)).

**Switch-cost for correct anti- and pro-saccade latencies of the switch versus repeat trials in the mixed-task block.** Analyses revealed non-significant main effects of task, condition and group \((F_s < 0.85, ps > 0.36)\) and neither the three-way interaction nor the two-way interactions approached significance \((F_s < 2.49, ps > 0.12)\). Additionally, there were no significant effects of error rates for switch-cost for anti- and pro-saccades of the switch versus repeat trials in the mixed-task block, however the Task × Condition interaction was significant \([F(1,85) = 5.86, p = 0.018, n_p^2 = 0.06]\). This significant interaction revealed a switch-cost in antisaccade errors for individuals
in the PEP condition \((M = 0.60, SD = 1.77)\) compared to a switch benefit in antisaccade errors for individuals in the control condition \([M = -0.19, SD = 1.72; t(89) = 2.15, p = 0.034]\), however no differences were observed in pro-saccade errors \((t (89) = -0.65, p = 0.518)\).

**Discussion**

The current study aimed to examine the potential underlying mechanisms of PEP in social anxiety by applying attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007). Extending previous work, the current study also manipulated PEP and employed the mixed emotional saccade paradigm to examine the main tenets of attentional control theory. Accordingly, it was expected that HSA individuals who engaged in PEP would exhibit impairments in two basic functions of the central executive (i.e., inhibition and shifting), relative to LSA individuals.

As expected, findings showed that correct antisaccade latencies and error rates were greater than correct pro-saccade latencies and errors, consistent with attentional control theory and previous findings (Ansari et al., 2008, Sluis et al., 2017c; Wieser et al., 2009). However, the HSA group in the PEP condition did not exhibit the predicted impairments on the inhibition and shifting functions compared to HSA individuals in the control condition or LSA individuals in either condition. Consistent with previous research by Sluis et al. (2017c), the main findings were for the LSA group only such that LSA individuals in the PEP condition exhibited shorter antisaccades and a switch benefit in antisaccades compared to LSA individuals in the control condition who demonstrated longer antisaccades and a switch-cost. These findings suggest that PEP facilitates the ability to inhibit automatic, prepotent responses and shift attention for LSA individuals when engaging in PEP following a social-evaluative situation.
It appears that LSA individuals who engage in PEP following a social-evaluative situation exhibit improved executive functioning performance potentially as a consequence of positive self-appraisal. Previous research has shown that more than 50% of non-clinical individuals experience repetitive and persistent thoughts that are positively valenced (Edwards, & Dickerson, 1987). Thus, it appears likely that LSA individuals who engage in PEP following a social-evaluative situation centre their post-event thoughts on the positive rather than negative aspects of their performance (Abbott & Rapee, 2004). Accordingly, positive appraisals about performance may be less salient than negative interpretation biases therefore consuming less cognitive capacity and reducing the depletion of attentional resources. Consequently, LSA individuals are able to more efficiently regulate their attentional control abilities due to positive subjective appraisals of their performance.

While the lack of predicted attentional control impairments for HSA individuals who engaged in PEP is consistent with previous work in the area (Sluis et al., 2017c; Wieser et al., 2009), it contradicts other research demonstrating anxiety-related effects on attentional control (Ansari & Derakshan, 2010; Ansari et al., 2008). On the basis of empirical research not finding anxiety-related attentional control impairments (Sluis et al., 2017c; Wieser et al., 2009), it appears that attentional control theory may neglect to account for other processes which determine whether one can volitionally regulate attention despite high anxiety levels. Given this shortcoming, Englert and Bertrams (2015) propose integrating attentional control theory with the strength model of self-control. According to the strength model of self-control, including the ability to regulate attention and emotion, predominant impulses can be volitionally superseded to achieve a specific goal (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Therefore, self-control strength may serve to moderate the anxiety-performance relationship whereby increased self-control strength allows performance to be maintained despite
high levels of anxiety (Englert & Bertrams, 2015). Relative to the current study, it is possible that HSA participants with temporarily available self-control strength may have been able to keep their performance levels consistent, hence making them more adept in regulating their attention. Given that HSA individuals may wish to minimise the high costs associated with perceived negative evaluation from others, temporary activation of self-control strength allows them to maintain task performance with LSA individuals, thus serving as a reward for a more desirable outcome. However this is only conjecture and will need to be confirmed in future studies. Given that the current findings relative to PEP are analogous to that of Sluis et al. (2017c) who examined attentional control relative to AP in social anxiety, it may be that attentional control theory neglects to account for unimpaired attentional control performance regardless of high anxiety levels. In light of these findings, theoretical models of attentional control may need to be revised or expanded upon in order to account for this potential shortcoming.

Despite the fact that the current study found some support for attentional control theory, limitations of the study should be mentioned. First, while the data obtained in the current study was acquired from an undergraduate sample, results attained were from an analogue sample categorised into high and low anxiety groups which is often analogous to that of findings from a clinical sample (Stopa & Clark, 2001). Nevertheless, it is important to mention that those in the HSA group may not have experienced social anxiety levels high enough to detect attentional control impairments. Second, the cognitive load of the task in the current study was considered low to moderate which may not have been high enough to detect attentional control deficits. It has been suggested that impaired executive functioning may only be observed when the cognitive load of the task is high (e.g., Murphy, McLaughlan, & Lee, 2017), such as concurrently performing two tasks, as opposed to when the cognitive load is low to
moderate which may facilitate performance for HSA individuals (Sluis et al., 2017c). Similarly, the cue offset and target onset duration in the current study was also not manipulated. While the interval duration of 500 ms applied in the current study is the most commonly applied duration to detect attentional control deficits (Sluis & Boschen, 2014; Sluis et al., 2017c), manipulating interval durations may produce diverse anxiety effects. For example, Ansari and Derakshan (2011) found that an interval duration of 400 ms (i.e., similar to that in the current study) produced comparable saccade latencies between high and low anxious individuals, whereas no interval duration (e.g., 0 ms) yielded poorer saccade performance for high anxious compared to low anxious participants. The findings from the current study in conjunction with Ansari and Derakshan (2011) suggest that medium, as opposed to short, interval durations may facilitate attentional performance for HSA individuals. Lastly, the current study neglected to examine other potential contributing factors that underlie PEP, including the role of self-control strength or valence of PEP thoughts.

The current findings have several implications for understanding how attentional control influences PEP in social anxiety. For example, models of SAD illustrate PEP as a maladaptive feature of social anxiety responsible for multiple dysfunctional outcomes associated with this condition. However, the current findings suggest that PEP may have an adaptive component highlighted by the comparable attentional control performance of HSA with LSA individuals. In addition, some of the main predictions of attentional control theory were not supported by the current findings. While this may be due to potential limitations of the current study, these findings do appear to highlight the shortcomings of attentional control theory relative to effective attentional performance despite high anxiety levels. Attentional control theory was originally developed as a framework for understanding attentional control in the context of cognitive performance and anxiety as a personality dimension (Derakshan & Eysenck,
In conclusion, the current study provides insight into the complex underlying mechanisms of PEP in social anxiety and adds to the growing literature on attentional control. It is evident that more work is needed to elucidate the precise mechanisms that determine when PEP is adaptive or dysfunctional with future studies potentially providing greater understanding in this area.
Chapter 5 Conclusion

Chapter 5 experimentally examined whether impairments in attentional control (i.e., inhibition and shifting functions of the central executive) underlie PEP in social anxiety. Thus, the study in chapter 5 manipulated PEP following delivery of a speech task using an objective behavioural paradigm (i.e., mixed emotional saccade task) to measure attentional control. While the predictions of an anxiety-related effect on impaired task performance was not observed, this chapter also revealed novel findings for LSA individuals, similar to chapter 4. Specifically, LSA individuals in the PEP condition exhibited a switch benefit compared to LSA individuals in the control condition, who demonstrated a switch-cost. Consistently, the findings from chapters 4 and 5 suggest that both AP and PEP facilitate attentional control abilities for LSA individuals when faced with a social-evaluative situation, such as a speech task.

The final chapter, chapter 6, concludes the thesis with a general discussion of the findings from the PhD research program, theoretical and clinical implications of the findings, limitations, and directions for future research.
CHAPTER 6: GENERAL DISCUSSION

Overview ....................................................................................................................... 147

Findings of the Research Program............................................................................ 147

Attentional Control Associated with Anticipatory Processing and Post-Event
Processing in Social Anxiety (Chapter 3)............................................................... 147

Attentional Control Theory and Anticipatory Processing in Social Anxiety (Chapter
4) ................................................................................................................................ 149

Attentional Control Theory and Post-Event Processing in Social Anxiety (Chapter
5) .................................................................................................................................. 150

Implications of the Program’s Findings ................................................................. 152

Implications of the Program’s Findings for Models of Social Anxiety Disorder .... 152

Implications of the Program’s Findings for Attentional Control Theory.............. 153

Implications of the Program’s Findings for the Assessment and Treatment of Social
Anxiety Disorder ................................................................................................. 154

Limitations of the Research Program and Future Directions ................................ 155

Study Samples ........................................................................................................ 155

Correlational Studies .............................................................................................. 156

Experimental Studies ............................................................................................ 156

Concluding Comments .......................................................................................... 158
Overview

Drawing on models of social anxiety disorder (SAD; Clark & Wells, 1995; Rapee & Heimberg, 1997) and attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007), the current PhD program of research examined the underlying mechanisms thought to be responsible for repetitive negative thinking (RNT) in social anxiety. While the majority of extant research suggests that both anticipatory processing (AP) and post-event processing (PEP) has damaging cognitive, behavioural, and affective consequences for those with SAD, there was a lack of research investigating the cognitive mechanisms thought to underlie AP and PEP in social anxiety. More specifically, it was unclear how ineffective control of attention was related to the maintenance of AP and PEP. Thus, the current PhD program of research applied attentional control theory more specifically to AP and PEP to empirically investigate the role of attentional control in these RNT processes in social anxiety.

The final chapter of this thesis will provide an overview of the current program of research by initially presenting the findings from the series of studies that were conducted, followed by discussion of the theoretical and clinical implications of these findings. Finally, critical appraisal of limitations of the studies presented in this thesis will be documented, concluding with directions for future research.

Findings of the Research Program

Attentional Control Associated with Anticipatory Processing and Post-Event Processing in Social Anxiety (Chapter 3)

Theoretical models of social anxiety emphasize the relevance of cognitive constructs, such as attention, in conjunction with the assertion that both AP and PEP are important RNT processes that shape and maintain social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). However, no prior research had specifically examined the
relationship between self-reported attentional control (i.e., total scores of attentional control, attentional focusing and attentional shifting) and both AP and PEP. As such, studies 1A (i.e., attentional control and AP) and 1B (i.e., attentional control and PEP) used correlational and mediation analyses to explore the associations between these and other related constructs. In particular, in studies 1A and 1B it was hypothesised that attentional control would be negatively correlated with social anxiety, AP and PEP. Furthermore, given that trait anxiety, positive affect, and negative affect have all been found to be associated with attentional control and social anxiety, these measures were also taken to gain further insight into the relationship between attentional control and cognitive symptoms of SAD.

As expected, the findings from study 1A revealed that social anxiety was negatively associated with attentional control and attentional shifting, and social anxiety was negatively correlated with attentional focus in study 1B. In terms of the specific cognitive processes of social anxiety, study 1A did not find an association between AP and any dimension of attentional control; however study 1B found that higher levels of PEP were associated with poorer attentional shifting as predicted. Further examination into the mediating effects of these relationships found that increased levels of trait anxiety mediated the relationship between decreased attentional shifting and higher levels of PEP, and increased levels of positive affect mediated the relationship between higher attentional control and lower levels of PEP.

Despite the lack of association between AP and attentional control in study 1A, a behavioural examination of the cognitive mechanisms that underlie AP was still deemed necessary to test for a causal relationship (study 2). While self-report measures provide useful insight into these constructs, the ability for humans to introspect is limited and behavioural measures of attentional control are useful to enhance understanding in the area. Conversely, the findings from study 1B provided preliminary
support for the potential role of attentional control relative to PEP in social anxiety which was experimentally examined in study 3.

**Attentional Control Theory and Anticipatory Processing in Social Anxiety**

(Chapter 4)

The aim of study 2 was to apply attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007) to experimentally examine the underlying mechanisms thought to be responsible for AP in social anxiety. Specifically, study 2 extended upon study 1A by using objective behavioural measures of attentional control (i.e., mixed emotional saccade task) to examine the inhibition and shifting executive functions of the central executive, in conjunction with an experimental manipulation of AP prior to the threat of a speech task to identify causal relationships. Thus, it was predicted that high socially anxious (HSA) individuals would exhibit greater impairment on executive functioning than low socially anxious (LSA) individuals, regardless of whether they were in the anticipatory or control condition, and that HSA individuals in the anticipate condition would exhibit more impairment on executive functioning than HSA individuals in the control condition, or LSA individuals in either condition.

As expected, correct antisaccade latencies were longer than correct pro-saccade latencies, along with higher error rates, demonstrating the validity of the task in study 2. However, the hypothesised effects of group or condition were not observed. More specifically, HSA individuals in the anticipate condition did not exhibit attentional control impairments compared to the HSA control group or the LSA groups in either condition. Interestingly, the novel findings from study 2 related only to the LSA group, with LSA individuals in the anticipate condition exhibiting a switch benefit compared to LSA individuals in the control condition, who demonstrated a switch-cost. In general, study 2 failed to demonstrate an attentional control impairment underlying AP in social
anxiety, and instead revealed that AP may indeed facilitate attentional control abilities for LSA individuals. As such, it appears that other potential contributing factors not examined in study 2, such as motivation or the cognitive load of the task, may underlie the maladaptive characteristics of AP in HSA individuals. Accordingly, study 2 found attentional control performance in HSA individuals to be analogous to that of LSA individuals, which may be explained by motivation. For example, HSA individuals may be motivated by perceived negative evaluations associated with poor performance resulting in the use of compensatory strategies to maintain task performance to a level similar to LSA individuals. Thus, motivation may act to moderate the anxiety-performance relationship.

Despite the lack of attentional control impairments underlying AP in social anxiety in study 2, it was still deemed necessary to experimentally examine the underlying mechanisms of PEP in social anxiety in study 3 given that PEP is considered a separate RNT process to that of AP. Additionally, preliminary support of an association between attentional control and PEP in social anxiety in study 1B warranted further exploration.

**Attentional Control Theory and Post-Event Processing in Social Anxiety**

(Chapter 5)

Study 3 extended upon study 1B by applying attentional control theory specifically to experimentally examine the potential underlying mechanisms of PEP in social anxiety. The design of study 3 was similar to study 2; however PEP was manipulated by having participants engage in PEP following a speech task, as opposed to AP prior to the threat of a speech task. Thus, some participants were required to engage in 10 minutes of PEP following social-evaluative threat in the form of a speech task. The predictions for study 3 were that HSA individuals would exhibit greater executive functioning impairment than LSA individuals, regardless of whether they
were in the PEP or control condition. Furthermore, it was expected that HSA individuals in the PEP condition would exhibit more executive functioning impairment than HSA individuals in the control condition, or LSA individuals in either condition.

Similar to study 2, correct antisaccade latencies were longer than correct prosaccade latencies, along with higher error rates, providing further validity of the task in study 3. While PEP is considered a separate RNT process to that of AP, it was interesting to note that the findings from study 3 were analogous to that of study 2, corroborating the notion that attentional control deficits may not be the underlying cause of RNT processes, such as AP and PEP, in SAD. Consistent with study 2, study 3 found that HSA individuals in the PEP condition did not exhibit attentional control impairments compared to the HSA group in the control condition or the LSA groups in either condition. Furthermore, the novel findings from study 3 also related only to the LSA group, whereby LSA individuals in the PEP condition exhibited shorter antisaccades and a switch benefit in antisaccades compared to LSA individuals in the control condition who demonstrated longer antisaccades and a switch-cost.

Overall, the findings from study 2 and study 3 suggest that both AP and PEP facilitate attentional control abilities for LSA individuals when faced with a social-evaluative situation, such as a speech task. As previously mentioned, motivation appears to play a vital role in explaining the improved executive functioning performance for HSA individuals which was analogous to LSA individuals. However positive self-appraisal may also provide a potential explanation for the novel findings for LSA individuals who engaged in RNT processes in both studies 2 and 3. Accordingly, while it appears that LSA individuals may potentially experience RNT processes, similar to AP and PEP, the valence of these thought processes for LSA individuals could be more positively skewed in that their thoughts are centred on the positive aspects of their upcoming or completed performance rather than the negative
aspects. Although attentional control theory provides a reasonable theoretical explanation for the underlying mechanisms responsible for both AP and PEP in SAD, the empirical findings from this program of research did not support this explanation. Thus, the unexpected and novel findings from this research program should be replicated in clinical samples to further clarify whether the attentional control deficits are indeed absent in explaining why RNT processes in SAD persist.

Implications of the Program’s Findings

Implications of the Findings for Models of Social Anxiety Disorder

Two of the most widely cited and prominent cognitive models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997) emphasize the role of RNT processes, such as AP and PEP, in the maintenance of SAD. While both models highlight AP and PEP as features of social anxiety that contribute to dysfunctional outcomes, no prior research had examined the underlying cognitive mechanisms potentially responsible for the perseverative nature of these modes of thought. Although the findings from this thesis failed to demonstrate support for impaired attentional control as an underlying mechanism responsible for AP and PEP, the findings did provide empirical support for an adaptive component of both AP and PEP. For example, the findings in studies 2 and 3 revealed that the anxiety experienced by HSA individuals who engaged in AP and PEP, both prior to and following a social-evaluative event, appears to have adaptive benefits in terms of their executive functioning. Given that the current PhD program of research did not show attentional control deficits underlying AP and PEP for HSA individuals, this thesis does provide insight into the complexities of the mechanisms underlying RNT processes in social anxiety (at least to the extent of social anxiety levels present in the study’s samples). Accordingly, it is evident that more research is needed to address the interacting effects of motivation, cognitive/emotional load of the task, and activation of self-control strength to determine whether these constructs are
indeed responsible for determining why individuals with SAD find it difficult to disengage from AP and PEP.

Findings from this thesis add to the small literature base suggesting an adaptive component of AP and PEP (Brown & Stopa, 2006; Makkar & Grisham, 2012; Mills, Grant, Lechner, & Judah, 2013) as evidenced by the comparable attentional control performance of HSA with LSA individuals. These findings provide impetus for revision or expansion of theoretical models of social anxiety, however further research will need to determine the precise mechanisms and under what conditions AP and PEP are adaptive or dysfunctional for individuals with SAD.

Implications of the Findings for Attentional Control Theory

Attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007) is a framework for understanding attentional control in the context of anxiety and cognitive performance. The main tenets of attentional control theory posit that anxiety is associated with deficits in cognitive efficiency, resulting in a decreased ability to inhibit task-irrelevant information and shift attention between tasks. Furthermore, these deficits are predominantly assumed to affect processing efficiency (i.e., the way cognitive resources are used to achieve desired outcomes), while not negatively impacting performance effectiveness (i.e., ability to perform a task).

According to the findings from this thesis, the main predictions of attentional control theory were generally not supported. Both studies 2 and 3 were comparable with regards to findings relative to AP and PEP, demonstrating that attentional control performance in HSA individuals was at a similar level to that of LSA individuals. The findings from studies 2 and 3 suggest that attentional control theory may neglect to account for other processes that determine whether an individual can regulate attention despite high anxiety levels. This potential shortcoming of attentional control theory may warrant expansion of the model to account for other processes, such as motivation.
or self-control strength, that may moderate the anxiety-performance relationship. Specifically, motivation to minimise the costs associated with perceived negative evaluation from others, along with temporary activation of self-control strength, may allow HSA individuals to maintain task performance with LSA individuals, hence increasing their ability to regulate attention. However, future studies employing clinical samples are needed to replicate and confirm the current findings.

Attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007) is a relatively new theory developed to build on the strengths and limitations from processing efficiency theory (Eysenck & Calvo, 1992). Insofar, attentional control theory had predominantly been applied in previous research in the context of ‘trait anxiety’ as a personality dimension, rather than in the context of psychopathology. Given that this PhD research program applied attentional control theory with a more clinical focus specific to social anxiety, it appears that applications of attentional control theory to understanding mental illness may still be in its infancy and may require expansion to account for attentional control performance with clinical populations, or perhaps attentional control theory is only relevant within the context of trait anxiety as a personality dimension. However, future research will need to confirm the current findings prior to firm conclusions being made. Future research applying attentional control theory within the context of psychopathology may have the potential to inform which processes contribute to the anxiety-performance relationship relative to SAD and indeed other anxiety disorders.

**Implications of the Findings for the Assessment and Treatment of Social Anxiety Disorder**

Much of the research on AP and PEP in SAD highlight the dysfunctional outcomes associated with this thought process. Studies 1 and 2 suggest that under certain conditions (i.e., when performing a task that is low to moderately cognitively
demanding), AP and PEP may indeed facilitate attentional control processes for HSA individuals illustrating an adaptive component of these RNT processes. These findings provide initial support for the complex nature of AP and PEP. More specifically, detecting the threshold point for the cognitive demands of a task appears important for identifying when AP and PEP facilitates performance for HSA individuals. This, in turn, has clinical relevance with regards to how this disorder is treated by actively focusing on how cognitive features of SAD, such as AP and PEP, can be advantageous for these individuals. By actively having individuals with SAD engage in AP and PEP for a limited time, cognitive performance may be enhanced in conjunction with simultaneously conducting *in-vivo* exposure to the anxiety experienced during this thought process, which should decrease over time.

**Limitations of the Research Program and Future Directions**

While the limitations from each study have been discussed in the respective chapters, this section will summarise the general limitations from the PhD program of research incorporating directions for future research in the area.

**Study Samples**

First and foremost, all the studies in this PhD program of research have exclusively used high socially anxious individuals as analogues to those diagnosed with SAD (compared to low socially anxious individuals). Nevertheless, it is generally accepted that social anxiety is continuously distributed in the general population (Stopa & Clark, 2001). On this basis, using an analogue sample for identifying processes that may be important in SAD has been justified by existing research that supports the validity of this sampling strategy (i.e., results obtained using an analogue sample are largely similar to results found using a clinical sample; Stopa & Clark, 2001). While the studies in this thesis exclusively used social anxiety analogue samples, the studies extended on previous work in the area (Chiupka; Moscovitch, & Bielak, 2012;
Gaydukeyvch & Kocovski, 2012; Hinrichsen & Clark, 2003; Kocovski, MacKenzie, & Rector, 2011; Morgan & Banerjee, 2008; Vassilopoulos, 2008) by using multiple measures of social anxiety (as opposed to a single measure) to ensure that the groups differed on multiple dimensions of social anxiety. Specifically, the studies included in this research program utilised measures including the Social Interaction Anxiety Scale, the Social Phobia Scale, and the Brief Fear of Negative Evaluation Scale to adequately capture the full range of social anxiety symptoms. With that said, key aspects of novel findings should always be contrasted between a clinical sample of those with SAD and normal controls.

**Correlational Studies**

While the correlational studies of this PhD research program provided insight into novel mediation relationships between constructs related to social anxiety (i.e., trait anxiety and positive affect), attentional control, and PEP, causality is unable to be inferred due to the correlational nature of the research (see study 1B). The experimental studies in this thesis did not examine these relationships in more depth, thus these correlational relationships need to be investigated in future research longitudinally to confirm directionality of these associations.

**Experimental Studies**

The design of the experimental studies (i.e., studies 2 and 3) were equivalent in terms of the task used to measure attentional control (i.e., mixed emotional saccade task). While the antisaccade task is a valid and reliable covert measure of attentional control that is not reliant on manual reaction times, future research may benefit from using additional overt behavioural measures of attentional control (e.g., odd-man-out task, attention network task), in conjunction with the antisaccade task, to confirm the findings from this thesis. For example, the attention network task (ANT; Fan, McCandliss, Sommer, Raz, & Posner, 2002) and the odd-man-out task (OMO; Ravizza
& Carter, 2008) are manual response tasks that can be used to measure the inhibition and shifting functions, respectively. Additionally, these measures should be positively associated with self-report measures of attentional control, namely the attentional control scale (ACS; Derryberry & Reed, 2002). Given the diverse findings in previous research on attentional control and anxiety (Ansari, Derakshan, & Richards, 2008; Dennis & Chen, 2007; Reinholdt-Dunne, Mogg, & Bradley, 2013; Wieser et al., 2009), it is possible that differences in tasks used may be responsible for the lack of anxiety-related effects on attentional control. The addition of overt behavioural measures in future research, such as the OMO and ANT, will either confirm the current findings from the antisaccade task, or highlight discrepancies which would warrant further exploration into the validity and purity of tasks used to assess attentional control.

Additionally, the experimental studies in this thesis did not assess for other potential contributing factors that underlie AP and PEP including the role of motivation, manipulating the cognitive load of the task, self-control strength, and valence of AP and PEP thoughts. For example, motivation and self-control strength may act as moderators relative to task performance. Specifically, HSA individuals with high levels of motivation or self-control strength may exhibit increased task performance relative to AP and PEP engagement, whereas HSA individuals with low levels of motivation or self-control strength may reveal impaired attentional control when engaging in AP or PEP, resulting in decreased task performance. Furthermore, attentional control deficits may only be observed in HSA individuals when the cognitive load of the task reaches a certain threshold point (i.e., high task demands as opposed to low-medium task demands), thus future research would benefit from replicating the current findings by manipulating the cognitive load of the task. Given this thesis did not demonstrate anxiety-related effects on attentional control; it is possible that these factors may partially contribute to the explanation of the underlying mechanisms of both AP and
PEP. However, an examination of these factors was beyond the aim and scope of the current PhD research program and therefore needs to be assessed in future research.

**Concluding Comments**

The current PhD program of research explored attentional control as an underlying mechanism of RNT processes in social anxiety, including both AP and PEP. The findings from this thesis provide insight into the complexities of the underlying mechanisms of AP and PEP and act as a preliminary gateway for future research to determine the exact mechanisms by which AP and PEP are dysfunctional and beneficial for HSA individuals. This thesis contributes to the growing literature on AP and PEP in social anxiety and highlights the importance of continuing to develop our knowledge toward understanding the cognitive mechanisms of RNT processes in social anxiety.

**Acknowledgements**

This work was supported by an Australian Postgraduate Award to Rachel Sluis and carried out under the supervision of Dr Mark Boschen, Professor David Neumann, and Dr Karen Murphy.

**Disclosure Statement**

The authors declare that they have no conflicts of interest.

**Informed Consent**

Informed consent was obtained from all individual participants included in the studies.

**Ethical Approval**

All procedures included in the studies have been approved by the Griffith University Human Research Ethics Committee.
References


Cek, D., Sánchez, A., Timpano, K. R. (2016). Social anxiety-linked attention bias to threat is indirectly related to post-event processing via subjective emotional


Appendices

Questionnaire measures used in the studies are not included due to copyright.