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An Examination of the Applicability of Dual-Process Models to Chronic Worry

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A thesis submitted in fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

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Contribution of the Candidate

The work presented in this thesis consists of research undertaken by the Candidate, in the School of Psychology at the University of Sydney. Ethics approval for all components of the project was sought and granted by the University of Sydney Human Research Ethics Committee.

The Candidate was responsible for developing the experiments and coordinating the research under the guidance and supervision of Associate Professor Caroline Hunt and Professor Louise Sharpe. Responsibility for all aspects of the research including topic identification, study design, formulation of hypotheses, task development, data collection and entry, statistical analyses and interpretation of results was primarily undertaken by the Candidate. The Candidate also wrote this thesis and accepts primary responsibility for this thesis.
Statement of Authentication

This thesis is submitted to the university in fulfillment of the requirement for Doctor of Philosophy.

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

Signature……………………………… Date……………………
Abstract

Worry, the cognitive component of anxiety, is present across the spectrum of anxiety disorders, however, the defining clinical features are most commonly studied in the context of generalised anxiety disorder (GAD). Compared to other anxiety disorders research has focused considerably less on worry and GAD. Recent theoretical suggestions have highlighted that the application of dual-process theories have potential benefit for advancing the conceptualization and understand of worry/GAD and its associated processes (e.g., cognitive biases). However, there is as yet little empirical research to test the major tenets of these accounts. This is the major aim of this research. To this end, relationships between individual processing style - as described by Cognitive Experiential Self Theory (CEST; Epstein, 1983; 1990) - and patterns of information processing (i.e., relationships between attential control and attention and interpretation biases) were examined in relation to self-report measures of worry (as assessed by the PSWQ and GADQ-IV). This research project consists of four empirical studies based on one sample of undergraduate university students. The first study was a self-report study that examined individual processing style and worry symptoms in a large sample ($N = 302$) of undergraduate students. In addition to self-reported processing style, the remaining three studies examined a subsample from Study 1 ($N = 106$) and used experimental tasks to directly assess the processing styles of participants. The tasks examined reasoning (Study 2; deductive, inductive, and probabilistic reasoning tasks), attentional control (Study 3 and Study 4; Antisaccade task), and interpretation and attentional biases (Study 4; lexical decision task; modified dot probe task) in relation to levels of worry. Results demonstrated a relationship between self-reported processing style and worry; when individuals endorsing high levels of worry are faced with a situation in which they worry they
reported engaging in higher levels of rational processing, compared to individuals with low levels of worry (Study 1). However, the results of Study 2, which assessed actual rather than perceived reasoning ability, did not confirm differences between those high and low in worry. Indeed, Study 2 revealed that this was a self-perception, as actual strengths or deficits on reasoning tasks were unrelated to processing style and levels of worry. No significant relationships were found between implicit tasks, self-reported processing style, and worry (Studies 3 and 4); therefore, possible models could not be explored with Structural Equation Modeling. The failure to replicate previous findings, with regard to attention and interpretation biases, as well as attentional control, are discussed in the context of limitations inherent in implicit measures of psychological processes. While these results provide no support for the hypotheses derived from the dual-processing theories, there are a number of limitations that may account for the findings. For example, employing reaction time paradigms to examine attention and interpretation biases, the lack of a worry induction component, and the consecutive presentation of multiple tasks to each participant may have impacted the findings. The need for future research focusing on the examination of multiple processes is vital so as to synthesize existing worry related knowledge, in order to advance current limitations in the understanding of the processes involved in worry.
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<td>Acceptance based model</td>
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<tr>
<td>ACS</td>
<td>Attentional Control Scale</td>
</tr>
<tr>
<td>ACT</td>
<td>Attentional control theory</td>
</tr>
<tr>
<td>AMW</td>
<td>Avoidance model of worry</td>
</tr>
<tr>
<td>CBT</td>
<td>Cognitive behavioural therapy</td>
</tr>
<tr>
<td>CEST</td>
<td>Cognitive experiential self theory</td>
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<td>CIDI</td>
<td>Composite international diagnostic interview</td>
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<td>DASS-S</td>
<td>Depression Anxiety and Stress Scales – Stress scale</td>
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<td>DSM</td>
<td>Diagnostic and statistical manual</td>
</tr>
<tr>
<td>EDM</td>
<td>Emotion dysregulation model</td>
</tr>
<tr>
<td>ERP</td>
<td>Event-related potential</td>
</tr>
<tr>
<td>ES</td>
<td>Experiential system</td>
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<tr>
<td>GAD</td>
<td>Generalised anxiety disorder</td>
</tr>
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<td>GADQ - IV</td>
<td>Generalised anxiety disorder questionnaire – fourth edition</td>
</tr>
<tr>
<td>ICD-10</td>
<td>International classification of diseases – 10th revision</td>
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<tr>
<td>IPM</td>
<td>Information processing model</td>
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<tr>
<td>IU</td>
<td>Intolerance of uncertainty</td>
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<tr>
<td>IUM</td>
<td>Intolerance of uncertainty model</td>
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<tr>
<td>MCM</td>
<td>Meta-cognitive model</td>
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<tr>
<td>NHE</td>
<td>Neutral homophone emotional context condition</td>
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<td>NHN</td>
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<td>NHU</td>
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<td>PMPI</td>
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<td>RT</td>
<td>Reaction time</td>
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Introduction to the project

This thesis is written as a series of four studies, each contained in its own chapter and consisting of an introduction, method, result, and discussion section. The rationale for this format is that it enables the presentation of this series of studies most efficiently and effectively. A literature review and introduction to the thesis are first presented to give a background on current theoretical understandings of generalised anxiety and worry, as well as providing a rationale for the empirical studies and the methods and approach to analyses contained therein:

Chapter 3 (Study 1):  *Rational and experiential processing in individuals who worry*

Chapter 4 (Study 2):  *Reasoning in individuals who worry*

Chapter 5 (Study 3):  *Attentional control in individuals who worry*

Chapter 6 (Study 4):  *Biases of attention and interpretation in individuals who worry*

The concluding chapter (Chapter 7) will offer a summary of the major findings, limitations and strengths of the project, the implications, both theoretical and clinical, as well as future research directions.

---

1 Two samples were recruited for the current project. All participants who participated in the project were included in Study 1, however, Studies 2-4 consisted of a subsample of Sample 1 and all of the participants recruited in Sample 2 (see Chapter 2, Figure 2.1, p. 67, for further details).
Chapter 1: Background and context of the project

1.1 Worry

1.1.1 Definition of the construct of worry

Worry is most commonly defined as: “… a chain of thoughts and images, negatively affect-laden and relatively uncontrollable; it represents an attempt to engage in mental problem-solving in an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes; consequently, worry relates closely to the fear process” (Borkovec et al., 1983, p. 10). Other definitions highlight the futility of worry and label it a state of ‘anxious apprehension’ (Stein, 2004), a continual heightened awareness of possible future danger, which is repeatedly rehearsed but never resolved, or regard worry as a problem-solving strategy, which also prepares one to cope with or prevent catastrophe (Brown, 1997). Regardless of the definition, a uniformity exists in relation to the perception of the key features of worry; it is the specific cognitive component of anxiety that is separate from the physiological aspects of anxiety and it is verbally encoded with content (Brown, 1997).

1.1.2 Current understanding of the phenomenon of worry

Research exploring the phenomena of worry has found it to be verbal-linguistic in nature (Borkovec & Inz, 1990; Freeston, Dugas, & Ladouceur, 1996; Hirsch, Hayes, Mathews, Perman, & Borkovec, 2012). The abstract verbal nature of worry implies that it is not associated with sympathetic activation and is, therefore, inherently not closely tied to physiological responding (Borkovec, 1994; Vrana, Cuthbert, & Lang, 1989). Overall, the phenomena of worry involves rehearsing possible aversive events and their outcomes, whilst simultaneously looking for ways to avoid the projected outcomes in order to better cope as a result of being better
prepared. As the nature and process of worry are compatible with successful problem-solving, preparatory coping (i.e., problem-solving) can evolve into worry if no outcome or solution is found (Mathews, 1990). Szabo and Lovibond (2002) examined the content of worry and confirmed that worry in itself is not maladaptive, but rather it is an attempt to problem solve. Pathological worry was, therefore, suggested to be a failure to effectively resolve the problem-solving process (Borkovec, Ray, & Stober, 1998; Szabo & Lovibond, 2002).

The function of worry is suggested to be a short term reduction in distress, as it enables avoidance of threatening imagery and distressing automatic activation (Mathews, 1990). Over time, this short-term stress reduction leads to deficits in emotional processing and the maintenance of anxiety related cognitions (Stein, 2004). Worry effects and consumes cognitive capacity and emotional resources (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Mennin, Heimberg, Turk, & Fresco, 2005; Ouimet, Gawronski, & Dozois, 2009), and creates both anxious and depressed affect (Andrews & Borkovec, 1988; Borkovec, Robinson, Pruzinsky, & DePree, 1983), and is associated with information processing biases that favour the processing of threatening information (e.g., MacLeod, Mathews, & Tata, 1986). Worry is particularly insidious for several reasons. First, it is difficult to dismiss (Borkovec, Shadick, & Hopkins, 1991). Second, not only does worry act as an avenue of threat avoidance but the avoidance leads to inhibition of the emotional processing, which in turn prevents the activation of fear structures in memory (Brown, 1997; Foa & Kozak, 1986; Mathews, 1990). It is the failure to access these fear structures that is thought to maintain anxiety, as they are necessary for the reduction of anxiety (Brown, 1997).
1.2 Transdiagnostic presence of worry

Despite the futility of worry in reducing anxiety, it is highly prevalent. It is present across the full range of anxiety disorders, as well as in a number of other disorders, and is coming to be conceptualised as a transdiagnostic process (Borkovec et al., 1991; Brown, Antony, & Barlow, 1992; Craske, Rapee, Jackel, & Barlow, 1989; Konstantellou, Campbell, Eisler, Simic, & Treasure, 2011; McLaughlin, Mennin, & Farach, 2007; Roemer, Molina, & Borkovec, 1997; Turk & Mennin, 2011). As worry is suggested to represent a higher-order trait, which has an impact on both the origins and course of anxiety and mood disorders (Brown, 1997; Clark, Watson, & Mineka, 1994; Watson & Clark, 1984), it highlights the importance of research into worry and its associated processes. Understanding worry may allow transdiagnostic insights into a wide range of disorders and, therefore, result in more effective treatment programs and services based on a more accurate, in-depth, understanding of the etiology and maintaining factors.

Overall, Worry is most closely linked to generalised anxiety disorder (GAD), where worry has come to be accepted as the central feature. Thus, in the process of examining worry, GAD cannot be ignored; first, because much of what we have come to know and understand about worry comes from the research literature examining worry is in the context of GAD, and, second, worry related research findings also have the strongest implications for GAD. Therefore, the next section will discuss GAD, its epidemiology, and its costs and effects on both a personal and societal level.

1.3 Generalised anxiety disorder

1.3.1 Diagnosis and characteristics of GAD

Generalised anxiety disorder (GAD) is a disabling, often lifelong psychological
condition that is characterized by pervasive symptoms of anxiety, which are driven by worry (Borkovec et al., 1983; Davey & Levy, 1998; Szabo & Lovibond, 2002). GAD first appeared as a diagnosis in the Diagnostic and Statistical Manual-III (DSM-III; American Psychiatric Association, 1980). At this time, it was a residual category that was considered only when other psychiatric diagnoses had been disregarded. Thus, GAD was both poorly defined and lacking in reliability (Turk & Mennin, 2011).

Chronic and pervasive worry only came to characterize GAD some seven years later, with the arrival of the DSM-III-R (American Psychiatric Association, 1987). The introduction of worry as the central feature of GAD has resulted in a more cohesive and coherent understanding of the diagnosis emerging within the literature; presently the diagnosis of GAD has comparable reliability to that of depression (Brown, Di Nardo, Lehman, & Campbell, 2001).

Currently, the diagnosis and classification standard for GAD, in the USA, Australia\(^2\) and for research purposes in Europe, is outlined in the recently published Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). GAD is defined as a chronic anxiety disorder that is characterized by persistent, excessive, and uncontrollable worry concerning a number of different domains (e.g., work, finances, relationships), which cause clinically significant distress and impairment for a defined period. Six criteria are proposed, which are necessary to either be met or accounted for in order for the diagnosis to be given. Most notably, the worry that is experienced is required to be focused on several themes and to be accompanied by at least three physiological symptoms, which are not accounted for by another disorder or circumstance.

\(^2\) Thus, the DSM system will be referred to for the purpose of this thesis.
In terms of worry themes, individuals with GAD have commonly occurring clusters of worry themes centered on personal and emotional threats to the self, rather than dangers in a more abstract sense (Mathews, 1990). Specifically, close relationships, social confidence, life accomplishments, work competence, financial solvency and general world problems (Mathews, 1990). However, the content of worry is largely dependent on current life circumstances. For example, students reported worrying about academic progress and family/interpersonal aspects (Borkovec et al., 1983), whilst elderly individuals diagnosed with GAD appear more concerned with physical health (Wisocki, 1988). Compared to the general population, individuals with GAD do not differ in terms of the presence of worry (Mathews, 1990). However, they are more sensitive to cues of future threat and tend to not only detect, but also select, more threatening interpretations in the processing of possible threat cues in their environment (Mathews, 1990).

In order for the diagnosis to be given, the intensity, duration, or frequency of the anxiety/worry must be disproportionate to that of the actual likelihood or impact of the feared event. Individuals with GAD have reported worrying and feeling anxious around 50% of the time (Sanderson & Barlow, 1990). A longitudinal descriptive study showed that, over a one-year period, individuals with GAD reported that few of their original worry themes had remitted (Constans, Barbee, Townsend, & Leffler, 2002). Specifically, only 7.4% of participants with a diagnosis of GAD were found to no longer engage in worry about domains presented at their initial interview (Constans et al., 2002). Furthermore, at the end of the one-year period 63% of the participants were found to have maintained worries about themes they had discussed in their initial evaluation (Constans et al., 2002).
Europe predominantly bases clinical diagnosis on the World Health Organization’s *Tenth International Classification of Diseases* (ICD-10). Where this classification system differs to the DSM is its focus on the psychic component (e.g., worry), rather than the somatic (e.g., muscle tension) or autonomic symptoms (e.g., increased arousal). In addition, the DSM focuses on a 6-month symptom presence, whereas the ICD-10 does not conceptualize GAD as a chronic disorder (Allgulander, 2006). These differences have been argued to result in ICD-10 diagnoses having more false positives and recognizing a different patient group to DSM diagnoses (Slade & Andrews, 2001). In contrast, DSM classifications are associated with higher levels of reported disability (Slade & Andrews, 2001). Concordance within and between classification systems requires improvement, especially in light of the reported high prevalence rates.

Despite recognition of the validity of the diagnosis and its high prevalence rates, GAD is often poorly recognized both in primary care setting and in general population. Reports suggest that as few as 30% of people with GAD receive the correct diagnosis, with even fewer receiving appropriate treatment, and that up to 70% of cases go undiagnosed (Allgulander, 2006; Bebington et al., 2000; Hoehn-Saric, 2005; Wittchen et al., 2002). Findings also suggest that between 28-66% of individuals with GAD seek treatment (Henderson, Andrews, & Hall, 2000; Wittchen, Zhao, Kessler, & Eaton, 1994), around a third (30%) of whom seek medical assistance for their numerous GAD related somatic ailments (Allgulander, 2006; Roy-Byrne & Wagner, 2004). GAD is most commonly confused with insomnia and various functional somatic disorders including: palpitation, migraine, and irritable bowel syndrome (Allgulander, 2006). It is one of most common diagnoses of patients with unexplained symptoms causing a diagnostic procedure (Allgulander, 2006). For
example, one study found that the 23% of the atypical chest pain in an emergency department was accounted for by GAD (Wulsin, Arnold, & Hillard, 1991). GAD is also the most commonly occurring emotional disorder in individuals presenting for treatment of physical conditions associated with stress (Blanchard, Scharff, Schwarz, Suls, & et al., 1990; Shear & Schulberg, 1995), and is frequently associated with susceptibility to comorbid medical conditions (Bowen, Senthilselvan, & Barale, 2000; Harter, Conway, & Merikangas, 2003).

Although the current conceptualization and understanding of GAD has evolved considerably over the last 30 years, GAD is considered the least stable and most open to change of all the anxiety disorders (Coutinho et al., 2010). This may reflect that, in contrast to the other anxiety disorders, GAD has only fairly recently been introduced as a diagnosis. Therefore, as research into GAD increases it can only be assumed that the concept of GAD as a diagnosis will continue to undergo refinement and take great strides forward in terms of scientific developments that offer a deeper understanding of the disorder. As such, it can be expected that the diagnosis of GAD will strengthen both in terms of its validity and reliability, which will lead to improved screening and more efficacious treatments (Turk & Mennin, 2011).

1.3.2 Comorbidity

A key debate in the literature has been the suggestion that GAD may better serve as a prodrome, variant, residual, or severity marker of mood disorder (e.g., depression; Kessler, DuPont, Berglund, & Wittchen, 1999). This argument was strengthened by the high comorbidity found between major depression and GAD (58-69.7%), and the limitations in terms of distinguishability of GAD from mood disorders; for example, the negative affect, physiological hyperarousal, and absence
of positive affect that are observed in both GAD and mood disorders (Goldberg, Krueger, Andrews, & Hobbs, 2009; Kessler & Wittchen, 2002; Maier et al., 2000). However, studies examining pure and comorbid GAD have argued that GAD is a disorder in its own right; GAD is usually the primary diagnosis in cases where it is comorbid with depression (Gorwood, 2004; Kessler, 2000; Olfson et al., 1997; Ormel, VonKorff, Ustun, Pini, & et al., 1994; Schonfeld et al., 1997). Furthermore, not only is GAD a significant predictor of subsequent depression, but the course of GAD has been observed to be independent of comorbidity (Gorwood, 2004; Kessler, 2000; Olfson et al., 1997; Ormel et al., 1994; Schonfeld et al., 1997). Finally, GAD has been found to have similar levels of comorbidity to other disorders (Grant et al., 2005), as well as having statistically significant independent associations with impairment (Kessler, DuPont, Berglund, & Wittchen, 1999), which offers further support that GAD is not a prodromal or residual form of another disorder.

Comorbidity with other disorders is high and increases both the chronicity and debilitation of GAD (Grant et al., 2005; Wittchen et al., 1994). Only one third of individuals with a diagnosis of GAD do not have an additional ongoing psychiatric diagnosis, with comorbidity suggested to be between 80-90% for those with a lifetime prevalence of GAD (Grant et al., 2005; Judd et al., 1998; Kessler, Chiu, Demler, & Walters, 2005; Wittchen et al., 1994). Major depressive disorder, dysthymia and posttraumatic stress disorder are most commonly comorbid with GAD (Turk & Mennin, 2011), although substance use/abuse (Shader & Greenblatt, 1993), panic disorder, mood disorders, social phobia and specific phobia are also frequently present (Grant et al., 2005; Massion, Warshaw, & Keller, 1993; Turk & Mennin, 2011). Comorbidity has serious implications for impairment, recovery, and outcome and leads to 50% more help seeking behavior (Bland, Newman, & Orn, 1997).
Individuals with GAD and other comorbid psychological disorders report poorer physical health (Shader & Greenblatt, 1993), and increased medical/physical comorbidity (e.g., Bowen et al., 2000; Harter et al., 2003; Noyes, 2001). Overall, when GAD is comorbid with other disorders a profound functional impairment is present (Hunt, Issakidis, & Andrews, 2002; Stein, 2004); the greatest levels of impairment are observed when GAD presents as comorbid with major depression (Kessler et al., 1999; Kessler, Keller, & Wittchen, 2001; Kessler, McGonagle, Zhao, Nelson, & et al., 1994). However, remission is also less likely for GAD patients with poor interpersonal skills, cluster C personality traits (Yonkers, Dyck, Warshaw, & Keller, 2000), and comorbid alcohol/substance abuse (Bruce et al., 2005). In summary, the presence of comorbid disorders in individuals with GAD is high and has considerable negative consequences; not only does it increase the chronicity and debilitation of GAD, it also negatively impacts treatment effectiveness (Bruce et al., 2005; Grant et al., 2005; Wittchen et al., 1994). In the next sections treatment effectiveness will be further discussed, in addition to prevalence rates, course and effects of GAD.

1.3.3 The Epidemiology of Generalised Anxiety Disorder

1.3.3.1 Prevalence and course of disorder

Prevalence rates of anxiety disorders vary greatly between published epidemiological reports and are particularly challenging to accurately estimate in relation to GAD, due to the diverse and constantly evolving diagnostic criteria (Allgulander, 2006). Additionally, underreporting and the underrepresentation of important populations, including the homeless, those in institutions, and those who cannot speak English, also has an impact (Allgulander, 2006). Therefore, despite
GAD being reported to be the most prevalent anxiety disorder in primary care settings - accounting for almost a quarter of patients presenting with an anxiety condition - current estimates may be conservative (Allgulander, 2006; Maier et al., 2000; Wells, 2009; Wittchen et al., 2002).

Over a 12-month period, prevalence rates were reported at 3.6% in Australia (2.4% for men, 3.7% for women; Henderson et al., 2000; Hunt et al., 2002; Statistics, 2008), whilst in the United States they ranged from 2.1 to 3.3% (Grant et al., 2005; Somers, Goldner, Waraich, & Hsu, 2006), and were somewhat lower in other (particularly developing) countries: Europe 1.7%; Mexico 0.8%; China 0.8%; South Korea 1%; Japan 1.2%; and 1.4% in South Africa (Lewis-Fernandez et al., 2010). Lifetime prevalence rates are estimated to be slightly higher, for example, they range from 4.1% - 6.3% in American samples (Grant et al., 2005; Somers et al., 2006) and from 5.1 - 5.9% in Australia (Henderson et al., 2000; Hunt et al., 2002; Statistics, 2008). Longitudinal studies suggest that 74% of GAD patients experienced their illness over a 12-year period (Bruce et al., 2005). Age has been found to impact prevalence rates, with onset being rare in children and adolescents (Wittchen, Lachner, Wunderlich, & Pfister, 1998); the majority of cases are observed in persons aged 20- 47-years (Turk & Mennin, 2011). Gender differences are also evident, with women more frequently diagnosed than men (Somers et al., 2006; Statistics, 2008).

In terms of the course of the disorder, GAD is chronic (Brown, Barlow, & Liebowitz, 1994) with individuals often feeling anxious all their lives, and describing themselves as anxious or worry prone personalities (Allgulander, 2006). This is reflected in some conceptualizations of GAD as a temperamental predisposition, or an exaggeration of a normal personality disposition (Akiskal, 1998; Rapee, 1991). Brown, Chorpita, Korotitsch, and Barlow (1997) even went as far as to suggest that
GAD is best conceptualized as a trait, or a general vulnerability, rather than an Axis I diagnosis. Because of the proposed relationship with personality, and the chronic and constant fluctuations in symptoms over time in response to life stressors (Stein, 2004), GAD is commonly neither recognized nor referred for treatment (Brawman-Mintzer & Lydiard, 1996; Keller, 2002; Rapee, 1991). Thus, individuals often suffer for many years before being diagnosed (Brawman-Mintzer & Lydiard, 1996; Keller, 2002; Rapee, 1991).

1.3.3.2 The effects of generalised anxiety disorder: Quality of life and societal costs

Due to the chronic and pervasive nature of GAD, the cost of GAD is high both in terms of individual burden and cost to society (Kessler et al., 1999; Ormel et al., 1994). A diagnosis of GAD is an important predictor of disability, impaired quality of life, wellbeing, life satisfaction (Wittchen, 2002), poor outcomes (Hunt, et al., 2002; Stein, 2004; Roy-Byrne & Wagner, 2004), negative impacts on work and social functioning (Stein & Heimberg, 2004; Turk & Mennin, 2011), as well as being related to substantial societal and economic costs (Ballenger et al., 2001; Wittchen, 2002).

For example, findings estimate that 53.2% of individuals with GAD experience high to very high psychological distress, second only to the distress experienced by individuals with agoraphobia. Impairment and disability in GAD is considerable and is comparable to that of major depression (Kessler et al., 1999), pure mood disorders (Grant et al., 2005), and chronic conditions such as arthritis and diabetes (Kessler et al., 2001; Maier et al., 2000). Additionally, in an Australian sample, GAD was found to interfere in various aspects of life with respondents reporting interference in their home life (24.1%), their work/study (24.2%), their close relationships (31.8%), and their social life (37.8%; Statistics, 2007). Overall, in Australia, GAD has been found
to be associated with the highest level of interference at an individual and societal level comparative to other anxiety disorders. Of those diagnosed with GAD, 48% experienced severe or very severe interference in at least one of the four domains of life (Statistics, 2007).

The societal cost of GAD results from reduced work productivity and increased healthcare costs. For example, in Australia, individuals with a diagnosis of GAD are reported to have decreased work productivity and to spend between 4.9 - 8.4 days out of role over a one-month period, which accounts for 2.7 million person-days out of role per month due to GAD. This is higher than other mental health disorder, affective disorders (2.1 million) or substance abuse (1.1 million; Statistics, 2007; Henderson et al., 2000). Thus, it is associated with significant economic burden (Souêtre et al., 1994). Other studies have estimated that over one-third of individuals diagnosed with GAD had more than a 10% decrease in work productivity and a 50% reduction in output, as well as being considered likely to be high users of primary healthcare (Wittchen et al., 2002).

In terms of healthcare costs, the World Health Organization multicenter study across 14 countries estimated the prevalence rates to be 8% of all primary care users (Maier et al., 2000; Sartorius et al., 1990). In addition, patients with pure GAD were found to have twice as many primary care visits as patients with depression, even after physical illness was accounted for (Wittchen et al., 2002). The burden of illness related to GAD appears to far outweigh the capacity of mental health service providers (Somers et al., 2006). GAD patients often present as ‘frustrating’ and ‘high utilizes’ (Allgulander, 2006), which perhaps reflects the limitations with current theory and treatment models. Despite these overwhelming findings, only between 28 - 66% of individuals with GAD have been found to seek help, which was much lower.
than for other types of disorders (half the rate than for affective disorders; Henderson et al., 2000; Wittchen et al., 1994).

1.3.3.3 Treatment effectiveness

Despite GAD being a disorder that is prevalent, chronic, and has a large costs both at the individual and societal level, currently there is a pressing need for more effective treatments. Unfortunately, despite the growing evidence base for effective treatments in the research literature, the effectiveness of treatments appears to be limited; treatment has only been found to be effective for around 50% of patients (Borkovec, Newman, Pincus, & Lytle, 2002; Borkovec & Ruscio, 2001; Gould, Safran, O'Neill Washington, & Otto, 2004), with women (46%) being less likely to attain remission following treatment in comparison to men (56%; Mancuso, Townsend, & Mercante, 1993; Yonkers, Bruce, Dyck, & Keller, 2003).

Some authors (e.g., Mennin, 2004; Roemer & Orsillo, 2002) suggest that poor treatment outcomes in GAD are due to the symptoms of the disorder challenging traditional cognitive behavioral approaches to treatment (Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006), whilst others argue that the poor outcomes are due to limitations in our conceptual models of the disorder (Koerner, 2014). Regardless, GAD remains the most treatment resistant of all the anxiety disorders; individuals with GAD, compared to other anxiety disorders, are more frequently left experiencing significant residual symptoms (Brown et al., 1994; Gould et al., 2004).

1.4 Summary

Although frequently present in all anxiety disorders, worry, the cognitive component of anxiety, is most commonly studied in the context of GAD (Borkovec et al., 1991; Brown et al., 1992; Craske et al., 1989; Konstantellou et al., 2011; McLaughlin et al., 2007; Roemer et al., 1997; Turk & Mennin, 2011). GAD has been
found to be prevalent, chronic, and debilitating with a large cost both at the individual and societal level (Kessler et al., 1999; Ormel et al., 1994; Roy-Byrne & Wagner, 2004; Stein, 2004). When compared to the other anxiety disorders, research that aims to understand the mechanisms underlying worry (and thereby GAD) has been neglected (Boschen, 2008). This may go some way to explaining the poor effectiveness of current treatments, relative to treatments for other anxiety disorders (Koerner, 2014). A more comprehensive understanding of worry has the potential to offer insight into individual factors that may contribute to the development and maintenance of anxiety disorders, especially GAD (Kristalyn Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006; Boschen, 2008). An important first step is to better understanding factors and processes involved in the development and maintenance of worry at the theoretical level. Therefore, current theories and models of worry, and GAD - due to their incorporation of worry as the central feature - will be discussed in the next section.

1.5 Theories and Models of Chronic Worry and Generalised Anxiety Disorder

Behar, DiMarco, Hekler, Mohlman, and Staples (2009) argued that in order for us to develop new, more effective treatments, or to more effectively utilize existing treatments we must further understand the mechanisms underlying worry. The past two decades has seen a significant increase in the development of theories and models that have helped shape our current understanding of the etiology and maintaining factors of GAD, and the central role of worry. Although theories of worry/GAD share an emphasis on the avoidance of internal affective experience (thoughts, beliefs, and emotions), they can be grouped into three clusters or types depending on their specific focus; (1) experiential/emotional models, (2) cognitive models, and (3) integrated models (see: Behar et al., 2009, for review). Although
many of the theories have more similarities than differences, the key models that have an existing evidence base will be individually discussed - using the framework of the aforementioned three clusters - followed by a final summary section (Section 1.5.4, pp. 44-48), which will offer a synthesis of the models.

### 1.5.1 Cognitive Models

#### 1.5.1.1 Description

The models contained within the ‘cognitive models’ cluster include: the Intolerance of Uncertainty Model (Dugas, Gagnon, Ladouceur, & Freeston, 1998), the Anxious Apprehension/‘Basic’ Anxiety Model (Barlow, 1988), the Information Processing Model (Rapee, 1991), and The Metacognitive Model (Wells, 1995). Both Barlow (1988) and Rapee (1991) drew on the existing literature across several decades to develop their early models of GAD. They both conceptualised GAD as the ‘basic’ anxiety disorder because its core features were thought to represent the fundamental processes of anxiety, and in fact all emotional disorders (Barlow, 2002; Rapee, 1991). However, this anxious apprehension process differs only in its content or focus, which determines the resulting psychopathology.

Barlow’s (1988, 2002) Anxious Apprehension Model stipulates that the ‘basic’ anxiety experienced in GAD is an ‘anxious apprehension’ - a future-orientated mood state where an individual is in a constant state of readiness to cope with potential upcoming negative events. Both physiological and biological reactions are argued to lead to an increase in self-focused attention and hypervigilance to threat, which in turn increases these physiological and biological reactions (Barlow, 2002). The strength of Barlow’s (1988) model is that it offers a framework from which to understand the key factors implicated in etiology, that is, how the development and
maintenance of GAD stems from a biological vulnerability, which combines with a psychological vulnerability. This vulnerability predisposes an individual to develop worry/GAD when they are faced with stressful negative life events.

Similarly, Rapee’s (1991) Information Processing Model (IPM) also posits that GAD results from anxious, presumably automatic, responses to a variety of internal or external, physical or social cues. However, the central role Rapee gives to attention, in these automatic responses to cues, implicates the role of erroneous information processing as central to the development and maintenance of GAD. Specifically, when threat cues are perceived Rapee argues that a variety of associated information - which is stored in long-term memory - is accessed (see Figure 1.1). Due to the extensive attentional resources that are employed in the detection of threatening information, individuals with GAD have a lowered threshold for threat (see double arrows in Figure 1.1). Thus, threatening associations are more likely to be accessed, and the threatening meaning is, therefore, more likely to be processed. Rapee’s (1991) model presents the affect of anxiety as a unique informational representation; when information related to threat is accessed, this triggers an ‘anxiety node’, which in turn relays back to the threatening information to further lower the threshold. Additionally, when the ‘anxiety node’ is accessed it leads to the generation of potential responses. The potential responses are associated with internal representations of likely outcomes of such responses, particularly focusing on the perceived ability to manage and control the threat; if the management of the specific threat is perceived to be possible the ‘anxiety node’ is not activated. Individuals with GAD are thought to have more associations and reduced number of associations of threat controlling actions.

In addition to Rapee’s (1991) model, the 1990s also led to the development of Meta-cognitive Model (Wells, 1995) and the Intolerance of Uncertainty Model.
Figure 1.1: Rapee’s (1991) information-processing model of the maintenance of generalized anxiety disorder.
(IUM; Dugas et al., 1998). These models focus on the role of maladaptive beliefs in the development and maintenance of GAD. The IUM (see Figure 1.2) centralizes intolerance of uncertainty (IU) - a dispositional characteristic that includes maladaptive beliefs about uncertain situations and events (Dugas, Buhr, & Ladouceur, 2004; Dugas et al., 1998; Dugas, Letarte, Rheaume, Freeston, & Ladouceur, 1995; Freeston, Rheaume, Letarte, Dugas, & et al., 1994) - as directly related to worry. The other components in the model, aside from IU, include a negative problem orientation (or a lack confidence in one’s ability to problem solve and the perception of problems as threatening), positive beliefs about worry (e.g., worry helps me cope), and cognitive avoidance. Unlike IU, the other components in the model are presented as being indirectly related to worry (Dugas et al., 1998; Maydeu-Olivares & D'Zurilla, 1996); IU serves to precipitate the chain of worry (see Figure 1.2), as well as negative problem orientation, and cognitive avoidance, which are present in GAD (Behar et al., 2009). Therefore, when faced with highly uncertain ambiguous situations individuals with GAD, due to their low tolerance for uncertainty, experience extreme distress and actively engage in worry in an attempt to cope or prevent aversive events from occurring (Borkovec & Roemer, 1995). However, the worry and accompanying anxiety leads to a negative problem orientation and cognitive avoidance, which then maintain the cycle of worry.

The Metacognitive Model (Wells, 1995) proposes that worry is maintained by positive reinforcement. The Metacognitive Model (MCM; see Figure 1.3) also proposes that worry is a strategy employed to allow individuals to cope with potential future problems, as well as being a response to “what if…” questioning (thoughts/doubts; Fisher & Wells, 2011). Worry is argued by the MCM to be triggered by intrusive negative thoughts and to be associated with a range of
Figure 1.2: The Intolerance of Uncertainty Model of GAD (Dugas et al., 1998)

Figure 1.3: Wells’ (1995) Metacognitive Model of GAD
ineffective strategies, aimed at avoidance of worry via behaviors aimed at control (Wells, 1999, 2004). Two types of worry are specified; encountering anxiety-activating situations results in positive beliefs about worry/Type 1 worry (e.g., “worry helps me cope”), which stimulates an anxiety response that may lead to negative beliefs about worry/Type 2 or meta-worry (e.g., worry is uncontrollable). Positive beliefs do not have specificity to GAD or pathological worry, although they play a central role in GAD due to their flow on effect in activating negative beliefs about worry (Wells, 2009). It is Type 2 worry that is argued to be responsible for the persistence of worry. Due to worry being perceived as the main coping strategy it remains unchallenged, which results in the associated dysfunctional beliefs remaining stable. Overtime, these beliefs combine with behaviors, such as avoidance, suppression and mental distraction, which act to corroborate and maintain the cycle (Fisher & Wells, 2011; Wells, 2005). Because these beliefs and behaviours are ineffective coping strategies they do not allow individuals to access disconfirming evidence against their beliefs that worry is dangerous or uncontrollable (Wells, 1999). Therefore, these coping strategies serve to reinforce the unhelpful worry related beliefs.

1.5.1.2 Empirical Support for Cognitive Models

Overall, evidence has been found in support of all the aforementioned models. Research suggests that GAD is associated with extremely high levels of trait anxiety (Szabo, 2011), and that negative life events increase the risk of GAD (Raskin, Peeke, Dickman, & Pinsker, 1982; Tweed, Schoenbach, George, & Blazer, 1989). These findings are consistent with Barlow’s (1988) model. Rapee’s (1991) model appears to have more extensive support than Barlow’s (1988) model; a considerable body of research indicates that GAD is associated with preferential attention towards threat,
the requirement for greater attentional resources, as well as an inflated interpretation of subjective personal risk both in terms of the probability and cost of danger occurring (see: Barlow & Durand, 2003; Craske, 1999; Mathews & MacLeod, 2005; Stapinski, Abbott, & Rapee, 2010). However, since the development of these models two decades ago, the research literature has developed significantly. Furthermore, research has shown a shift in focus away from the inflated perception of negative events per se, to also consider the core feature of perception of control (e.g., Chorpita & Barlow, 1998; Craske et al., 1989). Thus, research has begun to focus more intensely on aspects such as intolerance of uncertainty (IU) and metacognitions. Despite this shift in focus, considerable variation in findings from tests of the central assumptions of the Intolerance of Uncertainty Model (IUM) and Metacognition Model (MCM) has been observed. However, this may reflect a requirement for more robust methodologies.

Although evidence of the specificity of intolerance of uncertainty and the Intolerance of Uncertainty Model’s associated constructs to GAD is mixed (Behar et al., 2009; Buhr & Dugas, 2002; Dugas, Hedayati, et al., 2005; Holaway, Heimberg, & Coles, 2006; Ladouceur et al., 1999; Steketee, Frost, & Cohen, 1998; Tolin, Abramowitz, Brigidi, & Foa, 2003), there is some support for the model’s central assumptions. Higher levels of IU, perceived uncontrollability of experiences and consequent amplification of emotional distress have been observed in both analogue and clinical samples (Behar et al., 2009; Buhr & Dugas, 2002; Dugas et al., 1998; Dugas, Marchand, & Ladouceur, 2005; Dugas et al., 2007; Ladouceur, Blais, Freeston, & Dugas, 1998; Ladouceur et al., 1999). In addition, significantly greater difficulties with negative problem orientation (but not actual problem-solving), problem-solving confidence (Dugas et al., 1998; Dugas, Hedayati, et al., 2005;
Ladouceur et al., 1998; Robichaud & Dugas, 2005a, 2005b), increased levels of positive beliefs about worry (Buhr & Dugas, 2002; Dugas et al., 1998), and cognitive avoidance (thought suppression; Buhr & Dugas, 2002; Dugas et al., 1998) have also been demonstrated in participants with high levels of worry (Dugas et al., 2007). However, an overarching limitation with regard to research into the IUM is the lack of consistency in the assessment of the construct of ‘intolerance of uncertainty’. This highlights the need for further research with consistent operational definitions, in addition to studies that address other methodological limitations (e.g., reliance on self-report measures; Birrell, Meares, Wilkinson, & Freeston, 2011).

Significant limitations also exist with regard to the Meta-cognitive Model, particularly in terms of the lack of longitudinal data (Behar et al., 2009). However, there is some evidence in support of the MCM’s central predictions; no difference in engagement in Type 1 worry has been observed between participants with GAD, worriers without GAD (Ruscio & Borkovec, 2004), and non-worried anxious individuals (Davis & Valentiner, 2000), although negative beliefs about worry and meta-worry/Type 2 worry have been found to differentiate individuals with and without pathological worry (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Cartwright-Hatton & Wells, 1997; Davis & Valentiner, 2000; Ruscio & Borkovec, 2004; Wells & Carter, 1999, 2001). Yet, it appears unclear as to whether these negative beliefs about worry are specific to individuals with GAD or whether they are characteristic of anxiety disorders in general. Ruscio and Borkovec (2004) found that negative beliefs may be relevant for all individuals with high levels of worry, not just those with GAD, as similar levels of negative beliefs about worry and meta-worry have been observed in individuals with GAD, OCD (Cartwright-Hatton & Wells, 1997), and panic disorder (Wells & Carter, 2001). Criticism has also been voiced with
regard to negative beliefs about worry and Type 2 worry. Although distinguished as two separate entities, they are not reliably distinguished by measures associated with the model (e.g., the Meta-cognitions questionnaire; Behar et al., 2009; Cartwright-Hatton & Wells, 1997).

Overall, an overarching limitation of the cognitive models is that emotional aspects are overlooked in favor of cognitive components (McLaughlin et al., 2007); studies have tended to examine only individual components implicated in the models (e.g., biases of attention or interpretation), rather than testing all factors within the model concurrently. This thesis will aim to overcome some of these limitations by simultaneously examining multiple processes implicated in worry/GAD using the framework of models that take an integrated approach to account for both the cognitive and emotional aspects.

1.5.2 Emotional/Experiential Models

1.5.2.1 Description

The important role of emotions in the conceptualization and treatment of GAD is placed at the forefront in the emotional/experiential models of GAD: the Emotion Dysregulation Model (Mennin, Heimberg, Turk, & Fresco, 2002; Mennin et al., 2005) and the Acceptance-based Model (ABM) of GAD (Roemer & Orsillo, 2002; Roemer, Salters, Raffa, & Orsillo, 2005). Emotion regulation, that is, how individuals recognize, influence, manage, experience, give meaning to, and express their emotions in a context appropriate manner to effectively respond to life’s demands (Gross, 1998b), is the focus of the Emotion Dysregulation Model (EDM; Mennin et al., 2005). In contrast, the ABM conceptualizes GAD as a disorder characterized by experiential avoidance, whereby individuals with GAD are seen to have negative
reactions to their internal experiences (e.g., emotions) and, therefore, attempt to avoid these experiences by engaging in worry (Roemer et al., 2005). Overall, similar to the cognitive models, both emotional models perceive worry as an avoidant response (Mennin et al., 2002), and GAD as a multicomponent syndrome where worry acts as an attempt to control, avoid, or blunt the emotion that leads to the disruption of one's experience. Additionally, both models highlight the disconnection between internal states/emotions and one's environment. For example, individuals diagnosed with GAD react negatively to their internal experiences (e.g., negative thoughts or meta-emotions that the individual is unable to modulate), which lead to difficulties in awareness, monitoring, accepting, and interpreting emotions. Experiential avoidance strategies - avoidance of internal experiences that are perceived as threatening or aversive - are also integral to both models, whereby, in order to diminish the aversive internal experience individuals engage in avoidance strategies (e.g., worry).

The Emotion Dysregulation Model (EDM; see Figure 1.4) accounts for both limited knowledge and skill in the management of emotional experiences and expression of appropriate responses (modulation of expression of emotion). In addition, the EDM accounts for engagement in counterproductive strategies (maladaptive emotional management), such as worry, as individuals attempt to regulate their own emotional experience (Mennin et al., 2005; Turk, Heimberg, Luterek, Mennin, & Fresco, 2005). In contrast, the Acceptance-Based Model (ABM) (ABM; Roemer et al., 2005) focuses predominantly on the two mechanisms of avoidance that characterizes worry: perceived avoidance of low-probability future negative events (based on the belief that worry reduces likelihood of future negative events) and, experiential avoidance (see Figure 1.5). According to the ABM, active engagement in worry in response to threatening stimuli is thought to increase distress.
Figure 1.4: The Emotion Dysregulation Model of GAD (Mennin et al., 2002, 2005)

Figure 1.5: The Acceptance-Based Model of GAD (Roemer et al., 2005)
by interrupting the informative feedback an individual has with their environment, as well as leading to behavioural restriction (Roemer & Orsillo, 2002). Behavioral restriction - whereby participation in valued actions or activities that hold meaning for the individual are reduced, such as leisure activities or spending time with friends (Roemer & Orsillo, 2002) - is thought to decrease awareness of the present moment. This results in a cycle of becoming less engaged and, in turn, more distressed due to an increase in the present negative internal experiences (Behar et al., 2009). The Emotion Dysregulation Model focuses less on behavioural aspects and, instead, highlights that it is the difficulties with emotional modulation that lead to the experience of emotions being subjectively aversive, which precipitates the development of the unhelpful cycle of worry. Thus, engagement in worry is a cognitive control strategy, whereby an attempt is made to ‘fix’ the issues an individual has with regulatory processes. However, engagement in worry only acts to induce further dysregulation of emotional experience resulting in greater difficulty in managing emotional reactions to events during or immediately following periods of worry (McLaughlin et al., 2007).

1.5.2.2 Empirical Support for Experiential/Emotional Models

Although initial support was found for the EDM and the role of emotion dysregulation in individuals with GAD (Mennin et al., 2005), later findings have contradicted the key predictions of the model (Decker, Turk, Hess, & Murray, 2008; Novick-Kline, Turk, Mennin, Hoyt, & Gallagher, 2005). Research has found that individuals with GAD report emotion regulation deficits (Salters-Pedneault et al., 2006). Notably, maladaptive, as opposed to adaptive emotion regulation strategies, have been found in a non-clinical population endorsing GAD symptomatology (Aldao & Nolen-Hoeksema, 2011), and it appears to be the identification and labeling of
emotions that are most problematic. In addition, compared to their non-anxious counterparts, individuals with GAD report their emotional experiences as more intense (McLaughlin et al., 2007; Mennin et al., 2005; Turk et al., 2005), and regardless of active engagement in worry, they also have greater negative reactivity to emotions, as well as poorer emotional management skills (McLaughlin et al., 2007; Mennin et al., 2005; Turk et al., 2005).

In contrast, other studies have found emotional awareness and negative expressivity to be unrelated to chronic worry (McLaughlin et al., 2007; Salters-Pedneault et al., 2006). Furthermore, participants with GAD were not found to differ in the emotion regulation strategies they used, nor to report using them more frequently, compared to non-anxious controls (Novick-Kline et al., 2005). However, participants with GAD were found to have more nuanced descriptions of emotional reactions and to work harder than control participants to regulate emotions, such as engage in self-soothing strategies (Novick-Kline et al., 2005). This research builds a case that although individuals with GAD perceive their ability to differentiate emotions as limited, these perceptions do not reflect their capabilities (Novick-Kline et al., 2005). Despite the possibility that GAD leads to emotion dysregulation, studies are yet to directly test if emotion dysregulation deficits precede the development of chronic worry (Salters-Pedneault et al., 2006).

The ABM has a smaller research base, with only partial support offered for the central tenet that distress and avoidance of internal experiences contribute to the development and maintenance of GAD (Lee, Orsillo, Roemer, & Allen, 2010). Evidence suggests that experiential avoidance has been associated with chronic worry and GAD severity in clinical and non-clinical samples (Roemer et al., 2005). Furthermore, associations have been observed between emotion regulation difficulties
or lower levels of mindfulness, and GAD symptom severity or diagnosis (Borkovec & Roemer, 1995; Cartwright-Hatton & Wells, 1997; Freeston et al., 1994; Lee, Orsillo, et al., 2010). However, the behavioral restriction component of the ABM has been largely overlooked in research. According to the ABM values-consistent behavior (i.e., valued action) is particularly important in understanding quality of life impairment in GAD (Michelson, Lee, Orsillo, & Roemer, 2011). Preliminary findings indicate that individuals with GAD reported less engagement in valued action, compared to healthy control participants, with valued action being found to be correlated with measures of experiential avoidance, distress about emotions, and quality of life (Michelson et al., 2011). Michelson et al. (2011) reported that restrictions in valued actions contributed unique variance to diminished quality of life over and above gender, GAD severity, experiential avoidance, distress about emotions, and depression comorbidity (Michelson et al., 2011).

Due to the limitations with self-report measures, particularly when examining unconscious processes, experimental methodologies are required to further examine the central features of the ABM and whether threatening associations and avoidance are outside of conscious awareness. This is important in order to clarify the temporal relationship between the model’s constructs, to evaluate the key tenets of the model, and to determine causal relationships with more rigorous methodologies. Furthermore, significant theoretical overlap exists between the operationalization of constructs, as well as an acceptance-based behavioral approach and mechanisms of action suggested by other models, such as the emotion dysregulation model (e.g., Behar et al., 2009; Mennin et al., 2002; Roemer & Orsillo, 2002; Roemer et al., 2005).
In terms of limitations, the EDM proposes that emotions are aversive to GAD patients due to their deficits in emotional regulation (Mennin, 2004), however, there is currently no research that has examined this proposal. Additionally, research has yet to examine the dynamic nature of emotion dysregulation, which involves several processes that are expressed over time (Gross, 1998a; Rottenberg & Gross, 2003; Thompson, 1994). Currently, research exploring emotion dysregulation could reflect possible problems in a number of processes, such as the initial generation of emotions, or interpretation and use of these emotions (Lynch, Robins, Morse, & MorKrause, 2001; Mennin, Holaway, Fresco, Moore, & Heimberg, 2007). This may go some way to explaining the discrepant findings in the current research. Overall, research in support of the EDM is tentative, the proportion of variance accounted for by its factors in explaining GAD is modest, and the measurement of constructs needs to be improved (Mennin et al., 2007). Although both experiential models of GAD have promising findings in their support, they are still in the preliminary phases of investigation (Lee, Abegg, Rodriguez, Koehn, & Barton, 2010; Roemer & Orsillo, 2002; Roemer et al., 2005; Salters-Pedneault et al., 2006).

Limitations relevant to both experiential models include the presence of small sample sizes and the reliance on self-report measures. Self-report measures present a significant problem, as there is evidence that we are unreliable when required to offer insight into our internal processes (Nisbett & Wilson, 1977). Furthermore, the presence of chronic worry and GAD has been associated with difficulties in accessing and reporting emotional and cognitive experiences (Mennin, 2004). Therefore, the ability of self-report measures to capture the constructs of interest is questionable; participants’ perceptions may not reflect actual difficulties with emotion regulation or mindfulness skills. In light of the current limitation in research methodologies it is not
clear whether the measured constructs (e.g., experiential avoidance and fear of emotional responding) are specific to GAD or whether the results are due to co-occurring psychopathology, such as depression, or trait anxiety (Lee, Abegg, et al., 2010). In order to overcome these limitations, the studies included in this thesis will engage a large sample and predominantly employ experimental and implicit measures of the variables of interest, rather than relying solely on self-report measures.

1.5.3 Integrated Models

1.5.3.1 Description

The final models to be discussed are the integrated models, which include Borkovec’s Cognitive Avoidance Model of Worry (AMW; Borkovec, 1994; Borkovec, Alcaine, & Behar, 2004), Ouimet, Gawronski and Dozois’ (2009) Integrated Model, and Hirsch and Mathews’ (2012) cognitive model of pathological worry. The integrated models are perhaps the most compelling as they build on the aforementioned cognitive and emotional models by incorporating both cognitive and affective aspects. Furthermore, research examining the key assumptions of the integrated models employs rigorous psychophysiological experimental methodologies and, therefore, provides greater confidence in the research findings.

Borkovec’s model (see Figure 1.6) conceptualizes worry as a verbal linguistic, thought based activity (Behar, Zuellig, & Borkovec, 2005; Borkovec et al., 2004; Borkovec & Inz, 1990) that acts to suppress mental imagery associated with somatic and emotional activation (Borkovec & Hu, 1990; Vrana, Cuthbert, & Lang, 1986). This suppression leads to a disabling of the emotional processing of fear that would be necessary for habituation and extinction to be achieved (Foa, Huppert, & Cahill, 2006; Foa & Kozak, 1986). Thus, pathological worry is viewed as a perseverative,
Figure 1.6: The Avoidance Model of Worry and GAD (Borkovec, 1994)
cognitive activity that serves as avoidance. Specifically, catastrophic images are swapped for less distressing and somatically activating verbal linguistic activity, with worry acting as a cognitive attempt to problem solve and remove possible future threat, or to keep thinking about more distressing topics (e.g., interpersonal and difficult childhood experiences; Borkovec & Roemer, 1995). In this way, the aversive somatic and emotional experiences that accompany the process of fear are avoided and one is able to approach emotional topics at an abstract, conceptual level and avoid - in the short term - the aversive images, autonomic arousal, and intense negative emotions (Borkovec et al., 2004). As worry reduces arousal and stops activation of fear structures in memory, emotional processing is prevented, (Borkovec & Hu, 1990; Borkovec & Inz, 1990; Vrana et al., 1986, 1989) which, over time, leads to a more intense experience of anxiety and increasing engagement in worry to ‘dull’ and avoid distressing stimuli (Fisher & Wells, 2011). Worry is, therefore, an ineffective strategy that serves to perpetuate the cycle of anxiety by preventing emotional processing.

Hirsch and Mathews’ (2012) model (see Figure 1.7 and Figure 1.8) is somewhat different in its approach, whereby, an individual with pathological worry is argued to have an internal representation of threat that is activated more strongly, as a result of the increased influence of involuntary bottom-up processes (e.g., emotional processing biases and habits of thought). Thus, for worry prone individuals, negative thoughts intrude into consciousness due to the influence of involuntary processes, which activate stronger internal representation of threat. These in turn are unable to be inhibited due to insufficient voluntary control, which is required in order to overcome competing threat representations, resulting in poor maintenance of attention away from threat. In this way bottom-up processes - such as habitual biases of attention and interpretation - interact with deficits in top down processes (e.g., attentional
Figure 1.7: Hirsch and Mathews’ (2012) model as applied to non-anxious individuals

Figure 1.8: Hirsch and Mathews’ (2012) model as applied to worry-prone individuals
control) resulting in lowered maintenance of attention and enhanced threat representations, which intrude into consciousness and develop into worry. Thus, a processing style develops whereby habits develop and (i) become automated and repetitive; (ii) tend to persist; and (iii) lead to increased future intrusions. Cognitive biases for threat then develop that activate representations of threat and lead to protracted worry, as deficits in attentional control processes result in being unable to maintain focus on the intended task. Motivation to refocus attention is also thought to be reduced by beliefs that worry is uncontrollable or useful. Hirsch and Mathews’ (2012) model suggests that the more threatening the thought, or the more catastrophic the interpretation, the more unlikely attentional control will be utilized, and the more likely the worry episode will escalate. The worry episode, in turn, results in more catastrophic interpretations and more attentional capture. In individuals with high levels of worry, attentional control is unable to restrain this process, and the cognitive resources required to refocus attention are consumed and unable to be engaged.

Commonalities can be observed between Hirsch and Mathews’ (2012) model and the other cognitive models, as they also propose that cognitive characteristics (i.e., biases in the processing of emotional information, difficulties with executive control of attention, and the quasi-verbal nature of worry) contribute to the development and maintenance of pathological worry/GAD. However, cognitive and affective processes are incorporated in that voluntary and involuntary processes are accounted for. Therefore, Hirsch and Mathews’ (2012) model has the most obvious parallels with Ouimet et al.’s (2009) model; both models focus on voluntary top down processes and involuntary bottom-up processes as central to the development of anxiety/worry of pathological worry.
Although Ouimet et al.’s (2009) recent Integrative Model focused on a vulnerability to anxiety more generally, rather than being specific to worry, it implicates similar processes (e.g., information processing biases executive functioning and the relationship between voluntary and involuntary processes) as those described in Hirsch and Mathews’ (2012) model of worry. Due to these similarities, as well as the presence of worry across anxiety disorders, and the novel approach of examining the relationship of dual-process theory to worry, it was decided to include this model in the current discussion. Ouimet et al. (2009) highlight dual-processing systems as fundamental to psychopathology. They argue that it is the strength of threat-related associations (associative processes) and the strategies employed to invalidate such associations (rule based processes), in addition to individual differences in executive functioning, which are central to the development and maintenance of anxiety.

Specifically, it is argued that response or self-regulatory conflicts (e.g., impaired attentional disengagement) result from a conflict between responses elicited by the associative system and rule-based systems (Ouimet et al., 2009). For example, impaired attentional disengagement results from a conflict between an individual’s associative fear network, which may become activated by an anxiety provoking situation (engagement responses), whilst concurrently avoidance responses are generated by the rule-based system (engagement in active worry; Ouimet et al., 2009; Strack & Deutsch, 2004). Intuitive judgment and behavior are argued to be determined by an interplay between associative and rule-based processes. However, worry does not allow for the emotional experience to be processed and, thus, there is no dampening of the overactivation of the associative fear network; it remains active and enhances the likelihood of a threatening interpretations by the rule-based system.
Although there are striking parallels between the models, Hirsch and Mathews’ (2012) model specifically implicates deficits in attentional control, whilst Ouimet et al (2009) propose executive control processes more generally. In contrast, aside from implicating processes that could be classified as either automatic or controlled, Borkovec’s AMW has little in common with both Hirsch and Mathews (2012) and Ouimet et al.’s (2009) models. The latter two integrated models are based on the distinction between automatic and controlled processes, that are central to dual-process models, which have until recently been largely overlooked in relation to models of anxiety and pathological worry (e.g., Beck & Clark, 1997; McNally, 1995). This seems surprising in light of the extensive research that has provided strong evidence for the fundamental role of cognitive dysfunction and information processing deficits (e.g., biases in attention and interpretation) in the development and maintenance of anxiety and GAD (Beck & Clark, 1997; Hutton, 2008; Hutton & Ettinger, 2006; Mathews & MacLeod, 2005; Ouimet et al., 2009).

Ouimet et al. (2009) distinguish each stage of processing as either associative (bottom up) or rule-based (top down) processes and stipulate that it is individual differences in the interplay between these processes that contribute to a cognitive vulnerability to various types of anxiety disorders. Associative and rule-based processes are proposed to contribute to all stages of processing of threat-related stimuli in anxious individuals. Ouimet et al. (2009) provide a conceptual integration of anxiety-related cognitive biases by linking anxiety symptoms to basic information processes (including: orientation, engagement, disengagement, avoidance and interpretation; see Figure 1.9). The model stipulates that potential cognitive vulnerability to anxiety specifically arises from the activation of threat-related associations, the invalidation of threat strategy (i.e., via reappraisal), and the
**Figure 1.9:** Ouimet et al.’s (2009) Multi-process model of cognitive vulnerability to anxiety.

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3 *Note:* arrows signify predicted influences between processes and effects on behaviour.
effectiveness of executive control. In this way, Ouimet et al. (2009) argue that contemporary dual-systems models of information processing may offer a useful framework for future research aimed at understanding and conceptualizing anxiety, as well as the development of effective evidence based treatments.

1.5.3.2 Empirical Support for Integrated Models

In support of Borkovec’s model, studies have shown that in anxious individuals worry increases intrusive thoughts (Butler, Wells, & Dewick, 1995; Wells & Papageorgiou, 1995), is predominantly a verbal linguistic, thought based activity (Behar et al., 2005; Borkovec & Inz, 1990; Freeston et al., 1996), which serves an avoidant function (McLaughlin et al., 2007). As worry serves an avoidant function it is associated with lower levels of emotional arousal, as it prevents emotional processing by interfering with the physiological (Borkovec & Hu, 1990; Thayer, Friedman, & Borkovec, 1996; Vrana et al., 1986) and the subjective (Borkovec & Roemer, 1995; Sibrava & Borkovec, 2006; Vrana et al., 1986; Wells & Papageorgiou, 1995) components of emotional response. As discussed earlier in relation to the MCM and the IUM, evidence also strongly supports the notion of worry as a coping strategy designed to avoid or prepare an individual for aversive future events. Additionally, individuals with GAD have also been found to report having beliefs that worry is both helpful and useful to them (Cartwright-Hatton & Wells, 1997; Freeston et al., 1994; Tallis, Davey, & Capuzzo, 1994; Wells & Papageorgiou, 1998), even though such beliefs act to further reinforce the worry process due to its role in the avoidance of emotional experiences (Borkovec & Roemer, 1995). Unfortunately, the observation of an inhibitory effect of worry on somatic arousal, as per Borkovec’s model, has been inconsistent (Behar et al., 2009). A further limitation of Borkovec’s model is the lack of explanation as to why emotional experiences are aversive, or why individuals
with GAD want to avoid emotional experience (Borkovec & Roemer, 1995; Mennin et al., 2005; Salters-Pedneault et al., 2006).

Ouimet et al.’s (2009) and Hirsch and Mathews’ (2012) models have yet to be tested directly, however, the role of cognitive biases - specifically in attention (see: Bar-Haim et al., 2007, for meta-analysis) and interpretation (Dugas, Hedayati, et al., 2005; Halberstadt, Niedenthal, & Kushner, 1995; Mathews, Richards, & Eysenck, 1989; Mogg, Bradley, Miller, Potts, & et al., 1994) - have been confirmed. In terms of attentional bias, findings show that anxious, compared to non-anxious individuals, demonstrate preferential attention to threatening compared to non-threatening stimuli, for both subliminal (Mogg, Bradley, Millar, & White, 1995; Mogg, Bradley, Williams, & Mathews, 1993) and supraliminal presentations (Bradley, Mogg, White, Groom, & de Bono, 1999; MacLeod et al., 1986; Mogg, Mathews, & Eysenck, 1992; Mogg, Millar, & Bradley, 2000). Bar-Haim et al. (2007) undertook a meta-analysis of 172 studies of attentional bias in anxious and non-anxious participants and, overall, found clear evidence of highly anxious participants prioritizing the processing of threatening information significantly more than non-anxious participants. With regard to worry and GAD specifically, the meta-analysis identified 11 studies that reported the presence of attentional biases in adult individuals with chronic worry, compared to those low in chronic worry.

Additionally, working memory and the process of attentional control is also gaining increasing interest. For example, the ability to engage attentional control in order to switch attention from one stimulus to another is thought to be limited for anxious individuals when faced with threat-relevant stimuli (Hirsch & Mathews, 2012; Ouimet et al., 2009). Preliminary findings demonstrate that individuals with high levels of worry are less able to control their attention when compared to those.
with low levels of worry (Hayes, Hirsch, & Mathews, 2008; Stefanopoulou, Hirsch, Hayes, Adlam, & Coker, 2014). It is the combination of low attentional control and psychopathology that is suggested to be particularly problematic (Bardeen & Orcutt, 2011; Schoorl, Putman, Van Der Werff, & Van Der Does, 2014); higher levels of attentional control facilitate disengagement from threat, which in turn may improve emotional well-being (Fergus, Bardeen, & Orcutt, 2012). Therefore, greater attentional control may act as a protective function to increase functioning of top-down control processes to reduce negative emotional arousal, which leads to enhanced engagement and habituation to anxiety provoking stimuli (Bardeen, Tull, Stevens, & Gratz, 2014; Fergus et al., 2012). Furthermore, individual differences in top-down attentional control are argued to be of considerable importance in the expression of attentional bias in anxious psychopathology (Schoorl et al., 2014). For example, recent evidence suggests that attentional control moderates the relationship between attentional bias and worry (Bardeen et al., 2014).

In their review of the influence of affect on higher level cognition, Blanchette and Richards (2010) argue that both attentional and interpretation biases have been found to result from the competition between preattentive (bottom-up) threat evaluation mechanisms and top-down attentional control mechanisms. The focus on automatic and strategic biases is also reflected in more recent models of anxiety and GAD, which incorporate dual-process theory in their principals. For example, as stipulated previously, Hirsch and Mathews (2012; see Section 1.5.3, pp 31-35 for further details) propose that habitual biases, particularly in attention and interpretation, in conjunction with impairment of attentional control combine to result in the emergence of pathological worry.
In sum, prominent models of anxiety, and the growing body of research examining cognitive biases, point to the value of simultaneously examining biases of attention and interpretation (Hirsch, Clark, & Mathews, 2006; Mathews & MacLeod, 2005; Reid, Salmon, & Lovibond, 2006; Teachman, 2005; Teachman, Smith-Janik, & Saporito, 2007; White, Suway, Pine, Bar-Haim, & Fox, 2011). However, research to date has predominantly focused on examining information processing biases separately (e.g., attention or interpretation), despite this not accurately testing theoretical proposals that implicate multiple processing biases in the development and maintenance of worry/GAD (Teachman et al., 2007). Several studies have demonstrated that systematic changes in one cognitive bias affect other cognitive biases (Amir, Bomyea, & Beard, 2010; Salemink, Hertel, & Mackintosh, 2010; White et al., 2011). Exploring the temporal relationship of attentional bias to interpretation bias has been argued to be important, as more elaborate processing may override initial threat-related interpretive bias (White et al., 2011). In order to understand whether attentional and interpretation process are the result of a common underlying processing mechanism, or two distinct, orthogonal aspects of information processing with distinct effects on individual differences in anxiety, it is important to clarify the relationship between the biases and whether they related to early or late stage processing (White et al., 2011).

Of the studies that have simultaneously explored the pattern of biases in psychopathology (e.g., Teachman, 2005; Teachman et al., 2007), only one has studied GAD, and this was not in an adult population. Rozenman, Amir, and Weersing (2014) found attentional bias to be correlated with negative interpretations (threat-valence judgments and speed of responding), which, in turn, were the strongest predictor of anxiety symptoms in a small sample (N = 26) of children and
adolescents with a diagnosis of GAD. However, it was not clear whether interpretation biases were associated with different stages of attention (e.g. early versus later stage processing). Although models of worry/GAD implicate multiple cognitive biases (i.e., biases of attention and interpretation) in individuals with chronic worry (e.g., Hirsch and Mathews’, 2012, model), the prolific research on cognitive biases in anxiety has rarely simultaneously examined cognitive biases of different modalities (Mathews & MacLeod, 2005; Reid et al., 2006; Teachman, 2005; Teachman et al., 2007). Undertaking such research would be beneficial to clarify which aspect of information processing is fundamental (Ouimet et al., 2009); different theories place an emphasis on different stages of information processing. For example, attentional biases are argued as central by some authors (e.g., Bar-Haim et al., 2007; MacLeod et al., 1986; Mogg, Garner, & Bradley, 2007), whilst others place the focus on interpretative biases (Amir, Beard, & Bower, 2005; Mathews et al., 1989). Others still, argue that both are responsible due to the same cognitive mechanisms underlying both attentional and interpretive biases (Mathews & MacLeod, 2002). Specifically, Hirsch and Mathews (2012) stipulate that early stage attentional processes (< 200 msec) are driven by bottom up processes and, therefore, should not be related to interpretation bias, which is thought to only affect late stage attentional processes affected by top-down control. Furthermore, Ouimet et al.’s model (2009) proposes that late stage attentional bias, namely avoidance processes, result from interpretation bias. Given these gaps in understanding, this thesis will examine how the biases might interact to increase vulnerability to, and maintenance of, worry through testing the tenets of Hirsch and Mathews’ (2012) and Ouimet et al’s (2009) models and, overall, testing the applicability of dual-process models to worry.
1.5.4 Summary of Models

There are no shortage of models offering a conceptual account for the etiology and maintenance of GAD. Yet, although the aforementioned models focus on different psychological processes, there are similarities and significant overlaps (see: Behar et al., 2009, for review). Overall, models of worry/GAD predominantly view worry as a form of preservative thinking in response to a trigger (e.g., thoughts, feelings, events), which involves thinking about and coping with future aversive events. Other areas of overlap include the perception of worry as negatively impacting emotional processing, disrupting coping, and heightening and maintaining anxiety. Although not universally recognized, positive beliefs about the role of worry in maintaining GAD (e.g., AMW, IUM, and MCM), as well as worry as avoidance (e.g., ABM, EDM, Borkovec’s AMW, and Ouimet et al.’s integrated model) are common across many of the models. Overall, the models consistently view worry as interfering in the self-regulation of cognition and emotion, with findings providing evidence that worry, in response to threat, increases intrusive imagery and intensifies anxiety (Butler et al., 1995; Wells & Papageorgiou, 1995).

The models within each category (cognitive, emotional/experiential, integrated) share the most overlap. However, of all the models, Roemer and Orsillo’s (2002) ABM draws most directly from the concepts described in other models. There are theoretical overlaps between an acceptance-based behavioral approach and mechanisms of action suggested by both Roemer and Orsillo (2002; 2005; Acceptance-based Model) and Mennin et al. (2002; Emotion Dysregulation Model). Specifically, with regard to mechanisms focused on the difficulties that arise from maladaptive attempts at emotion regulation and intense distress about, and avoidance of, emotional experiences (Treanor, Erisman, Salters-Pedneault, Roemer, & Orsillo,
Additionally, similarities are also apparent between mindfulness, a focus of ABM, and the key tenant of intolerance of uncertainty in the IUM (Dugas & Koerner, 2005).

The integrative nature of Borkovec’s AMW means it can also be viewed alongside the ABM and EDM, within an emotion regulatory framework; worry is viewed as a cognitive control strategy employed to attempt to manage regulatory problems associated with subjectively distressing emotional experience (Mennin et al., 2005). The remaining integrated models (Ouimet et al., 2009; Hirsch & Mathews, 2012) reflect most clearly the central information processing components in Rapee’s (1991) model. However, they have advanced to incorporate more recent research highlighting information processing components implicated in chronic worry, over and above attentional processes. Thereby, they account for both voluntary and involuntary processes. There are also features that distinguish between the models. For example, the AMW uniquely incorporates the behavioral analysis of worry and GAD, whilst the IUM focuses specifically on cognitive or schema-based concepts, the MCM centers on metacognitive beliefs about uncontrollability and danger, and the EDM is unique in accounting for deficits in the ability to accurately identify and label emotional states. Differences are also apparent in how the models account for the process by which worry becomes excessive, generalized, and uncontrollable.

Despite the development of this range of models, and the body of supportive evidence for these models, several questions remain. First, if worry and negative affect are found across the anxiety disorders, what are the factors that lead specifically to an individual developing GAD, as opposed to another anxiety disorder. Second, which of the models or constructs best fit GAD, and, therefore, provides the best insight into effective treatment strategies (Fisher & Wells, 2011). Despite the
proliferation of models, there is insufficient evidence for a single robust model of GAD, and one possible explanation is that the majority of studies examining models of GAD have employed self-report measures (Behar et al., 2009). However, the integrated models have begun to employ more experimental measures and, therefore, are advanced our understanding of GAD, which is leading to a body of research that employs rigorous psychophysiological experimental methodologies that provide greater confidence in the conclusions that can be drawn.

Although it has been argued in this thesis that Ouimet et al.’s (2009) and Hirsch and Mathews’ (2013) models are as yet untested, these models provide significant promise. Both models suggest that the basic tenets of dual-systems models may support the development of a theory of GAD, which is able to subsume most of the broader concepts presented in the existing models of worry and GAD. For example, Ouimet et al. (2009) suggest that reinterpreting threat-relevant attentional and interpretive biases (which they equate to vulnerability to anxiety) using the core assumptions of dual-systems models may help elucidate the nature of the relationship between cognitive biases within anxiety disorders, such as the stage of attentional bias (early versus later stage) associated with interpretation bias, or whether these processes are related to either the associative or rule-based system. Therefore, the application of dual-process models to pathological worry may be worthy for several reasons. First, many of the concepts found within models of GAD fit well with the broader concepts of voluntary and involuntary processes accounted for by dual-process models. Second, the application of dual-process models may lead to a more integrative understanding of worry/GAD, which is necessary in order to advance limited treatment outcomes.
Employing an adult sample, this thesis will examine the relationship between attention and interpretation biases at a range of early and late stages of processing to better understand how the biases might be interpreted in a dual-process framework, so as to better understand what leads to a vulnerability to, and maintenance of, worry. Specifically, the current project will employ tasks that examine attention (dotprobe task) and interpretation (homophone semantic priming task) biases in order to examine the associations between these biases. As previously mentioned, Hirsch and Mathews’ (2012) and Ouimet et al’s (2009) models suggest that the presence of, and association between, attention and interpretation biases are strongly implicated in anxiety and worry. Namely, the inability to overcome competing threat representations that contribute to worry arises from the relationship between “bottom-up” (biases) processes (that will be measured by attention and interpretation biases task) that are suggested to activate representations of threat, and insufficient voluntary “top-down” control. Voluntary “top-down” control will be examined with an attentional control task (antisaccade task; Study 3 and Study 4). Furthermore, Ouimet et al (2009) argue that research has largely focused on the distinction between automatic and strategic processes, however, the relationship between these processes has been overlooked. Therefore, as previously mentioned, the relationship between the biases of attention and interpretation (automatic processes) will be examined in terms of their association to one another, as well as to attentional control (strategic processes).

In addition to the aforementioned theories, Epstein’s Cognitive Experiential Self Theory (CEST) will also be examined to determine whether the rational and experiential processing styles (as measured by questionnaires and reasoning tasks) relate to worry (Study 1 and Study 2) and to associative (attention and interpretation
biases; Study 4) and strategic processes (attentional control; Study 3) as measured by experimental tasks (see Sections 2.2.5-2.3.3.1, pp. 73-90, for further discussion). In this way, the current project aims to examine the applicability of dual-process theories to worry. In the methodology section (Chapter 2, p. 64), as well as the aims and hypotheses section of each study, there will be a further description and discussion of the paradigms employed to test the various aspects of the models the study is aiming to examine.

The studies included in this thesis will also aim to overcome the limitations of previous research by predominantly employing experimental and implicit measures, rather than relying on self-report measures. Overall, this thesis will examine a range of processes implicated in worry/GAD using the framework of dual-process models that take an integrated approach in accounting for both cognitive and emotional aspects in individuals who worry. The next section will describe dual-process theory more generally before discussing applications, including to psychopathology.

1.6 Dual-Process Models

Dual-process theories emerged in the literature over 30 years ago, yet, only in the last decade has research begun to fully explore the diversity of their possible applications. The key aspect of dual-process models is the distinction between automatic and strategic processes. Research has provided extensive evidence for the existence of two (dual) information-processing systems (see: Evans, 2008, for review); one (System 1, the experiential system) is rapid, associative, and automatic and the other (System 2, the rational system) is slow, rule-based, sequential, controlled and capacity limited. System 2 can be conceived of as broader than the concept of mental logic, as it also includes processes such as inhibition/the suppression of System 1 (Braine & O'Brien, 1998a, 1998b). Evans (2008) suggests
that the processes involved in System 2 are strategic processes, those that require access to a single, capacity-limited central executive and, therefore, they are processes that are correlated with individual differences in cognitive capacity and are disrupted by concurrent working memory load. The strategic processes of System 2 are rule-based, are conscious, intentional, controllable, and inefficient in relation to employment of cognitive resources. System 2 processes can be described as the rational analysis of concepts and their relationship to each other on the basis of symbolic reasoning and syllogistic inference (Bargh, 1994; Gawronski & Bodenhausen, 2006; Ouimet et al., 2009; Strack & Deutsch, 2004).

In contrast, System 1 is responsible for the organization of mental representations and categorization of stimuli on the basis of similarity and temporal contiguity (Sloman, 1996). The processes involved in System 1 do not require access to working memory (Evans & Over, 1996, 1997; Pacini & Epstein, 1999; Reber, 1993; Stanovich, 1999), are automatic processes, and are unconscious, unintentional, uncontrollable, and efficient in employing cognitive resources (Bargh, 1994). However, it may not be one unitary system, as more than one form of implicit processing may exist. As such, any discussion on dual-process models must highlight that there are at least two processing systems and, therefore, it may be more meaningful to describe System 1 as a set of autonomous subsystems (Stanovich, 2004). Thus, one must understand the limitations inherent in current dual-process models and avoid oversimplifying dual-process models, for example, by conceptualizing them as separate systems (Keren & Schul, 2009). In addition, the two parallel processes highlighted by dual-process theories are thought by some theorists to interact; automatic unconscious processes control behavior without awareness and cause the enactment of strategic processes to explain and make sense of these
behaviors (Epstein, 1991b; Evans & Over, 1996; Stanovich, 2004; Wilson & Dunn, 2004). In this way, behavior is influenced by both systems with individual differences in motivation, and ability to engage in effortful processing, dictating which system is predominant (Ouimet et al., 2009). If there is a conflict or incompatibility between the systems, self-regulatory conflicts may result (Strack & Deutsch, 2004). For example, arousal will modulate both systems, as arousal that is either too high or too low will undermine strategic processing, which results in the domination of automatic processing (Strack & Deutsch, 2004).

Evans’ (2008) undertook a review aimed to determine whether the more-researched dual-process models were accounting for similar concepts and were, therefore, interchangeable (see: Table 1.1 and Table 1.2). As with previous attempts at merging the various dual-process models into one dual-system theory (Evans, 2003; Evans & Over, 1996; Stanovich, 1999), Evans (2008) also found that a single, generic dual-process theory was not comprehensive enough to achieve this. Although similarities between the models were evident - namely their distinction between cognitive processes, which are fast, automatic and unconscious, and those that are slow, deliberate, and conscious - there are differences in the multiple implicit processes distinguished by different theorists, which cannot be classified into two systems. Therefore, Evans (2008) proposed a need to classify dual-process theories, as fitting into a variety of categories. Testing the tenets of dual-process models has proved challenging, as the examination of many processes can only be inferred. For example, there currently exists no process-pure measures of attention, interpretation, or memory (McNally, 1995), with current measures incorporating both strategic and automatic processing (see: Sherman et al., 2008). Because of this limitation,
Table 1.1: *Label attached to dual-processes in the literature as compiled by Evans (2008) on the assumption of a generic dual-system theory.*

<table>
<thead>
<tr>
<th>References</th>
<th>System 1</th>
<th>System 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fodor (1983, 2001)</td>
<td>Input modules</td>
<td>Higher cognition</td>
</tr>
<tr>
<td>Schneider &amp; Schiffrin (1977)</td>
<td>Automatic</td>
<td>Controlled</td>
</tr>
<tr>
<td>Epstein (1994)</td>
<td>Experiential</td>
<td>Rational</td>
</tr>
<tr>
<td>Chaiken (1980)</td>
<td>Heuristic</td>
<td>Systematic</td>
</tr>
<tr>
<td>Reber (1993); Evans &amp; Over (1996)</td>
<td>Implicit/tacit</td>
<td>Explicit</td>
</tr>
<tr>
<td>Sloman (1996); Smith &amp; DeCoster (2000)</td>
<td>Associative</td>
<td>Rule based</td>
</tr>
<tr>
<td>Hammond (1996)</td>
<td>Intuitive</td>
<td>Analytic</td>
</tr>
<tr>
<td>Stanovich (1999, 2004)</td>
<td>System 1 (TASS)</td>
<td>System 2 (analytic)</td>
</tr>
<tr>
<td>Nisbett et al. (2001)</td>
<td>Holistic</td>
<td>Analytic</td>
</tr>
<tr>
<td>Lieberman (2003)</td>
<td>Reflexive</td>
<td>Reflective</td>
</tr>
<tr>
<td>Toates (2006)</td>
<td>Stimulus bound</td>
<td>Higher order</td>
</tr>
<tr>
<td>Strack &amp; Deutsch (2004)</td>
<td>Impulsive</td>
<td>Reflective</td>
</tr>
</tbody>
</table>
### Table 1.2: Clusters of attributes associated with dual systems of thinking (see: Evans, 2008).

<table>
<thead>
<tr>
<th>System 1</th>
<th>System 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cluster 1 (Consciousness)</strong></td>
<td></td>
</tr>
<tr>
<td>Unconscious (preconscious)</td>
<td>Conscious</td>
</tr>
<tr>
<td>Implicit</td>
<td>Explicit</td>
</tr>
<tr>
<td>Automatic</td>
<td>Controlled</td>
</tr>
<tr>
<td>Low effort</td>
<td>High effort</td>
</tr>
<tr>
<td>Rapid</td>
<td>Slow</td>
</tr>
<tr>
<td>High capacity</td>
<td>Low capacity</td>
</tr>
<tr>
<td>Default process</td>
<td>Inhibitory</td>
</tr>
<tr>
<td>Holistic, perceptual</td>
<td>Analytic, reflective</td>
</tr>
</tbody>
</table>

| Cluster 2 (Evolution) | |
| Evolutionarily old | Evolutionary recent |
| Evolutionary rationality | Individual rationality |
| Shared with animals | Uniquely human |
| Nonverbal | Linked to language |
| Modular cognition | Fluid intelligence |

| Cluster 3 (Functional characteristics) | |
| Associative | Rule based |
| Domain specific | Domain general |
| Contextualized | Abstract |
| Pragmatic | Logical |
| Parallel | Sequential |
| Stereotypical | Egalitarian |

| Cluster 4 (Individual differences) | |
| Universal | Heritable |
| Independent of general intelligence | Linked to general intelligence |
| Independent of working memory | Limited by working memory capacity |
assumptions have relied on time-course responding (i.e., responses to stimuli presented at different durations; e.g., Koster, Crombez, Verschuere, Vanvolsem, & De Houwer, 2007), or have utilized mathematical modeling (e.g., McNally, Otto, Hornig, & Deckersbach, 2001) to estimate contributions of automatic and strategic processes. Sherman et al. (2008) argue that attempts to separate automatic and strategic processes are questionable, as they may conflate important differences between qualitatively distinct aspects (i.e., in relation to attention; orientation, interpretation, engagement, disengagement and avoidance), when features of both automaticity and control are in fact present in behaviors and cognition (e.g., Bargh, 1992; Sherman et al., 2008).

1.6.1 Applications of dual-process models

Despite the limitations in measuring and testing dual-process models, there exists an extensive body of literature examining dual-process theory. However, much of the literature sits within one of two disconnected domains: cognitive psychology, including reasoning, judgment and decision-making (Evans, 2006; Kahneman & Tversky, 1982; Klaczynski & Lavallee, 2005; Stanovich & West, 1999) or social psychology (Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004). Therefore, dual-process theories have been classified in the manner to which they are applied; offering insight into either (1) social cognition or (2) higher level cognition (e.g., reasoning, judgment and decision-making; Evans, 2008).

Dual-process models of higher level cognition (i.e., human reasoning; Evans, 2006; Klaczynski & Lavallee, 2005; Stanovich & West, 1999) posit that belief-based reasoning - whereby there is a tendency to evaluate the strength of an argument based on the plausibility rather than how strongly it supports the conclusion - is our natural response when required to make an evaluation of logical validity. However, this can
be overcome by the application of conscious effortful analytic reasoning (Evans, 2008). Heuristic responses are presented as the default, which control behavior directly unless analytic reasoning intervenes (Evans, 1989; 2006). Evidence in support of dual-process accounts of reasoning include the observation of more logical and less belief-biased reasoning under strong deductive reasoning instructions, and an association between logical accuracy and intelligence when problems cannot also be solved by a logical route (see: Osman, 2004, for review). Additionally, support has been offered for dual-process accounts of reasoning in the finding that working-memory load, or instructions to respond rapidly, increase levels of typical biases as well as reduce logical accuracy (see: Osman, 2004, for review).

Within the judgment and decision making literature, there are three dominant research paradigms: (i) heuristics and biases research, which is focused particularly on judgments of probability (Dawson, Gilovich, & Regan, 2002; Kahneman & Tversky, 1982); (ii) the study of decision making under risk (Wu, Sause, & Zacker, 2005); and (ii) social judgment theory (Doherty & Kurz, 1996). Of most interest to the current project is the research into heuristics and biases, as this domain incorporates erroneous information processing and beliefs, which have an impact on behaviour, factors that are also present and implicated in worry (e.g., Hayes, Hirsch, Krebs, & Mathews, 2010; Mathews & MacLeod, 2005; Hirsch & Mathews, 2012). Biases have been found to be associated with System 1, although analytic reasoning can intervene to override biases, thereby resulting in more rational behaviour being linked with System 2. However, although deliberate reasoning can be applied to inhibit the biased response, thus resulting in reflective reasoning, it should be noted that the activation of System 1 does not always result in erroneous responding, nor
does the activation of System 2 (and, therefore, overriding of System 1 responses) necessarily lead to more functional responses.

Rather than a focus on cognitive architecture and evolution, as in the cognitive dual-process theories, dual-process models of social cognition particularly focus on issues concerning consciousness, free will, and the implications for moral and legal responsibilities of individuals. For example, automatic and unconscious processing of social information examining social perception, stereotyping, and attitudes, and their dissociation from explicit beliefs and conscious processing (Bargh, 2006; Chaiken & Trope, 1999; Hassin, Aarts, & Ferguson, 2005; Hassin, Uleman, & Bargh, 2005; Smith & DeCoster, 2000; Wilson, 2002). As the social cognition dual-process theories focus on links between unconscious processing and implicit forms of knowledge representation they are, therefore, most translatable to our understanding of psychopathology. These models offer an explanation for to how it may be possible to change explicit attitudes even when implicit attitudes still take precedence in behavior (Bargh, 1999; Bargh & Williams, 2006; Devine, 1989), an occurrence that is prevalent in anxiety disorders (e.g., Hayes, Hirsch, Krebs, & Mathews, 2010; Mathews & MacLeod, 2005).

Recently, the application of dual-process theory to emotion has been generating increasing interest (Evans, 2008). Although largely overlooked in the dual-process literature, emotions are classified as processes that relate to System 1 (see Table 1.1) and are argued to be automatic in nature (e.g., Epstein, 1990; Evans, 2008; Hassin, Uleman, et al., 2005). It is perhaps this omission of emotional processes - that dual-process research has tended to overlook emotional processes - which has resulted in little emphasis being put on dual-process models with regard to their application to psychopathology and clinical psychology.
1.6.2 The application of Dual-Process Models to psychopathology

The core assumptions of dual-process theories have begun to be incorporated into cognitive theories of depression (Beevers, 2005), PTSD (Brewin, Dalgleish, & Joseph, 1996), the development of addictive behaviors and addiction (Wiers et al., 2007), and in anxiety and worry (Ouimet et al., 2009; Hirsch & Mathews, 2012). For example, research has demonstrated that threat-related interpretive biases in social anxiety can be viewed through a dual-process framework, whereby interpretive biases result from an interplay between indicators of implicit and explicit social anxiety and working memory capacity (Salemink, Friese, Drake, Mackintosh, & Hoppitt, 2013). Researchers are also becoming aware of the presence of a conflict between System 1 and System 2 in phobias and compulsive behaviors, such as gambling, overeating, and smoking (Evans, 2008). Behavior has been found to become irrational because an individual compulsively behaves in a manner that is at odds with explicitly stated goals, which can lead to the experience of ‘two minds in one brain’ (Evans, 2008) or a brain ‘at war’ with itself (Stanovich, 2004).

Negative automatic thoughts are present in most psychological disorders, although they are particularly reflective of anxiety-biased schema, and are a blend of both implicit (System 1) and explicit (System 2) processing (Teachman & Woody, 2004). For example, if a tendency to preferentially attend to threat cues combines with the interpretation of ambiguity as threatening, negative thoughts and anxiety arise (Teachman & Woody, 2004). In this way, parallels can be drawn between current conceptualizations of GAD and dual-process theory. For example, GAD is characterized by habitual, stuck patterns of responding across domains (Borkovec, 1994; Roemer & Orsillo, 2002) relating to System 1, with a disjunction between mental content and experience thought to be present and to interrupt the informative
feedback and relationship an individual has to their environment (Mennin et al., 2002). This is reflected in individuals with GAD and worry presenting with associated deficits in the ability to engage in goal-directed behaviors (System 2) when distressed, displaying deficits in impulse control, and limited ability to access effective regulation strategies (Emotion Dysregulation Model; Mennin et al., 2002). Pathological worry has also been found to result from being unable to inhibit maladaptive beliefs, appraisals and responses (processes implicated in System 1), as well as being a result of the failure to effectively resolve System 2 processes, such as problem-solving (Borkovec et al., 1998; Szabo & Lovibond, 2002; Wells & Carter, 2001). One dual-process theory that is particularly appealing in the application to psychopathology, due to the explicit links and import placed on emotion, is Epstein’s Cognitive Experiential Self theory.

1.6.3 Epstein’s Cognitive Experiential Self Theory

Cognitive-Experiential Self-Theory (CEST) is a cognitive based personality theory developed by Seymour Epstein (Epstein, 1983, 1990). Evans (2008) places CEST within the social cognition category, although it shares many common features with two-system theories of reasoning. CEST focuses on an implicit self-theory which, consistent with other dual-process models, assumes that there are at least two partially independent conceptual systems (see Table 1.3), or modes of thought, which operate in parallel: the logical, analytical rational system (RS) that operates at the conscious level, and the preconscious, intuitive, emotional experiential system (ES; Epstein, 1991b, 1998b; Epstein, Lipson, Holstein, & Huh, 1992; Kirkpatrick & Epstein, 1992). Epstein proposes that each system has access to distinct knowledge.

Note: Epstein also discusses a third system – the Associative System – however, this is largely overlooked and is not explored in experimental research studies. As such, it will not be further discussed in this thesis.
Table 1.3: *Comparison of Epstein’s (1991b) Experiential and Rational Systems*

<table>
<thead>
<tr>
<th>Experiential system</th>
<th>Rational system</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Holistic</td>
<td>1. Analytic</td>
</tr>
<tr>
<td>2. Automatic, effortless</td>
<td>2. Intentional, effortful</td>
</tr>
<tr>
<td>3. Affective: Pleasure-pain oriented (what feels good)</td>
<td>3. Logical: Reason oriented (what is rational)</td>
</tr>
<tr>
<td>4. Associationistic connections</td>
<td>4. Logical connections</td>
</tr>
<tr>
<td>5. Behaviour mediated by &quot;vibes&quot; from past events</td>
<td>5. Behavioural mediated by conscious appraisal of events</td>
</tr>
<tr>
<td>6. Encodes reality in concrete images, metaphors, and narratives</td>
<td>6. Encodes reality in abstract symbols, words, and numbers</td>
</tr>
<tr>
<td>7. More rapid processing: oriented toward immediate action</td>
<td>7. Slower processing: oriented toward delayed action</td>
</tr>
<tr>
<td>8. Slower and more resistant to change: Change with repetitive or intense experience</td>
<td>8. Changes more rapidly and easily: changes with strength of argument and new evidence</td>
</tr>
<tr>
<td>10. More crudely integrated: Dissociative, emotional complexes; context-specific processing</td>
<td>10. More highly integrated: Context-general principles</td>
</tr>
<tr>
<td>11. Experienced passively and preconsciously: we are seized by our emotions</td>
<td>11. Experienced actively and consciously: We are in control of our thoughts</td>
</tr>
<tr>
<td>12. Self-evidently valid: &quot;Experiencing is believing&quot;</td>
<td>12. Requires justification via logic and evidence</td>
</tr>
</tbody>
</table>
forms; his theory is distinct in the proposed linkage of the two systems (two competitive, yet interacting, processing styles), as well as offering an account for emotion, particularly in the context of psychopathology.

The preconscious ES automatically assimilates reality, informs behavior and is claimed to be the source of heuristics. CEST states that via our ES we form an implicit theory about ourselves and the world (known as our self theory), which is created from experiences that involve significant others or those that are highly emotional. The ES is thought to generalise and relate information to activated schemas of our self-theories that results in the use of heuristics (Epstein, 1991a; Epstein et al., 1992). CEST perceives that although the experiential system is both highly efficient and adaptive it can, in some circumstances, be prone to errors and the source of maladaptive biases (Denes-Raj & Epstein, 1994). It is because of the ES’s strong relationship to heuristic thinking, that it is believed to cause irrational inappropriate reactions, including cognitive biases and errors (Epstein, 1991b, 1998d; Epstein et al., 1992; Shiloh, Salton, & Sharabi, 2002). These reactions are then maintained by a failure to control the ES, which is outside of conscious awareness (Epstein, 1991b, 1998c). CEST explains maladjustment (in general) as the dominance of one system over the other or conflicting responses from the two systems, which can result from the conflict between basic needs, and/or as problematic beliefs (Epstein, 1998a). As such it is important to note that maladjustment can result from either system and, therefore, rational or strategic processing does not necessarily equate to adaptive or functional responses.

Research findings support the tenets of CEST and offer evidence for multiple systems of learning and memory. For example, there exists an associative learning system that implicitly acquires knowledge of the world, which cannot be explicitly
called to mind but is directly influencing behavior (Carruthers, 2006; Sherry & Schacter, 1987). In addition, early life experiences are seen as pivotal in the development of individual processing styles (Epstein, 1983, 1990). Individual differences have been observed with regard to an individual’s reliance on the two processing modes, both in general and in specific situations (Burns & D'Zurilla, 1999; Epstein, Pacini, DenesRaj, & Heier, 1996), with implications for adaption, wellbeing and psychopathology being evident (Burns & D'Zurilla, 1999; Claes, Witteman, & van den Bercken, 2009). Although the interplay between the two systems is important, a dominance or deficit in one system has the most significant and problematic implications (Epstein, 1983, 1990).

Empirical support for CEST has also been demonstrated with reasoning tasks and two self-report measures - the Rational-Experiential Inventory (REI; Pacini & Epstein, 1999), a general measure of processing style, and the Perceived Modes of Processing Inventory (PMPI; Burns & D'Zurilla, 1999), a situation specific measure of processing style. Through employing these measures CEST has been examined in relation measures of personality (Epstein et al., 1996), to identity formation (Berzonsky, 2008), coping ability (Epstein, 1992), the impact of emotions on rationality (Pham, 2007), and psychopathology (e.g., Kerns, 2006). In terms of psychopathology, processing styles have been found to be associated with a number of presentations, including depression (Pacini, Muir, & Epstein, 1998), schizotypy (Kerns, 2006), eating disorder related behaviours and coping styles (Claes et al., 2009), and neuroticism (Marks, Hine, Blore, & Phillips, 2008; Pacini & Epstein, 1999) - a personality trait closely linked to GAD (Mackintosh, Gatz, Wetherell, & Pedersen, 2006). Furthermore, these processing styles have been linked to beliefs about the world being predictable and controllable (Klaczynski, Fauth, & Swanger,
1998), and the susceptibility to heuristics and framing effects (Shiloh et al., 2002). Individuals with a less dominant rational processing style demonstrate reduced reasoning and problem-solving performance (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992), factors which are also implicated in pathological worry (Dugas et al., 1995; Hayes et al., 2008).

Reasoning tasks have been used to examine dual-process models as they deliberately place the rational and experiential systems in conflict by requiring analytic/rational processing to override heuristic experiential processing (Denes-Raj & Epstein, 1994; Epstein, Denes-Raj, & Pacini, 1995; Epstein et al., 1996; Kirkpatrick & Epstein, 1992; Pacini & Epstein, 1999; Stanovich & West, 1998). In comparison to verbal based paradigms less empirical research has employed behavioural measures of reasoning. However, behavioural reasoning tasks are appealing for several reasons. First, they engage the experiential mode whilst simultaneously bypassing implicit demand characteristics. For example, individuals who implicitly want others to see them as rational are less likely to engage in attempts to present themselves as rational (Kirkpatrick & Epstein, 1992). Second, behavioural tasks are appealing as the outcomes of both processing modes are immediately and equally accessible (Kirkpatrick & Epstein, 1992). Overall, CEST implicates lower reasoning scores to a low dispositional rational processing style and higher levels of a dispositional experiential processing style (Epstein, 1998c), with findings demonstrating that heuristic responses are significantly correlated with an experiential processing style (Denes-Raj & Epstein, 1994; Denes-Raj, Epstein, & Cole, 1995; Epstein et al., 1996; Kirkpatrick & Epstein, 1992; Pacini & Epstein, 1999; Stanovich & West, 1998).
1.7 Conclusion

Generalised Anxiety Disorder (GAD) is the most understudied of all the anxiety disorders (Dugas, Anderson, Deschenes, & Donegan, 2010), which is concerning considering the negative impact and cost of chronic worry both at an individual (Stein & Heimberg, 2004; Turk & Mennin, 2011; Wittchen, 2002) and societal level (Ballenger et al., 2001; Wittchen, 2002). Furthermore, there is consensus that there is room for significant improvement in regards to treatment outcomes (see: Hanrahan, Field, Jones, & Davey, 2013, for meta-analysis), with treatment found only to be effective for around 50% of patients (Borkovec et al., 2002; Borkovec & Ruscio, 2001; Gould et al., 2004). However, although models of GAD and worry are numerous and encompass both cognitive and emotional aspects of the disorder, no one model stands out in providing a thorough account of the disorder. Theoretical advances and the realization of a cohesive theory of worry/GAD could potentially lead to much needed advances in therapeutic approaches. Foa and Kozak (1997) have called for a synthesis of already acquired knowledge across the disparate psychology literatures in order to progress efficacious treatments (i.e., CBT). For example, a larger-scale synthesis of existing GAD related knowledge and the explicit incorporation of theories of normative behaviour into clinical models might improve the current limitations with regard to theory and, therefore, the treatment of worry (Koerner, 2014). Epstein (1985) also argues that the development of a more cumulative science could be achieved through establishing integrative theory, whereby ‘mini-theories’ can be subsumed under boarder concepts. Therefore, it would seem that, in light of Ouimet et al.’s (2009) and Hirsch and Mathews’ (2012) recent theoretical suggestions, the application of dual-process theory and the role of associative and rule-based processes in accounting for worry/GAD might offer an
overarching framework to conceptualize and understand worry and its associated processes (e.g., cognitive biases). Thus, the current project aimed to explore the applicability of current dual-process theories in accounting for the processes involved in chronic worry and, therefore, GAD.
2.1 Aims and Methods

2.1.1 Statement of Aims

As indicated in the previous chapter, dual-process theories remain largely unexplored in relation to worry, despite theoretical contentions that suggest they would benefit our understanding of the etiology and maintenance of worry (Ouimet et al., 2009; Hirsch & Mathews, 2012). Therefore, the overall aim of the studies included in this thesis is to explore the relationship between individual processing style and worry, and to determine whether the consideration of processing style and patterns of information processing (i.e., relationships between attentional control and attention and interpretation biases) improves our ability to understand heightened levels of worry over and above existing explanations.

This thesis reports the findings from four studies. The first study examined participants’ self-reports of their processing style and worry symptoms (see below) in a large sample of undergraduate students. In addition to self-reported processing style, the remaining three studies included experimental tasks that assessed the implicit processing styles of participants. The overall aim of this thesis was to explore the relationship between all the variables in the current project, with the purpose of testing and providing evidence for current dual-process models of anxiety (e.g., Hirsch & Mathews, 2012), as well as developing a model which incorporated individual processing style. The four studies that were conducted related to the following aims:

1) Questionnaire Study 1: The main aim of this study was to determine whether the processing styles of participants with high levels of worry differed from those with low levels of worry as predicted by Epstein’s (e.g., 1998a) dual-
process theory, Cognitive Experiential Self Theory (CEST). In this proof of concept study, questionnaire measures were employed to determine whether self-perceived processing style differed depending upon self-reported worry.

2) *Empirical Study 2*: An experimental methodology was employed with the aim of corroborating the findings from the first questionnaire study, and further exploring the applicability of CEST in accounting for worry. To this end, we inquired whether participants with high levels of worry demonstrated poorer problem-solving or rational judgment skills (syllogistic reasoning task; inductive preferences task; probabilistic reasoning task) compared to those with low levels of worry.

3) *Experimental Study 3*: Experimental Studies 3 and 4 aimed to examine the relationship of Epstein’s specified individual processing styles and components, such as attentional control, and cognitive biases of attention and interpretation, that are central to models of anxiety and worry (e.g., Hirsch & Mathews, 2012; Ouimet et al., 2009). Therefore, Study 3 focused on the aspect of attention control (with the antisaccade task) and its relationship to processing style and worry and its related symptoms.

4) *Experimental Study 4*: Experimental Study 4 aimed to investigate the relationship between the biases of attentional (dotprobe task) and interpretation (homophone semantic priming task) in individuals who worry, as well as the relationship of attentional control to these biases and, in turn, to Epstein’s processing styles.
2.2 General Methodological Issues

2.2.1 Participants and Procedure

Participants in the current studies were all first year psychology students recruited from the University of Sydney. A subset \((N = 31)\) of the Sample 1, who were recruited to complete the online questionnaire in Study 1, were invited (based on DASS Stress scale scores, see below: Section 2.2.2 p. 69) to participate in studies 2-4 (see Figure 2.1). In addition, the participants \((N = 75)\) recruited for Sample 2 (Study 2-4), also contributed to the data in Study 1. Although the same sample was used across Studies 2-4, the testing protocol required individually running participants through the various tasks over two testing sessions; data was collected from one participant at a time and took a total of two and a half hours per participant (total of 265 hours of testing was undertaken for Studies 2-4). The University of Sydney Human Research Ethics Committee approved all study protocols and all participants provided informed consent before participating (see Appendix A). All participants were offered course credit was for their participation and were informed that after the testing session all collected data would remain de-identified. Inclusion criteria across all the studies were identical. Inclusion criteria included being 18 years or older, having normal, or corrected to normal vision, and a high level of English proficiency.

Worry is increasingly thought of as a transdiagnostic process, seen across the full range of anxiety disorders and in a number of other disorders (Borkovec et al., 1991; Brown et al., 1992; Konstantellou et al., 2011; McLaughlin et al., 2007; Turk & Mennin, 2011). Therefore, present research employed an analogue population of participants with high and low levels of worry, but who did not necessarily have a clinical diagnosis for GAD or any other psychological disorder. The justification for
Sample 1

Online questionnaire battery
(N = 244)

Incomplete Questionnaires
(N = 17)

Complete Questionnaires
(N = 227)

Study 1
(N = 302)

Sample 2

Recruited via prescreen questionnaire – high and low DASS Stress scores
(N = 75)

Individuals with high and low DASS Stress scores recruited for Study 2-4
(N = 31)

Studies 2 – 4
(N = 106)

Figure 2.1: Participant allocation by total project and individual study
using an analogue sample was that there is strong support for qualitatively similar experiences of worry in both clinical and non-clinical and analogue student populations (Borkovec et al., 1983; Stokes & Hirsch, 2010; Vasey & Borkovec, 1992). Additionally, strong support has been found for the dimensional nature of pathological worry, whereby normal and pathological worry are not discrete constructs, rather comprising opposite ends of a continuum (Ruscio, Borkovec, & Ruscio, 2001). Such findings highlight the importance of a transdiagnostic perspective of the process of worry; understanding worry as a process that is common across disorders rather than a discrete diagnostic category. In light of this, research in non-clinical and analogue samples offers several opportunities; such as it allows us to further our understanding of the process of persistent worry without limiting it to a diagnosis of GAD. The decision to select a non-clinical student sample was also arrived at as the current studies are best seen as preliminary investigations of the application of CEST to worry. Nonetheless, because the research was interested in determining factors that differed between those with and without clinical levels of worry, when classifying participant’s levels of worry and symptom scores, only those who endorsed scores within the clinical range (representative of individuals with GAD) on valid and reliable measures of GAD were classified as having high levels of worry. In contrast, those with low levels of worry obtained scores that were well within the range of scores previously found in community normative samples. While the use of extreme samples increases the degree of confidence that the results reflect differences between those with clinical versus normal levels of worry, the degree to which they reflect findings with particular diagnostic groups, such as those with GAD, is unclear.
2.2.2 Prescreen Questionnaire

In order to participate in studies 2-4, a prescreening procedure was used. First year psychology students (approximately 2000) who were studying undergraduate Introductory Psychology at the University of Sydney were asked to complete a battery of questionnaires in the first week of their semester. Although individual researchers cannot access the results of these screening questionnaires, they can nominate a particular range of scores on a questionnaire and only those students who scored in that range are able to access the experiment. In the present study, the Stress scale of the DASS-21 (DASS Stress; Lovibond & Lovibond, 1995a) was used as a screener. Therefore, only participants who either scored in or above the moderate range (19+) or within the normal range (<15) in that pre-screening questionnaire were able to volunteer for the study. These scores were selected based on previous research reflecting distress in clinical samples and community norms (Crawford & Henry, 2003; Lovibond & Lovibond, 1995a; Lovibond & Lovibond, 1995b). A prescreen was used to ensure the examination of the impact of extreme groups. For uniformity, participants from Study 1 who scored within the stipulated high and low range on the DASS Stress scale were also invited to participate.

As the screening battery required consensus across numerous groups of researchers for the inclusion of very brief questionnaires the DASS Stress scale was selected. The DASS Stress scale held the advantage over the PSWQ or the GADQ-IV in that it was the fastest scale to administer. Furthermore, the DASS Stress scale has been demonstrated to measure the emotional symptoms associated with self-reported pathological worry (Brown et al., 1997; Szabo, 2011), and has also been found to have valid discriminate and convergent validity, as well as presenting high internal
consistency, in both clinical and non-clinical populations with worry/GAD (Brown et al., 1997; Crawford & Henry, 2003; Henry & Crawford, 2005).

2.2.3 Determining extreme groups for analyses

In order to create high/low worry groups for analyses the samples in studies 1-4 were split into three groups (high worry/low worry/intermediate worry), once the data had been collected. The splits were undertaken on both PSWQ and GADQ-IV scores (see Table 2.1). The high worry group consisted of participants who endorsed scores, on one of the two scales that, based on previous findings, fell within the clinical range (e.g., PSWQ > 61; GADQ-IV > 15; Brown et al., 1992; Fresco, Mennin, Heimberg, & Turk, 2003; Newman et al., 2002). Where participants were in the high worry group on one scale but were in the low worry group on the other scale, they were not included in analyses. However, if participants reported within the high worry group on one scale and in the intermediate worry group on the other, they were included in the high worry group. In contrast, in order to meet criteria for the low worry group participants were required to score within the normal range on both scales (i.e., PSWQ < 45; GADQ < 5), as based on previous research (Brown et al., 1992; Fresco et al., 2003; Newman et al., 2002). Inclusion criteria differed slightly between Study 1 and studies 2-4 (see Table 2.1), as an attempt was made to generate approximately equivalent participants in both high and low worry groups. Details of the process whereby participants were included and excluded in final analyses are specified in the empirical chapters.

2.2.4 Demographic variables

In order to clarify the generalizability of the sample, demographic variables were collected using a brief demographic questionnaire. The following aspects were assessed:
Table 2.1: *Criteria scores and number of participants per group*

<table>
<thead>
<tr>
<th>Study</th>
<th>PWSQ</th>
<th>Criteria score</th>
<th>GADQ-IV</th>
<th>Criteria score</th>
<th>No. participants for analysis*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>16-35</td>
<td>101</td>
<td>0-4</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>173</td>
<td>36-57</td>
<td>152</td>
<td>5-18</td>
<td>176</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>58-80</td>
<td>80</td>
<td>19-33</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
<td>16-45</td>
<td>35</td>
<td>0-5</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>46-60</td>
<td>35</td>
<td>6-14</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>61-80</td>
<td>36</td>
<td>15-33</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>16-45</td>
<td>31</td>
<td>0-5</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>46-60</td>
<td>31</td>
<td>6-14</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>61-80</td>
<td>33</td>
<td>15-33</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>16-45</td>
<td>32</td>
<td>0-5</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>46-60</td>
<td>30</td>
<td>6-14</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>61-80</td>
<td>32</td>
<td>15-33</td>
<td>34</td>
</tr>
</tbody>
</table>

* see: Chapter 2, Section 2.2.3, p.70, for further details of participants included in high and low worry group analyses
1) Participants were asked to state their age due to research demonstrating that both rational and experiential processing strengthen with age to adulthood, and then begin to decline again in elderly populations (Hutton & Ettinger, 2006; Sladek, Bond, & Phillips, 2010).

2) Gender was also assessed. Although men are more likely than women to endorse higher levels of engagement in rational processing, women are more likely to identify as experiential processors (Pacini & Epstein, 1999). Higher prevalence rates of worry have been found in women, compared to men, although the relationship between gender and worry has been largely overlooked (Robichaud, Dugas, & Conway, 2003; Zlomke & Hahn, 2010).

3) Lastly, ethnic group was assessed by asking participants to endorse their ethnicity from a list of common ethnic groups. There is evidence indicating that GAD is more prevalent in Australian populations (3.6%) than other ethnicities (see: Chapter 1, Section 1.3.3.1 pp. 10-11, for further details).

Results

Although a subset of the participants in Study 1 also completed studies 2-4 (see Figure 2.1), analyses revealed little variation in terms of demographic variables. Across all the studies, participants ranged from 18 to 49 years of age, with the 302 participants included in Study 1 having an average age of 19.29 (SD = 2.89), whilst the 106 participants in studies 2-4 had an average age of 19.79 (SD = 4.51). The sample was predominantly female in both Study 1 (72.7% women; 26.1% men; 1.2% other) and studies 2-4 (75.5% women; 24.5% men). With regard to ethnicity, in Study 1, 49.5% stated their ethnicity as Australian, and 24.9% stated they were of either South-East Asian (e.g., Vietnamese, Indonesian), North-East Asian (e.g., Chinese, Korean), or Southern and Central Asian descent. Similar to Study 1, the sample in
studies 2-4 were of a majority of Australian descent (43.4%), however, 22.6% stated their ethnicity as North-Western European (e.g., UK, Irish, German) or Southern and Eastern European (e.g., Italian, Macedonian, Polish, Russian), whilst only 20.7% of the participants were of Asian descent. Participants’ first language was predominantly stipulated as English for both Study 1 (55.9%) and studies 2-4 (79.2%).

2.2.5 Questionnaires

The following measures were given to all participants in the current studies (a copy of all the measures included in this project can be found in Appendix D). The Cronbach’s α for each measure used in the current project are available in Table 2.2. Evidence supporting the reliability and validity of the processing style and symptoms measures is discussed below.

2.2.5.1 Processing Style Measures

To determine an individual’s level of experiential and rational thinking two self-report measures were used: the Rational-Experiential Inventory (REI; Pacini & Epstein, 1999), a general measure of trait processing style, and the Perceived Modes of Processing Inventory (PMPI; Burns & D’Zurilla, 1999), a situation specific measure of state processing style. Although the REI and PMPI both measure rational and experiential processing styles, they include different questions that assess state and trait processing style, respectively. The PMPI has been validated as a measure of situational or state (rational and experiential) processing style, which examines how individuals perceive themselves to respond when they are actively engaged in worry. In contrast, the REI has been validated as a trait or general measure of (rational and experiential) processing style that examines how individuals perceive themselves more generally (REI).
Table 2.2: Cronbach’s α scores for Processing Style and Symptom Measures described above.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processing style</strong></td>
<td></td>
</tr>
<tr>
<td>REI-R</td>
<td>.772</td>
</tr>
<tr>
<td>REI-E</td>
<td>.801</td>
</tr>
<tr>
<td>PMPI-R</td>
<td>.879</td>
</tr>
<tr>
<td>PMPI-E</td>
<td>.882</td>
</tr>
<tr>
<td><strong>Symptom measure</strong></td>
<td></td>
</tr>
<tr>
<td>DASS</td>
<td>.943</td>
</tr>
<tr>
<td>PSWQ</td>
<td>.867</td>
</tr>
<tr>
<td>GADQ</td>
<td>.871</td>
</tr>
</tbody>
</table>
Rational-Experiential Inventory (dispositional processing style)

The Rational-Experiential Inventory (REI; Epstein et al., 1996) is a 40-item self-report questionnaire measuring two independent, orthogonal constructs (Bjorklund & Backstrom, 2008; Epstein et al., 1996; Pacini & Epstein, 1999); the rational scale and the experiential scale. It is a cross-culturally valid and reliable measure of trait processing style (Bjorklund & Backstrom, 2008; Epstein et al., 1996; Witteman, van den Bercken, Claes, & Godoy, 2009). The REI measures trait or dispositional processing style and asks participants to respond by indicating the number that best represents their feelings about each statement. The rational scale consists of two sub-scales: rational ability (10 items; e.g., “Using logic usually works well for me in figuring out problems in my life”) and rational engagement (10 items; e.g., “I enjoy thinking in abstract terms”). Similarly, the experiential scale consists of two 10-item subscales: experiential ability and experiential engagement. Participants are asked to respond on a five-point Likert scale, where “1” is completely false and “5” is completely true of themselves. Nineteen items are reverse coded before each subscale is summed and divided by 10 to give total scores.

Perceived Modes of Processing Inventory (situational processing style)

The Perceived Modes of Processing Inventory (PMPI; Burns & D'Zurilla, 1999) is a 32-item self-report measure of situational (state) processing style; in the current studies it specifically asked participants to “consider yourself as you typically cope with situations which cause you worry in your life”. It assesses three perceived information-processing styles, two of which were examined in this study: the 12-item Rational Processing scale (e.g., “I usually stick to the “facts” and try to use a logical approach to cope”) and the 10-item Emotional Processing scale e.g., “My feelings usually determine how I will cope”. As this study’s focus was on worry, participants
were asked to self-report on their dominant mode of information processing in situations in which they worry specifically. Scores in each of the subscales are summed to give a total score. The PMPI has been found to have high internal consistency and to be a valid and reliable measure (Burns & D'Zurilla, 1999).

2.2.5.2 Symptom measures

The following symptom measures were selected as they are the most commonly used screening tools for worry and generalised anxiety disorder that are employed both in research and clinical practice.

The Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) was developed as a 16-item self-report questionnaire to assess chronic pathological (or trait) worry. Participants are required to rate items such as “My worries overwhelm me” on a Likert scale of one to five, where one is not at all typical and five is very typical. Items one, three, eight, 10, and 11 are reverse scored then all 16 items are summed to give a possible score range of 16-80, where higher scores are suggestive of more worry. The PSWQ is commonly used in both research and clinical practice with evaluation on both clinical and non-clinical populations demonstrating the PSWQ to have good convergent and discriminant validity, as well as good reliability and consistency (Brown et al., 1992; Meyer et al., 1990; Molina & Borkovec, 1994).

Generalised Anxiety Questionnaire – IV

Measurement of symptoms of generalised anxiety disorder (GAD) encompasses not only the act of worrying but the physiological symptoms that accompany it. Newman et al.’s (2002) self-report the Generalised Anxiety Disorder
Questionnaire – IV (GADQ-IV), is a measure of GAD symptomatology based on DSM-IV criteria (Newman et al., 2002). The GADQ-IV consists of nine questions: five yes/no questions, one question asking individuals to rate their symptoms of worry, another asking participants to check from a list of physiological symptoms such as “Restlessness or feeling keyed up or on edge”, and two Likert scale questions where participants rate distress (i.e., “How much are you bothered by worry and physical symptoms (how much distress does it cause you)?”) and interference (i.e., “How much do worry and physical symptoms interfere with your life, work, social activities, family, etc.?”) on a scale of zero to eight where “0” is none and “8” is very severe.

Continuous scoring was used for the GADQ-IV whereby a sum total of the responses was calculated. Newman et al. (2002) devised this scoring system in an attempt to generate scores that best reflected DSM-IV diagnostic thresholds for the diagnosis of GAD. In order to determine a total score, all questions that are answered with “yes” are scored as “1” and all answers with a ‘no’ recorded are scored as “0”. The numbers circled for items eight and nine (distress and interference) were divided by four before being added to give a total score. Total scores ranged from 0-33. Previous research has found the GADQ-IV to have good internal consistency, test-retest reliability, strong convergent and discriminant validity, as well as having good specificity and sensitivity (Newman et al., 2002).

**Depression Anxiety Stress Scale**

The DASS Stress scale is one of three subscales from the Depression Anxiety Scale 42 (DASS; Lovibond & Lovibond, 1995a) It is a 14-item scale that measures the emotional symptoms associated with self-reported pathological worry (Brown et al., 1997; Szabo, 2011) and evaluates symptoms of tension (“I was in a state of
nervous tension”), irritability (“I felt that I was rather touchy”), agitation (“I felt that I was using a lot of nervous energy”), impatience (“I found myself getting impatient when I was delayed in any way”), and an inability to relax (“I found it difficult to relax”). Respondents are asked to indicate which number best represents how much the statements (14 questions) applied to them over the past week, where “0” = did not apply to me at all and “3” = applied to me very much, or most of the time. Scores on each subscale are then summed to give a total score, with scores ranging from 0-42. Individuals who score in the 0-14 range are classed as being within the normal population, 15-18 in the mild range, 19-25 in the moderate range, 26-33 in the severe range and 37+ in the extremely severe range (Lovibond & Lovibond, 1995b).

Although the DASS was originally developed to assess levels of stress, it is often used as a measure to screen for GAD. Whilst the PSWQ and the GADQ-IV encapsulate the cognitive processes present in worry, previous research has demonstrated that the DASS Stress scale captures the specific emotional experience accompanying worry (Szabo, 2011). It demonstrates valid discriminate and convergent validity, as well as presenting high internal consistency, in both clinical and non-clinical populations (Brown et al., 1997; Crawford & Henry, 2003; Henry & Crawford, 2005).

2.3. Experimental Task Selection

Most dual-process theories have as their core assumption the fact that it is not just the content of people’s thoughts but the way in which they process information that is important to the development of psychopathology (e.g., Epstein, 1998c; Ouimet et al., 2009; Beck & Clark, 1997). Hence, there is a focus on implicit processes. By their nature, most theorists would agree that implicit processes are not always in the conscious realm and, as such, are better assessed through experimental
tasks that assess particular processes. Therefore, in the present thesis, an effort has been made to assess the implicit processes that are hypothesized to have a role in the development or maintenance of pathological worry. The tasks employed in the current study are described below.

2.3.1 Study 2: Problem-solving and Reasoning Tasks

In addition to dual-process theories, models of pathological worry highlight the importance of reasoning and problem-solving (Borkovec et al., 1998; Brown, 1997; Szabo & Lovibond, 2002). Problem-solving and reasoning with regard to worry and GAD have predominantly been explored with self-report questionnaires that query perceived reasoning ability (e.g., Davey, 1994b; Gosselin, Dugas, & Ladouceur, 2002; Ladouceur et al., 1998). In order to improve upon self-report methodologies, as well as assessing the application of Epstein’s dual-process model to the process of worry, tasks were selected that have been previously, and most commonly, used to examine individuals’ reasoning abilities with regard to the relationship between the rational and experiential systems.

The selected tasks were vignettes and behavioural measures of reasoning that have been demonstrated to place the two systems (rational and experiential) in conflict, which is integral to the dual-process literature (see Chapter 1, Section 1.6, pp. 48-61 for further discussion). Errors observed on reasoning and judgment tasks that relate to principles of heuristic responding represent the operation of the experiential system (Epstein et al., 1992). It has been found that when problem-solving and reasoning, people often ignore statistical concepts such as base rates and rely on judgmental heuristics such as availability, anchoring effects, and salience (Denes-Raj & Epstein, 1994; Nisbett, Krantz, Jepson, & Kunda, 1983). Therefore, examining participants’ performance on reasoning tasks allowed for the examination
as to whether these negative beliefs correspond to actual deficits in actual reasoning, problem-solving implementation and to a specific processing style.

In measuring reasoning ability, traditionally there are three types of reasoning most commonly examined: (i) deductive reasoning, (ii) statistical inference or inductive reasoning and (iii) probabilistic reasoning. Based on previous research in the reasoning and dual-processing literatures, three tasks were selected for Study 2 to match each of these components of reasoning ability: a deductive reasoning task (Markovits & Nantel, 1989; Sa, West, & Stanovich, 1999), an inductive reasoning task (Fong, Krantz, & Nisbett, 1986; Jepson, Krantz, & Nisbett, 1983; Stanovich & West, 1998), and probabilistic reasoning task (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992). See Chapter 4, Section 4.1.3 pp. 122-124 and Appendix E for further details of the tasks. Although these tasks have yet to be applied in research examining individuals who worry, they were selected as they are well established and frequently used paradigms in the wider reasoning literature and have been used to demonstrate evidence for dual-processing models (e.g., Denes-Raj & Epstein, 1994; Evans, Over, & Manktelow, 2008; Kirkpatrick & Epstein, 1992; Sa et al., 1999; Stanovich & West, 1998; Stupple, Ball, & Ellis, 2013). A brief description of the reasoning tasks used in the current project follows:

2.3.1.1 Deductive reasoning: Syllogistic reasoning task

Deductive reasoning tasks are most commonly employed in research examining human reasoning, whereby the effect of prior knowledge, beliefs, and opinions in disrupting impartial rational responses to arguments can be examined. For the current project a task taken from Markovits and Nantel (1989) and adapted by Stanovich and West (1998) and Sa, West, and Stanovich (1999; see Appendix A for items) was employed.
The task involves participants being presented with two premises and a conclusion, which they are required to decide whether the conclusion follows logically from the premises (even if the premise is not in itself believable), assuming that the premises are true. For example, for Ben to graduate he needs a C average and Ben graduates, so we can logically conclude that he has a C average. The logical validity of the item is important and some of the items are logically valid despite the fact that the premises are known to be untrue (e.g., All things that are smoked are good for the health and cigarettes are smoked, so we can logically conclude that cigarettes are good for health). Participants are given one point for every logical deductive reasoning response these are summed to give a total deductive reasoning score.

2.3.1.2 Statistical reasoning: Inductive preferences task

Inductive reasoning tasks have been used to examine heuristics and biases and have largely been examined in research that is separate to deductive reasoning (Stanovich & West, 1998). Responses to inductive reasoning tasks offer the opportunity to examine the tendency for human judgment to be influenced by compelling but unrepresentative personal and case evidence at the cost of considering more representative, diagnostic, statistical evidence (Stanovich & West, 1998). In contrast to deductive reasoning, where conclusions are either valid or invalid, inductive reasoning problems present premises, which offer information that allows for a probable or credible conclusion to be drawn. The questions used in the current study were multi-choice questions similar to those used in Stanovich and West (1998), which were adapted from Fong et al. (1986) and Jepson et al. (1983).

The items selected to examine inductive reasoning simulate real-life decisions, for example, a vignette is presented about Henry who is trying to make a decision
between two university classes he wants to take. The vignette states that “past student course evaluations indicate that Course A is better taught. However, Henry attended the first meeting of both classes and found that Course B seemed to be better”. Participants are then asked to choose between four alternatives with regard to what they think Henry should do. Each question provided different information that was in some instances conflicting. For example, participants were provided with statistical evidence as either probabilistic or aggregate base-rate which supported the information provided (i.e., past student evaluations in the case of Henry), as well as being given concrete case or personal experience that was counter to the information provided (i.e., Henry’s opinion after attending the first meeting of both classes). Participants employing statistical principles (rational processing) should avoid making inferences based on small samples or the personal case experience (experiential processing), and one point is awarded for every answer employing statistical principles. The sum of these is the total score. Previous research has published significant findings with a multiple choice question structure (Stanovich & West, 1998), this was, therefore, selected for the current study.

2.3.1.3 Probabilistic reasoning task: Jellybean game

Probabilistic reasoning tasks are also used to demonstrate conflict between the rational and experiential processing systems. People have been found to judge the probability of an unlikely event as lower when it is presented in the form of a ratio of smaller rather than larger numbers. The behavioural probabilistic reasoning task included in the current study followed the method described in Denes-Raj and Epstein (1994) and Kirkpatrick and Epstein (1992), which was adapted from Miller, Turnbull, and McFarland (1989). For example, when participants are offered two containers, the first containing one red of 10 beans and the other 10 red of 100 beans, which both
contain 10% red beans. Studies have demonstrated that over two thirds of participants demonstrate the ratio-bias phenomenon and will select from the container with the larger number of beans, which reflects the non-optimal, subjective choice and engagement in heuristic experiential processing (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992). In order to make the rational choice, a dominance of rational processing is required in order to override experiential processing which would result in the subjective, heuristic choice. Therefore, the size (big or small) of the container that participants choose is recorded as the dependent variable. A subjective probability score between 0-4 is calculated from the responses; scores are calculated by the choice of container which is coded as “0” or “1” depending on whether participants chose the subjective choice, which reflected engagement in heuristic experiential processing (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992).

In the current study there were two win conditions and two lose conditions, whereby choosing a red bean meant either a win (win condition) or a loss (lose condition) of one point. Probabilities of winning or losing in the four conditions are presented in Table 2.3. Although the mathematical probabilities in the two bowls were identical, many people have a gut-level preference for one bowl or the other. In the ‘win’ conditions, the heuristic choice is the large container on the 10% win condition as individuals have a tendency to view the odds as more favorable when the ratio is expressed in larger (e.g., 10 white beans in 100 red beans) than smaller (e.g., one white bean in 10 beans) numbers, with the opposite being true for the 90% win condition. Conversely, on lose conditions, the odds are perceived as more favorable when the ration is expressed in smaller than larger numbers on the 10% lose condition, and more favorable when expressed in large numbers (10 in 90 rather than
Table 2.3: Probabilities of winning or losing in the four conditions of the probabilistic reasoning task

<table>
<thead>
<tr>
<th></th>
<th>10% Probability</th>
<th>90% Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Win</td>
<td>Condition 1</td>
<td>Condition 2</td>
</tr>
<tr>
<td>Lose</td>
<td>Condition 3</td>
<td>Condition 4</td>
</tr>
</tbody>
</table>
one in nine) on the 90% lose condition (Kirkpatrick & Epstein, 1992). One point was given for every heuristic choice participants made, these were then summed to give a total subjective probabilistic reasoning score.

2.3.2 Study 3: Attentional Control

Individual differences in attentional control are argued to have implications for information processing biases and the development of chronic worry (Hirsch & Mathews, 2012; Salemink & Wiers, 2012), with attentional control being found to moderate the relationship between attentional bias and levels of worry (Bardeen et al., 2014). See Chapter 1, Section 1.5.3.2, p. 39 and Chapter 6 for a full discussion. To date, studies have predominantly measured attentional control using self-report, most commonly the attentional control scale (Derryberry & Reed, 2002). This has consistently been stipulated as a limitation to this area of enquiry, as it is argued that self-report measures examine beliefs about attentional control rather than providing an index of actual attentional control abilities (Fergus et al., 2012; Spada, Georgiou, & Wells, 2010).

However, to demonstrate attentional control deficits in individuals with high levels of worry, Hayes and colleagues (2008) employed a non self-report random key-pressing task, which was also used in conjunction with the N-back task by Stefanopoulou et al. (2014). The random key-pressing task required participants to press a random key (different from the last key pressed on the key board) whenever they heard a beep and to return to thinking about a presented thought (e.g., “what would be bad about that”), or in the case of Stefanopoulou et al.’s (2014) study it was given in conjunction with the N-Back Task. The N-Back task requires participants to watch a sequence of letters, and to press a key whenever an item is identical to the one presented “n” positions before.
Although these methodologies are an improvement on studies that have predominantly relied on self-report measures, they are not without their limitations. Namely, using differences in RTs to measure cognitive processes has been argued to be unreliable (Borkenau, Paelecke, & Yu, 2010). There has also been suggestion that RT measures access momentary personal or contextual factors that result in findings on RT tasks not consistently being replicated (Barden, Maddux, Petty, & Brewer, 2004; LeBel & Paunonen, 2011); results on RT measures vary considerably as a function of physiological, hormonal, emotional and other changes in the respondent (LeBel & Paunonen, 2011). For example, response execution is susceptible to disruption effects that are suggested to be particularly problematic in highly emotional participants or when using emotion provoking stimuli (Mogg & Bradley, 2006). Furthermore, manual RT data must not only infer the allocation of attention but also take into account that the distal relation between key presses may be open to confounding effects of emotional information and mediating processes (Armstrong & Olatunji, 2012; Mogg & Bradley, 2006). Therefore, one task that appears promising and improves on the limitations of both self-report and reaction time tasks is the antisaccade/prosaccade task. It examines saccadic eye movements and has been frequently employed in the wider anxiety literature to examine attentional control (Camchong, Dyckman, Austin, Clementz, & McDowell, 2008; Clementz, McDowell, & Stewart, 2001; Hutton & Ettinger, 2006; McDowell et al., 2002; McDowell, Dyckman, Austin, & Clementz, 2008; McDowell et al., 2005). This task will be discussed in the next section

2.3.2.1 The Antisaccade and Prosaccade tasks

The antisaccade task was first introduced by Hallet in 1978 (see: Hutton, 2008, for reviews; Hutton & Ettinger, 2006), and involves participants being given a
cue, which requires them to look towards or away from an object/image presented on
the screen whilst their eye movements are measured (Derakshan, Salt, & Koster,
2009; Hallett, 1978; Hutton, 2008; Hutton & Ettinger, 2006; Nummenmaa, Hyona, &
Calvo, 2006; Taylor & Hutton, 2009; Wieser, Pauli, & Muehlberger, 2009). The
antisaccade task requires participants to enact control over their attention, specifically
to inhibit the reflexive saccade responses. Participants unconsciously are drawn to
look toward a visually presented stimuli on either the left or right of a central
fixation, even though they have been instructed to direct attention/generate volitional
saccades in the opposite direction (see Figure 5.1, Chapter 5 p. 139). In contrast, the
prosaccade task, which is presented with the antisaccade task (either in separate
blocks of trials, or alternating with antisaccade trials), requires participants to make
the natural response and enact a saccade (look) towards the presented stimuli. The
most common variables of interest in the antisaccade/prosaccade task are latency and
error rate. Antisaccade latencies have been typically found to be 100-150ms longer
than in prosaccade (Munoz & Everling, 2004). Compared to their non-anxious
counterparts, individuals with anxiety have been found to demonstrate increase
latency on the antisaccade, but not prosaccade task, whereas error rates have been
found to be unrelated to levels of anxiety (Ansari & Derakshan, 2011b; Ansari,
Derakshan, & Richards, 2008; Antoniades et al., 2013; Everling, Dorris, & Munoz,
1998; Fischer et al., 1993; Hartnegg & Fischer, 2002).

The simplicity of the antisaccade methodology has led to it being employed to
examine various aspects of psychopathology (Gooding & Basso, 2008; Hutton &
Ettinger, 2006). Since its introduction it has since been a useful tool for examining
various aspects of cognition including control of attention, working memory, and to
simultaneously examine reflexive and volitional responses - processes which have all

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be implicated in the development and maintenance of worry (e.g., Hayes et al., 2008; Hirsch & Mathews, 2012; Stefanopoulou et al., 2014) and in anxious individuals (Derakshan, Salt, et al., 2009; Hallett, 1978; Hutton, 2008; Hutton & Ettinger, 2006; Nummenmaa et al., 2006; Taylor & Hutton, 2009; Wieser et al., 2009)

The appeal of the antisaccade task for the current project lies both in previous research findings demonstrating an effect of anxiety on attentional control, as well as the tasks ability to simultaneously examine both volitional and reflexive responses (components of dual-process models) in individuals endorsing high and low levels of worry. The creation of a ‘process-pure’ measure of information processing has proved to be extremely difficult, as all measures comprise a mix of multiple distinct automatic and strategic processes (Sherman et al., 2008). Thus, in the absence of a ‘process pure’ measure of the information processing systems (Sherman et al., 2008), the antisaccade task offers a more direct measure of rational processing and the relationship between the systems, as well as outcomes when the two systems are put into conflict.

2.3.3 Study 4: Cognitive Biases Tasks

Fear and anxiety are important, normal, and adaptive reactions to threat, as they enable one to determine potentially threatening stimuli so that cognitive, affective, and behavioral processes can be activated to ensure safety is maintained (LeDoux, 1996). However, these processes are over-activated in pathological anxiety, with individual differences in the processing of threat-relevant material argued to lead to the development and maintenance of anxiety (Beck & Clark, 1997). One popular approach that allows a more direct examination of the role of automatic and strategic processes concurrently is to employ methodologies that measure cognitive biases. The role of erroneous information processing, particularly threat-relevant cognitive biases...
are well established as having a role in the development and maintenance of anxiety disorders (Mathews & MacLeod, 2005). However, what remains in contention is whether biases are a result of automatic or strategic processes (Beck & Clark, 1997; Matthews & Wells, 2000; McNally, 1995). McNally (1995) suggests that whilst biases may be involuntary and unconscious, they are not resource-free or effortless. Ouimet et al. (2009) argue that examining the basic mechanisms of these processes may at least provide an integrative dual-process framework that can guide and enable future research and intervention. Therefore, although it is important to acknowledge the limitations of distinctions between the systems, and methodologies to capture these automatic or unconscious processes have been extensively researched with findings clearly highlighting the presence of cognitive biases.

2.3.3.1 Attentional Bias Tasks

Models of pathological anxiety/worry suggest that individuals who are prone to worry are more likely to orient their attention towards threat and subsequently are unable to disengage from that threat (Ouimet et al., 2009; Hirsch & Mathews, 2012). Cisler and Koster’s (2010) integrative review considers the three components of attentional bias and their role in anxiety. These components are facilitated attention for threat, delayed disengagement from threat, and attentional avoidance. *Facilitated attention* for threat refers to the speed with which attention is orientated to threatening stimuli has been the most consistently observed of the attentional processes in anxiety. *Delayed disengagement* from threat refers to the degree to which, once a stimulus has become the focus of attention, it holds attention and impacts the switching of attention away from threat. Aside from one study (Carlson & Reinke, 2008), which employed masked stimuli, consistent evidence of difficulty disengaging
from threat has been observed in individuals with anxiety on the dot probe task (Koster, Crombez, Verschuere, & De Houwer, 2006; Koster, Crombez, Verschuere, & De Houwer, 2004; Salemink, van den Hout, & Kindt, 2007c). However, the observation of delayed disengagement appears dependent upon presentation times, in addition to threat intensity (see: Cisler, Bacon, & Williams, 2009, for review).

Overall, there is mutual agreement that individual differences in attention to threat are central to our understanding of anxiety (e.g., Beck & Clark, 1997) and GAD (e.g., Hirsch & Mathews, 2012), theories of attentional processing differ in the emphasis that they place on the various stages of processing (e.g., Fox, Russo, Bowles, & Dutton, 2001). Some authors argue that the key characteristic in anxiety disorders is the inhibition in disengagement from threat (Gole, Koechel, Schaefer, & Schienle, 2012), whilst others argue that it is the initial orientation and engagement with threat or avoidance which are central (e.g., Hirsch et al., 2011; Koster et al., 2007; Mackintosh & Mathews, 2003; Oathes, Squillante, Ray, & Nitschke, 2010; Sagliano, Trojano, Amoriello, Migliozzi, & D'Olimpio, 2014). Although attention to threat is a normal adaptive function for all humans, reduced ability to control or stop attending to threatening stimuli may result in a specific vulnerability to pathological anxiety (e.g., Ouimet et al., 2009). Attentional biases are relevant to the current research as they are implicated in the activation of internal representations of threat, which if not able to be inhibited by voluntary control or if the emotional experience cannot be processed, may lead to the development of worry (Hirsch & Mathews, 2012; Ouimet et al., 2009).

Therefore, due to attentional bias having important implications in understanding the process of worry we considered a range of potential paradigms thought to assess attentional bias for threat (see: Bar-Haim et al., 2007, for meta-
analysis). Specifically, we also wished to examine attentional bias so as to further explore the suggested relationships between attention and interpretation biases, as well as attentional control. However, although visual search and spatial cuing tasks have been employed in the study of worry and GAD, the most common measures of attentional bias tasks in the anxiety literature are the modified dotprobe task and the emotional Stroop task (Cisler & Koster, 2010). The e-Stroop (see: Bar-Haim et al., 2007, for review) task requires participants to label colors of emotionally valenced words, which are usually presented in categories (e.g., negative, neutral, positive). High-anxiety has been shown to slow the naming of colors in negatively-valence words and greater interference has been observed in anxious participants’ naming of the colours of threat-related words (Bar-Haim et al., 2007).

Although the Stroop task has been widely employed in the study of anxiety/worry, significant limitations have been documented. For example, it is unclear whether results may be influenced by late stage processes, which are unrelated to attention (Algom, Chajut, & Lev, 2004; Bar-Haim et al., 2007). In assuming the results do relate to attention, it cannot be determined whether findings in anxious participants on the Stroop task are a result of attention being drawn toward threatening stimuli, if delayed responding is related to enhanced attention and/or delayed responding to threat (Algom et al., 2004), or whether the observed automatic attentional bias is in fact related to deficits in maintaining attentional focus (Fox, 1993). Additionally, emotional inference effects are also observed. This suggests that all words presented are automatically processed for meaning, but subsequently disregarded if irrelevant. However, when presented with a word that is highly related to one’s current concern, rejection is seen as irrelevant, and, therefore, responding is slower (Algom et al., 2004). Overall, the most commonly cited criticism of the Stroop
task is that response bias cannot be ruled out, whereby participants demonstrate inhibited responsiveness in the presence of threatening stimuli (Cloitre, Heimberg, Holt, & Liebowitz, 1992; McNally, 1996). In contrast, the modified dot probe paradigm - the primary measure used in the field - has over 100 published studies and is considered the gold standard for investigating attentional bias for threat (Bar-Haim et al., 2007; Cisler & Koster, 2010; Fox et al., 2001; Kappenman, Farrens, Luck, & Proudfit, 2014; MacLeod et al., 1986). Widespread use of the dot probe paradigm has influenced the manner in which we conceptualize and understand attentional bias (Staugaard, 2009).

The dot probe paradigm was developed by MacLeod et al. (1986) to overcome the problems with the Stroop task in examining aspects of psychopathology (Bar-Haim et al., 2007). Typically it consists of the presentation of two different valenced stimuli (e.g., emotional faces; one neutral and one angry) to either side, or to the top and bottom, of a central fixation on a screen (see Figure 6.1, p. 177). This is then followed by the presentation of a dot in place of one of the stimuli, to which participants are required to indicate the location as quickly as possible. Trials are congruent - with the probe and threatening stimuli placed in the same location - or incongruent - whereby the probe and threatening stimuli are placed in opposite locations. Despite the aforementioned limitations with reaction time (RT) measures, as mentioned previously examining RTs on the dot probe task is the gold standard for investigating attentional bias for threat (Bar-Haim et al., 2007; Cisler & Koster, 2010; Fox et al., 2001; Kappenman et al., 2014; MacLeod et al., 1986); Reaction times (in milliseconds) are the dependent variable with shorter response times indicating that attention has been allocated to the area of the screen where the probe appeared.
Longer RTs indicate that attention was required to be shifted to an unattended area in order to detect the probe.

The selection of the dot probe task over the Stroop task was also informed by the advantage of being able to simultaneously examine the processes of engagement and disengagement by differing not only the presentation stimuli (i.e., threatening vs neutral faces), but also the presentation duration (Carlson & Reinke, 2008; Fox, Mathews, Calder, & Yiend, 2007; Fox, Russo, & Dutton, 2002; Koster et al., 2004; Mathews, Fox, Yiend, & Calder, 2003; Mogg et al., 2000). Findings suggesting the influence of contextual factors (Fox, 1996) on automatic processing biases, led to the examination of both early (engagement i.e., latencies < 500ms) and late (disengagement - latencies between 500-1000ms) attentional processes, which are of particular interest in the current project given its focus on a dual-process model of worry. Despite the variables of interest in the current study being able to be examined most efficiently by the use of a dot probe task, it must, however, be noted that examining manual reaction times (RTs) on the dot-probe task is only “snapshot”, restricted to a single time point within a trial (Armstrong & Olatunji, 2012; Mogg & Bradley, 2006). This imposes limits on the ability to effectively and efficiently examine dynamic attentional processes.

In order to explore early and late attentional processes in the context of dual-process models, the current study examined responses to stimuli presented across a variety of presentation times. To date, dot probe studies examining attentional bias in individuals with worry/GAD have predominately employed unmasked word based stimuli presented at 500ms, 1000ms, or 1250ms (see: Mogg & Bradley, 2005 for review), with only two studies employing masked word-based stimuli presented at shorter durations times of 14ms - 50ms (Mathews, Ridgeway, & Williamson, 1996;
Mogg, Bradley, & Williams, 1995). However, in the wider anxiety literature, there is also good evidence of attentional bias occurring at 100ms (e.g., Koster et al., 2007) and, although results are less clear, at very short durations (e.g., 28ms), and longer durations (e.g., 200msec and 500 msec) also (e.g., Koster et al., 2007; Mackintosh & Mathews, 2003; Sagliano et al., 2014).

In light of previous research, 16ms, 33ms, and 100ms stimuli presentation duration times were selected to examine early attentional processes in the current project. The 33ms and 100ms timeframes have been used previously to demonstrate early stage attentional biases (e.g., Carlson & Reinke, 2008; Koster, Crombez, Verschuere, Van Damme, & Wiersema, 2006; Koster et al., 2007). Furthermore, as attentional orientation processes are suggested to occur earlier than 30ms (Ouimet et al., 2009), with some evidence suggesting that faces are processed subliminal even at presentation times of 16ms (Wronkaa, Walentowskaa, & Asanowiczb, 2010), a 16ms stimuli presentation time was also selected. In terms of later stage processing biases, 200ms, 500ms and 1500ms stimuli presentation times were chosen as there is a body of evidence suggesting that when stimuli are presented at these timeframes attentional biases (namely avoidance and disengagement) are observed (e.g., Koster, Crombez, Verschuere, Van Damme, et al., 2006; Koster et al., 2007; Mogg, Bradley, De Bono, & Painter, 1997).

Facial stimuli were selected for the current study as they have been argued to be more ecologically valid as they are more salient and threatening than words, due to the recognition of facial stimuli being an automatic processes that can occur without awareness (Morris, Öhman, & Dolan, 1998). The reliability of the dot probe tasks using photographic facial images has also been found to be more robust (Staugaard, 2009). Valenced images may be more strongly related to affective information in
GAD than words, as images have privileged access to the systems in which affective information is stored (Glaser & Glaser, 1989; Gotlib, Krasnoperova, Yue, & Joormann, 2004). Additionally, we are biologically wired to analyze facial expressions of emotion, especially anger (Esteves, Dimberg, & Öhman, 1994; Fox et al., 2001). Therefore, pictures of neutral and angry facial expressions - employed in previous dot probe tasks in anxious populations (Carlson & Reinke, 2008; Fox et al., 2007; Mogg et al., 2000) - were selected as stimuli for the current project.

2.3.3.2 Interpretation Bias Task

Interpretation relates to the process by which meaning is determined from ambiguous information with the aim of constructing a mental representation. The resolution of ambiguous events and situations (which can occur with or without awareness) is fundamental to our everyday lives, as we are constantly presented with situations that we must decipher. For example, determining the meaning behind a comment or a loud noise in the night (Blanchette & Richards, 2010). Of most interest to researchers is the impact of emotional states on the resulting interpretations of different situations. Specifically, the ability to accurately determine ambiguous signs, which could be related to danger or harm and are vital for our adaptive functioning and survival (Blanchette & Richards, 2010).

Models, in particular dual-process models, of pathological worry suggest that individuals who are prone to worry are more likely interpret ambiguous information as threatening (Beck & Clark, 1997; Hirsch & Mathews, 2012). In fact, as stipulated previously, individual differences in the processing of threat-relevant material are suggested to be causal in the development and maintenance of anxiety and worry (e.g., Beck & Clark, 1997; Hirsch & Mathews, 2012; Mathews & Mackintosh, 2000; Mathews, Ridgeway, Cook, & Yiend, 2007; Salemink, van den Hout, & Kindt, 2007a,
2007b), with Cognitive Bias Modification (CBM) studies confirming such suggestions (e.g., Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Salemink et al., 2007b; Salemink, van den Hout, & Kindt, 2009). Both Hirsch and Mathews (2012) and Ouimet et al. (2009) argue that individuals with high levels of worry should be able to be distinguished from those with low levels of worry based on biases of interpretation, which in turn can be expected to be related to low levels of rule based processes (e.g., reasoning and attentional control). Refer to Chapter 1, Section 1.5.3, pp. 31-44, for a more detailed account. Research supports the aforementioned theoretical suggestions with anxious individuals tending to interpret ambiguous stimuli as threatening (e.g., Blanchette & Richards, 2003; Dugas, Hedayati, et al., 2005; Eysenck, Mogg, May, Richards, & Mathews, 1991; Halberstadt et al., 1995; Mathews et al., 1989; Mogg et al., 1994).

Homophone (e.g., “sleigh/slay”) spelling tasks have traditionally been employed to examine interpretation bias, despite this methodology producing inconsistent findings (Blanchette & Richards, 2003; Lawson & MacLeod, 1999; Mathews et al., 1989). Such tasks aurally present a list of words for participants to spell. Some of the words are ambiguous in that they are homophones with two possible meanings. Ambiguous sentence tasks have also been employed to examine interpretation bias. For example, Eysenck et al. (1991) presented ambiguous sentences to participants with clinically diagnosed anxiety disorders and found that they provided threatening (rather than non-threatening) interpretations compared to non-clinically anxious individuals. Interpretation bias for threat has also successfully been observed in anxious participants with memory recognition paradigms. This research involved participants being presented with a series of ambiguous sentences (threatening or neutral) and being requested to rate the unpleasantness before
completing an unexpected memory recognition test for disambiguated variants (threatening/ non-threatening) of the sentences.

Overall, with regard to paradigms exploring interpretive bias in individuals with high levels of worry/GAD (i.e., see above), several methodological limitations are present. First, the predominance of self-report measures, second, the potential impact of memory biases and the lack of clarity as to whether response selection biases are in action. In addition, findings suggest that participants who are aware of the purpose of the research task show stronger interpretative biases (Hazlett-Stevens & Borkovec, 2004; Salemink et al., 2007a, 2007b).

In light of such limitations, alternative paradigms in the wider anxiety literature have been developed to measure interpretive bias. One such task, which more directly assesses interpretation bias is the lexical-decision semantic-priming paradigm (e.g., Blanchette & Richards, 2003; Carlson & Reinke, 2008; Fox et al., 2007; Fox et al., 2002; Mathews et al., 2003; Mogg et al., 2000; Richards & French, 1992; Richards, Reynolds, & French, 1993; Walsh, McDowall, & Grimshaw, 2010). The lexical-decision semantic-priming task involves participants being aurally presented with a homophone word (“sleigh/slay”) shortly before a visual word is presented on the screen (snow/die/table), to which they must respond whether the words are related/unrelated (Blanchette & Richards, 2003; Dearing & Gotlib, 2009; Lawson & MacLeod, 1999; Mathews et al., 1989; Walsh et al., 2010).

This technique has been used to examine semantic activation of different meanings of the same ambiguous prime, by presenting target words that are related to different meanings and comparing the time taken to respond to related/unrelated words (Richards & French, 1992). The task is most frequently presented as a reaction time task, whereby the processing of a target word is thought to be facilitated when a
related (compared to unrelated) word is processed shortly before its presentation (Blanchette & Richards, 2003; Dearing & Gotlib, 2009; Lawson & MacLeod, 1999; Mathews et al., 1989; Walsh et al., 2010). This finding reflects that dominant meanings of ambiguous primes are retrieved first, with the subordinate meaning activated more slowly (Simpson & Burgess, 1985). Overall, the lexical decision task has been argued to improve on other methodologies that examine interpretation bias by: (1) requiring shorter response latencies so that there is less time for interference by conscious or strategic processes to become involved; (2) examining response time, which is a more direct measure than written responses; (3) being able to compare response times to valenced and non-valenced stimuli. To date interpretation bias has predominantly been examined using word-based stimuli, and as interpretation bias is assumed to be a result of later stage, rule-based system processing, word-based stimuli are deemed most appropriate (Epstein, 1998a; Ouimet et al., 2009).

2.4 Data Preparation

For Study 1, a power analysis undertaken with G*power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) showed that with 80% power at an alpha level of 0.05 and assuming a small to medium effect size (0.25) - as observed in other questionnaire studies with similar variables - 299 participants were needed. However, oversampling ensured we had sufficient participants once high and low worry groups had been formed.

As the current project consisted of studies which were novel and some of the first research to examine processing style in worry, we also wanted to ensure the studies had sufficient power. Therefore, for Study 2, Study 3 and Study 4 we estimated effect sizes (Cohen’s $d$) from literature based on the experimental tasks.
The reasoning tasks (Study 2) employed have not been used in relation to worry, or GAD samples so it was not possible to calculate population relevant effect sizes. However, in studies examining similar populations, an effect size of $d = 0.64$ is observed for subjective probability tasks and $d = 0.56$ on deductive reasoning tasks (Klaczynski, 2001). Although there have been no studies examining antisaccade performance in adult populations endorsing GAD symptoms (Study 3), similar studies examining participants with high levels of anxiety demonstrate an effect size of $d = 0.66$ (Ansari et al., 2008). The dot probe task (Study 4) was found to have an effect size of $d = 0.45$ across studies of participants with high and low levels of worry and GAD (Bar-Haim et al., 2007), and an effect size of $d = 0.47$ was observed on a semantic priming homograph task (Study 4) in a university student sample of participants screened for GAD (Hazlett-Stevens & Borkovec, 2004). Therefore, with 91 participants, the between group comparisons would all have sufficient power to identify small effect sizes.

Preliminary data screening was conducted on all variables to identify outliers as well as to determine whether the variables were normally distributed. Variables were assumed to be normally distributed if the skewness and kurtosis of the distribution were within the acceptable range. All variables in Study 1 were normally distributed. For the remaining studies several outliers were observed and not all variables were normally distributed. Because there were variables present that were not normally distributed, even after altering outlier scores, we ran analyses on transformed variables. However, a similar pattern of results emerged with no significant differences observed between transformed and untransformed variables. Therefore, we chose to report analyses undertaken on untransformed variables.
Substituted means were inserted in the homophone interpretation bias task when individual data points were missing. No means were substituted in the other tasks because no further data points were found to be missing. The procedure of substituting means assumes that data were missing from the results randomly and, as the presence of missing data often related to malfunctions with the equipment. Little’s missing completely at random (MCAR) test was undertaken in SPSS to ensure that the missing data were random. Little’s MCAR test for the homophone interpretation bias task resulted in a chi-square = 11.995 (df = 24; p = .981), which indicates that the data was missing at random and no identifiable pattern was observed within the missing data. Information about outliers and the distribution of variables will be reported in each experimental chapter.
Chapter 3: Study 1

Rational and Experiential Processing in Individuals Who Worry: A Dual-Process Account

As argued in the introductory chapter of this thesis, the distinction between automatic and strategic processes has led to significant theoretical developments in the conceptualization of psychopathology (e.g., Beck & Clark, 1997; Hirsch & Mathews, 2012; Ouimet et al., 2009). Yet, the majority of these developments have occurred outside the context of dual-process theories of cognition, where the distinction between automatic and strategic processes is central. The relative absence of dual-process theories from literature examining psychopathology is particularly notable given the literature on dual-process theories is both extensive and well established (see: Evans, 2008, for review).

The dual-process theory that will be the focus of this Chapter is Epstein’s Cognitive Experiential Self Theory (CEST; Epstein, 1983; 1990) as it is arguably particularly relevant to psychopathology, due to its strong focus on personality and individual processing style. As described earlier (Chapter 1, Section 1.6.3, pp. 57-61) CEST proposes two distinct, interactive conceptual systems that inform behaviour and conscious thought: a rational system, and an experiential system (e.g., Epstein et al., 1996). Individuals who have an imbalance, such as the dominance of an automatic/experiential processing style in conjunction with weak control (rational) processes, have been found to be most at risk for psychopathology (e.g., depression, eating disorders; Burns & D'Zurilla, 1999; Claes et al., 2009; Epstein, 1998c; Kerns, 2006). Although limited in number, self-report studies offer support for a relationship between processing style, wellbeing, and psychopathology (Burns & D'Zurilla, 1999; Claes et al., 2009; Epstein et al., 1996). However, individual differences in processing
style appear to depend largely on situational variables (Epstein, 1990, 1994), with more recent studies highlighting the differences between situational (how someone responds in a specific situation), and dispositional (how someone responds more generally) processing styles (Claes et al., 2009).

To date, despite processing styles being linked with aspects of psychopathology (see Chapter 1, Section 1.6.3, pp. 57-61 for further details), the applicability of CEST to anxiety and worry has yet to be explored. This is particularly surprising as recent models implicate dual-process theory in accounting for worry (Hirsch & Mathews, 2012; Ouimet et al., 2009). Additionally, there are parallel findings in the separate literatures on dual-processing theory, and worry and anxiety. For example, in the case of anxiety, cognitive biases are known to characterize anxiety disorders (e.g., Hayes, Hirsch, Krebs, & Mathews, 2010; Mathews & MacLeod, 2005), with biases in attention and interpretation claimed to be fundamental in the development and maintenance of pathological worry (Hirsch & Mathews, 2012). With regard to processing style, the presence of cognitive biases and the acceptance of heuristic thinking as rational is linked to pattern of processing where an individual engages largely in dispositional experiential processing (see Chapter 2, pp. 73-76 for description and clarification between dispositional and situational processing styles) whilst underutilizing dispositional rational processing (Pacini & Epstein, 1999; Shiloh et al., 2002). Parallels also exist between characteristics of pathological worry and dispositional processing style in relation to deficits in both working memory capacity and problem-solving (Dugas et al., 1995; Hayes et al., 2008).

Of note, individuals with high levels of worry are asked to offer self-appraisals they often report negative appraisals, which do not necessarily correspond to actual
deficits. This is most clearly observed in the case of problem-solving. Although a relationship between a low dispositional processing style and deficits in problem-solving ability has been observed (Denes-Raj & Epstein, 1994), it is the negative appraisals and perceptions that individuals with high levels of worry have about their ability to problem solve, rather than problem-solving deficits per se, which are problematic (Belzer, D'Zurilla, & Maydeu-Olivares, 2002; Dugas et al., 1995; Hayes et al., 2008; Ladouceur et al., 1998). For example, studies have found no difference in problem-solving ability between individuals with high and low levels of worry (Dugas et al., 1995; Ladouceur et al., 1998).

During worry episodes, problem-solving attempts are argued to be impacted by negative beliefs and appraisals that act to maintain the worry cycle and prolong the problem-solving process (Ladouceur et al., 1998). Thus, it is important to consider possible differences between dispositional and situational processing style, as no difference has been observed in problem-solving ability between individuals with high and low levels of worry. Therefore, it is likely that no difference in dispositional rational processing would be observed, however, due to the impact of negative beliefs and appraisals related to problem-solving in the context of worry (Ladouceur et al., 1998; Robichaud & Dugas, 2005a, 2005b), higher levels of situational processing would be expected to be observed during active periods of worry.

The similarities between characteristics associated with individual differences in processing style and pathological worry raises the question as to whether different styles of processing could be associated with pathological worry. For example, individuals who engage in excessive worry could exhibit a processing style characterized by an over reliance on dispositional experiential processing and an under reliance on dispositional rational processing. Therefore, integrating the
disparate literatures on dual-process theory and pathological worry may provide a useful framework to better understand the factors that contribute to the development of pathological worry (Ouimet et al., 2009). As the association between individual processing styles and worry has not been systematically studied, the aim of the present study is to determine the nature of individual differences in both situational and dispositional processing styles, in individuals with high and low levels of worry. In this way, the applicability of Epstein’s CEST will be examined. Specifically, using processing style questionnaires (PMPI and REI) we will test whether individual differences in processing styles can account for individual differences in worry.

In light of previous research (e.g., Burns & D’Zurilla, 1999; Dugas et al., 1995; Fletcher, Marks, & Hine, 2011; Ladouceur et al., 1998; Pacini & Epstein, 1999; Shiloh et al., 2002), it is hypothesized that no difference will be observed between participants with high and low levels of worry with regard to dispositional rational processing. However, as active periods of worry are characterised by engagement in problem-solving attempts (Szabo & Lovibond, 2006), which rely heavily on rational processing (Fong et al., 1986), it is expected that higher levels of situational rational processing will be observed in the high, compared to the low worry group.

In terms of dispositional experiential processing, research suggesting a link between cognitive biases and processing errors in individuals with higher levels of worry (Hayes et al., 2010). This leads to the expectation that dispositional experiential processing will be observed in individuals endorsing high but not low levels of worry. We hypothesized that when engaged in worry (situational processing), no difference would be observed in situational experiential processing between participants with high and low levels of worry, as worry is cognitive in nature, and the risk for psychopathology is increased by the presence of one dominant system (Burns &
D'Zurilla, 1999; Claes et al., 2009; Epstein, 1998c; Kerns, 2006). Due to gender differences observed in research into both worry (e.g., Robichaud et al., 2003) and processing styles (Epstein et al., 1996), differences between male and female participants will be examined.

3.1 Method

3.1.1 Participants and Procedure

A total of 344 first year undergraduate psychology students were recruited. Chapter 2, Section 2.2.1 (pp. 66-68) and 2.2.3 (p. 70) provide full details of the procedure, participants, and constitution of the high and low worry groups. A total of 17 participants were excluded from analyses after submitting incomplete surveys. In order to create the high/low worry groups a three-group split was undertaken, which left a total of 157 (72 low and 85 high worry) participants in the final analyses. The sample consisted of 74.5% women (25.5% men) with a mean age of 19.7 years.

3.1.2 Measures

Participants completed an online questionnaire battery, which was administered by LimeSurvey (version 1.87). The questionnaire battery included the Penn State Worry Questionnaire (PSWQ), the Generalised Anxiety Disorder Questionnaire-IV (GADQ-IV), the Rational Experiential Inventory (REI) and the Perceived Modes of Processing Inventory (PMPI). See Chapter 2, Section 2.2.5 (pp. 73-76) for further details and psychometric properties of the measures.

3.1.3 Planned analyses

Three outlying scores were observed in study one, two on the REI-R and one on the REI-E. These were replaced by substitution. The GADQ-IV’s distribution was also found to be negatively skewed (see Chapter 2, Section 2.4 p. 98 for rationale for using untransformed variables). In order to test the hypotheses with regard to
differences in processing style by gender and level of worry, two mixed model analyses of variance were conducted. The mean scores on processing style scales (PMPI and REI scores) acted as the within subject variables, whilst high or low worry group and gender acted as the between subjects variables. One 2 x 2 x 2 ANOVA examined dispositional processing style (rational and experiential) by level of worry (high versus low) and gender (male versus female), whilst the other examined situational processing style (rational and experiential) by level of worry and gender. Follow-up t-tests were conducted to assess differences in between subject variables.

3.2 Results

Means and standard deviations of processing style and symptom scales are shown in Table 3.1.

3.2.1 Situational processing style

The ANOVA showed a main effect (see Figure 3.1) of situational processing style \( F(1, 153) = 124.25, p < .001 \), indicating that, overall, when engaged in worry participants endorsed higher levels of rational \( (M = 37.14, SD = 8.88) \) than experiential processing \( (M = 26.10, SD = 7.44) \). Participant responses on scales of situational rational and experiential processing differed depending on the levels of worry with a significant situational processing style x worry interaction observed: \( F(1, 153) = 4.36, p = .04 \). T-tests showed a difference between high \( (M = 38.77, SD = 8.85) \) and low \( (M = 35.22, SD = 8.60) \) worry groups on rational processing \( (t(155) = -2.53, p = .01) \), whereas experiential processing did not differ between the groups \( (t(155) = -1.23, p = .21) \). A significant situational processing style x gender interaction was also revealed \( F(1, 153) = 10.04, p < .01 \). T-tests indicated that this resulted from female participants reporting higher levels of situational experiential processing \( (M = 26.86, SD = 7.72) \) than male participants \( (M = 23.88, SD = 6.09) \);
Table 3.1: *Means (standard deviations in parenthesis) for situational and dispositional processing style scales and symptom scores by level of worry and gender.*

<table>
<thead>
<tr>
<th>Measures</th>
<th>High worry</th>
<th>Low worry</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (N=11)</td>
<td>Women (N=74)</td>
<td>Total (N=85)</td>
</tr>
<tr>
<td>Symptom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GADQ-IV</td>
<td>19.81 (6.54)</td>
<td>21.64 (6.55)</td>
<td>21.40 (6.54)</td>
</tr>
<tr>
<td>PSWQ</td>
<td>65.0 (6.78)</td>
<td>67.20 (6.03)</td>
<td>66.92 (6.13)</td>
</tr>
<tr>
<td>Dispositional</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REI-E</td>
<td>2.84 (0.31)</td>
<td>3.02 (0.27)</td>
<td>3.00 (0.28)</td>
</tr>
<tr>
<td>REI-R</td>
<td>3.03 (0.18)</td>
<td>3.04 (0.20)</td>
<td>3.04 (0.20)</td>
</tr>
<tr>
<td>Situational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMPI-E</td>
<td>23.64 (6.49)</td>
<td>27.26 (8.06)</td>
<td>26.78 (7.93)</td>
</tr>
<tr>
<td>PMPI-R</td>
<td>43.46 (9.20)</td>
<td>38.07 (8.64)</td>
<td>38.77 (8.85)</td>
</tr>
</tbody>
</table>

*Note: N = 157. GADQ – IV = Generalised Anxiety Disorder Questionnaire – IV; PSWQ = Penn State Worry Questionnaire; PMPI – E = Perceived Modes of Processing Inventory, Emotional scale; PMPI – R = Perceived Modes of Processing Inventory, Rational scale; REI – E = Rational Experiential Inventory, Experiential; REI – R = Rational Experiential Inventory, Rational scale.*
Figure 3.1: Mean self-report Perceived Mode of Processing Inventory (PMPI) scores by situational processing style scales (Rational, Experiential) and gender in high and low worry groups
\[ t(155) = -2.22, \ p = .03 \]. Situational rational processing style scores were not found to differ significantly as a result of gender: \[ t(155) = 1.52, \ p = .13 \]. Worry was also found to be unrelated to gender as the three-way interaction of processing style x worry x gender was not significant: \[ F(1, 153) = .52, \ p = .47 \].

### 3.2.2 Dispositional Processing Style

The ANOVA examining mean dispositional processing style (see: Figure 3.2) showed no significant main effect of processing style \[ F(1, 153) = 3.13, \ p = .08 \]. The processing style x worry \[ F(1, 153) = 2.07, \ p = .15 \], and processing style x gender interactions \[ F(1, 153) = .86, \ p = .36 \] were also not significant. Neither was the three-way interaction of processing style x worry x gender: \[ F(1, 153) = 2.86, \ p = .09 \].

### 3.3 Discussion

It was hypothesized that higher levels of situational rational and dispositional experiential processing would be observed in individuals reporting high, compared to low, levels of worry. Additionally, due to documented differences between men and women in both worry (e.g., Robichaud et al., 2003) and processing style (Epstein et al., 1996), gender differences were assessed. Our hypotheses were only partially confirmed. Consistent with hypotheses, when faced engaged in worry (i.e., situational processing style) participants with high, compared to low, levels of worry demonstrated greater rational compared to experiential processing. Indeed, follow-up analyses confirmed that this was because those high in worry reported engaging in increased levels of rational processing compared to those low in worry. In contrast, when faced with a situation in which they worry, women were found to engage in more experiential processing than men. However, an increase in experiential processing amongst worriers is not better accounted for by gender effects as no relationship was observed between processing style, gender, and levels of worry.
Figure 3.2: Mean self-report Rational Experiential Inventory (REI) scores by dispositional processing style scales (Rational, Experiential) and gender in high and low worry groups.
We also hypothesized that, for dispositional processing style, those high in worry would report more experiential compared to rational processing. However, this hypothesis was not supported. That is, participants with high levels of worry were not found to differ from participants with low levels of worry in regard to their reports of dispositional levels of experiential processing. As expected no worry related differences were observed between dispositional rational and situational experiential processing styles.

Despite there being no previous studies that have investigated the role of dispositional versus situational processing in pathological worry, these results emphasise the importance of considering both situational and dispositional processing style, particularly when exploring the relationship of processing style to psychopathology (Burns & D'Zurilla, 1999; Claes, Witteman, & van den Bercken, 2009). Furthermore, the results suggest that when engaged in worry people with high worry are more likely to rely on rational processing, consistent with the idea that individuals high in worry rely on a particular form of rational processing to try and solve the problem that is at the source of their worry. Previous research has shown that during worry episodes the very nature of worry requires increased engagement in problem-solving attempts, which rely on rational processing (Fong et al., 1986; Szabo & Lovibond, 2006). However, also consistent with previous findings - that no real difference in actual performance on reasoning or problem-solving tasks has been observed – this rational processing style does not reflect a difference in levels of general, trait, or dispositional self-perceptions of rationality between individuals with high and low levels of worry (Davey, 1994a; Dugas et al., 1995; Ladouceur et al., 1998; Shewchuk, Johnson, & Elliott, 2000). In order to provide further clarification, there is a need for research exploring the relationship between perceived rationality
and measures of rational processing performance (e.g., problem-solving or reasoning tasks) in the context of worry.

Although not previously examined in relation to worry, prior research led to the expectation that dispositional experiential processing would be associated with higher levels of worry. For example, there is an association between an over-reliance on dispositional experiential processing and the presence of cognitive biases and the acceptance of heuristic thinking as rational (Pacini & Epstein, 1999; Shiloh et al., 2002). Furthermore, cognitive biases have been found to be associated with high levels of worry (Bar-Haim et al., 2007; Hazlett-Stevens & Borkovec, 2004; Hirsch et al., 2011; Mathews et al., 1989). As a dispositional experiential processing style has been found to be responsible for heuristic thinking and cognitive biases and, although not explicitly tested in this study, cognitive biases have previously been linked to high levels of worry, we expected to find individuals with high levels of worry to demonstrate high levels of a dispositional experiential processing style. However, the current study found no relationship between high levels of worry and a dominant dispositional experiential processing style. As previous research based on the principles of CEST has focused largely on personality aspects (i.e., neuroticism) or psychopathology - where the key characteristic symptoms are not so clearly cognitive (Claes et al., 2009) - the current finding, that those high in worry did not report dispositional experiential processing style but instead reported a dominant situational rational processing style, may well reflect the cognitive nature of worry.

The finding of a dominant situational rational processing style is consistent with current of models of worry, which stipulate worry to be a cognitive strategy in which people attempt cope and solve the worrying situation (Borkovec & Roemer, 1995; Davey, 1994a). Of particular relevance are Wells’ (1995), and Borkovec’s
(1994) models (see Chapter 1, pp. 19-21, and pp. 31-33 for detailed discussion of these models). Both Wells (1995) metacognitive model and Borkovec’s Cognitive Avoidance Model of Worry (AMW; Borkovec, 1994; Borkovec et al., 2004) highlight the cognitive nature of worry and stipulate that worry is a cognitive strategy that individuals engage in to cope with anticipated problems. Wells’ theory places emphasis on beliefs about worry maintaining the worry cycle. Worry is thought to be initially triggered by intrusive negative thoughts that activate beliefs about worry and lead to a range of ineffective strategies aimed at avoidance of worry via attempts at cognitive control (Wells, 2004; Wells & Carter, 1999). Similarly, Borkovec (1994) conceptualizes worry as a perseverative, cognitive activity that serves as avoidance - a cognitive attempt to problem solve and remove possible future threat, or avoid thinking about more distressing topics (Borkovec & Roemer, 1995).

Although gender differences in relation to worry have been reported, they remain largely unexplored (Robichaud et al., 2003). Despite the current study addressing gender, no worry related gender differences were found. However, consistent with previous research into processing style (Epstein et al., 1996), women demonstrated higher levels of experiential processing than men (Pacini & Epstein, 1999). The experiential system is argued to be the seat of emotions - with those either high or low in experiential processing reported to be less emotionally well adjusted (Epstein, 1992; Pacini et al., 1998). However, due to the lack of a relationship observed between gender, mode of processing, and worry, these findings did not offer insight into understanding how men and women may worry in different ways.

To the author’s knowledge, this is the first study to compare individuals with high and low levels of worry with regard to self-reported individual processing style as characterised by CEST. The findings provide preliminary evidence that
participants’ level of worry has significant implications for individual differences in processing style, particularly when confronted with periods of active worry (e.g., Burns & D’Zurilla, 1999; Claes et al., 2009). Ouimet et al. (2009) have argued that the application of dual-process theory to anxiety disorders might lead to important theoretical developments (Ouimet et al., 2009). These results confirm that further investigations of the nature of processing styles in anxiety disorders are warranted. Additionally, if the present findings are replicated in a clinical sample there could be implications for treatment. Currently, Cognitive Behaviour Therapy (CBT) is the most empirically supported, and evidence based treatment for generalised anxiety and anxiety disorders more generally (Arch & Craske, 2008). The cognitive challenging components incorporated in CBT focus and rely on engaging the rational system to determine the validity of beliefs. However, if the current findings are shown to be robust, the efficacy of these strategies might be enhanced through increasing the focus on the experiential components of CBT (e.g., use of imagery), in order to engage experiential processing.

Several limitations require noting with regard to this study. Firstly, although participants in the high worry group lay within the clinical range with regard to self-reported levels of worry and GAD symptoms, the study relied on an analogue worry sample (see Chapter 2, Section 2.2.1, pp. 64-66 for further details). However, there is no evidence to suggest that the processes that are characteristic of worry differ between clinical and non-clinical populations. Indeed, the qualitative experience of worry has been found to be similar between clinical and non-clinical populations (Borkovec et al., 1983). Further, the approach was to get distinct groups of high and low worry by using an extreme groups approach (see Chapter 2, Section 2.2.3, p. 70) instead of a median split. Nonetheless, these results need to be replicated in a sample
of individuals who meet criteria for generalised anxiety disorder before there can be full confidence in their wider applicability. A second limitation relates to the current sample consisting of predominantly young adults. As both rational and experiential processing decrease with age (Sladek et al., 2010), further research using participants across a broader age range is required. Lastly, the employment of self-report measures is a limitation that must be considered. Responses provided on self-report measures by individuals high in worry can be influenced by an individual’s perceptions, which are open to distortion (Eng & Heimberg, 2006). Therefore, employing experimental measures in a clinical sample to replicate and corroborate these preliminary findings would be beneficial, particularly to clarify whether individuals with higher levels of worry are reporting their perceived, rather than preferred, processing style.

In summary, although erroneous information processing is implicated in the development and maintenance of chronic worry (e.g., Bar-Haim et al., 2007; Hirsch et al., 2011; Hirsch & Mathews, 2012; Mathews et al., 1989), individual differences in processing style between individuals with high and low levels of worry have not been previously examined (Hirsch & Mathews, 2012; Mathews & MacLeod, 2005). The current questionnaire-based study takes the first step to address this gap in the literature. The hypotheses were partially supported, with individuals endorsing high levels of worry also endorsing higher levels of situational rational compared to experiential processing than individuals with low levels of worry. However, there were no indications of differences between those who reported high and low levels of worry reporting differences in dispositional processing styles. The preliminary findings in this study emphasise not only the significance of considering individual processing style in relation to chronic worry, they also emphasise the importance of a dual-process perspective in research considering both dispositional and situational
aspects of processing style. The pattern of individual processing style observed in individuals with high levels of worry appears to reflect the future orientated cognitive nature of worry, rather than the emotional symptoms which accompany worry. Further research employing experimental paradigms would be helpful to extend and corroborate these preliminary findings; this will be the focus of the next chapter. Overall, despite the preliminary nature of the current study, it provides evidence of the potential applicability of dual-process theory in extending our understanding of information processing in the development and maintenance of worry.
Chapter 4: Empirical Study 2

Reasoning in Individuals Who Worry: A Dual-Process Account

As outlined in the introductory chapter of this thesis, most theories of generalised anxiety disorder (GAD) consider chronic worry to be an attempt to problem-solve future orientated concerns (Borkovec et al., 1983; Dugas et al., 1998; Mennin et al., 2005; Salters-Pedneault et al., 2006). Although these theories differ as to why some people are unable to resolve this cycle of futile problem-solving, there is general agreement and empirical support for poorer reasoning and problem-solving performance contributing to chronic worry (Davey, 1994a; Dugas et al., 1995; Robichaud & Dugas, 2005b).

The emphasis on problem-solving in chronic worry has led researchers to investigate differences in both problem-solving ability and actual performance between people with and without high levels of worry and GAD. Evidence suggests that the problem-solving of those with chronic worry is affected by factors that can occur at any of the various steps in the problem-solving process, which can effect performance, rather than there being deficit in problem-solving ability per se (Belzer et al., 2002; Davey, 1994b; Dugas et al., 1998; Dugas et al., 1995; Hayes et al., 2008; Ladouceur et al., 1998; Robichaud & Dugas, 2005b). Both Anderson, Goddard, and Powell (2009) and Davey (1994b) found that when individuals who worry are faced with real-life problem-solving situations no deficits are observed, in fact, during worry episodes, individuals with chronic worry are found to be actively engaged in problem-solving attempts (Szabo & Lovibond, 2006), which rely heavily on rational processing (Fong et al., 1986). Thus, high levels of worry have only been found to be associated with negative appraisals and perceptions toward problem-solving, low problem-solving confidence and poor perceived control over the problem-solving
process, which act to maintain the worry cycle and prolong the problem-solving process (Anderson et al., 2009; Davey, 1994b; Ladouceur et al., 1998). Therefore, any observed worry related problem-solving deficits appear to occur as a result of the solution implementation not solution generation phase of the process (Davey, 1994b). Despite this recent focus on the role of reasoning and problem-solving, as it contributes to worry, current research paradigms are largely based on self-report measures which are vulnerable to bias and distortion and may not accurately reflect the processes underlying poor problem-solving performance (Eng & Heimberg, 2006). Additionally, current research has yet to employ methodologies from the wider reasoning literature, which have a strong evidence base with regard to human reasoning processes.

Traditionally within the general reasoning and problem-solving literatures, two types of experimental tasks have been employed to assess problem-solving skills: verbal based problems using vignettes or written questions, and experimental behavioural tasks. The verbal-based problem tasks relate specifically to the use of deductive or inductive reasoning, which underlie problem-solving, reasoning and human rationality (Reverberi, Pischedda, Burigo, & Cherubini, 2012; Stanovich & West, 1998). Therefore, if individuals with higher levels of worry have poorer reasoning and problem-solving skills than those with low levels of worry, one would expect them to be less proficient at deductive and inductive reasoning. However, these paradigms have not as yet been applied to worry.

As discussed previously, Cognitive Experiential Self Theory (CEST; Epstein, 1983; 1990; Pacini & Epstein, 1999), specifically addresses individual differences in the two processing style (see Chapter 1, Section 1.6.3, pp. 57-61): the rational style, based on logic, numerical analysis and rational thought processes and the experiential
style, which is based on learned experience and intuitive thought processes (e.g., Epstein et al., 1996). Individuals with a less dominant rational processing style demonstrate reduced reasoning and problem-solving performance, as well as decreased working memory capacity (Denes-Raj & Epstein, 1994; Fletcher et al., 2011; Kirkpatrick & Epstein, 1992), factors which are also implicated in pathological worry (Dugas et al., 1995; Hayes et al., 2008). As mentioned previously, during worry episodes, individuals demonstrate restricted working memory capacity and reduced problem-solving performance (Belzer et al., 2002; Hayes et al., 2008).

In terms of measuring both reasoning and processing style, employing reasoning measures that place the two systems (rational and experiential) in conflict are integral to the dual-process literature. Their usefulness lies in that research into problem-solving and reasoning depicts solutions as either resulting from individuals analytically deconstructing the components and optimally solving problems or, alternatively, engaging less optimal, superficial, methods (Reber, Ruch-Monachon, & Perrig, 2007). Therefore, the outcomes of both processing modes are immediately and equally accessible (Kirkpatrick & Epstein, 1992). One such paradigm is the ratio-bias probabilistic reasoning task (developed from Miller et al. (1989) and employed by Kirkpatrick and Epstein (1992)). The ratio-bias phenomenon is the subjective judgment of a low probability event as being more likely when the probability is presented in the context of a ratio of larger numbers (e.g., 10 in 100 rather than 1 in 10). Participants are influenced by the presence of large numbers (Denes-Raj & Epstein, 1994; Pacini et al., 1998) and tend to respond automatically to frequency information rather than taking rational considerations (Pacini & Epstein, 1999). The ratio-bias can relate to either strong experiential processing, weak rational processing, or both, due to the rational system being associated with control of experiential
response tendencies (Pacini & Epstein, 1999). However, incentives such as enforced conditions where participants win or lose a point appear to also impact results. Although economic models would assume that incentives make people behave more rationally (Mukherjee & Srinivasan, 2013), previous findings demonstrate that context (the presence of large numbers) and incentives act to exacerbate individual processing styles and engagement in heuristic responding (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992).

Overall, although it has been established that, during worry episodes, individuals with chronic worry demonstrate restricted working memory capacity and reduced problem-solving performance (Belzer et al., 2002; Hayes et al., 2008; Leigh & Hirsch, 2011), few studies have progressed past theoretical assertion to consider the relevance of dual-process models and the complex interplay between the rational and experiential systems in the processes that underlie chronic worry. In Study 1 (see previous chapter), we found preliminary evidence for an association between worry and perceived situational rational processing. Specifically, when individuals reporting high levels of worry were faced with a situation that caused them to worry, they reported engaging in increased levels of rational processing compared to individuals with low levels of worry. However, these findings were based on self-report measures that are open to distortion (Eng & Heimberg, 2006). Therefore, using experimental reasoning paradigms, this study aimed to assess the possible application of a dual-process framework, specifically individual processing styles, to pathological worry and reasoning performance. Thus, the findings will further examine the applicability of Epstein’s processing styles (CEST) in accounting for worry (psychopathology), using more direct experimental measures. Additionally, it offers the opportunity to further investigate whether individuals with high levels of worry actually have poorer
reasoning skills; or whether the reasoning and, therefore, problem-solving performance is related to negative self-perceptions and beliefs.

If worry is associated with actual deficits in reasoning and problem-solving implementation, we would expect that people high in worry would perform more poorly on all reasoning tasks particularly on behavioural reasoning tasks. CEST suggests lower reasoning scores to be related to low dispositional rational processing and higher levels of dispositional experiential processing, neither of which is expected to be related to levels of worry based on findings from Study 1. Although Study 1 showed that, when faced with a situation in which they worried, participants with higher levels of worry demonstrated increased levels of situational rational processing, this is thought to relate to challenges at the solution implementation not solution generation phase of the problem-solving process (Davey, 1994b). Thus, we expected that any observed relationship between situational processing style and actual reasoning performance would not be moderated by participants’ level of worry. The relationship between processing style, worry/GAD symptoms and reasoning have not yet been examined, therefore, the analyses will also assess the relationships between these variables. Since there were no interactions between gender and worry in Study 1 (see Chapter 3, p. 101), gender was not further explored.

4.1 Method

4.1.1 Participants

As described in Chapter 2, the current study consisted of 112 participants selected through a prescreen procedure (high and low Stress scores on the DASS). See Chapter 2, Section 2.2.1, pp. 66-69 for further details. Participants completed the study components in the same 1.5 hour session as some of the tasks described in experimental Study 4 (Chapter 6). Six participants did not complete the study
components due to arriving late to the session, therefore, a total of 106 participants were included in final analyses.

4.1.2 Measures

Symptom and processing style measures

The Generalised Anxiety Disorder Questionnaire –IV (GADQ-IV), the Penn State Worry Questionnaire (PSWQ), the Rational-Experiential Inventory (REI) and the Perceived Modes of Processing Inventory (PMPI) were presented in one of two counterbalanced orders and were completed by participants via LimeSurvey (version 1.87). For further details about the measures and their psychometric properties see Chapter 2, Section 2.2.5, p. 73.

4.1.3 Problem-solving and reasoning tasks

4.1.2.1 Deductive reasoning: Syllogistic reasoning task

Deductive reasoning involves syllogisms whereby two premises are offered from which a definite conclusion is then logically drawn, which follows even if the premises are not in themselves believable (Markovits & Nantel, 1989; Sa et al., 1999: see Appendix A for items). Further details and examples of the task have been described in Chapter 2, Section 2.3.1.1, p. 80 and Appendix E. Prior to completing the survey participants were informed that they would be presented with two premises and a conclusion, which they would then need to decided whether it followed logically from the premises assuming that the premises were true. It was highlighted that answers should evaluate the items logical validity and not the believability of the conclusion. The 24 problems were presented to participants via LimeSurvey (version 1.87). Participants were given one point for each answer that correctly stated whether the conclusion followed/did not follow logically from the premise. These were then
summed to give a total deductive reasoning score with higher scores representing more rational choices.

4.1.3.2 Statistical reasoning: Inductive preferences task

Via LimeSurvey (version 1.87), participants were presented with six multi-choice inductive reasoning problems that simulated real-life decisions (Fong et al., 1986; Jepson et al., 1983; Stanovich & West, 1998). Inductive reasoning problems present premises, from which a probable or credible conclusion can be drawn. Participants were informed that the problems did not have strictly right or wrong answers and that the study was interested in how people explain and predict events when limited information is provided. Further details on the task can be found in Chapter 2 (Section 2.3.1.2, p. 81) and examples are presented in Appendix E. Participants employing statistical principles (rational processing) should avoid making inferences based on small samples or the personal case experience (experiential processing). Items were scored from 1 – 4 (see: Ajzen, 1977; Bar-Hillel, 1980), with higher scores given to answers that included the aggregate information and, therefore, represented the statistical or rational choice. Lower scores were given to answers based on evidence from the single case, personal experience information, which is representative of a choice related to experiential processing.

4.1.3.3 Probabilistic reasoning task: Jellybean game

This task followed the method described in Denes-Raj and Epstein (1994) and Kirkpatrick and Epstein (1992). Participants were told that they would be presented with a choice of two containers from which they would select one container from which to attempt to pick a red bean to win one point, on ‘win trials’, and avoid choosing a bean so as not to lose a point on ‘lose trials’. They were told that the task was an attempt to try and understand how people play a game of chance and it was
emphasized that although the mathematical probabilities in the two bowls were identical, many people had a gut-level preference for one bowl or the other. A Latin Square randomization determined the order in which the conditions (i.e., 90% win, 10% win, 90% lose, 10% lose) were presented. The size (big or small) of the container was recorded and participants were asked to state their thoughts, which had led to their decision to choose either a large or small container. Further details on the task can be found in Chapter 2 (Section 2.3.1.3, p. 82).

Answers were coded as “0” or “1” depending on the whether participants chose the subjective choice of container - which reflected engagement in heuristic experiential processing (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992) - with a total possible score of four. For example, with regard to 10% win conditions, the ratio-bias effect can be observed whereby the heuristic choice is the large container as individuals have a tendency to view the odds as more favorable when the ratio is expressed in larger (e.g., 10 white beans in 100 red beans; 10% condition) than smaller (e.g., 1 white bean in 10 beans; 10% condition) numbers, with the opposite being true for 90% win conditions; the odds are perceived as more favorable when the ration is expressed in smaller than larger numbers (Kirkpatrick & Epstein, 1992). This phenomena is more readily observed on “win” than “lose” trials (Denes-Raj & Epstein, 1994), however, with regard to “lose” conditions CEST predicts the opposite to win conditions; participants will favor the small bowl in the 10% lose condition (Condition 3) as the 1-in-10 odds of drawing a losing bean from the small container seem more remote in comparison to the odds of drawing a losing bean from the large container. In contrast, participants should favor the large container in the 90% lose condition (Condition 4) as the likelihood of odds of selecting a red bean from the small container (9 red beans in 10 losing) seems convincingly large.
4.2 Planned Analyses

SPSS version 21.0 was used to conduct the analyses. All variables in Study 2, were normally distributed, with only one outlier detected. An outlier on the total reasoning score was observed and this score was altered to sit one unit lower than the next most extreme score before analyses were undertaken. Z-scores for inductive and deductive reasoning questionnaires were calculated. These were then summed to form a composite score for statistical reasoning (see: Stanovich & West, 1998). This was labelled total reasoning score and was used in the analyses. An extreme groups approach based on PSWQ and GADQ-IV scores was also undertaken on the 106 participants who completed all components of the study, 81 participants remained, with 42 in the high worry group and 39 in the low worry group (see Chapter 2, Section 2.2.3, p.70, for further details).

First, analyses were undertaken to examine heuristic responses on the subjective probability task as a function of worry. To this end, a mixed ANOVA was performed examining the within subjects factors of trial valence (10% versus 90% probability) and trial type (win versus lose trials) by level of worry (high versus low; between subject factor). Where differences emerged, t-tests were performed to further examine differences between the groups.

In order to examine the relationship between processing style scales and reasoning tasks scores, as well as the relationship of these variables symptom scales, correlations were undertaken, as were moderation analyses. The correlation analyses were undertaken on the complete data set (no split: \( N = 106 \)), whilst moderation analyses were examined for extreme groups only; high \( (N = 27) \) and low \( (N = 36) \)
worriers (total $N = 63$) to assess the impact of worry (high/low) on the relationship between situational processing style and reasoning scores/heuristic scores.

4.3 Results

Descriptive statistics for processing style, symptom measures, and reasoning task can be found in Table 4.1.

4.3.1 Analyses of variance: Subjective probability task and worry

In relation to the subjective probability task, the number of heuristic responses across the trials was analysed in a mixed model 2 (valence: 10% versus 90% probability) x 2 (trial type: win versus lose) x 2 (group: high versus low worry) ANOVA, with group as the between-subjects variable. A significant main effect of valence was observed $F(1, 79) = 8.12, p = 0.01$ with more heuristic responses made on 10% trials ($M = 0.71$, $SD = 0.46$) than on 90% trials ($M = 0.39$, $SD = 0.49$). The valence x trial type interaction was significant: $F(1, 79) = 31.35, p < 0.001$. More heuristic responses were made on 10% win than lose trials ($t(105) = 3.50, p < 0.01$), whilst the reverse was found for lose trials - more heuristic responses were made on 90% lose than win trials ($t(105) = 3.17, p < 0.01$). No other main effects or interactions were found to be significant, responses did not differ between high and low worry groups ($F < 1$).

4.3.2 Correlational analyses

Correlations, between the reasoning tasks and symptom and processing style measures are presented in Table 4.2. In terms of the reasoning variables, the total reasoning score (comprised of results from inductive and deductive reasoning tasks) was found to be negatively correlated with situational experiential processing scores ($r = -.25, p = .011$), and positively correlated with dispositional rational processing scores ($r = .24, p = .013$). No relationship was observed between subjective
Table 4.1: Symptom Measure Means and Standard Deviations and comparison of group Means on processing style questionnaires

<table>
<thead>
<tr>
<th>Scale</th>
<th>Low worry M</th>
<th>SD</th>
<th>High worry M</th>
<th>SD</th>
<th>Total Sample M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptom</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GADQ-IV</td>
<td>3.33</td>
<td>2.30</td>
<td>21.52</td>
<td>7.25</td>
<td>11.65</td>
<td>9.67</td>
</tr>
<tr>
<td>PSWQ</td>
<td>40.39</td>
<td>8.17</td>
<td>67.19</td>
<td>8.24</td>
<td>54.19</td>
<td>14.03</td>
</tr>
<tr>
<td><strong>Dispositional</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REI_E</td>
<td>6.28</td>
<td>1.27</td>
<td>6.08</td>
<td>1.27</td>
<td>6.28</td>
<td>1.23</td>
</tr>
<tr>
<td>REI_R</td>
<td>7.44</td>
<td>1.23</td>
<td>6.61</td>
<td>1.34</td>
<td>7.06</td>
<td>1.27</td>
</tr>
<tr>
<td><strong>Situational</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMPI_E</td>
<td>24.33</td>
<td>6.91</td>
<td>24.88</td>
<td>7.29</td>
<td>25.24</td>
<td>7.03</td>
</tr>
<tr>
<td>PMPI_R</td>
<td>36.51</td>
<td>7.40</td>
<td>40.33</td>
<td>9.29</td>
<td>38.05</td>
<td>8.41</td>
</tr>
<tr>
<td><strong>Reasoning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub. Probability</td>
<td>2.08</td>
<td>.96</td>
<td>2.21</td>
<td>.98</td>
<td>2.18</td>
<td>1.00</td>
</tr>
<tr>
<td>Total Reasoning</td>
<td>.05</td>
<td>1.78</td>
<td>-.05</td>
<td>1.43</td>
<td>-.022</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Note: Total Sample N = 106; low worry group N = 39; high worry group N = 42 (total n = 81); PSWQ = Penn State Worry Questionnaire; GADQ – IV = Generalised Anxiety Disorder Questionnaire – IV; PMPI – E = Perceived Modes of Processing Inventory, Emotional scale; PMPI – R = Perceived Modes of Processing Inventory, Rational scale; REI – E = Rational Experiential Inventory, Experiential; REI – R = Rational Experiential Inventory, Rational scale; M = Mean; SD = Standard deviation.
probability scores (results from the probabilistic reasoning task), total reasoning scores, and processing style and symptom scores.

### 4.3.3 Moderation Analyses

Four moderation analyses were undertaken to confirm that worry did not moderate a relationship between situational processing style (both rational and experiential) and reasoning (total reasoning score and subjective probability scores). None of the moderation analyses were significant, as can be observed in Table 4.3 and Table 4.4.

### 4.4 Discussion

This study aimed to further assess the possible application of a dual-process framework in accounting for worry through the use of experimental reasoning tasks. It was expected that if worry was associated with negative beliefs about problem-solving that correspond to actual deficits in reasoning and problem-solving implementation, individuals with high levels of worry would perform more poorly on all reasoning tasks. Additionally, in keeping with CEST, a dominant dispositional experiential system and/or low level of dispositional rational processing were expected to correspond to lower reasoning scores and more non-normative responding. No differences were expected between participants with high and low levels of worry with regard to relationships between situational processing style and actual reasoning performance. The analyses offered partial support for the hypotheses.

Worry was found to be unrelated to actual deficits in reasoning, and heuristic responding on the probabilistic reasoning task was unrelated to both processing style and level of worry. Although the current results do not offer support for Borkovec’s Avoidance Model of Worry, which argues that ineffective/effective problem-solving are related increased/reduced perceptions of threat, they corroborate and expand
Table 4.2: Correlations of Situational and Dispositional Processing Style Scales with Symptom Measures and Reasoning

<table>
<thead>
<tr>
<th></th>
<th>PSWQ</th>
<th>GADQIV</th>
<th>PMPI-E</th>
<th>PMPI-R</th>
<th>REI-E</th>
<th>REI-R</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasoning</td>
<td>-.030</td>
<td>-.038</td>
<td>-.247*</td>
<td>.006</td>
<td>-.097</td>
<td>.240*</td>
<td>-</td>
</tr>
<tr>
<td>Sub. Prob.</td>
<td>.088</td>
<td>.066</td>
<td>.026</td>
<td>.010</td>
<td>-.020</td>
<td>-.057</td>
<td>-.188</td>
</tr>
</tbody>
</table>

Note: N = 106. PSWQ = Penn State Worry Questionnaire; GADQ – IV = Generalised Anxiety Disorder Questionnaire – IV; PMPI – E = Perceived Modes of Processing Inventory, Emotional scale; PMPI – R = Perceived Modes of Processing Inventory, Rational scale; REI – E = Rational Experiential Inventory, Experiential; REI – R = Rational Experiential Inventory, Rational scale.
* p < .05. ** p < .01. *** p < .001.

Table 4.3: Moderation Regression Analyses of Situational Rational Processing Style, High and Low Worry/GAD symptoms and Reasoning Scores as the Outcome

Variables

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Subjective Probability</th>
<th>Total Reasoning Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
</tr>
</tbody>
</table>

**Step 1**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PMPI-R</td>
<td>-.021</td>
<td>-.163</td>
</tr>
<tr>
<td>Worry high_low</td>
<td>.145</td>
<td>1.109</td>
</tr>
</tbody>
</table>

ΔR² = .020
F = .618, .484

**Step 2**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PMPI-R</td>
<td>-.121</td>
<td>-.282</td>
</tr>
<tr>
<td>Worry high_low</td>
<td>.145</td>
<td>1.097</td>
</tr>
<tr>
<td>PMPI_R x worry</td>
<td>.105</td>
<td>.244</td>
</tr>
</tbody>
</table>

ΔR² = .001
F = .426, .887

Note: N = 63. PMPI – R = Perceived Modes of Processing Inventory, Rational scale
* p < .05. ** p < .01.
Table 4.4: Moderation Regression Analyses of Experiential Situational Processing Style, High and Low Worry/GAD symptoms and Reasoning Scores as the Outcome Variables

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Subjective Probability</th>
<th>Total Reasoning Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMPI-E</td>
<td>-.090</td>
<td>-.703</td>
</tr>
<tr>
<td>Worry high_low</td>
<td>.147</td>
<td>1.154</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.028</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>.857</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMPI-E</td>
<td>.387</td>
<td>.979</td>
</tr>
<tr>
<td>Worry high_low</td>
<td>.194</td>
<td>1.467</td>
</tr>
<tr>
<td>PMPI_R x worry</td>
<td>-.509</td>
<td>-1.273</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.026</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1.118</td>
<td></td>
</tr>
</tbody>
</table>

Note: N = 63. Worry = Penn State Worry Questionnaire; GAD symptoms = Generalised Anxiety Disorder Questionnaire – IV; PMPI – E = Perceived Modes of Processing Inventory, Experiential scale
* p < .05. ** p < .01.
previous findings by demonstrating that worry is unrelated to problem-solving and reasoning skills per se (Davey, 1994b; Ladouceur et al., 1998). Current research into pathological worry highlights the importance of beliefs and self-perceptions with regard to performance on tasks of higher-level cognitive functions. For example, Dugas et al.’s (1998) Intolerance of Uncertainty Model (IUM) of worry highlights a negative problem orientation, rather than a deficit in problem-solving skills, as characteristic of worry, and indeed no differences have been observed in problem-solving performance on experimental tasks between individuals with and without worry (e.g., Robichaud & Dugas, 2005b). Furthermore, Wells’ (1995) Metacognitive Model argues for the central role of beliefs in the development and maintenance of chronic worry (these models are described in full in Chapter 1, Section 1.5, pp. 16-43). Thus, the current study highlights the discrepancy between self-perceptions and performance in individuals with high levels of worry and supports the importance of beliefs and self-perceptions, which are central to cognitive models of worry/GAD, in understanding the development, maintenance, and treatment of worry (Davey, 1994a; Dugas et al., 1995; Shewchuk et al., 2000).

There was some evidence of a relationship between self-reported processing style and actual reasoning abilities; participants with low dispositional rational and a high situational experiential processing style were found to perform lower on statistical reasoning. However, no relationship was found between increased worry/GAD symptoms, processing style and reasoning scores. The findings in Study 1 (Chapter 3, pp. 101 - 116) demonstrated that when faced with periods of active worry (i.e., situational processing style) participants with high, compared to low, levels of worry reported increased levels of rational processing. However, no
significant relationships were observed between reports of preferred situational processing styles, actual reasoning skills and levels of worry. Therefore, although individuals with high levels of worry perceive themselves to use rational processing more than those with low levels of worry, the current findings suggest that this is purely their perception as neither strengths nor actual deficits were observed in rational thinking or reasoning skills per se.

Effective problem-solving relies heavily on rational processing and metacognitive processes (e.g., monitoring and evaluation), which are required to override experiential processing (Fong et al., 1986; Ricco & Overton, 2011). Data in the current study is consistent with previous findings; higher reasoning scores were associated with higher levels of dispositional rational processing and less engagement in a situational experiential processing (Denes-Raj & Epstein, 1994; Klaczynski & Daniel, 2005; Stanovich, Toplak, & West, 2008; Stanovich & West, 1998; Stanovich & West, 2008; Stupple, Ball, Evans, & Kamal-Smith, 2011). These relationships indicate that, when faced with situations in which they worry, individuals who perceive themselves to be less rational respond in a more emotional, intuitive manner and are more likely to use a heuristic style of processing. Cognitive Experiential Self Theory (CEST) would argue that it is these individuals, who both perceive themselves to have a less rational disposition and to engage in more experiential processing when faced with periods of active worry, who are most at risk for pathological levels of worry. CEST assumes that the dominance of one system over the other is predictive of reasoning, problem-solving performance, and non-normative responding, as well as being associated with psychopathology (Burns & D'Zurilla, 1999; Claes et al., 2009). However, the results of this study do not support this contention. That is, there was no relationship observed between worry, processing style, and reasoning scores.
One possible explanation for the lack of association is that the current study did not contain a worry induction component. The results from Study 1 demonstrate that participants report different results when asked to think about situations in which they worry, compared to how they respond more generally. It is possible the current findings reflect the absence of worry with regard to its impact on reasoning task performance. This supports the findings from Study 1 (Chapter 3, pp. 101-116), which highlight the importance of taking into account the impact of both internal and external context in relation to both perception and behaviour is an important consideration in future research examining worry.

The discrepancy observed in this study between self-reported rationality and performance on reasoning tasks has significant implications for research into worry. It highlights the fact that self-report is a person’s assessment of their abilities, which is influenced by the perceptions and biases that they hold. Therefore, the biases common to those who worry (e.g., increased self-doubt, lack of self-efficacy in problem-solving) are likely to influence their judgments in reporting on their cognitive abilities and deficits. Hence, the current results strongly argue for the importance of using experimental paradigms to directly assess cognitive processes, rather than simply asking participants to characterize their own cognitive processes. There are also wider applications with regard to clinical treatments. The current findings are in line with recent meta-analyses and randomised control trials that support the efficacy of cognitive based therapies, which target erroneous self-perceptions and cognitive biases that may be contributing to the maintenance of anxiety (e.g., cognitive therapy, metacognitive therapy; Cuijpers et al., 2014; van der Heiden, Muris, & van der Molen, 2012; Wells & King, 2006).
The current study has several limitations. First, the sample was comprised of a non-clinical analogue sample. However, as stated earlier, clinical and non-clinical populations have a qualitatively similar experience of worry, thereby offering justification for the adequacy of non-clinical samples for research into worry (Borkovec et al., 1983; Stokes & Hirsch, 2010). Second, the current study tested the null hypothesis that worry would not moderate the relationship between processing style and reasoning and that there would be no worry related group differences observed in actual reasoning performance. However, testing for the presence of no observed difference can be very difficult to interpret, as there can be multiple reasons for the observation of non-significant findings, such as methodological limitations or low power. Third, although we carefully selected the experimental tasks in order to investigate levels of both statistical and heuristic reasoning it is possible that the hypothetical nature of these problems and the lack of a worry induction component meant that they may have failed to elicit a disruption to the problem-solving process, which may occur in real-life situations. Future research would be beneficial that employs a problem-solving paradigm, such as the Means-Ends Problem-Solving Test (MEPS; Platt & Spivack, 1975), which examines a more direct measure of problem-solving that may be more reflective of the problem-solving challenges observed in individuals with chronic worry/GAD. Nonetheless, the current findings certainly accentuate that major reasoning and problem-solving deficits are not inherent in individuals with high levels of worry. However, research that aims to further differentiate problem-solving performance deficits from problem-solving ability deficits so that one can examine worry related performance deficits would be beneficial.
In conclusion, this study extended previous research by integrating dual-process theory and findings from the problem-solving and reasoning literatures more generally, as this applies to pathological worry. These results confirm and extend the findings in Study 1 (Chapter 3, pp. 101-116) that self-reported processing style, particularly high situational and low dispositional rationality, is associated with worry and GAD symptomatology. A strength of this study was the use of both self-report and experimental paradigms, which offered the opportunity to overcome the possible distortions of self-perceptions (Eng & Heimberg, 2006). The findings have implications more broadly in that they are consistent with cognitive models of worry and GAD (e.g., the Metacognitive Model and Intolerance of Uncertainty Model), which highlight the role of beliefs and biases in self-perceptions (e.g., a negative problem orientation) as common to those who worry. In light of the reasoning tasks in the current study being found to be unrelated to levels of worry, we were unable to gain further insight - via experimental rather than self-report measures - of the possible applicability of dual-process models (i.e., CEST) in accounting for worry. Therefore, the following study will turn to focus on attentional control, as demonstrated by performance on the antisaccade task, to further examine the applicability of alternative dual-process/integrated models of worry - specifically the relationship between reflexive (bottom-up, experiential) and volitional (rule-based, rational) processes and their association to chronic worry.
Chapter 5: Experimental Study 3

The Impact of Worry on Attentional Control: A Dual-Process Account

As discussed in the introduction to this thesis, a common theme in theories of anxiety disorders is the suggestion that individuals who are vulnerable to anxiety have certain information processing biases, which lead them to become vigilant to threat-related stimuli (Barlow, 2002; Sheppes, Luria, Fukuda, & Gross, 2013), as well as having difficulty disengaging from those stimuli (Amir, Elias, Klumpp, & Przeworski, 2003; Fox et al., 2001; Koster et al., 2004; Yiend & Mathews, 2001). Meta-analyses confirm that on common measures of attention bias, such as the dot-probe and Stroop tasks, individuals with clinical levels of anxiety are characterized by selective attention to threatening cues (Bar-Haim et al., 2007). However, more recent psychological models of anxiety (Derakshan & Eysenck, 2009; Hirsch & Mathews, 2012) have shifted focus from emphasizing attentional biases in anxiety to also focus on deficits in attentional control, an aspect of executive function (Visu-Petra, Miclea, & Visu-Petra, 2013).

Attentional control, as conceptualised by attentional control theory (ACT; Eysenck, Derakshan, Santos, & Calvo, 2007), involves processes underlying the ability to intentionally ignore distracting information, as well as shifting attention from one aspect to another via the use of deliberate conscious processes. Attentional control is the ability to concurrently suppress automatic stimulus driven reactions whilst simultaneously engaging one’s goal-directed attentional system to control one’s focus (Eysenck & Derakshan, 2011; Richards, Benson, & Hadwin, 2012). Therefore, the distinction between controlled and automatic processes is central to research into attentional control. This is also reflected in current theoretical developments in chronic worry, which account for attentional control deficits within a
dual-process framework (Hirsch & Mathews, 2012; Ouimet et al., 2009). Dual-process models and attentional control are particularly relevant to anxiety and worry, essentially due to the impact of threat; once an individual is exposed to threat both habitual (automatic) and intentional (controlled) aspects of processing are engaged.

Hirsch and Mathews’ (2012) recently proposed model of worry (see Chapter 1, Section 1.5.3, pp. 31-43 for a more detailed discussion) highlights both voluntary top down attentional control processes, in addition to emotional processing biases, as being central to the development and maintenance of worry. The basic premise of the model is that processing biases of attention and interpretation occur outside of awareness and lead to a strong and stable representation of threat-related information, which in turn contributes to the likelihood that they will reach awareness as thoughts. As these threatening thoughts take a verbal form, they are inevitably harder to ignore due to their detrimental impact on working memory capacity and executive function (Leigh & Hirsch, 2011). Hirsch and Mathews (2012) propose that the form worry takes (“quasi-verbal”), in addition to deficits in attentional control, allows for the perpetuation of further biases and a repeated cycle of worry, which is often perceived as uncontrollable.

Research evidence is building to support the role that deficits in voluntary top-down attentional control processes are argued to play in anxiety (Bishop, 2009; Derryberry & Reed, 2002; Eysenck et al., 2007; Osinsky, Gebhardt, Alexander, & Hennig, 2012), with methodologies favoring the use of tasks based on saccadic eye movements. For example, the antisaccade task (Hallett, 1978) is becoming increasingly popular as it is a simple methodology, that produces quality data, which can be subjected to rigorous mathematical and computational analyses (Antoniades et al., 2013). The antisaccade task (see Chapter 2, Section 2.3.2.1, pp. 86-88 for a more
detailed discussion of this paradigm) requires participants to focus on a white circle that is replaced by a cue, which acts to direct participants to move their eyes either toward or away from a stimulus presented to one side of the central fixation. Attentional control is measured by the time (saccade latency) it takes an individual to inhibit the reflexive (bottom up) response and to control (top down) their gaze so as to generate an eye-movement (an antisaccade) in the opposite direction to stimuli presented (see Figure 5.1). The antisaccade task is most commonly presented in combination with the prosaccade task, which requires one to move their gaze from a central fixation to look toward the presented stimuli.

Initially, research exploring the association between anxiety and anti- and pro-saccade task performance focused primarily on examining these tasks in separate blocks. Ansari et al. (2008) were the first to employ a task-switching (between anti- and pro-saccade trials) paradigm, whereby they examined participants’ responses when presented with mixed blocks of anti- and pro-saccade trials. Adding a task-switching component offers the opportunity to examine the impact of shifting, and, therefore, also the impact of task complexity and flexibility on performance (Ansari & Derakshan, 2010; Everling & Fischer, 1998).

The majority of antisaccade studies in anxiety have compared individuals with high versus low trait anxiety, with levels of worry and/or the impact of GAD on attentional control remaining largely unexplored. With regard to comparisons of those with high versus low trait-anxiety, no differences have been observed with regard to errors on either the antisaccade task or prosaccade tasks (Ansari & Derakshan, 2010, 2011a; Ansari et al., 2008; Brassen, Gamer, Rose, & Buechel, 2010; Garner, Attwood, Baldwin, James, & Munafò, 2011). Therefore, anxiety does not impair performance effectiveness, as participants with high levels of anxiety are as accurate
Figure 5.1. (A) Switch and repeat trials. (B) Anti- and prosaccade tasks.
as those with low levels of anxiety in generating antisaccades/prosaccades (Ansari et al., 2008; Derkshan et al., 2009; Ansari & Derakshan, 2010). In contrast, findings consistently show that trait anxiety impacts performance efficiency and impairs attentional control. Specifically, inhibition of reflexive eye movements in anxious, compared to non-anxious individuals, have been found to have to take significantly longer with regard to controlling the direction of their saccades on antisaccade, compared to prosaccade, trials (Ansari & Derakshan, 2010, 2011a; Ansari et al., 2008; Brassen et al., 2010; Garner et al., 2011).

Although findings consistently demonstrate that high trait anxious participants are less efficient than low anxious participants at enacting control over their attention on the antisaccade task, whether the addition of threatening stimuli adds further to poor attentional control by demonstrating a greater antisaccade effect is less clear (Derakshan & Eysenck, 2009; see: Garner, Ainsworth, Gould, Gardner, & Baldwin, 2009; Reinholdt-Dunne et al., 2012). Four out of a total of five studies have demonstrated an effect of stimuli valence, whereby, in comparison to individuals with low trait anxiety, individuals with high levels of trait anxiety had an additional increase in antisaccade latencies in the present of threatening compared to neutral stimuli (e.g., Derakshan & Eysenck, 2009). High compared to low-anxious individuals were slower to initiate saccades towards stimuli of threatening scenes (antisaccades; Cornwell, Mueller, Kaplan, Grillon, & Ernst, 2012; Garner et al., 2011), and showed greater antisaccade cost (participants are slower to look away from presented stimuli) for angry than neutral faces (Reinholdt-Dunne et al., 2012).

In addition to the use of threatening stimuli, another methodological characteristic that appears to increase the antisaccade task is adding a task-switching component. As previously described, adding a task switching component to the
antisaccade task increases the complexity and has been found to result in slower latencies in high trait anxious (see: Berggren & Derakshan, 2013, for review). Paradoxically, as a result of pre-cuing enabling attentional resources to be allocated to the task at hand low-anxious individuals have been observed to demonstrate switch benefits, whereby in comparison with non-mixed trials shorter latencies were recorded when switching between anti- and pro-saccade trials (Ansari et al., 2008; Barton et al., 2002; Cherkasova, Manoach, Intriligator, & Barton, 2002). The lack of switch-benefit observed in individuals with high levels of anxiety is thought to result from reduced working memory resources, a decreased ability to utilize cues to enable task set reconfiguration, and a decreased ability to exercise efficient top-down attentional control to distribute attentional resources according to task demands (Ansari et al., 2008).

The aim of this study is to extend the results of the antisaccade task to adult individuals high and low in worry. To date, this has not been specifically investigated. The hypotheses were based on three factors. First, theoretical assertions emphasize the role of reduced attentional control in individuals with pathological worry (Hirsch & Mathews, 2012). Therefore, worry is thought to be specifically responsible for consuming control capacity (Hirsch & Mathews, 2012) and reducing the ability to enact attentional control (Eysenck et al., 2007). The persistent and inflexible negative cognitive activity observed in pathological worry suggests that greater impairment should be observed on the antisaccade task (attentional control) compared to disorders such as specific phobias and panic, as these later disorders are characterized by acute episodes of fear/panic (Hayes et al., 2008). As such, the current study aims to test the central tenet in both Hirsch and Mathews’ (2012) and Ouimet et al’s (2009) models that deficits in top down attentional control/impairment of the central executive
function are associated with the development and maintenance of anxiety/worry. Second, as worry is present across the range of anxiety disorders (see Chapter 1, Section 1.2, p.4 for further discussion; Borkovec et al., 1991; Brown et al., 1992; Konstantellou et al., 2011; McLaughlin et al., 2007; Turk & Mennin, 2011), many of those high in anxiety are likely to be high in worry; therefore, it seems likely that those high in worry would demonstrate similar patterns of performance on the anti-saccade/pro-saccade task to participants with high levels of anxiety. Thirdly, two studies that have adapted the random key-pressing task and N-Back task (see Chapter 2, Section 2.3.2, pp. 85-86 for further details) to assess attentional control in relation to worry, have found preliminary evidence for individuals with high levels of worry demonstrating less ability to control their attention, as both with and without the presence of threat worry depletes attentional control resources (Hayes et al., 2008; Stefanopoulou et al., 2014). Hayes, Hirsch, and Mathews (2008) found that in individuals with high levels of worry, worry depletes resources resulting in participants being less able to shift their attention away from worry to focus on the task at hand. In contrast, Stefanopoulou et al. (2014) examined the impact of active worry versus thinking about a possible future event on reaction time performance and found that, when worrying, participants with GAD compared to control participants were less proficient in performing the random key-press task. Participants with GAD were also found to perform poorly on the N-Back task under high load conditions. Taken together these findings were suggested to reflect that worry consumed attentional control resources and, therefore, for individuals with high levels of worry, fewer available attentional resources are present to manage the theme of their thoughts (Hayes et al., 2008; Leigh & Hirsch, 2011).
As such, we make the following hypotheses: First, individuals with high, compared to low levels of worry, will have more difficulty with attentional control and task switching, which will be observed as slower antisaccade latencies particularly when switching between anti- and pro-saccade tasks. Second, these effects are also expected to be greater in the presence of threatening cues. Last, it is also hypothesized that no difference in error rates will be observed between individuals with high and low levels of worry.

5.1 Method

5.1.1 Participants

The participants in this study were 106 first-year psychology students. Data for five participants could not be used, as they did not complete all components of the study. A further seven were excluded from analyses due to poor tracking or technical failures whilst administering the task. This left a total of 94 participants. After extreme group splits were performed the sample consisted of 73 participants included in the final data set examining high (n=38) and low (n=35) worry groups. Multiple linear regression analyses were planned to be undertaken on the complete data set (N = 94); an extreme groups approach was not used for these analyses in order to increase power. For further details about the sample see: Chapter 2, Section 2.2.1, p.66. The task took approximately 25 minutes and participants completed the antisaccade task study components individually during a one-hour session during which the reasoning tasks (Study 2) and interpretation bias task (Study 4) were also administered.

5.1.2 Measures

The Penn State Worry Questionnaire (PSWQ), Generalised Anxiety Disorder Questionnaire-IV (GADQ-IV), and two processing style measures - the Rational-
Experiential Inventory (REI) and the Perceived Modes of Processing Inventory (PMPI) - were administered in one of two counterbalanced orders via LimeSurvey (version 1.87). A full description of the measures and their psychometric properties can be found in Chapter 2, Section 2.2.5, pp. 73-78.

5.1.3 The Antisaccade and Prosaccade tasks

Cue and Target Stimuli

A small white circle 7mm in diameter (0.7° visual angle) presented on a grey scale background served as the central fixation prior to each trial. Once fixation was achieved, the white circle then acted as the cue to indicate whether an anti- or pro-saccade was required. Participants were instructed that the cue would change colour to indicate the required saccade direction; red required participants to look away from the image (antisaccade), whilst green required participants to look toward the image (prosaccade). The fixation and cue stimuli were created using the Microsoft Paint graphics application. The “target” stimuli were a selection of images obtained from the International Affective Picture System (Ansari & Derakshan, 2011a, 2011b; Ansari et al., 2008; Garner et al., 2011; Jazbec, McClure, Hardin, Pine, & Ernst, 2005). The selected images were comprised of neutral and threatening (50% moderate and 50% high valence and arousal) 2-D colour images, which have previously been employed in attentional research in anxiety (IAPS; Lang, Bradley, & Cuthbert, 1999). The images were cropped using Adobe Flash CS3 software, they subtended 8.5° x 11.5° (height = 8.5cm; width = 11.5 cm) and were presented on a grey background. The center of the picture was located at 9.5° visual angle to the left or right of the center of the fixation circle. An 18-inch, 32-bit colour LCD monitor with a resolution of 1,024 x 768 pixels acted as the host PC, which ran the experiment.
Experimental Task

Threatening and neutral anti- and pro-saccade tasks were presented at random in the same block of trials (see Figure 1). This led to the proliferation of ‘switch’ and ‘repeat’ trial types which were used to examine participants task-switching ability; a repeat trial consisted of two similar trial types in sequence (e.g., an antisaccade trial followed by an additional antisaccade trial), whilst a switch trial consisted of a change in trial type from the preceding one (e.g., a prosaccade following an antisaccade trial). There were equal ‘switch’ and ‘repeat’ trials, which were also randomly presented.

Eye-Tracking Device and Software

Participants’ eye movements were recorded with an EyeLink1000 eye tracker ("Eyelink 1000 [Apparatus and software]," 2010). The eyetracker had a sampling rate of 1000Hz, which means that during trials participants’ eye movements were recorded continuously at 1000 Hz. The measures generated are based on the corneal reflection (caused by infrared light source) in relation to one of the participant’s pupils; only the saccades of the right eye were recorded. A chin and forehead rest were used to minimise head movements and to ensure that the sitting and viewing distance were uniform (57cm) between participants and across trials. The eye-tracking system and software were automatically synchronised at the beginning of each trial.

5.1.3.1 Experimental Procedure

Eye-movements were recorded on a Macintosh computer, running Windows XP version 2002, and the task was administered using the Experiment Builder software ("Eyelink 1000 [Apparatus and software]," 2010), which ensured millisecond timing accuracy. Instructions were presented as text for participants to read, however, verbal confirmation that they had understood the instructions was also sought. The importance of speed and accuracy were highlighted.
Participants completed the task in a small, dimly lit cubical at a viewing distance of 57cm from the computer monitor. A total of eight practice trials, with feedback, were presented at the start of the experiment. The importance of focusing on the white dot was emphasised, as well as minimising blinking during trials. The eye-tracker was calibrated for each participant at the beginning of the testing session and then repeated again between each of the four blocks of trials. Calibration consisted of the participant fixating on a series of points appearing at various locations on a nine-point grid, which the software uses to indicate whether or not valid gaze points can be calculated.

Presentation order was random for each participant and the trials were completed in four blocks of 56 trials (total of 224 trials; see Figure 5.2 for breakdown), with a few minutes pause between each block. In order to avoid the potential impact of anticipatory saccades, the simultaneous cue (central fixation turning to red/green) and target (threatening/neutral picture) onset were activated only after participants had focused on the central fixation point at a varied fixation time between 750 – 1500msec. Specifically, the time between the fixation and simultaneous cue/target onset time was randomised to either 750ms, 1,000ms, 1250ms, or 1500ms. The central fixation was used to control the initial retina position across all participants. This was made possible by defining a circular diameter area of 3° visual angle around the central fixation point. If participants gaze fell outside of this fixation zone an ‘error’ sign was presented requesting participants to focus on the white circle until it changed colour. Once fixation had been established the white fixation circle was randomized to change to either green or red before the target stimuli were presented. Participants were required to respond by making a saccade either “away” (antisaccade) in the opposite direction to the target when the circle was
Figure 5.2: Antisaccade task methodology: Breakdown of trials presented
red or by looking “toward” (prosaccade) the target when presented with a green dot. The target was presented for 200msec and presentation to the right or left peripheral field of vision was randomised.

5.1.4 Eye Movements Data Preparation

The variables examined in this study were directional accuracy (the percentage of errors made by participants) and latency of first correct saccade, (the time lapsed between onset of either the red or green cue and the saccade toward the correct area of interest). Saccades were defined as latencies with velocities exceeding 30°/sec and amplitudes > 3° that were made after cue onset. Trials were excluded if eye-tracking was interrupted due to lost pupil (including blinks), or if no eye movements were made. If the eye was not within approximately 1.5° visual angle of the central fixation at the time of target appearance the trial was rendered invalid. Exclusion criteria also included trials with recorded latencies shorter than 55msec, as these are deemed anticipatory, as well as latencies greater than 600msec after target onset (Antoniades et al., 2013). This led to the loss of 9.82% of antisaccade trials and 7.81% of prosaccade trials. Lastly, in order to examine the impact of task switching, the first experimental trial in each block was excluded from analyses as it was not preceded by a trial and thus was neither a switch nor repeat trial. This methodology is common practice in the task switching literature (e.g., Ansari & Derakshan, 2010).

5.2 Planned Analyses

The following eight variables were found to contain outliers and, even after these were corrected, to not satisfy standard criteria for a normal distribution: one outlier each on both the antisaccade and prosaccade switch trial error percentage variable, as well as the prosaccade and antisaccade repeat trial error percentages. Two outliers were observed on prosaccade neutral stimuli trial error percentages but
only one data point was an outlier with regard to antisaccade neutral stimuli trial error percentages. Additionally, on prosaccade threatening stimuli trial error percentages, two outlying variables were detected, and one outlier was detected on antisaccade trials.

All analyses were undertaken with SPSS version 21.0. Initial analyses consisted of a series of mixed model analyses of variance (ANOVAs). Two mixed ANOVAs were performed to examine saccade latencies (within subjects factor) by level of worry (between subject factor). Firstly, a 2 (task: anti-, pro-saccade) x 2 (stimuli: threat, neutral) x 2 (high, low worry) ANOVA was employed to examine latencies of correct saccades, whilst the second 2 (task: anti-, pro-saccade) x 2 (trial type: switch, repeat) x 2 (worry: high, low) ANOVA examined the impact of switch and repeat trials on correct saccade latencies. Additionally, two mixed ANOVAs were also employed to examine saccade error rates. A 2 (task: anti-, pro-saccade) x 2 (stimuli: threat and neutral) x 2 (high and low worry) ANOVA were employed to examine saccade error rates, whilst a second ANOVA examined the impact of switch and repeat trials on error rates: 2 (task: anti-, pro-saccade) x 2 (trial type: switch, repeat) x 2 (worry: high, low) ANOVA. Where differences emerged, univariate and t-tests were performed to further examine differences between the groups.

The next set of analyses aimed to assess the relationship between scores on the symptom scales, processing style scales, and attentional control. To this end, multiple linear regression analyses were planned to be undertaken on the complete data set and to focus on any variables that were found to demonstrate significance in the preliminary correlational analyses. Prior to these analyses attentional control scores were calculated, whereby saccade latencies on prosaccade trials were subtracted from saccade latencies on antisaccade trials. The attentional control scores represent the
degree to which participants are able to enact control over their attention, with lower scores representing more attentional control than higher scores.

5.3 Results

5.3.1 Latencies of correct saccades

A mixed design ANOVA examined the mean latencies for correct trials as a function of Task (anti- and prosaccade), Stimuli (threatening and neutral), and Group (high and low worry; see: Figure 5.3). Descriptive statistics are shown in Table 5.1. Main effects of Trial $F(1, 71) = 84.71, p < .001$, and Stimuli $F(1, 71) = 8.26, p < .01$ were revealed; participants were faster to respond on pro- ($M = 334.78, SD = 57.21$) than antisaccade ($M = 370.22, SD = 61.92; t(72) = -8.97, p < .001$) trials, and, overall, responded with faster latencies in the presence of threatening ($M = 364.16, SD = 60.45$) than neutral ($M = 357.08, SD = 53.82; t(72) = 2.72, p < .01$) stimuli. Although the Task x Stimuli interaction ($F(1, 71) = 2.45, p = .12$), and the Task x Stimuli x Group interaction ($F(1, 71) = .83, p = .37$) failed to reach significance, a significant interaction of Stimuli x Group was observed: $F(1, 71) = 4.68, p = .03$.

To clarify these findings, the interaction of stimuli and level of worry (group) was explored. Analyses confirmed that Stimuli (threat, neutral) had no impact on performance latency for participants with high levels of worry: threatening stimuli ($M = 351.56, SD = 57.83$) and neutral stimuli ($M = 350.19, SD = 52.82; t(37) = .57, p = .571$). In contrast, participants with low levels of worry initiated faster saccades on trials containing threatening ($M = 361.22, SD = 60.25$) than neutral stimuli ($M = 351.45, SD = 49.27; t(35) = 3.17, p < 0.01$).

5.3.2 Switch and repeat saccade latencies

A Task (anti-, pro-saccade) x Trial type (switch, repeat) x Group (high-, low- worry) mixed design ANOVA (Figure 5.4) revealed a main effect of
Table 5.1: *Mean saccade latencies (milliseconds) and percentage error rates within trial, stimuli, and task factors (standard deviation of mean in parenthesis).*

<table>
<thead>
<tr>
<th>Stimuli</th>
<th>High worry (n=38)</th>
<th>Low worry (n=35)</th>
<th>Level of worry and task type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Antisaccade</td>
<td>Prosaccade</td>
<td>Antisaccade</td>
</tr>
<tr>
<td>Threat</td>
<td>367.83 (66.09)</td>
<td>335.30 (55.75)</td>
<td>377.70 (61.57)</td>
</tr>
<tr>
<td></td>
<td>5.96 (5.17)</td>
<td>3.85 (3.49)</td>
<td>4.44 (4.17)</td>
</tr>
<tr>
<td>Neutral</td>
<td>370.89 (54.87)</td>
<td>329.48 (57.12)</td>
<td>369.87 (47.76)</td>
</tr>
<tr>
<td></td>
<td>6.71 (5.74)</td>
<td>2.59 (2.52)</td>
<td>5.95 (4.55)</td>
</tr>
<tr>
<td>Trial</td>
<td>378.06 (64.14)</td>
<td>338.91 (54.19)</td>
<td>381.85 (59.20)</td>
</tr>
<tr>
<td></td>
<td>7.17 (6.08)</td>
<td>4.99 (4.28)</td>
<td>6.01 (4.78)</td>
</tr>
<tr>
<td>Repeat</td>
<td>360.66 (56.85)</td>
<td>325.87 (58.80)</td>
<td>365.72 (50.71)</td>
</tr>
<tr>
<td></td>
<td>5.50 (4.94)</td>
<td>1.50 (1.80)</td>
<td>4.38 (3.75)</td>
</tr>
</tbody>
</table>
Figure 5.3. Mean correct saccade latencies (msec) by Task (anti-, pro-saccade) and Stimuli type (threatening, neutral) in high and low worry groups
Figure 5.4. Mean correct saccade latencies (msec) by Task (anti-, pro-saccade) and Trial type (switch, repeat) as a function of worry (high, low groups)
Trial: $F(1, 71) = 55.58, p < .001$, with participants responding more quickly on repeat ($M = 346.12, SD = 53.01$), than switch ($M = 360.87, SD = 56.77$) trials. No further main effects or interactions were found to be significant ($Fs < 1$).

5.3.3 Incorrect Saccades

Overall, the percentage of errors recorded was higher on antisaccade ($M = 10.81\%, SD = 8.69$) than on prosaccade trials ($M = 5.55\%, SD = 4.84$; $t(72) = 5.74, p < .001$; see Table 5.1). A mixed design ANOVA was performed with Group (high-, low-worry) as the between-subject factor, and Task Errors (anti-, pro-saccade) and Stimuli Errors (threat, neutral) as within-subject factors (see Figure 5.5). A main effect of Task $F(1, 71) = 32.09, p < .001$, but not Stimuli $F(1, 71) = .56, p = .46$ was found. An interaction was also observed between Task and Stimuli $F(1, 71) = 35.44, p < .001$. Specifically, on antisaccade trials participants made more errors in the presence of neutral ($M = 6.35, SD = 5.18$) compared to threatening stimuli ($M = 5.23, SD = 4.75$; $t(72) = 3.22, p < .01$). Whereas, on prosaccade trials more errors were observed in presence of threatening ($M = 3.65, SD = 3.18$) compared to neutral stimuli ($M = 2.21, SD = 2.18$; $t(72) = 5.48, p < .001$). These findings were unrelated to levels of worry; Group X Task and Group X Stimuli interactions were not found to be significant, $F < 1$.

Lastly, the impact of switch and repeat trials on error rates were assessed. A main effect was found for both Task (anti-, pro-saccade) and Trial (switch, repeat) errors, $F(1, 71) = 31.95, p < .001$ and $F(1, 71) = 84.65, p < .001$ respectively. The Task x Trial interaction also reached significance: $F(1, 71) = 8.01, p < .01$. Overall, more errors were observed on repeat ($M = 11.43\%, SD = 9.33$) than switch trials ($M = 5.89\%, SD = 5.16$; $t(72) = 5.72, p < .001$). Participants made more errors on antisaccade switch ($M = 6.62\%, SD = 5.49$) than repeat trials ($M = 4.96, SD = 4.42$;
as well as prosaccade switch \( (M = 4.47\% , SD = 3.79) \) than repeat trials \( (M = 1.41, SD = 1.66; t(72) = 8.72, p < .001) \). No significant findings were observed in relation to levels of worry with all Group interactions showing \( F > 1 \) (see Figure 5.5).

**5.3.4 Preliminary Analyses: Correlational Analyses**

Bivariate correlations between attentional control scores and symptom scales and processing style scales are presented in Table 5.2. The attentional control scores represent the degree to which participants are able to enact control over their attention with lower scores representing more attentional control than higher scores. No significant correlations were observed between attentional control scores and either processing style or symptom scores. As the correlational results (see: Table 5.2) indicated no significant relationships between symptom scores, processing style and attentional control, no multiple regression analyses were undertaken.

**5.4 Discussion**

The aim of the current study was to explore the association between worry and attentional control with the antisaccade task, both in the presence of neutral and threatening stimuli, as well as with a task-switching component. It was predicted that individuals with high, compared to low levels of worry, would demonstrate less attentional control and more difficulty (slower latencies) task switching between anti- and pro-saccade tasks. The presence of threat was also expected to produce greater effects, whereby it was anticipated that participants with high levels of worry would demonstrate slower latencies on task switching trials that contained threatening stimuli. Additionally, no difference in error rates was expected as a result of participants’ level of worry.

The hypotheses were largely unsupported. Overall, participants were faster to
Table 5.2: Correlations of symptom measures and processing style measures and attentional control scores

<table>
<thead>
<tr>
<th></th>
<th>PSWQ</th>
<th>GADQ-IV</th>
<th>PMPI-E</th>
<th>PMPI-R</th>
<th>REI-E</th>
<th>REI-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Att.Control</td>
<td>.028</td>
<td>.052</td>
<td>-.023</td>
<td>-.136</td>
<td>-.013</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Note: N = 94. PSWQ = Penn State Worry Questionnaire; GADQ – IV = Generalised Anxiety Disorder Questionnaire – IV; PMPI-E = Perceived Modes of Processing – Experiential scale; PMPI-R = Perceived Modes of Processing – Rational scale; REI-E = Rational Experiential Inventory – Experiential scale; REI-R = Rational Experiential Inventory – Rational scale **p < 0.01; *p < 0.05

Figure 5.5. Percentage of errors in directional accuracy by Task (anti-, pro-saccade) and Stimuli type (threat, neutral) as a function of worry (high, low)
Figure 5.6. Percentage of errors in directional accuracy by Task (anti-, pro-saccade) and Trial type (switch, repeat) as a function of worry (high, low)
respond on pro- than anti-saccade trials, as well as repeat than switch trials, as expected. However, unexpectedly, no worry related attentional control deficits were observed. Unexpectedly, the only difference between the groups was that those with low levels of worry were faster to respond to threatening than neutral stimuli. As expected error rates reflected previous findings in that they were unrelated to symptom scores (Ansari & Derakshan, 2010, 2011a; Ansari et al., 2008; Hayes et al., 2008; Kristjansson, Chen, & Nakayama, 2001; Sheremata & Sakagami, 2006).

The lack of worry related attentional control deficits observed in the current study are not consistent with the proposed role of attentional control in the development and maintenance of worry and anxiety more generally (Eysenck et al., 2007; Hirsch & Mathews, 2012; Jazbec et al., 2005). A major assumption of Attentional Control Theory (ACT; Eysenck et al., 2007) is that anxious individuals are characterised by deficits in attentional control (i.e., goal directed attention). Worry is particularly thought to deplete the resources required for the effective use of the top-down attentional system (required in attentional control), thereby contributing to a shift toward bottom-up processing (Eysenck & Calvo, 1992; Eysenck et al., 2007). This is thought to contribute to reduced performance efficiency (slower latencies); effectiveness (comparative error rates) is not impacted due to the engagement of compensatory cognitive mechanisms and increased effort (Derakshan, Salt, et al., 2009; Eysenck et al., 2007).

Hirsch and Mathews (2012) cognitive model of worry also focuses on attentional control deficits as central to generalised anxiety disorder. Their model takes into account the duality of attention, in that both the goal-driven attentional system (top down control) and the stimulus-driven attentional system (bottom-up control) are implicated in worry. Specifically, the combination of emotional
processing biases (i.e., attention and interpretation biases) in conjunction with attentional control deficits is assumed to be responsible for the development and maintenance of pathological worry. Hirsch and Mathews (2012) suggest that the management of worry can be achieved by increasing controlled attention whilst simultaneously inhibiting competing threat representations. However, the current findings do not offer support for attentional control deficits in individuals with high levels of worry, although this could relate to a number of internal and external factors that may have been influencing performance.

Recent studies in the wider anxiety literature have highlighted that the presence of a combination of internal and external factors are required in order for expected antisaccade performance to be observed (Berggren, Richards, Taylor, & Derakshan, 2013). Notably, deficits in cognitive control are a direct result of an individual’s particular dispositional level of attentional control, which may then interact with the parameters of the experiment (Pilar Pacheco-Unguetti, Acosta, Lupianez, Roman, & Derakshan, 2012). Task parameters include, for example, demanding, high perceptual load tasks that fully occupy an individual's attentional resources, yet are not so demanding that they deplete attentional control, appear to reduce differences observed between high and low trait-anxious individuals (Ansari & Derakshan, 2011b; Basten, Stelzel, & Fiebach, 2011; Bishop, 2009; Derakshan & Eysenck, 2009; Eysenck et al., 2007; Osinsky et al., 2012; Pilar Pacheco-Unguetti et al., 2012). Moderate to high task demands have been suggested to allow individuals with high trait-anxiety to engage increased effort and additional cognitive resources in order to compensate for any potential deficits in inhibitory control (Ansari & Derakshan, 2011a; Jennings & van der Molen, 2005; Osinsky et al., 2012). Due to the diversity of variables in the current study, - including threat/neutral stimuli and the
presence of a task-switching component - it is likely that the task demands were moderate to high compared to standard antisaccade tasks. Additionally, motivation also contributes to the likelihood that anxious individuals will employ compensatory strategies (Hayes, MacLeod, & Hammond, 2009). Research examining executive functioning in relation to worry have demonstrated that although worry creates cognitive interference it also has a specific motivational function, whereby increased effort maintains or improves performance (on tasks examining updating, inhibition, and shifting) through the employment of compensatory strategies (Visu-Petra et al., 2013). Therefore, it is possible that the conditions of the current study allowed individuals with high levels worry to match the performance of (and in the case of prosaccade neutral trials, to outperform) their less anxious counterparts.

In terms of accounting for the lack of worry related differences observed between threatening and neutral stimuli on antisaccade trials, evidence suggests that task demands also affect the impact of emotional stimuli (King & Schaefer, 2011; MacNamara, Ferri, & Hajcak, 2011; Van Dillen & Koole, 2009). Although emotional stimuli are preferentially and automatically processed due to their potential implications for wellbeing (Clarke & Johnstone, 2013), high task load can act to reduce the salience of threat stimuli and eliminate response differences between emotional and neutral stimuli (King & Schaefer, 2011; Van Dillen & Koole, 2009). Specifically, in tasks that are more complicated although threatening information is processed, it is prevented from interfering with performance as the task complexity engages top-down regulatory mechanisms (e.g., increased cognitive effort; Clarke & Johnstone, 2013; Van Dillen & Koole, 2009). This notion that increased task complexity engages compensatory top-down mechanisms is supported by experimental (King & Schaefer, 2011; Van Dillen & Koole, 2009) and neuroimaging
(MacNamara et al., 2011) studies, as well as a recent antisaccade study (Berggren et al., 2013). Taken together, in the current study, findings suggest that participants with high levels of worry were able to match the antisaccade performance and, in the case of prosaccade trials containing neutral stimuli, surpass the performance of their non-anxious peers.

Another aim of the present study was to investigate the impact of worry on task switching performance. Difficulties in shifting of attention are related to worry (Hirsch & Mathews, 2012) and have been found to be prevalent in GAD (Dorahy, McCusker, Loewenstein, Colbert, & Mulholland, 2006). In terms of antisaccade performance, although not previously explored in adults who worry, a paradoxical reduction in saccade latencies on ‘switch’ compared to ‘repeat’ trials when switching from pro-to anti-saccade trials has consistently been found in low, but not high, anxious individuals (e.g., Ansari et al., 2008; Barton et al., 2002; Cherkasova et al., 2002). However, despite the current study recording faster latencies on repeat compared to switch trials, no differences in response latencies for switch and repeat trials were found to be associated with symptom measure scores. Thus, the hypothesized switch benefit was not observed in participants with low levels of worry. The application of a strategy that reduced inhibitory demands but established an ‘automatic mode’ of responding may have contributed to the non-anxious participants’ results. Taking a bottom-up processing approach has been found to reduce participants’ inability to utilize the cue to improve performance, particularly on switch trials (Diamond, 2009). Although not measured in the current study, individual differences in motivation could again offer an explanation for the unexpected findings. Motivation has a large impact on tasks examining cognitive control and it maybe possible that the nature of the task simultaneously increased
motivation in participants with high levels of worry (due to its level of complexity), whilst decreasing motivation for participants reporting low levels of worry (possibly due to the effort to engage in the task leading to boredom and reversion to an automatic mode of responding) (Berggren & Derakshan, 2013; Kouneiher, Charron, & Koechlin, 2009).

There are a number of limitations that need to be taken into account. First, as noted in earlier chapters, this study used a non-clinical student sample, which may limit the generalizability of the findings but is arguably valid for the study of pathological worry. However, it will be beneficial for future research to examine the impact of worry on attentional control in a clinical sample with a diagnosis of generalised anxiety disorder. Additionally, although the antisaccade task has many benefits, it has been argued that both the sample recruited as well as the methodology employed can impact findings (Bishop, 2009; Chiau et al., 2011; Osinsky et al., 2012). In the current study, participants were requested to respond as quickly and accurately as possible on the task. Recently, Antoniades et al. (2013) undertook a review of the literature and queried the impact of instructions on performance. The review highlighted the impact of instructions on task performance; studies that highlighted the importance of accurate responses presented different results to those that requested participants respond as quickly as possible (Antoniades et al., 2013). Responding as quickly as possible was argued to not capture the typical performance of subjects (Antoniades et al., 2013). Recent proposals have been presented to develop a standardized antisaccade protocol to strengthen the methodology and help make comparisons between the studies more meaningful. However, even taking into account the antisaccade methodology used in the current study, it failed to replicate
consistently reported effects with the antisaccade task in other studies (e.g., Ansari & Derakshan, 2010, 2011a; Ansari et al., 2008; Brassen et al., 2010; Garner et al., 2011).

In trait anxious individuals, individual differences in automatic and strategic processes impact their capacity to voluntary control attention in the effort to cope (Derryberry & Reed, 2002). However, the current findings highlight previous suggestions (e.g., Visu-Petra et al., 2013) of the importance of accounting for the impact of both external situational (e.g., task demands) and internal personality factors (e.g., motivation and individual differences in attentional control) and their impact on cognitive control (dys)functions in understanding the interplay between involuntary and voluntary processes. To this end, future research that clarifies the impact of these factors (e.g., internal personality factors, and external situational factors) on individuals with clinical levels of worry would be valuable in order to better understand the relationship between worry and inhibitory control (Berggren & Derakshan, 2013; Derakshan, Smyth, & Eysenck, 2009; Fox, 1994; Wieser et al., 2009). Furthermore, the relationship between attentional bias and attentional control is gaining increasing interest with preliminary findings demonstrating the role of attentional control as a moderator of attentional bias and worry (Bardeen et al., 2014). Further research that clarifies this relationship would be beneficial. To date, studies have focused upon trait anxiety at the cost of examining state anxiety. Therefore, future research should also include methodologies that actively induce worry in order to determine the impact of active periods of worry on attentional control.

In summary, this study used an antisaccade methodology to examine the association between worry and attentional control, in the presence and absence of threat. Although the current findings require replication, they offer preliminary evidence that, like trait anxiety, high levels of worry are not associated with increased
error rates, and, therefore, worry does not appear to impair performance effectiveness. No evidence of attentional control deficits were observed in relation to worry. Therefore, the current study has not contributed to the literature that supports the important role of attentional control in worry/GAD. Further research in individuals with clinical levels of GAD is required, as well as exploring the possible moderating role of attentional control in the relationship between attentional bias and worry. This will be examined in the following chapter.
Chapter 6: Experimental Study 4

Biases of Attention and Interpretation in Individuals Who Worry: A Dual-Process Account

The role of erroneous information processing is highlighted as being central to many of the current models of worry and GAD (e.g., Eysenck, 1992; Hirsch & Mathews, 2012), with biases in the content and process of thoughts and beliefs being of central importance (Dugas, Marchand, et al., 2005; Hirsch, Mathews, Lequertier, Perman, & Hayes, 2013; Wells, 1995, 2004). So far, this thesis has demonstrated a relationship between processing style and worry/GAD symptoms, yet participants’ self-reported processing style was not found to reflect actual strengths or deficits in rational thinking or reasoning skills, per se. Furthermore, despite employing a rigorous experimental methodology, no evidence was observed of a direct relationship between attentional control deficits and levels of worry. However, there is preliminary evidence (e.g., Bardeen et al., 2014; Schoorl et al., 2014) for an indirect relationship between attentional control and worry - such that attentional control impacts the relationship between attentional bias and worry - which would, therefore, be beneficial to further examine.

Attentional bias can be defined as the systematic inclination to attend to particular aspects in one’s environment, such as specific events or information (Hayes & Hirsch, 2007). Biases towards threat have been established as a risk factor for worry and GAD (Mogg & Bradley, 2005). Evidence suggests that attentional biases contribute to the etiology and maintenance of excessive worry, as patients are more likely to identify minor threat cues in the environment, which reinforce dysfunctional beliefs that the world is unsafe (Olatunji, Ciesielski, Armstrong, Zhao, & Zald, 2011).
Bar-Haim et al.’s meta-analysis (2007) discussed in detail in Chapter 1 (Section 1.5.3.2, p. 39) found clear evidence of highly anxious participants prioritizing the processing of threatening information significantly more than non-anxious participants. However, there are still aspects that warrant further exploration with interest turning to attempts to better understand the nature of these attentional biases. Although research to date has predominately focused on facilitated attention and delayed disengagement (see Chapter 2, Section 2.3.3.1, pp. 89-95 for further details), there have been a number of findings in the literature that suggest, under some conditions, avoidance may also occur in response to threat. Some studies show that avoidance, rather than difficulty disengaging, are characteristic of populations where the threat is real (e.g., Bar-Haim et al., 2010; Livermore, Sharpe, & McKenzie, 2007; Shechner et al., 2012; Wald et al., 2011). Therefore, the relationship between threat and attention may be non-linear, that is, at moderate levels of threat, attentional bias may increase, whereas when the threat is high (e.g. life-threatening), avoidance may ensue. However, the evidence for avoidance being fundamental to worry is both limited and inconsistent (Bradley, Mogg, Falla, & Hamilton, 1998; Gole et al., 2012; Hirsch et al., 2011; Koster, Crombez, Verschuere, & De Houwer, 2006; Koster, Verschuere, Crombez, & Van Damme, 2005; Mogg, Bradley, Miles, & Dixon, 2004). Although attentional bias has not been widely examined in worry per se, there is evidence of delayed disengagement (Gole et al., 2012) and facilitated attention implicated in the process of worry (Hirsch et al., 2011; Oathes et al., 2010; Weinberg & Hajcak, 2011). On the basis of the research it is more likely that facilitated attention and difficulty disengaging would be associated with high levels of worry, rather than avoidance.

Overall, the aforementioned findings highlight the importance of assessing
attentional bias as a multi-stage process consisting of overlapping stages (e.g., Posner, 1980) that may have a differential influence on the development and maintenance of anxiety (Ouimet et al., 2009). Therefore, methodologically rigorous studies that consider the stage of information processing (i.e., early vs late processing examined via time course analyses) when exploring attentional bias in individuals with high levels of worry will help to better elucidate the specific attentional biases that characterize worry. Examining various stimulus duration presentations (e.g., 16ms, 200ms, 500ms; Mogg et al., 2004; Oathes et al., 2010) - that reflect different stages of information processing - at which attentional biases are observed has been an ongoing focus in the wider anxiety literature, as differential patterns of attentional anxiety-related biases of threat have been found as a result of presentation time (i.e., biases related to early versus later stage of information processing; e.g., Koster et al., 2007; Sagliano et al., 2014). Of the studies that compare people with high versus low anxiety across time course, the findings are somewhat mixed. There is good evidence for biases occurring at shorter times (e.g. 100 msec, although not 28msec), which are representative of facilitated attentional engagement (e.g., Koster et al., 2007). However, results are less clear at longer durations (e.g., 200msec and 500 msec), which have been used to provide evidence of difficulty disengaging and attentional avoidance (e.g., Koster et al., 2007; Mackintosh & Mathews, 2003; Sagliano et al., 2014).

One of the most commonly used measures of attentional bias is the dot probe task (see: Bar-Haim et al., 2007 for review; Bradley, Mogg, & Millar, 2000; MacLeod et al., 1986). See Chapter 2, Section 2.3.3.1, pp. 89-95 for a more detailed rationale for the dot probe task selection. Of the 11 studies exploring adult samples with worry/GAD in Bar-Haim et al.’s (2007) meta-analysis, six employed the dot probe
task (see: Mogg & Bradley, 2005 for review). Except in one instance, individuals with worry/GAD, compared to non-anxious controls, have, overall, been found to respond (both with manual reaction times and eye movement studies) faster to dot probes in the place of threatening stimuli (see: Mogg & Bradley, 2005 for review; Oathes et al., 2010). To date, dot probe studies examining attentional bias in individuals with worry/GAD have predominately employed unmasked word based stimuli presented at 500ms, 1000ms, or 1250ms (see: Mogg & Bradley, 2005 for review); two studies have examined responses to facial expression stimuli presented at 500ms, 1000ms and 1250ms and observed attentional bias (Bradley et al., 1999; Mogg et al., 2000). In addition, only two studies of participants with worry/GAD have used very short presentation times of masked word-based stimuli - at 14ms or 50ms - and only one of those found evidence of attentional bias (Mathews et al., 1996; Mogg, Bradley, & Williams, 1995). This calls into question whether the very early biases found in other anxiety disorders (see Bar-Haim et al., 2007, for meta-analysis), generalize to individuals with high levels of worry. These data highlight the need to understand the temporal dynamics of attentional bias specifically associated with worry. Further, attentional bias to facial expression stimuli across various time frames (e.g., masked and unmasked stimuli presented at 16ms, 100ms, 200ms, 500ms, 1500ms) has yet to be explored with the dot-probe task in relation to individuals with chronic worry (Zvielli, Bernstein, & Koster, 2014b). Therefore, although it is generally agreed that people with worry show attentional biases the time course remains unclear.

Furthermore, despite previous research demonstrating that individuals with high levels of worry are less able to control their attention (see Chapter 5, pp. 136-164, for further discussion) than those with low levels of worry (Hayes et al., 2008; Stefanopoulou et al., 2014), this was not observed in the previous study (Chapter 5,
pp. 136-164). However, attentional control has also been argued to be of considerable importance in the expression of attentional bias in anxious psychopathology (Schoorl et al., 2014). Notably, recent evidence suggests that attentional control moderates the relationship between attentional bias and worry (Bardeen et al., 2014).

In contrast to the large attention bias literature (Bar-Haim et al., 2007), there are only 13 studies of interpretation biases in trait anxiety or worry/GAD; only two specifically focus on worry/GAD. Overall, interpretation bias has been observed in individuals with anxiety, and worry, and presents as a tendency to interpret ambiguous stimuli as threatening (e.g., Blanchette & Richards, 2003; Byrne & Eysenck, 1993; Eysenck et al., 1991; Lawson & MacLeod, 1999; MacLeod, Campbell, Rutherford, & Wilson, 2004; Mathews et al., 1989; Mogg et al., 1994). Interpretation bias is of increasing interest to researchers, due to its role in dual-process models of anxiety (e.g., Ouimet et al., 2009; Hirsch & Mathews, 2012). For example, a recent study of social anxiety has provided preliminary evidence for threat-related interpretive biases resulting from an interplay between implicit and explicit processes and working memory capacity (Salemink et al., 2013). Thereby, offering support for dual-process theory, which argues that both implicit and explicit processes determine information processing biases and behavior, and that aspects of cognitive control influence the impact of those processes on self-regulation (e.g., Ouimet et al., 2009; Hirsch & Mathews, 2012, Salemink et al., 2013).

Studies examining interpretation bias have differed significantly in terms of the research paradigms employed; three methodologies are predominantly used: homophone spelling tasks, ambiguous sentence completion tasks, and semantic-priming lexical decision tasks (see Chapter 2, Section 2.3.3.2, pp. 95-98 for further details). However, they all confirm the presence of interpretation bias. Of the
paradigms used to examine interpretation bias, the lexical decision task methodologies have the most robust findings, which may in part be due to it being a reaction time task methodology, rather than a self-report measure. Overall, research has demonstrated good evidence for interpretation bias in anxious individuals, using both word-based and non-verbal (i.e., facial expressions) stimuli (In-Albon, Klein, Rinck, Becker, & Schneider, 2008).

One of the principal studies of interpretive bias was undertaken by Mathews et al. (1989). They employed a homophone (sleigh/slay) spelling task (see Chapter 2, Section 2.3.3.2, p. 95, for a more detailed discussion of this task) to investigate interpretation bias in participants with clinical levels of GAD, those recovered from GAD, and control participants. Relative to controls and recovered participants, participants with GAD more frequently used the threatening spellings of the homophones. Mathews et al. (1989) concluded that although different meanings of ambiguous stimuli may be processed in parallel by all participants, the presence of an interpretive bias results in anxiety-prone individuals becoming preferentially aware of the more threatening meaning.

The second study to explore interpretative bias in a population with worry/GAD examined the role of context by employing a lexical decision task with homophone primes. Hazlett-Stevens and Borkovec (2004) investigated whether individuals with GAD rely on antecedent information to interpret ambiguity, and whether such an effect can be observed in the absence of threat. Their results suggest that, compared to non-anxious participants, individuals with GAD utilize antecedent words to interpret threat-related homophone primes. However, although both studies demonstrated the presence of interpretation bias in participants with worry/GAD, the relationship between interpretation bias and attentional bias - which is implicated in
both Hirsch and Mathews’ (2012) and Ouimet et al.’s (2009) models - has not yet been explored.

Although Epstein’s (1983; 1990) CEST makes no specific predictions about information processing biases of attention and interpretation, it highlights the role of two distinct but interactive systems in psychopathology: the *rational system* (similar to the rule based system described in Ouiment et al., 2009) and the *experiential system* (similar to the associative system described in Ouiment et al., 2009). According to CEST, psychological distress (i.e., worry) results from a conflict between the systems and a failure of the rational system to enact control over the experiential system (Epstein, 1991b, 1998d; Epstein et al., 1992; Shiloh et al., 2002). Parallels can be drawn between such suggestions and Hirsch and Mathews’ (2012) model, which highlights deficits in attentional control as central to pathological worry, as well as Ouimet et al.’s (2009) prediction that it is a failure of the rule-based system to dampen the associative system, and it is this that is central to having a vulnerability for anxiety.

With this in mind the current study aimed to compare attentional bias for threat at different presentation times (early versus late processes) and their relationship to interpretation of ambiguous homophones, in a group of participants who were either high or low in worry. The, current study also aimed to examine whether attentional control (as measured in Study 3, Chapter 5, pp. 136-164) moderated the relationship between attentional bias and worry. Hirsch and Mathews’ (2012) propose that emotional processing biases and impaired attentional control combine to maintain worry, however, this has yet to be directly tested with experimental measures. In addition, Ouimet et al (2009) suggest that interpretation biases relate to the rule based system, whilst attentional bias to threat is the
behavioural response to the activation of threat associations in the associative system. Therefore, the aim was to test this aspect of their model by examining the relationship between biases of attention and interpretation. Furthermore, the relationship between self-reported processing style to biases at different stages of attention (early and late stages of processing) and interpretation in individual with high, compared to low, levels of worry was also examined.

Information processing bias measures were expected to distinguish participants with high and low levels of worry. Specifically, we expected that individuals who endorsed high levels of worry would show both attentional and interpretation biases, characterized by early processing attentional bias toward threat, as well as late processing bias of difficulty disengaging from threat (Carlson & Reinke, 2008; Fox et al., 2007; e.g., Fox et al., 2002; Hirsch & Mathews, 2012; Mathews et al., 2003; Mogg et al., 2000; Ouimet et al., 2009). Furthermore, attentional control was also expected to moderate the observed relationships between attentional biases and worry (Bardeen et al., 2014). It was also hypothesized that an overall effect of context would be observed on the interpretation bias task, whereby participants with high levels of worry would likely be faster to interpret ambiguous homophones related to presented context than unrelated target words, and this effect was expected to be more pronounced when presented with emotional threat related context words (Blanchette & Richards, 2003; Hirsch & Mathews, 2012; Ouimet et al., 2009; Richards & French, 1992; Richards et al., 1993; Walsh et al., 2010).

Hirsch and Mathews’ (2012) model leads to the expectation that early stage attentional processes (< 200 msec) are driven by bottom up processes and, therefore, should not be related to interpretation biases. Instead, interpretation biases are thought to affect those attentional processes affected by top-down control, or in other words,
later attentional processes. In terms of measures of processing style, Hirsch and Mathews' (2012) models predicts that where early biases of attention to threat are present these will relate to a dominant self-reported experiential processing style (bottom up processes), whereas later stage attentional and interpretation biases for threat will relate to self-reported dysfunction or dominance of the rational processing system (top-down processes) in individuals with high levels of worry.

6.1 Method

6.1.1 Participants and Procedure

As described in Chapter 2 (Section 2.2, pp. 66-68), this study is based on 106 first year undergraduate psychology students who occupied either a high or low worry group. Participants individually completed the study components during a 1.5 hour session. One participant did not complete the crossmodal homophone priming task (interpretation bias measure), eight participants did not complete the dot-probe and antisaccade tasks, whilst a further three were excluded due to technical failures that occurred in administering the tasks. This left a total of 94 participants included in the final modified dot-probe task and the combined dot-probe, crossmodal priming task, and attentional control analyses.

6.1.2 Measures

LimeSurvey (version 1.87) was used to administer the PSWQ, the GADQ-IV, and the two processing style questionnaires - the Rational-Experiential Inventory (REI) and the Perceived Modes of Processing Inventory (PMPI). The questionnaires were presented in one of two counterbalanced orders and were completed by participants via LimeSurvey (version 1.87). For further details about the measures and their psychometric properties see Chapter 2, Section 2.2.5, pp. 73-78.
6.1.3 Dot-probe task

6.1.3.1 Materials and Apparatus

Dot-probe task stimuli

Twelve black and white 2-D facial identities (five men and seven women), from the Pictures of Facial Affect developed by Ekman and Friesen (1976), were selected for stimuli (see Appendix G). An additional eight 2-D faces (four women, four men), from a standardized facial collection (Gur et al., 2002), were used to create the ‘mask’ stimuli and two practice trial face pairs (one man and one woman). The facial identities were selected based on those used in previous research that could be edited to create stimuli that were uniform (Carlson & Reinke, 2008; Fox et al., 2007; Mogg et al., 2000; see Appendix G for Ekman codes).

Once selected, the images were matched for brightness and converted by FastStone Capture into JPGs before being cropped into ovals using Adobe Flash CS3 Professional software. It was ensured that the faces selected had a central gaze and all hair and all non-facial areas were removed; this resulted in an additional two women than men included in the final stimuli. The ovals subtended 8.5 x 11° (height = 8.5 cm; width = 11 cm) and the center of the oval was presented on a grey background, 9.2° visual angle from the center of a white fixation cross (1 x 1° visual angle). The face pairs always consisted of the same individual in order to minimize the facial identity differences, other than emotional expression. The combinations of neutral /angry face pairs were presented in one of four possible combinations (see Figure 6.1 for an example of congruent trials): the angry face on the left hand side of the screen and both congruent (combination 1) and incongruent (combination 2) with the location of the target dot, and the angry face on the right hand side of the screen and congruent (combination 3) and incongruent (combination 4) with the target dot stimulus. The
mask faces were made up of neutral facial pairs only, with the dimensions identical to the non-masked stimuli. However, although the face stimuli were presented to the left or right of the central fixation, the masks were offset vertically above the cue face by 1° visual angle in order to minimise the impact of possible motion of facial features (Carlson & Reinke, 2008; Liddell et al., 2005). Masked stimuli were offset vertically, rather than horizontally, so that the masks were above the central line so as to avoid potential biasing of attention with participants being drawn to look to the side of the screen where the dot probe was presented (Carlson & Reinke, 2008). The target stimulus was a white dot (created in Microsoft paint) measuring 5mm in diameter (0.5° visual angle). The dot was presented to the left or right of the white fixation cross, the center of the dot was separated by 9° visual angle from the center of the fixation cross.

Collection of Manual Response

A Microsoft sidewinder plug and play game pad was used to collect the manual reaction time responses. For the dot-probe task, manual reaction time (RT) was defined as the time it took participants to identify the position (left or right) of the target dot by pressing the corresponding button on the response pad.

Experimental Task Specifications

A chin and headrest were used to ensure uniformity in the visual angle (participants were positioned at 57cm from the screen). The modified dot probe detection task (MacLeod et al., 1986; Mogg, Bradley, Millar, et al., 1995) was presented on a 32-bit colour, 18in LCD monitor with a resolution of 1,024 x 768 pixels that was connected to a Mackintosh computer running Windows XP version 2002. The experiment was created and presented by experiment builder software (SR Research Ltd., Mississauga, Canada, 2010).
6.1.3.2 Experimental Procedure

Participants were seated in a small dimly lit cubical and presented with task instructions to read. They were instructed to look at the fixation cross at the start of every trial. It was then stated that two faces would appear, one to the left of the fixation and one to the right. After the faces were presented participants were informed that they would disappear and a small white dot would appear in the position of one of the faces. They were asked to respond by pressing the button on the Microsoft button pad that corresponded (left or right) with the location of the dot. The instructions highlighted the importance of speed and accuracy, in pressing the button that corresponded to the dots location. It was verbally confirmed that participants understood the nature and requirement of the experimental task before experimental trials began.

A block of practice trials (total of 16 trials), with feedback, preceded the 264 experimental trials (120 of which used masked stimuli: see Figure 6.1 for further details). Participants completed the experiment in four blocks, with each block containing 66 trials (total of 264 trials). A short break was offered between each of the four blocks. Of the total trials, 96 were congruent with the dot appearing in the same location as the angry face, 96 were incongruent, and the remaining 72 were baseline trials containing (either neutral-neutral or angry-angry face pairs, see: Carlson & Reinke, 2008). The probability of the cue appearing on left or right was equal, as was the presentation of angry and neutral faces. Experiment Builder randomised presentation, and, therefore, the position of the angry face and probe were presented in all of the possible four combinations (see above in Stimuli section pp. 174-175 for further details) across trials.

In order to avoid anticipatory responses, each trial was preceded by a white
*Variable fix: 500ms, 750ms, 1000ms and 1500ms

Figure 6.1. Congruent trials of masked and non-masked modified Dot-probe task
fixation-cross presented for 500-1500ms (specifically, 500ms, 700ms, 1000ms or 1500ms; see: e.g., Mogg et al., 2004). The fixation-cross remained on the screen throughout the trial. The facial stimuli presentation times consisted of two groups; one to capture early processing (16msec, 33msec, 100msec) and one to capture later processing of threat (200msec, 500msec, 1500msec). Masked trials consisted of facial stimuli that were presented for either 16msec or 33msec proceeded by the presentation of a mask for 100ms, before the target dot appeared. The dot remained on the screen until participants had made a manual reaction time response or until 2500msec had lapsed. The task took approximately 30 minutes to complete.

6.1.4 Antisaccade task

The antisaccade task, as described in Chapter 2 (Section 2.3.2.1, pp. 86-88), and Chapter 5 (Section 5.1.3, pp. 144-148) was used to measure attentional control. Please refer to the previous Chapter for full details of the task and experimental procedure.

6.1.5 Crossmodal homophone task

6.1.5.1 Experimental Procedure

Participants were instructed that the task involved listening to a word and responding as to whether it was related or unrelated to another word presented visually on the computer screen. They were informed that the aim of the experiment was to identify as quickly as possible whether the two presented words were related or unrelated. If participants judged the words to be related (e.g., you hear "pink" and see the word "colour") they were requested to press the button on the right hand side of the response pad, or if they deemed them to be unrelated (e.g., you hear "pink" and see the word "banana") to then press the button on the left hand side. The instructions were presented as text for participants to read, however, verbal confirmation that they
had understood the instructions was also sought and the importance of speed and accuracy were highlighted.

The aim of the experiment was to assess whether high and low anxious participants differed in the speed and accuracy (dependent variables) of their response times to threatening words. A total of 16 practice trials (each of the eight cue words were presented with two visual target words), with feedback, were presented prior to one block of 260 experimental trials. Participants completed the task in one of two orders, the second of which was a counterbalanced version of the first order. Prior to the start of each trial a white fixation cross (1 x 1° visual angle) was presented in the centre of the screen. Participants were requested to focus on this cross, and, in order to avoid the potential impact of anticipatory responses, the simultaneous cue (central fixation) and target (word) onset were activated only after participants had focused on the central fixation point for a variable randomised period of time (750msec; 1000msec; 1200msec; 1500msec). If participants responded prior to the appearance of the written word an ‘error’ sign was presented requesting participants to wait for the presentation of the word visually before responding. After the fixation timer lapsed the auditory presentation of a cue word was presented, followed by the visual presentation of a word (for either 400msec or 1200msec), which replaced the fixation cross. The task took approximately 10 minutes to complete.

6.1.5.2 Materials and Apparatus

Stimuli

A total of 130 cue/priming words, which can be found in Appendix H, were collated for this task. Of the 130 priming words, 80 words were unambiguous filler words of neutral content which acted as a baseline, and the remaining 50 were homophones – words that have two or more different meanings, although pronounced
in the same manner (e.g., here and hear). Of the 50 homophones 21 had both a threatening and a neutral interpretation (e.g. die, dye), whilst 29 homophones had a neutral/neutral (e.g. cent, sent) interpretation. The homophone priming words were presented followed by either a related target word with a neutral or emotional context word, or a target word that was unrelated to the prime. Participants were requested to respond as to whether the target word was related or unrelated to the homophone prime. An additional eight words (and 16 matched related/unrelated words) were used for practice trials prior to the commencement of experimental trials. The words were selected from previous research into interpretation bias in anxious populations (Blanchette & Richards, 2003; Mathews et al., 1989). Audacity (version 1.2.6) was used to record, and later edit, a native Australian speaker reciting the 130 priming cue words. The visual target words were presented in Times New Roman, were white in colour, had a font size of 50, and were presented on a grey background.

Collection of Manual Response

Similar to the aforementioned dot-probe task, a Microsoft sidewinder plug and play game pad collected the manual reaction time responses. The manual reaction time (RT) was recorded as the time between the visual presentation of a word and the manual press of the correct button.

Specifications and Experimental Task

The same set up and equipment as described for the dot-probe task, including Experiment builder software (SR Research Ltd., Mississauga, Canada, 2010), was employed. Additionally, participants wore headphones to complete the task. Each word of the 130 prime/cue words were presented verbally prior to the visual presentation of a target word. The time between the initiation of the spoken word and the presentation of the visual target word was 2500msec. Participants were required to
respond whether the words were related or unrelated after the presentation of the visual target by pressing the corresponding button on the button box. A response was required within 2500msec in order for the trial to be classified as valid (Walsh et al., 2010).

6.2 Data Preparation

Reliability analyses were undertaken on all three experimental tasks, see Table 6.1. Cronbach’s alphas suggested all three tasks had good internal consistency. Nine variables in Study 4 were observed to have outliers, six of which failed to meet criteria for a normal distribution. See Chapter 2, Section 2.4, pp. 98-100, for further details and rationale for undertaking analyses on the variables without conducting transformations.

Dotprobe task outliers

RT button bias at 100ms had one outlier, whilst two outlying scores were also observed for RT button bias at 200ms; these were replaced by a value that was one unit lower than the next most extreme response. Lastly, an outlier was observed for the RT button bias 1500ms variable. Although the outliers were altered using standard methods, the RT button bias reaction times at 1500ms were still not found to be normally distributed with a positive kurtosis score above the standard acceptable range.

Homophone task outliers

Three reaction time variables on the homophone cross-modal priming task (Mean RT for: neutral words; neutral homophones; threat homophones) were found to have one outlier. Neutral percentage errors and homophone threat percentage errors were also found to have outlier each in their distributions. Three variables had a distribution that was positively skewed, with mean RT for neutral words and mean
Table 6.1 *Cronbach’s α scores for Experimental Tasks.*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homophone task</td>
<td>.812</td>
</tr>
<tr>
<td>Dotprobe task</td>
<td>.997</td>
</tr>
<tr>
<td>Prosaccade task</td>
<td>.984</td>
</tr>
<tr>
<td>Antisaccade task</td>
<td>.871</td>
</tr>
</tbody>
</table>
RT for threat homophones demonstrating skew and percentage of errors on neutral word trials having demonstrating both a positive skew and Kurtosis outside of acceptable parameters.

*Dot-probe task: Response Data (Reaction Times)*

Reaction times (button presses) under 100ms (0%) or above 2000ms (.01% see: Fox, 2002) were excluded from analyses. In addition, incorrect button presses (errors) were also excluded. Given that less than 1.8% of the data was discarded as either outliers or errors, the discarded data was not subject to further investigation.

*Homophone task: Response Data (Reaction Times)*

Homophone trials which elicited reaction times of less than 200msec (0%) or more than 2500ms (0.1%) were not included in the final analyses (Walsh et al., 2010). A further 0.3% of the trials were removed, as they were invalid, due to participants responding prior to the presentation of the visual context word.

6.3 Planned Analyses

As with Study 3 (Chapter 5, pp. 136-164) an extreme group split was performed on the participants who were recruited for this program of research (see Chapter 2, Section 2.2.3, p. 70). High and low worry groups based on combined scores from the GADQ-IV and PSWQ were generated (see: Table 1 for descriptive statistics). Combined analyses consisted of a total sample size of $N = 94$. Following the group splits on the 105 participants who completed the homophone task, 80 participants (high $N = 41$ and low $N = 39$) remained for the homophone analyses, whilst 66 (high $N = 34$ and low $N = 32$) of the original 94 participants were included in the dot-probe and combined task analyses.

SPSS version 21.0 was used to conduct all analyses. Initial analyses consisted of four mixed model analyses of variance. Two mixed ANOVAs were performed to
examine homophone task performance (within subjects factor) by level of worry (between subject factor). First, a 3 (context condition: emotional context, neutral context, and unrelated) by 2 (stimuli: threat, neutral) by 2 (high and low worry) ANOVA was employed to examine RT speed, whilst the second 2 (worry: high, low) x 3 (condition: neutral words, neutral homophones, and threat homophones) ANOVA explored response accuracy. Additionally, two MANOVAs, both employing level of worry (high, low) as the independent variable, separately examined the dependent variables of dot-probe manual RTs of early (16msec, 33msec, and 100msec; first MANOVA) and late (200msec, 500msec, and 1500msec; second MANOVA) processing. Where differences emerged, univariate and t-tests were performed to further examine differences between the groups.

In order to test the relationship between scores on the symptom scales, processing style scales, and interpretation and attentional bias concurrently, it was anticipated that multiple linear regression analyses were planned. These analyses were to be undertaken on the complete data set (N = 94) and focused on any variables that might be found to demonstrate significance in the preliminary correlational analyses. Prior to analyses, attentional bias scores were calculated with the following formula, which takes into consideration the possible advantage of the target and probe appearing in the same location:

\[
\text{Bias index} = ((\text{CL}_\text{PR} - \text{CR}_\text{PR}) + (\text{CR}_\text{PL} - \text{CL}_\text{PL})) / 2
\]

where C is the cue, P is the probe, L is the left location, and R is the right location. Therefore, ‘CL_ PR’ represents a trial where the cue appears to the left of the screen prior to the presentation of the probe to the opposite (right) side of the screen. The bias index scores represent the degree to which attention is directed either toward (i.e., positive score that represents vigilance) or away from (i.e., negative score which
represents avoidance) the cue (threatening face). Interpretation bias scores were also calculated prior to computing bivariate correlations. Separate scores for the three context conditions (emotional, neutral, unrelated) were calculated, whereby the RTs to target neutral words in the three context conditions presented following neutral valenced homophones were subtracted from RTs to emotional target words in the various context conditions following threat homophones.

As we anticipated undertaking moderation analyses to explore for a possible moderation of the relationship between attentional bias and worry/GAD symptoms by attentional control, as suggested in Hirsch and Mathews’ (2012) model a high and low attentional control group was calculated. These groups were determined by undertaking a tertile split on attentional control scores. The high attentional control group consisted of 29 participants ($M = -7.55$, $SD = 25.94$) and the low attentional control group included 29 participants ($M = 71.41$, $SD = 15.88$), therefore, a total of $N=58$ participants were included in the moderation analyses.

### 6.4 Results

#### 6.4.1 Descriptive statistics

Descriptive statistics for symptom measures are reported in Table 6.2 and mean reaction times (RTs) for correct responses and accuracies for each presented valence conditions on the homophone task are in Table 6.3. The mean response latencies and manual reaction times for the modified probe detection task are shown in Table 6.4.

#### 6.4.2 Preliminary Analyses: Homophone crossmodal-priming task

Two mixed model ANOVAs were undertaken to examine differences in both RTs (Figure 6.2) and accuracy (Figure 6.3) for high and low worriers. The mixed model ANOVA examining accuracy, condition (neutral words, neutral homophones,
Table 6.2: Symptom Measure, and Processing Style Means and Standard Deviations

<table>
<thead>
<tr>
<th>Scale</th>
<th>Low worry</th>
<th></th>
<th>High worry</th>
<th></th>
<th>Total Sample</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Symptom</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GADQ-IV</td>
<td>3.53</td>
<td>(2.26)</td>
<td>21.81</td>
<td>(7.04)</td>
<td>11.46</td>
<td>(9.59)</td>
</tr>
<tr>
<td>PSWQ</td>
<td>41.12</td>
<td>(7.93)</td>
<td>67.50</td>
<td>(8.75)</td>
<td>53.85</td>
<td>(13.67)</td>
</tr>
</tbody>
</table>

Note: Total Sample N = 94; low worry group N = 34; high worry group N = 32 (total n = 66); PSWQ = Penn State Worry Questionnaire; GADQ – IV = Generalised Anxiety Disorder Questionnaire – IV; M = Mean; SD = Standard deviation.

Table 6.3: Homophone crossmodal priming task Means and Standard Deviations by Stimuli Valence Condition

<table>
<thead>
<tr>
<th>Stimuli Valence Condition</th>
<th>Low worry</th>
<th></th>
<th>High worry</th>
<th></th>
<th>Total sample</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Neutral</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>708.94</td>
<td>(144.58)</td>
<td>691.68</td>
<td>(131.27)</td>
<td>700.09</td>
<td>(137.31)</td>
</tr>
<tr>
<td>%error</td>
<td>12.29%</td>
<td>(8.28)</td>
<td>10.84%</td>
<td>(7.85)</td>
<td>11.55%</td>
<td>(8.04)</td>
</tr>
<tr>
<td><strong>Homophone neutral</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional RT</td>
<td>755.01</td>
<td>(210.98)</td>
<td>740.49</td>
<td>(166.93)</td>
<td>747.57</td>
<td>(188.61)</td>
</tr>
<tr>
<td>Neutral RT</td>
<td>742.10</td>
<td>(236.49)</td>
<td>703.68</td>
<td>(176.75)</td>
<td>722.41</td>
<td>(207.59)</td>
</tr>
<tr>
<td>Unrelated RT</td>
<td>797.73</td>
<td>(224.24)</td>
<td>817.88</td>
<td>(240.80)</td>
<td>808.06</td>
<td>(231.62)</td>
</tr>
<tr>
<td>%error</td>
<td>30.84%</td>
<td>(14.51)</td>
<td>22.77%</td>
<td>(17.12)</td>
<td>26.71%</td>
<td>(16.32)</td>
</tr>
<tr>
<td><strong>Homophone threat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional RT</td>
<td>703.40</td>
<td>(265.47)</td>
<td>664.03</td>
<td>(152.20)</td>
<td>683.22</td>
<td>(214.52)</td>
</tr>
<tr>
<td>Neutral RT</td>
<td>742.10</td>
<td>(236.49)</td>
<td>703.68</td>
<td>(176.75)</td>
<td>722.41</td>
<td>(207.59)</td>
</tr>
<tr>
<td>Unrelated RT</td>
<td>729.15</td>
<td>(231.97)</td>
<td>751.15</td>
<td>(151.02)</td>
<td>740.42</td>
<td>(193.79)</td>
</tr>
<tr>
<td>%error</td>
<td>26.40%</td>
<td>(12.89)</td>
<td>24.94%</td>
<td>(13.55)</td>
<td>25.65%</td>
<td>(13.17)</td>
</tr>
</tbody>
</table>

Note: Total Sample N = 94; low worry group N = 41; high worry group N = 39 (total n = 80). RT – reaction time; Emotional – homophone with emotional context word; Neutral – homophone with neutral context word; Unrelated – homophone with unrelated context word.
Figure 6.2: Mean correct reaction time (msec) by context (emotional, neutral, unrelated) and Stimuli type (neutral homophones, threat homophones).
Figure 6.3: Mean percentage errors by Stimuli type (neutral words, neutral homophones, threat homophones) in high and low worry groups

Table 6.4: Modified probe detection task manual reaction time (RT) bias mean scores and standard deviations

<table>
<thead>
<tr>
<th>Trial</th>
<th>Low worry</th>
<th></th>
<th>High worry</th>
<th></th>
<th>Total sample</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>16 msec</td>
<td>1.87</td>
<td>(30.73)</td>
<td>9.01</td>
<td>(36.21)</td>
<td>5.33</td>
<td>(33.43)</td>
</tr>
<tr>
<td>33 msec</td>
<td>8.31</td>
<td>(22.66)</td>
<td>-1.97</td>
<td>(39.66)</td>
<td>3.33</td>
<td>(32.21)</td>
</tr>
<tr>
<td>100 msec</td>
<td>9.48</td>
<td>(36.66)</td>
<td>11.43</td>
<td>(33.13)</td>
<td>10.43</td>
<td>(34.74)</td>
</tr>
<tr>
<td>200 msec</td>
<td>2.16</td>
<td>(39.89)</td>
<td>-8.39</td>
<td>(31.47)</td>
<td>-2.95</td>
<td>(36.17)</td>
</tr>
<tr>
<td>500 msec</td>
<td>9.83</td>
<td>(36.36)</td>
<td>-1.42</td>
<td>(33.63)</td>
<td>4.37</td>
<td>(35.25)</td>
</tr>
<tr>
<td>1500 msec</td>
<td>-6.34</td>
<td>(53.18)</td>
<td>-5.26</td>
<td>(41.81)</td>
<td>-5.81</td>
<td>(47.64)</td>
</tr>
<tr>
<td>Total</td>
<td>3.38</td>
<td>(14.40)</td>
<td>2.52</td>
<td>(21.96)</td>
<td>2.96</td>
<td>(18.32)</td>
</tr>
</tbody>
</table>

Note: Total Sample N = 94; low worry group N = 31; high worry group N = 33 (total n = 66)
threat homophones) by group (high, low worry), presented a significant main effect of condition $F(2, 77) = 83.42, p < .001$. However, this was not found to differ between participants with high and low levels of worry, as the interaction did not reach significance: $F(2, 77) = 2.03, p = .14$. Therefore, although participants accuracy did not differ as a result of their level of worry, or between threatening ($M = 25.65\%$) and neutral ($M = 26.71\%, t = -.55, p = .59$) homophones, significantly fewer errors were made on neutral word trials ($M = 11.55\%$) than trials containing either neutral ($t = -8.96, p < .001$) or threat homophones ($t = -10.86, p < .001$).

The reaction time, context condition (emotional, neutral, unrelated) by stimuli valence (threat, neutral) by group (high, low worry), mixed model ANOVA found a significant main effect of condition, $F(2, 77) = 7.91, p < .01$. The presence of emotional or semantically related context words led to faster reaction times. A main effect of stimuli was also observed: $F(2, 77) = 16.50, p < .001$; participants responded more quickly in the presence of threatening than neutral homophones. However, these main effects were again found to be unrelated to participants’ level of worry as both two-way and the three-way interactions were not significant ($F<1$). Therefore, although RTs differed as a result of the context and valence of the presented words, the observed differences were unrelated to participants’ level of worry.

6.4.3 Preliminary Analyses: Modified probe detection task

Two MANOVAs were conducted to examine early and late processing manual reaction times. The early processing manual RT MANOVA had group (high, low worry) as the independent variables (IV) and reaction times to early presentation time trials (16ms, 33ms, 100ms) as the dependent variables (DV). The multivariate result for the dependent variables in relation to group was not found to be significant Wilks’ Lambda $F(3, 62) = .99, p = 0.40$. The late processing multivariate result - late
processing manual RT of group (high, low worry) as the IV and presentation time (200ms, 500ms, 1500ms) as the DV - was also not significant Wilks’ Lambda $F(3, 62) = .1.01, p = 0.39$. Therefore, no evidence was found for attentional biases either in early or late processing, regardless of participants’ level of worry.

6.4.4 Preliminary Analyses: Correlational Analyses

Correlations between the homophone task, modified probe detection task, attentional control scores and symptom and processing style measures are presented in Table 6.5. For a table of correlations for all variables in the project see Appendix J (p. 378). No significant correlations were observed between processing style or symptom scores with regard to attentional or interpretation bias scores.

Participants who were more likely to demonstrate attentional bias at 1500msec were also found to be more likely to interpret ambiguous stimuli as threatening when presented in a neutral context ($r = .22, p = .040$). Additionally, participants who were observed to have an attentional bias at 100msec were less likely to interpret ambiguous stimuli as threatening when they were presented in an emotional context ($r = -.21, p = .049$). Lower attentional control scores were associated with increased levels of late stage attentional bias at 1500msec: $r = -.23, p = .030$. Despite this finding, and the findings that attentional bias at 1500msec was related to participants demonstrating higher levels of interpretation bias as well as attentional bias at 100msec being observed in participants with lower levels of interpretation bias, these correlations were unrelated to worry and GAD symptom scores. Therefore, as the correlational results (Table 6.5) indicated no significant relationships between symptom scores, processing style and interpretation bias (homophone task), or attentional bias as measured by manual RTs, no multiple regression analyses were undertaken. Moderation analyses were undertaken to further explore the possibility of
Table 6.5: Correlations of symptom measures, processing style measures, attentional control scores, homophone crossmodal priming task conditions and dotprobe attentional bias calculations

<table>
<thead>
<tr>
<th></th>
<th>InterpN</th>
<th>InterpU</th>
<th>InterpE</th>
<th>Att.B16</th>
<th>Att.B33</th>
<th>A.B100</th>
<th>A.B200</th>
<th>A.B500</th>
<th>A.B1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSWQ</td>
<td>.090</td>
<td>-.073</td>
<td>.005</td>
<td>-.145</td>
<td>.044</td>
<td>-.056</td>
<td>-.104</td>
<td>.074</td>
<td></td>
</tr>
<tr>
<td>GADQ-IV</td>
<td>.027</td>
<td>-.100</td>
<td>.033</td>
<td>-.130</td>
<td>.050</td>
<td>.033</td>
<td>-.132</td>
<td>.011</td>
<td></td>
</tr>
<tr>
<td>PMPI-E</td>
<td>.094</td>
<td>.031</td>
<td>.072</td>
<td>.081</td>
<td>.003</td>
<td>-.016</td>
<td>.153</td>
<td>-.168</td>
<td>-.068</td>
</tr>
<tr>
<td>PMPI-R</td>
<td>.138</td>
<td>.123</td>
<td>-.044</td>
<td>.020</td>
<td>-.014</td>
<td>.154</td>
<td>-.125</td>
<td>-.151</td>
<td>-.027</td>
</tr>
<tr>
<td>REI-E</td>
<td>.070</td>
<td>.007</td>
<td>.125</td>
<td>-.083</td>
<td>-.007</td>
<td>-.072</td>
<td>-.042</td>
<td>-.129</td>
<td>.032</td>
</tr>
<tr>
<td>REI-R</td>
<td>-.121</td>
<td>.028</td>
<td>.005</td>
<td>-.089</td>
<td>.072</td>
<td>-.085</td>
<td>-.039</td>
<td>.061</td>
<td>-.022</td>
</tr>
<tr>
<td>Att.Cont.</td>
<td>.068</td>
<td>.022</td>
<td>-.003</td>
<td>.079</td>
<td>.094</td>
<td>.073</td>
<td>-.145</td>
<td>.040</td>
<td>-.233*</td>
</tr>
<tr>
<td>InterpretN</td>
<td>-</td>
<td>-.032</td>
<td>-.115</td>
<td>-.113</td>
<td>-.019</td>
<td>.019</td>
<td>.021</td>
<td>-.112</td>
<td>.217*</td>
</tr>
<tr>
<td>InterpretU</td>
<td>-</td>
<td>-</td>
<td>-.068</td>
<td>-.032</td>
<td>.021</td>
<td>.024</td>
<td>.062</td>
<td>.056</td>
<td>.019</td>
</tr>
<tr>
<td>InterpretE</td>
<td>-</td>
<td>-</td>
<td>-.145</td>
<td>.033</td>
<td>-.204*</td>
<td>.130</td>
<td>.021</td>
<td>-.038</td>
<td></td>
</tr>
<tr>
<td>Att.bias16</td>
<td>-</td>
<td>.147</td>
<td>.039</td>
<td>.211*</td>
<td>.119</td>
<td>-.180</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Att.bias33</td>
<td>-</td>
<td>.083</td>
<td>.233*</td>
<td>.015</td>
<td>.062</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Att.B100</td>
<td>-</td>
<td>.015</td>
<td>-.044</td>
<td>-.148</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Att.B200</td>
<td>-</td>
<td>-.051</td>
<td>.099</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Att.B500</td>
<td>-</td>
<td></td>
<td></td>
<td>-.237*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N = 94. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; PMPI-E = Perceived Modes of Processing – Experiential scale; PMPI-R = Perceived Modes of Processing – Rational scale; REI-E = Rational Experiential Inventory – Experiential scale; REI-R = Rational Experiential Inventory – Rational scale; Att.Cont = Attentional control score; InterpretN = Interpretation bias neutral context; InterpretU = Interpretation bias unrelated context; InterpretE = Interpretation bias emotional context; Att.B = Attentional bias.

**p < 0.01; *p < 0.05**
attentional control moderating the relationship between attentional biases (multiple presentation times 16ms-1500ms) and worry and GAD symptomatology. However, none of the moderation analyses were found to be significant (see: Appendix I for results).

6.5 Discussion

The current study aimed to examine self-reported worry/GAD symptoms and individual processing style and their relationship to the cognitive biases of attention and interpretation. It was expected that information processing bias measures would distinguish participants with high and low levels of worry. Specifically, in terms of interpretation bias, an overall effect of context was expected, whereby those endorsing high levels of worry were expected to respond faster when presented targets that offered a context cue, particularly targets with a threat related emotional context. Participants with high compared to low levels of worry were also expected to demonstrate early and late stage attentional biases, and a significant relationship was anticipated between late stage attentional processing biases and interpretation bias. It was hypothesized that, for individuals with high (compared to low) levels of worry, the presence of attentional bias would be observed for those with a dominant experiential processing style, whereas interpretation biases were expected to be related to dysfunction or dominance of the rational processing system.

The hypotheses were not supported. Although an effect of context was observed with participants demonstrating threat-related interpretation bias to ambiguous stimuli, particularly in the presence of threat related context words, this was unrelated to participants’ levels of worry. There was also no evidence for differential levels of attentional biases – in either early or late attentional processing – in individuals with high and low levels of worry. In terms of the relationship between
the biases, no worry related differences were observed. Furthermore, attentional control was not found to moderate relationships between attentional biases and worry/GAD symptom scores. Finally, symptom scores and self-reported processing style were also found to be unrelated to interpretation and attentional biases as measured by manual RTs.

Thus, unexpectedly, the current study did not observe specificity for worry of the cognitive biases of attention and interpretation. The current pattern of results failed to replicate the robust findings in the literature that individuals with high and low levels of worry can be distinguished by both early (Mogg, Bradley, Millar, et al., 1995; Mogg et al., 1993) and late (Bradley et al., 1999; MacLeod et al., 1986; Mogg et al., 1992; Mogg et al., 2000) threat-related attentional biases (see: Bar-Haim et al., 2007 for meta-analysis; Mogg & Bradley, 2005; Mogg, Bradley, Millar, et al., 1995). Previous studies employing the dot probe task - with methodologies replicated in the current study - have consistently found that both early and late processing stage attentional biases for threat are characteristic of individuals with high levels of worry (Carlson & Reinke, 2008; Fox et al., 2007; e.g., Fox et al., 2002; Hirsch & Mathews, 2012; Mathews et al., 2003; Mogg et al., 2000; Ouimet et al., 2009).

Although lower levels of attentional control and higher levels of later stage processing attentional bias (at 1500ms) were observed, these variables were unrelated to symptom scores. Thus, whilst this association supports findings and theoretical suggestions of a relationship between attentional control and attentional bias (Bardeen et al., 2014; Derryberry & Reed, 2002; Schoorl et al., 2014), based on theoretical suggestions (Ouimet et al., 2009; Hirsch & Mathews, 2012) and previous findings (Bardeen et al., 2014), we expected to see attentional control moderating the
relationship between attentional bias and symptom scores. However, none of the moderation analyses were found to be significant.

The current study did not reflect the commonly reported findings that individuals who present with high levels of worry/GAD demonstrate interpretive bias, whereby participants with high levels of worry are faster to interpret ambiguous homophones as threatening, particularly when presented in an emotional context (e.g., Blanchette & Richards, 2003; Byrne & Eysenck, 1993; Dugas, Hedayati, et al., 2005; Eysenck et al., 1991; Lawson & MacLeod, 1999; MacLeod et al., 2004; Mathews et al., 1989; Mogg et al., 1994). In individuals both with (Blanchette & Richards, 2003; Hazlett-Stevens & Borkovec, 2004) and without (Hill & Kemp-Wheeler, 1989b) high levels of worry lexical decisions have also been consistently observed to be significantly quicker when primes are emotionally or semantically related to targets. Therefore, in the case of immediate threat interpretations, the observed pattern of semantic activation found for threatening meanings should be the same as that found for dominant meanings (Blanchette & Richards, 2003); RTs should be short unless two or more competing meanings are activated that substantially differ in their affective valence, whereby the individual should have more difficulty and, therefore, RTs should be increased (Hock & Krohne, 2004). In previous research participants with high compared to low levels of worry demonstrate faster reaction times to ambiguous stimuli with threat related meanings (Blanchette & Richards, 2003; Hazlett-Stevens & Borkovec, 2004), a finding not replicated here. Furthermore, the current findings demonstrated no relationship between interpretation bias and worry, despite using methodology that has been robustly associated with significant findings.

Williams, Watts, MacLeod, and Mathews (1997) propose that it is important to make a distinction between early (automatic i.e., attention) and later (where
meaning is constructed i.e., interpretation) cognitive processing, as they both have differential, albeit crucial, impacts to the development of pathological anxiety. Therefore, the temporal relationship between attention (early and later stage processing) and interpretation (later stage processing) biases are important to understand (White et al., 2011; Williams et al., 1997). However, as no relationships were observed between biases of attention, interpretation and levels of worry/GAD symptoms, the current findings cannot offer insight into these relationships (White et al., 2011).

Theoretically, interpretation biases should be associated with attentional biases at longer, but not shorter presentation times (Ouimet et al., 2009; Hirsch & Mathews, 2012). While the current data offered some support for these predictions, that is, interpretation bias was associated with attention bias at 1500 msec, they were unexpectedly not related to attentional biases at other late stages of processing (200 and 500 msec). Additionally, the negative relationship between interpretation bias and early stage attentional processing biases at 100 msec was unexpected. Thus, the current results should be interpreted cautiously. Multiple correlations were assessed with no correction for multiple comparisons, which, if conducted, would have rendered the found associations no longer significant. Further, we would have expected significant relationships at 200 msec and 500 msec as well. Finally, the size of the correlations were small and, therefore, the clinical relevance of these is unclear.

The only study which has, to date, simultaneously examined attention and interpretation biases and their relationship to worry/GAD employed a sample of children and adolescents. Rozenman et al. (2014) found a relationship between the biases of both attention and interpretation with participant levels of interpretation bias predicting worry. As no relationship between worry/GAD symptoms and biases of
attention or interpretation was observed in the current sample it neither supported nor extended Rozenman’s data. Thus, although the basic tenets of dual-systems models may offer the benefit of elucidating the nature of cognitive biases in individuals with high levels of worry this could not be examined in the current study due to the lack of significant findings.

Making sense of the current data, particularly the lack of worry related findings, is challenging. However, although there are several plausible reasons, the inconsistency of the current data with previous literature should be considered in light of the limitations of the current study. It is more likely that the current findings reflect aspects of the methodology employed and the population sampled, rather than calling into question the well-established role of cognitive biases in the etiology and maintenance of excessive worry.

The failure to replicate previous findings with the dot probe task (Bradley et al., 1999; Carlson & Reinke, 2008; Mogg & Bradley, 2005; Mogg et al., 2004; Mogg, Bradley, & Williams, 1995; Mogg et al., 2000; Oathes et al., 2010) may relate to the complexity and a lack of stability of the task under different conditions. This is the first study of participants with high and low levels of worry that has presented such a varied time course for stimuli presentation. The fact that the tasks were also given in the context of a series of different tasks examined in this thesis may also have affected the results. Low motivation and participant fatigue may have led to participants not engaging in the task but rather responding in an automated way. Some authors use “catch trials”, where participants’ are presented with blank trials (where no dot probe is presented or no cue in the antisaccade/prosaccade task) in order to deter automated responding, but this was not used in the present study. Using a dot-probe task that
contained a forced judgment component would have also been beneficial. For example, requesting participants to indicate whether an arrow (the probe) is pointing left or right, or whether the probe is the letter E or the letter F, rather than just indicating the location of the probe. Adding a judgement component would have ensured that the participants had to actually look at the probe in order to respond correctly. Without this judgement component it is unclear that the latency to respond indicates the actual time taken to detect the probe. Additionally, aside from the antisaccade task, the current study collected behavioural reaction time data, rather than employing an eye-tracking methodology; eye-tracking methodology has demonstrated more robust findings than manual RTs and offers the opportunity to examine multiple timeframes in one trial. Furthermore, data based on manual reaction time responses (button presses) has been suggested to be problematic as an index of attentional bias. Specifically, individuals’ response times have been found to be poorly correlated with attentional processes (Algom, Chajut, Lev, 2004). Eye-tracking and neurophysiological methodologies are more rigorous due to their ability to more directly examine attentional responses to threat. Thus, undertaking further research of the relationship between attention and interpretation bias with an eye-tracking methodology would be beneficial.

The failure to replicate interpretation bias as a result of participants’ level of worry may reflect the well-documented challenges in examining interpretation bias. Difficulties can arise due to both internal and external cues being subject to interpretative bias (Blanchette & Richards, 2003; Lawson & MacLeod, 1999; MacLeod et al., 2004; Mathews et al., 1989), the impact of emotional state (Richards et al., 1993), context (Blanchette & Richards, 2010; Nygaard & Lunders, 2002), and task parameters (Blanchette & Richards, 2003; Mogg et al., 1994; Richards & French,
1992), which have all been suggested to affect findings. Although worry is associated with threat-related inference, this does not necessarily translate to threat-related inferences being arrived at more quickly (Blanchette & Richards, 2010). However, previous studies using similar paradigms to the one employed in the current study have demonstrated reduced lexical decision times for threat-related targets (Blanchette & Richards, 2003; Hill & Kemp-Wheeler, 1989a, 1989b; Kemp-Wheeler & Hill, 1992; Richards & French, 1992).

A further limitation with regard to all the tasks in the current study may relate to the diffuse and idiosyncratic nature of individuals’ worry concerns (Craske et al., 1989; Roemer et al., 1997). The stimuli employed in the current study may not have sufficiently reflected individual participants’ worry themes. In light of this, future research that employs threatening stimuli generated to be specifically relevant for each individual participant would be optimal. For further discussion of the specific limitations of the antisaccade task refer to the previous chapter’s discussion section (Chapter 5, Section 5.4, pp. 155-164).

Despite these methodological issues, this study had a number of strengths. It was the first to present stimuli across a range of presentation times (rather than the predominant presentation times of 500ms or 1250ms) within a dot probe methodology so to examine the time course of attentional bias in relation to worry. As the current study evaluated attentional bias over a variety of presentation times (covering early and late stages of processing) it offered the opportunity to explore the aspects of attention most related to interpretation bias, as well as the variety of possible effects of attention on the etiology and maintenance of worry more generally (Ouimet, Radomsky, & Barber, 2012; Zvielli et al., 2014b). The use of an interpretation bias task that examined the impact of context was another strength of the study; context
may offer a more accurate understanding of how people might respond when threat representations are activated. Overall, individually examining information processing biases neglects the exploration of theoretical proposals (Teachman et al., 2007). However, despite this, surprisingly few studies have simultaneously examined biases of attention and interpretation in relation to worry (or anxiety more generally). Although no significant findings were demonstrated in the current data with relation to individual processing style, processing biases, and worry this was the first time these factors have been explored simultaneously.

Currently, there is no “process pure” measure of information processing, with all measures comprising of a mix of multiple distinct automatic and strategic processes (Eysenck, 1992; Sherman et al., 2008). Therefore, research that continues to untangle the stages of basic cognition within the chain of information processing has important implications and offers the opportunity to better understand the mechanisms underlying worry so that clinical interventions can continue to be developed and refined (Rozenman et al., 2014). Although the current study suggests Epstein’s individual processing styles may have little to offer in extending our understanding of worry, the conclusions that can be drawn are limited, and the current results require replication.

In summary, the impact of worry on information processing, even when stimuli are presented outside awareness, has been well documented with individuals with high levels of worry demonstrating an enhanced ability to detect threatening stimuli. Yet, despite the convincing evidence supporting theoretical suggestions of the role of attention and interpretation in the development and maintenance of worry, these variables have rarely been examined simultaneously, particularly in an adult population (Mathews & MacLeod, 2005; Rozenman et al., 2014). Attention and
interpretation biases were examined, as well as self-reported individual differences in processing style and worry/GAD symptoms. Although a relationship was observed between attention and interpretation biases at early and late stages of processing, these were found to be unrelated to levels of worry and individual processing style. As the results are not consistent with previous worry-related findings, it is likely they reflect methodological limitations. Future research should continue to focus on examining the distinction between automatic and strategic processes within the same sample in order to explore the applicability of dual-process theory in worry (Beck & Clark, 1997; Hirsch & Mathews, 2012; McNally, 1995; Ouimet et al., 2009).
Chapter 7: General Discussion

7.1 Overview of the Project

7.1.1 Summary and Major Findings

Worry is the central feature of GAD and has also been found to be present in most anxiety disorders (Borkovec et al., 1991; Brown et al., 1992; Craske et al., 1989; Konstantellou et al., 2011; McLaughlin et al., 2007; Roemer et al., 1997; Turk & Mennin, 2011). Yet, despite its prevalence and the significant costs associated with chronic worry/GAD (Ballenger et al., 2001; Kessler et al., 1999; Ormel et al., 1994; Wittchen, 2002), it is recognized as the most understudied of all the anxiety disorders, which has led to the recent proliferation of models (Boschen, 2008). As empirical support for the majority of these models is only in its preliminary stages, the existence of one overarching theory that appears able to sufficiently account for the processes involved in worry remains elusive.

Epstein (1985), Koerner (2014) and Foa and Kozak (1997) have all called for a more explicit synthesis of already acquired knowledge. They argue that the conceptualization, understanding, and treatment of psychopathology and, specifically, chronic worry can best be advanced by the ‘cross-fertilization’ of clinical psychology and nonclinical experimental psychology (e.g., cognitive psychology, social psychology, personality). In other words, a large-scale synthesis of research related to worry/GAD and its processes that explicitly incorporates theories of normative behaviour into clinical models is required. One such example of this synthesis is the incorporation of principles from dual-process models of information processing, and models of anxiety and worry.
Recent models and theories of anxiety and worry have indeed attempted to explain worry as a consequence of voluntary/rational and involuntary/experiential processes (Ouimet et al., 2009; Hirsch & Mathews, 2012). Specifically it is an imbalance between the two distinct systems of information processing; the experiential system that is a fast, impulsive system (attentional bias, interpretation bias) and the rational system, which is a regulatory executive system that can moderate the impact of the experiential system (Epstein, 1998c; Salemink & Wiers, 2012). Individuals with a dominant experiential system and a weak rational system are thought to be most vulnerable for the development and maintenance of psychopathological behaviour (Epstein, 1998c; Salemink & Wiers, 2012). With this in mind, the current project aimed to explore the applicability of dual-process theory in accounting for worry, and its well-established processes (e.g., cognitive biases).

This project reports findings from four studies that assessed the relationship between processing style (as measured by self-report questionnaires), individual differences in patterns of information processing (as measured by implicit tasks), and worry. In particular, it was hoped that the consideration of individual patterns of processing and processing style within a dual-process framework would improved our understanding of heightened levels of worry over and above existing models. The first study was a proof of concept study, which examined participants’ self-reports of individual processing style and worry symptoms in a large sample of undergraduate students. In addition to examining individual processing style, the remaining four studies used experimental tasks designed to place the two systems in conflict, and included the assessment of problem-solving and rational judgment, attentional control task, and biases of attention and interpretation.
Findings from Study 1 (Chapter 3, pp. 101-116) demonstrated a relationship between individual processing style and worry/GAD symptoms. Overall, when faced with active worry (i.e., situational processing style) participants with high, compared to low, levels of worry demonstrated increased levels of rational processing. However, the findings from Study 2 (Chapter 4, pp. 117-135) showed no relationship between processing style, reasoning scores and levels of worry. Therefore, it appears that the relationship between symptom scores and processing style do not reflect actual strengths or deficits in rational thinking or reasoning skills, per se. The findings in Study 2 did, however, offer support for two modes of processing information which reflect performance on reasoning tasks; a rational mode, which is more responsive to statistical than heuristic principals, and an intuitive-experiential system that exhibits the opposite pattern reflecting heuristic principals (Denes-Raj & Epstein, 1994). These findings reflected previous research that has also demonstrated an association between higher reasoning scores and aspects of a more rational processing style (Denes-Raj & Epstein, 1994; Klaczynski & Daniel, 2005; Stanovich et al., 2008; Stanovich & West, 1998; Stanovich & West, 2008; Stupple et al., 2011). However, as there was no evidence of a relationship between reasoning, processing style and symptom scores, the findings were not consistent with one of the central tenets of CEST, which argues that the dominance of one system over the other is predictive of psychopathology (Burns & D'Zurilla, 1999; Claes et al., 2009).

In addition to the findings in the current project offering limited support for CEST, Hirsch and Mathews’ (2012) and Ouimet et al.’s, (2009) models were also unsupported; there was no evidence of attentional control deficits, and no attention or interpretation biases were observed in relation to worry or individual processing style (Study 3 and Study 4). Notably, in terms of attentional control, the antisaccade results
were difficult to interpret. However, overall, the current findings do not support previous research, which demonstrates a relationship between attentional biases, impaired attentional control and worry. Furthermore, different time courses in interpretation and attentional biases did not vary as a result of worry and GAD symptoms. Therefore, current findings cannot offer insight into the impact of worry on processing biases.

7.1.2 Intended Scope of the Project

To date, research has not simultaneously explored the relationship between cognitive biases of attention and interpretation, attentional control, and individual processing style in order to test the assumptions of the aforementioned models. Therefore, an overarching aim of this project was to undertake Structural Equation Modelling to test the fit of possible dual-process models (Epstein, 1983; 1990; Ouimet et al., 2009; Hirsch & Mathews, 2012), which best incorporate the variables in the current project and their ability to account for the process of worry. Although there is evidence to support some of the central tenets in each of these dual-process models, the majority of the research has investigated these processes separately (see: Bar-Haim et al., 2007, for review; Bardeen et al., 2014; Hayes et al., 2008; Hazlett-Stevens & Borkovec, 2004; Mathews et al., 1989; Rozenman et al., 2014; Stefanopoulou et al., 2014). This was the major rationale for having administered the range of experimental tasks to the current sample.

However, as the bivariate relationships did not offer support for the basic relationships that were predicted by the models (see Appendix J, p. 378, for correlation matrix, which is mentioned in Chapter 6, Section 6.4.4, p. 190), Structural Equation Modelling was not undertaken and it was not possible to test the potential fit of possible dual-process models. The results showed that of the possible 138
correlation co-efficients that were conducted, only six were significant. Therefore, it is likely that the current pattern of results reflect Type 1 errors and, for this reason, Structural Equation Modelling was not undertaken. Overall, due to the the large number of correlations and only moderate to weak significant associations observed, there is a strong likelihood of Type 1 error, whereby an effect is detected that is not actually present. Thus, if we controlled for Type 1 error by, for example, conducting bonferroni corrections, the correlations would no longer be significant. Further, the correlations themselves are small, therefore, their clinical relevance is unclear. This raises the conundrum that although the project set out to provide a stringent test of dual-process theories in relation to worry - by including both self-report and implicit measures - the data provide very little support for dual-process theories. What is perhaps most perplexing is that if one relies more heavily on implicit measures employed, which actually test the processes rather than report about the processes incorporated in dual-process models, the support for these models is even more limited. As such, the theory was unsupported.

7.1.3 Summary

Taken together, the overall conclusion one draws from the current project findings is that dual-process models, specifically Epstein’s CEST, was unable to account for the process of worry/GAD symptoms. However, theory cannot be falsified or dismissed on the basis of one set of studies on a single sample and further research must be conducted in order to reach firmer conclusions. Therefore, caution needs to be taken in the conclusions drawn from the current data and the potential benefits of dual-process theories should not be overlooked, especially as they have the potential to offer detailed, specific, and integrative frameworks from which to study cognitive biases in relation to worry (Hirsch & Mathews, 2012; Ouimet et al., 2009).
Thus, the current findings need to be considered in the context of methodological limitations in the various studies.

### 7.2 Project Limitations

#### 7.2.1 Sample

Although participants in the high worry group had scores of self-reported worry and GAD symptoms that were within the clinical range, a possible explanation for the lack of current findings may be the use of a non-clinical analogue sample. However, as discussed in the methodology section (Chapter 2, Section 2.2, pp. 66-69) clinical and non-clinical populations have a qualitatively similar experience of worry, thereby offering justification for the adequacy of non-clinical samples for research into worry (Borkovec et al., 1983; Stokes & Hirsch, 2010). Additionally, we examined a relatively large sample and attempted to create distinct groups of individuals with high and low levels of worry by taking an extreme groups approach, rather than employing a median split.

It could be argued that examining linear relationships may have been a more appropriate way of analyzing the current data. However, even when correlations were examined (see Appendix J, p. 378) the results were not significant. As neither the linear relationships nor the extreme group analyses produced significant findings, we can be confident in the lack of significant findings. Furthermore, according to G*power 3.1 (Faul et al., 2007) we had sufficient power (80% power) at an alpha level of 0.05 to predict a small effect size (0.25). Therefore, any effect that was not observed in the current findings is also unlikely to have clinical relevance. Nonetheless, the results need to be replicated in a clinical sample of individuals who meet criteria for generalised anxiety disorder before we can have confidence in their wider applicability.
Further exploration across a broader age range, as well as exploring gender differences more thoroughly, would also be beneficial. Both rational and experiential processing decrease with age and the current sample consisted of predominantly young adults (Sladek et al., 2010). In addition, although Study 1 had a sufficiently large sample size to explore gender differences, the lack of gender related findings in Study 1 and the low ratio of male participants in the remaining studies meant that gender was not further examined. Gender differences with regard to the study of attentional biases and attentional processes towards emotional stimuli in individuals with high and low levels of worry have been largely overlooked (Sass et al., 2010). However, significant gender differences are apparent in relation to prevalence rates of anxiety disorders (McLean, Asnaani, Litz, & Hofmann, 2011), as well as observed differences between men and women in attentional processes towards emotional stimuli (Sass et al., 2010; Tran, Lamplmayr, Pintzinger, & Pfabigan, 2013).

The final limitation with regard to the current project is that essentially the same sample of participants was examined; all participants completed Study 1 and a subsample of those participants completed Studies 2-4. This was necessary as we wished to examine multiple worry related processes simultaneously. Thus, the testing protocol was such that it required the same participants to be individually run through the various tasks; data was collected from one participant at a time and took a total of two and a half hours (over two testing sessions) per participant. Due to the use of the same sample the generalizability of the findings are questionable. In addition, it cannot be ruled out that the limited significant findings are related to the specific sample employed. Further research with both clinical and non-clinical populations would help determine the generalizability of the findings from the sample included in the current project.
7.2.2 Task parameters

A range of limitations with regard to various tasks employed in the project must also be acknowledged.

7.2.2.1 Self-report measures

Despite the symptom and processing style measures being found to have good psychometric properties (see Chapter 2, Section 2.2.5, pp. 73-78 for further discussion), responses to self-report measures given by individuals high in worry are limited to an individual’s perceptions, which are open to distortion (Eng & Heimberg, 2006). It must also be noted that the observation of two thinking styles (as observed in studies employing processing style questionnaires) does not necessarily provide evidence for dual-processes arising from two distinct cognitive systems. Furthermore, processing style questionnaires present reports of participants’ perceived rather than preferred processing styles.

7.2.2.2 Experimental measures

Although, overall, the use of experimental measures was a strength of the current project, it was a limitation that the attentional control scale (Derryberry & Reed, 2002) was not included in the questionnaire battery. Previous studies have predominantly employed the attentional control scale (ACS) to examine the relationship of attentional control to anxiety/worry, as well as its moderating role between attentional bias and anxiety/worry. Therefore, the lack of significant findings with regard to attentional control may be due to the methodology employed (i.e., not using the ACS). Such suggestions are supported by the data presented in Study 2, which showed that significant findings related to rationality and reasoning on self-report measures did not reflect performance deficits per se. Therefore, it could be that previous findings with regard to the ACS are reporting findings based on beliefs about
attentional control rather than actual attentional control abilities (Fergus et al., 2012; Spada et al., 2010). It would have been beneficial to clarify this by incorporating the ACS in the current project.

Overall, with regard to the experimental measures used in the current studies, the failure to replicate previous findings may reflect limitations inherent in implicit reaction time measures of behaviour. Despite their limitations, implicit measures are perceived as not being so open to biased responding, such as social desirability, and the lack of requirement for introspection or accessing of mental states beyond self-awareness. However, LeBel and Paunonen (2011) have raised the general issue of replicability and relatively poor psychometric properties across implicit tasks (Fazio & Olson, 2003), including poor convergent validity between implicit measures (Wittenbrink & Schwarz, 2007). There has also been suggestion that implicit measures access momentary personal and contextual factors. These are argued to impact on the ability to replicate findings (Barden et al., 2004; LeBel & Paunonen, 2011), and may explain the poor test re-test reliability that is often observed (particularly with relation reaction time measures; Schmukle, 2005). For example, the current literature on attentional biases largely incorporates studies examining RT measures of attention (Armstrong & Olatunji, 2012), yet RT measures vary considerably as a function of physiological, hormonal, emotional and other changes in the respondent (LeBel & Paunonen, 2011).

7.2.2.3 External factors

A combination of both internal (e.g., participant motivation) and external (e.g., complexity of the task) factors have been found to impact participant performance on experimental tasks such as the antisaccade task (Berggren et al., 2013). For example,
with regard to antisaccade task performance, tasks with a high perceptual load that fully occupy an individual's attentional resources, yet are not so demanding that they deplete attentional control, reduce observed differences between high and low trait-anxious individuals (Ansari & Derakshan, 2011b; Basten et al., 2011; Bishop, 2009; Derakshan & Eysenck, 2009; Eysenck et al., 2007; Osinsky et al., 2012; Pilar Pacheco-Unguetti et al., 2012). Moderate to high task demands allow anxious individuals to engage increased effort and additional cognitive resources in order to compensate for any potential deficits in inhibitory control (Ansari & Derakshan, 2011a; Jennings & van der Molen, 2005; Osinsky et al., 2012). Due to the task employed in the current project being more complex than those predominantly reported in the literature (i.e., due to threat/neutral stimuli and the presence of a task-switching component, with antisaccade and prosaccade tasks presented simultaneously), it could be that the lack of findings are a result of moderate to high task demands leading participants with high levels of worry to engage in increased effort and to utilize additional cognitive resources.

Task demands also affect the impact of emotional stimuli (King & Schaefer, 2011; MacNamara et al., 2011; Van Dillen & Koole, 2009). Due to their potential implications for wellbeing (Clarke & Johnstone, 2013) emotional stimuli are preferentially and automatically processed, at times without the need for attention (e.g., Morris et al., 1998; 2001; Dolan and Vuilleumier, 2003). However, cognitive load can act to reduce the salience of threat stimuli and eliminate response differences between emotional and neutral stimuli (King & Schaefer, 2011; Pessoa, Kastner, & Ungerleider, 2002; Van Dillen & Koole, 2009). Specifically, the current studies used tasks that examined various aspects (e.g., task switching in the antisaccade task; masked and non-masked stimuli with a varied time course for stimuli presentation in
the dot probe task) and it is possible that the cumulative effects of the various tasks, not just the tasks themselves, contributed to create high load conditions. In the presence of high, but not low load conditions, threat information is processed but actively prevented from interfering with performance by engagement of top-down regulatory mechanisms and increased cognitive effort (Clarke & Johnstone, 2013; Van Dillen & Koole, 2009). The impact of task load is supported by experimental (King & Schaefer, 2011; Van Dillen & Koole, 2009) and neuroimaging (MacNamara et al., 2011) studies. Therefore, further research that more directly tests and controls for the impact of task load, particularly when multiple tasks are presented is required.

Questions also exist around the robustness of the psychometric properties of experimental reaction time tasks (Schmukle, 2005). For example, using differences in RTs to measure cognitive biases has, in general, been argued to be unreliable (Borkenau et al., 2010). Different findings have been observed with the dot probe task between RT measures and more direct measures such as ERPs and eyetracking data (Kappenman et al., 2014). For example, where no evidence of attentional bias is apparent with RT data, eyetracking data on the same task has been found to show clear attentional bias for threat (Kappenman et al., 2014). Recent findings suggest that a lack of significant findings with RT based measures may be a result of the failure to map and analyze the dynamic temporal nature of emotional attention, which is a process that is expressed repeatedly and continuously over time (Zvielli, Bernstein, & Koster, 2014a). For example, Zvielli et al. (2014a) found that traditional measures of attentional bias (as used in this study) had very low levels of reliability and argued that this was a result of the failure to accurately capture attentional bias across time. Their findings demonstrated that attentional bias is a dynamic process expressed as shifts toward or away from relevant stimuli in phasic bursts over time (Zvielli et al.,
as opposed to the previously held conceptualization whereby attentional bias was thought to be static and stable (e.g., Mogg and Bradley, 1998; Williams, Watts, MacLeod, & Mathews, 1988). Eye-tracking apparatus has successfully demonstrated the tendency of some participants on the dot probe task to ignore the presented stimuli and to instead search only when the probe appears (Bradley et al., 2000). Therefore, it is possible that due to the “snapshot” of attentional bias recorded in RT measures on the current study, the participants may have engaged in such a strategy, which may have obscured the presence of attentional bias in our sample (Staugaard, 2009).

7.2.2.4 Internal factors

Internal factors might also have had a pervasive impact across the tasks employed in the current project. High levels of motivation have been found to increase the likelihood that anxious individuals will employ compensatory strategies to modulate their performance in the presence of anxiety (Hayes et al., 2009). Research examining cognitive control in relation to worry has demonstrated that although worry creates cognitive interference it also has a specific motivational function, whereby increased effort maintains or improves performance (e.g., on tasks examining updating, inhibition, and shifting) through the employment of compensatory strategies (Visu-Petra et al., 2013). Therefore, under the right conditions, such as in when completing more complex, higher load tasks (see Chapter 5, p. 136 for further details), individuals with higher levels worry can potentially match or outperform their less anxious counterparts.

As this research included multiple tasks and was completed over two testing sessions (total of 2.5 hours) it is possible that participant fatigue may have impacted upon the findings. The failure to replicate commonly reported findings on all of the
tasks employed could be explained by fatigue, which may have led participants to respond in an automated way, thereby resulting in non-significant findings on all the implicit measures. Additionally, some authors have argued that the mixed results reported in studies on attentional bias in anxious participants may be accounted for by cognitive factors, such as attentional control, which have considerable impact on biased attentional processing of threatening information (Cisler & Koster, 2010). For example, low attentional control would lead participants with high levels of worry to be more easily distracted by both internal (e.g., worrying thoughts) and external (e.g., threatening stimuli) factors than their non-anxious counterparts (Beckwe, Deroost, Koster, De Lissnyder, & De Raedt, 2014; Hirsch & Mathews, 2012). However, the current findings offered no support for this suggestion because no relationship was found between attentional control and levels of worry, or for attentional control moderating the relationship between attentional bias and worry.

7.2.2.5 The role of state versus trait worry

As mentioned previously in relation to Study 2 (Chapter 4, p. 119), the current studies did not contain a worry induction component. The results from the self-report questionnaires on processing style demonstrate that participants report different results when asked how they respond in situations in which they worry, compared to how they respond more generally. Overall, it is possible the current findings reflect the absence of worry with regard to its direct impact on task performance. For example, although the experimental tasks were carefully selected based on previous research it is possible that the hypothetical nature of these problems (e.g., with regard to the reasoning tasks) and the lack of a component inducing worry (on implicit tasks) meant that they failed to elicit a disruption to processes which may
occur in real-life worry episodes. To date, studies have predominantly focused upon trait worry at the cost of more subjective measures of worry. However, Oathes et al. (2010) found that PSWQ scores were not correlated with measures of threat vigilance, which highlighted the importance of worry inductions for promoting threat bias; induced worry exacerbates worry related findings with responses to threat being faster due to facilitation by the presence of worry (McKay, 2005; Oathes et al., 2010). Salemink and Wiers (2012) also found that state, but not trait, worry impacted findings, in terms of attentional control; attentional control moderated the relationship between state, but not trait, worry and interpretive bias.

Emotions are multifactorial in nature and are made up of subjective feelings, physiological and neurological responses, as well as cognitive processes and action tendencies (Scherer, 2000). Therefore, examining processes when participants are in an active worry phase would be beneficial. Future research should include methodologies that actively induce worry in order to determine the impact of active periods of worry on the variables of interest.

7.2.2.6 Stimuli

A further potential limitation with regard to the experimental tasks examining attentional control, and attentional and interpretation biases relates to the stimuli employed. It is possibly difficult to identify sufficiently threatening stimuli as GAD is not associated with any specific target of anxiety, with the nature of individuals’ worry concerns being both diffuse and idiosyncratic (Craske et al., 1989; Mogg & Bradley, 2006; Roemer et al., 1997; Salters-Pedneault, Tull, & Roemer, 2004). Therefore, the stimuli employed in the current study may not have sufficiently reflected individual participant worry themes to elicit the hypothesized responses.
However, as the current studies employed well-documented methodologies (including employing stimuli found to elicit biased responses) that have been used frequently, and reported significant findings, the lack of replication remains unexpected. To address these limitations, future research would benefit from employing threatening stimuli generated to be specifically relevant for each individual participant, as individuals have been found to demonstrate more extreme reactions to such stimuli (Oathes, Siegle, & Ray, 2011; Siegle, Steinhauer, Carter, Ramel, & Thase, 2003; Staugaard, 2009).

7.3 Project Strengths

These methodological limitations notwithstanding the studies had a number of strengths. This was the first time that the antisaccade task had been employed with both threatening stimuli and a task-switching component in order to examine participants with high and low levels of worry. Second, the presentation of a dot probe task with valenced stimuli across such a range of time courses was novel. Third, although erroneous information processing is implicated in the development and maintenance of chronic worry (e.g., Bar-Haim et al., 2007; Hirsch et al., 2011; Hirsch & Mathews, 2012; Mathews et al., 1989), to our knowledge, this was the first attempt at comparing individual differences in processing style - as characterised by CEST - between individuals with high and low levels of worry. In addition, a strength of this study included the substantial sample size, which was larger than those employed in the majority of previous studies using similar experimental paradigms. As discussed previously (see Section 7.2.1, p. 206), according to G*power 3.1 (Faul et al., 2007) the substantial size of the sample recruited for the current project resulted in sufficient power (80% power) at an alpha level of 0.05 to predict a small effect size (0.25).
Thus, one can be fairly confident that an effect that was not observed in the current findings is also unlikely to have clinical relevance.

A further strength of the project was the use of experimental paradigms. For example, the current results corroborate and expand previous findings by demonstrating - with the use of behavioural and verbal reasoning task methodologies rather than self-report questionnaires - that worry is unrelated to problem-solving and reasoning skills per se (Davey, 1994b; Ladouceur et al., 1998). In addition, previous studies examining regulatory control processes and their moderating role in the relationship between attentional bias and anxiety/worry have predominantly employed a questionnaire of regulatory control – the attentional control scale (Derryberry & Reed, 2002). The reliance on self-report measures has consistently been stipulated as a limitation to this area of enquiry and it has been argued that the current self-report measure examines beliefs about attentional control rather than providing an index of actual attentional control abilities (Fergus et al., 2012; Spada et al., 2010).

Lastly, the concurrent examination of attentional control and biases in attention and interpretation via experimental measures was a particular strength of the current study. To date, research has tended to focus on the examination of only one of these variables as they relate to worry, although theory implicates a range of processes (Teachman et al., 2007). Despite the convincing evidence supporting theoretical suggestions of the role of attention and interpretation in the development and maintenance of worry, these variables have rarely been examined simultaneously, particularly in an adult population (Mathews & MacLeod, 2005; Rozenman et al., 2014). As the current study evaluated attentional bias over a variety of presentation times (that covered early and late stages of processing) it also offered the opportunity
to explore not only the aspects of attention most related to interpretation bias, but the
variety of possible effects of attention with regard to worry more generally (Ouimet et al., 2012; Zvielli et al., 2014b). Understanding the stages of processing that are related
to attentional bias, as well as the relationship between attentional and interpretation
biases is important as it has the potential to improve our understanding of the
processes involved in worry, and to ultimately advance diagnosis and inform
intervention (Beck & Clark, 1997; Cisler et al., 2009). Overall, although the current
study presented limited significant findings, it aimed to overcome a number of
limitations that exist in the extant literature in regard to worry/GAD. To this end, an
attempt was made to synthesize existing knowledge regarding worry and its processes
and to incorporate theories of normative behaviour (dual-process models) into clinical
models with the aim of furthering knowledge.

7.4 Theoretical Implications

Ouimet et al. (2009) have argued that the application of dual-process theory to
anxiety disorders might lead to important theoretical developments by clarifying the
relationship between voluntary and involuntary processes involved in anxiety and
worry (Ouimet et al., 2009). Individuals with relatively strong automatic processes
(experiential system) and weak regulatory control (rational system) are thought to be
particularly vulnerable to develop (and then maintain) psychopathology, such as
worry (Epstein, 1992; Pacini et al., 1998; Salemink & Wiers, 2012). Although the
findings in the current study offer some support to this notion with a relationship
observed between processing style and symptom scores, overall, the findings did not
support the dual-processing models.

In accounting for the present findings of a dominant situational rational
processing style in participants with high levels of worry, both Wells’ and Borkovec’s
models are supported, as they stipulate that worry is a cognitive activity which individuals employ as a coping strategy. The pattern of individual processing style observed in individuals with high levels of worry appears to reflect the future orientated cognitive nature of worry, rather than the emotional symptoms which accompany worry. Overall, the current findings related to processing style emphasise the importance of considering both situational and dispositional processing style, particularly when exploring the relationship of processing style to psychopathology (Burns & D'Zurilla, 1999; Claes, Witteman, & van den Bercken, 2009). These findings also clearly highlight the importance of context, as self-reported differences were recorded between situational and dispositional processing style. Therefore, taking into account the impact of both internal and external context in relation to both perception and behaviour is an important consideration in future research examining worry. For example, as discussed in the project limitations, the importance of undertaking research with an induced worry component would be beneficial as the current findings suggest this would more accurately capture the experience and performance of individuals with high levels of worry.

The findings with regard to relationships between a situational rational processing style and higher levels of worry are consistent with current of models of worry, which stipulate worry to be a cognitive strategy in which people attempt to cope and solve the worrying situation (Borkovec & Roemer, 1995; Davey, 1994a). However, overall, there was limited support for the tenets of CEST. Cognitive Experiential Self Theory would argue that individuals who both perceive themselves to have a less rational disposition and to engage in more experiential processing would be most at risk for pathological levels of worry. CEST assumes that the dominance of one system over the other is predictive of reasoning, problem-solving
performance, and non-normative responding, as well as being associated with psychopathology (Burns & D'Zurilla, 1999; Claes et al., 2009). However, the results of this study do not support this contention. That is, there was no relationship observed between worry, processing style, and reasoning scores, which, thereby, highlights the limited applicability of CEST in accounting for worry.

The discrepancy observed in the current project between self-reported rationality and actual performance on reasoning tasks has significant implications for research into worry. It highlights the fact that self-report is an individual’s assessment of their abilities, which are influenced by the perceptions and biases that they hold. Therefore, the biases common to those who worry (e.g., increased self-doubt, lack of self-efficacy in problem-solving) are likely to influence their judgments in reporting on their cognitive abilities and deficits. Hence, the current results strongly argue for the importance of beliefs and self-perceptions in understanding the development, maintenance, and treatment of worry (Davey, 1994a; Dugas et al., 1995; Shewchuk et al., 2000). The findings also argue for the use of experimental paradigms to directly assess cognitive processes, rather than simply asking participants to characterize their own cognitive processes. The lack of association between self-reported processing style and cognitive biases in the current study suggest that implicit cognitive biases of attention and interpretation, that have been found to be present in pathological worry (e.g., Hayes et al., 2010; Hirsch & Mathews, 2012; Mathews & MacLeod, 2005), may be too qualitatively different from belief related biases and heuristic thinking to be able to draw parallels between these processes.

The current project also highlights that, unlike the content of thoughts and beliefs that are relatively easy to assess by explicit enquiry, there are significant difficulties inherent in examining information processing biases. For example, in
terms of attentional bias and the dot probe task, the lack of findings in the current study calls into focus recent evidence for the questionable psychometric properties of the dot probe task (Cisler et al., 2009; Dear, Sharpe, Nicholas, & Refshauge, 2011; Oathes et al., 2011; Schmukle, 2005; Zvielli et al., 2014a; Zvielli et al., 2014b). Schmukle (2005) were the first to examine the internal consistency and retest reliability of the dot probe task, employing both words and pictorial (scenes) stimuli. They concluded that the inconsistent findings, particularly with non-clinical samples, rendered the dot probe task an unreliable measure of attentional allocation. The psychometric properties have since been examined with regard to facial stimuli, and although facial stimuli were more robust than pictorial scenes or word based stimuli, no stable relationship was found between attentional bias scores for individual participants across testing sessions (Staugaard, 2009). However, as a group anxious compared to non-anxious participants demonstrate consistent vigilance for emotional faces reflecting research that facial emotion captures attention. Research examining the dynamics of emotional attention in time, as well as the processes that influence it (e.g., attentional control), require further attention in order to permit a more accurate understanding of the nature of attentional bias, as well as ultimately advancing intervention (Zvielli et al., 2014a).

Hirsch and Mathews’ (2012) cognitive model of pathological worry proposed that negative thoughts and worry arise from an interaction between involuntary processes (e.g., habitual biases of attention and interpretation) favoring threat content, and insufficient or misdirected voluntary resources, such as attentional control. Therefore, accounting for individual differences in attentional control is argued to have implications for information processing biases and development of psychopathology such as worry emerging (Hirsch & Mathews, 2012; Salemink &
The theoretical assumption that worry impairs attentional control is based on the view that there are two attentional control systems: a voluntary or goal-driven system (i.e., influenced by individual goals) and an involuntary or stimulus-driven system (i.e., influenced by salient stimuli; Corbetta & Shulman, 2002; Miller & Cohen, 2001). Recent dual-process models (e.g., Ouimet et al., 2009) propose that regulatory control processes play an important role in psychopathology by moderating the impact of information processing biases. Although the two systems are interacting (Pashler, Johnston, & Ruthruff, 2001), Eysenck, Derakshan, Santos, and Calvo’s (2007) attentional control theory suggests that worry is particularly attention demanding and, consequently, consumes more voluntary attentional resources required to control it. As such, worry impairs attentional control by enhancing the influence of bottom-up processes over the more efficient top-down, goal-driven processes. It is the combination of low attentional control and symptomatology that are suggested to be particularly problematic (Bardeen & Orcutt, 2011; Schoorl et al., 2014); higher levels of attentional control facilitate disengagement from threat, which in turn may improve emotional well-being (Fergus et al., 2012). Therefore, greater attentional control may act as a protective function to increase functioning of top-down control processes to reduce negative emotional arousal leading to enhanced engagement (i.e., attentional bias) and habituation to anxiety provoking stimuli (Bardeen et al., 2014; Fergus et al., 2012).

Despite such theoretical suggestions, the impact of attentional control on the relationship between attentional bias and worry has received little attention. However, preliminary findings highlight the moderating role of attentional control on attentional biases in anxiety/worry (Beckwe et al., 2014; Hirsch & Mathews, 2012). Overall, the current findings were not consistent with these preliminary studies demonstrating a
link between attentional control and worry, which argues for individual differences in top-down attentional control being of considerable importance in the expression of attentional bias in anxious psychopathology (Hayes et al., 2008; Schoorl et al., 2014; Stefanopoulou et al., 2014). However, the current study was the first to use the antisaccade task to explore attentional control in relation to worry in an adult population. Despite reaction time tasks becoming increasingly popular, previous studies examining regulatory control processes and their moderating role in anxiety (e.g., PTSD and trait anxiety) and attentional bias have predominantly employed a questionnaire of regulatory control – the attentional control scale (Bardeen et al., 2014; Derryberry & Reed, 2002). Therefore, although the current experimental methodology improved on previously employed self-report measure of attentional control, the lack of current findings may have arisen due to limitations inherent in experimental tasks.

With regard to experimental measures, findings are often impacted by an interaction between situational and personality factors (Visu-Petra et al., 2013). For example, in relation to cognitive control in worry, Derryberry and Reed (2002) propose that individual differences in anxiety and coping result from the interplay of automatic and strategic processes, which affect anxious individuals’ capacity to use voluntary attention to enact control in the effort to cope. It is possible that individuals in this study, although endorsing GAD symptomatology, applied attentional resources in a manner which supported their coping. Thus attentional control may relate to a processing style rather than a processing deficit (Bishop, 2009). Derryberry and Reed (2002) found that anxious “good attenders” demonstrated better inhibition to dominant response codes than anxious “poor attenders”. Thus, attentional control deficits should not be viewed as common to all individuals with GAD, rather one’s
capacity to voluntarily control attention in both in general, as well as in specific situations will effect performance and coping. Therefore, understanding the interplay between involuntary and voluntary processes has important implications; individual differences in attentional control may serve a protective function and individuals with poor attentional control may be those most vulnerable to clinical disorders (Clarke & Johnstone, 2013). However, good attentional control may contribute to anxiety in circumstances when effortful attention facilitates maladaptive coping strategies, such as when efforts are made to control uncontrollable situations (Derryberry & Reed, 2002).

Overall, the lack of significant findings in this thesis may have implications with regard to the administration of multiple tasks. To date, the majority of research examining attention and interpretation biases is based on single task studies. Within each of the task components there are limitations such as order effects. For example, one study observed interpretive bias only in the first half of the task (Mogg et al., 1994). Therefore, such effects may have been compounded with the use of multiple tasks in the current studies. However, in order to test for the applicability of dual-process models, and cognitive models more generally, we require the capacity to simultaneously examine a variety of processes by administering multiple tasks. Future research that addresses such challenges is vital in order to advance our current understanding of the processes involved in worry.

The potential benefits of dual-process theories should not be overlooked, especially as they have the potential to offer detailed, specific, and integrative frameworks from which to study cognitive biases in relation to worry. Additionally, dual-process models have the potential to serve as a guide to enable the development of more effective intervention, as well as to increasing our insight and understanding
of chronic worry (Hirsch & Mathews, 2012; Ouimet et al., 2009). Although the current study presented limited findings, it aimed to address the current limitations with regard to research into worry and GAD. Synthesizing existing knowledge regarding worry and its processes, and attempting to incorporate theories of normative behaviour (dual-process models) into clinical models, are important to furthering knowledge (Koerner, 2014). Foa and Kozak (1997) call for a ‘scientific synchrony’ across disciplines in order to progress cognitive-behavioural therapy, which is suggested to be hindered by the current oversight of ‘cross-fertilization’ between clinical and experimental psychology (Koerner, 2014). Therefore, attempting to address such concerns is a necessity in moving the worry/GAD research agenda forward (Koerner, 2014).

7.5 Clinical Implications

Until further research is undertaken to examine the variables in the current project in a clinical population with chronic worry, the clinical implications of the current project must remain tentative. However, the findings suggest that in terms of treating individuals who present for treatment of worry and GAD, several factors may need to be considered. First, when faced with a situation in which they worry, individuals with high levels of worry perceive themselves to engage in a more rational processing style than those with low levels of worry. This highlights the cognitive nature of worry, whereby worry is a cognitive strategy that individuals engage in to cope with future potential problems (thoughts/doubts). It needs to be understood that the perceptions of processing style were not supported by performance on the reasoning tasks, with an obvious discrepancy between perceptions and actual observable behaviours. This may indicate that individuals high in worry rely on a particular form of rational processing to try and solve the problem that is at the source
of their worry. For example, previous research has shown that during worry episodes the very nature of worry requires increased engagement in problem-solving attempts, which rely on rational processing (Fong et al., 1986; Szabo & Lovibond, 2006), as well as automatic biases in anxiety disorders requiring cognitive resources rather than being capacity-free (McNally, 1995). Not only does it call into question the accuracy of a person’s assessment of themselves and their abilities, it focuses attention on the influence of perceptions and biases that are intricately linked to the beliefs an individual holds about themselves, others, and the world.

Therefore, in line with more recent meta-analyses and randomised control trials of successful treatment outcomes, current treatments should focus on cognitive based therapies (e.g., cognitive therapy, meta-cognitive therapy; Cuijpers et al., 2014; van der Heiden et al., 2012; Wells & King, 2006). Currently, the gold standard treatment for worry and GAD is still Cognitive and Behavioral Therapy (CBT; Arch & Craske, 2008), and, it is argued that treatment should focus on the role of beliefs with regard to perceptions of rationality, rather than other standard Cognitive Behavioural Therapy treatment components such as problem-solving (Cuijpers et al., 2014; Durham et al., 2004; van der Heiden et al., 2012; Wells & King, 2006). If future research confirmed the applicability of dual-process models, these processes could be targeted. For example, although interpretation biases may occur rapidly and/or outside awareness, cognitive intervention aimed at developing strategic cognition to intervene so one has the capability to explore the situation thoroughly, rather than responding on the initial interpretation, would be beneficial. Furthermore, educating individuals about the involuntary nature of their anxiety related responses may also be useful in supporting individuals to understand why they feel anxious when logically they are able to state no known reason for their worry (Teachman &
Overall, the areas of enquiry undertaken in the current project are important in order to further our understanding of the processes involved in chronic worry so that research can better inform interventions, which, to date, are often ineffective in treating chronic worry (Borkovec et al., 2002; Borkovec & Ruscio, 2001; Brown et al., 1994; Gould et al., 2004; Salters-Pedneault et al., 2006).

### 7.6 Future Research

Future research should continue to focus on examining the distinction between automatic and strategic processes within the same sample in order to further explore the theoretical suggestion of the applicability of dual-process theory in worry (Beck & Clark, 1997; Hirsch & Mathews, 2012; McNally, 1995; Ouimet et al., 2009). However, the tendency for oversimplification of current dual-process models, which are argued to suggest two overly separate systems (Keren & Schul, 2009), needs to be considered. Therefore, it would also be beneficial to examine the applicability of multilevel, interactive and iterative models (e.g., Cunningham, Zelazo, Packer, & Van Bavel, 2007), which are not restricted to unidirectional sequences. It should also be noted that overlaps have been observed between worry, and other negative cognitive-affect phenomenon (e.g., rumination; Beckwe et al., 2014; Fresco, Frankel, Mennin, Turk, & Heimberg, 2002). Therefore, although the current study did not examine other measures of negative repetitive thinking, it would be beneficial for future research to assess to what degree the relationships examined in the current body of research are unique to worry.

In addition, although it has been well established that worry is automatic in nature, and that maladaptive schemata and implicit and explicit information processing biases are clearly implicated (Beck, Emery, & Greenberg, 1985; Bradley
et al., 1999; Hazlett-Stevens & Borkovec, 2004; MacLeod et al., 1986; Mathews et al., 1989; Mogg, Bradley, Millar, et al., 1995; Mogg et al., 1993; Mogg et al., 1992; Mogg et al., 2000; Teachman et al., 2007), the clinical applications of these findings have been limited (Teachman & Woody, 2004). Future research could focus on the benefits of such findings in terms of their potential to enhance both assessment and intervention (Palfai & Wagner, 2004; Teachman & Woody, 2004). For example, despite CBT being the most validated treatment, the mechanisms guiding successful treatment remain elusive and many clients continue to receive minimal benefits (Borkovec et al., 2002; Borkovec & Ruscio, 2001; Brown et al., 1994; Gould et al., 2004; Hofmann & Smits, 2008; Salters-Pedneault et al., 2006). Therefore, examining implicit cognition may only offer a greater understanding of the mechanisms guiding successful treatment, but also provide additional tools to respond to those who have minimal treatment success (Teachman & Woody, 2004).

To this end, there are several aspects that would be beneficial for future research to focus upon. First, examining a clinical sample is important. Second, as variation in results (e.g., in interpretation bias tasks and attentional control tasks) have been found to be linked to levels of state, but not trait anxiety (Salemink et al., 2007a; Salemink & Wiers, 2012), inclusion of a worry induction procedure would be beneficial. Third, to date, there is no ‘process pure’ measure of information processing, with all measures comprising of a mix of multiple distinct automatic and strategic processes (Eysenck, 1992; Sherman et al., 2008). Therefore, research that continues to untangle the stages of basic cognition within the chain of information processing has important implications. Furthermore, it offers the opportunity to better understand the mechanisms underlying worry so that clinical interventions can continue to be developed and refined (Rozenman et al., 2014). For example,
employing cognitive bias modification procedures for both interpretations (CMB-I) and attention (CMB-A) would be beneficial. These methodologies allow for the manipulation of factors implicated in the etiology and maintenance of anxiety disorders (Amir & Taylor, 2012; Mathews & MacLeod, 2005), and have had some success in demonstrating differential emotional vulnerability under conditions of heightened stress (e.g., Amir, Weber, Beard, Bomyea, & Taylor, 2008).

The CBM-A trains attention away from threat related stimuli, and can also be used to train attention towards threat related material to provide experimental comparisons, whilst the CBM-I trains interpretation of emotionally ambiguous material in a negative or positive way in order to induce a negative or positive bias. Previous findings have demonstrated that experimentally manipulating, for example, interpretation of ambiguous information can causally influence worry and related outcomes (e.g., negative thought intrusions; e.g., Hayes et al., 2010). Furthermore, Interpretive training has been shown to alter both interpretive and attentional biases (Amir et al., 2010) and, thereby, reduce trait and state anxiety in those with GAD (Brosan, Hoppitt, Shelfer, Sillence, & Mackintosh, 2011). Further exploration of such findings might offer more insight into dual-process models of anxiety which propose that information processing biases work together (e.g., Ouimet et al., 2009), as well as those models which suggest the biases stem from a common mechanism to maintain symptoms (e.g., Bishop, 2007; Mathews & Mackintosh, 1998; Ouimet et al., 2009). Such research has the potential to reveal possible determinants of threat-related biases (Salemink et al., 2013), which in turn may lead to information about mechanisms underlying worry. Understanding the mechanisms underlying worry would offer the ability to modify them, thereby affecting symptoms of psychopathology.
Addressing the many methodological limitations that beset this research literature (see discussion in limitation section) is also necessary, such as employing eye-tracking and neurophysiological (e.g., event-related potential studies), rather than reaction time (RT) methodologies on the dot-probe task. Eye-tracking methodologies are becoming increasingly popular as they allow for a direct and continuous measurement of covert visual attention (Armstrong & Olatunji, 2012). Eye-tracking and neurophysiological methodologies demonstrate more robust findings than manual RTs for several reasons. Namely, they have the ability to more directly examine attentional responses to threat and, therefore, allocation of attention does not have to be inferred. In addition, the distal relation between key presses, which may be open to confounding effects, do not have to be taken into account (Mogg & Bradley, 2006). In terms of confounding effects, response execution has been found to be susceptible to disruption effects that are particularly problematic in highly emotional participants or when using emotion provoking stimuli (Mogg & Bradley, 2006). Furthermore, eye-tracking and neurophysiological methodologies offer the opportunity to examine multiple timeframes in one continuous trial rather that the “snapshot” nature of RT measures whereby data is restricted to a single time point within a trial, which imposes limits on the ability to effectively and efficiently examine dynamic attentional processes (Armstrong & Olatunji, 2012; Kappenman et al., 2014; Mogg & Bradley, 2006).

Further research exploring attentional control would also be beneficial due to its potential capacity to serve a protective role, whereby greater attentional control allows an individual to remain in a threatening situation in order to facilitate habituation rather than engaging in less adaptive regulation strategies such as emotion avoidance (Bardeen et al., 2014; Fergus et al., 2012). In addition, further research
with experimental measures that include a worry induction methodology would be useful to further clarify the moderating role of attentional control in cognitive biases in individuals with high levels of worry, and psychopathology more generally (Bardeen et al., 2014).

Lastly, as discussed with regard to theoretical implications, we require the capacity to simultaneously examine a variety of processes by administering multiple tasks in order to test for the applicability of dual-process models, and cognitive models more generally. The specific combinations of the tasks and their novel components may have generated a constellation of previously unexamined factors and, therefore, an important aim of future research is to addresses the apparent challenges in administering multiple tasks in order to advance our current understanding of the processes involved in worry. The current findings suggest that it might be beneficial to present shorter tasks in several separate testing sessions. Future research that effectively examines multiple tasks in one sample is vital to synthesize existing knowledge regarding worry and to advance our current understanding of the processes involved in worry (Koerner, 2014).

### 7.7 Summary and Concluding Remarks

In summary, despite the theoretical promise (e.g., Hirsch & Mathews, 2012; Ouimet et al., 2009) of the applicability of dual-process models to the processes involved in chronic worry, research exploring dual-process models has been limited. The current project attempted to address this gap in the literature with four studies that assessed attention and interpretation biases, attentional control, reasoning, and individual differences in perceived processing style and their relationship to worry. In addition, the current studies also attempted to address a gap in the literature and test
multiple processes, as opposed to previous studies, which have tended to focus on the examination of one aspect (e.g., attention bias, interpretation bias, or reasoning). Across the studies, symptom scores were only found to be related to higher levels of a situational rational processing style, and with regard to implicit measures there was a failure to replicate previous findings, with no significant worry related findings observed. Unfortunately this meant that a full structural model that incorporated all these processes could not be tested. The results highlight the discrepancy between self-report and experimental measures, and bring into focus the role of beliefs and self-perceptions in relation to worry. The findings are discussed with regard to methodological limitations, for example, limitations inherent in implicit measures of psychological processes, which may have been compounded in the current project by the administration of a series of various tasks. Despite the lack of worry related findings, the importance of the capacity to simultaneously examine a variety of processes - by administering multiple tasks - is highlighted in order to test for the applicability of dual-process models, and cognitive models more generally. Future research focusing on such challenges is vital in order to synthesize existing knowledge regarding worry, as well as to advance our current understanding of the processes involved in worry (Koerner, 2014). This ultimately has clinical implications and may support progress in improving the insufficient current treatments for pathological worry (i.e., Cognitive Behavioural Therapy), which are suggested to be hindered by the current oversight of ‘cross-fertilization’ between clinical and experimental psychology (Foa & Kozak, 1997; Koerner, 2014).
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APPENDIX A

Ethics Approval from University of Sydney (modifications included)

The University of Sydney

Human Research Ethics Committee

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Deputy Manager
Human Research Ethics Administration

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Ref: IM/PR

15 December 2009

Assoc Prof Caroline Hunt
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Dear Associate Professor Hunt

I am pleased to inform you that the Human Research Ethics Committee (HREC) at its meeting held on 1 December 2009 approved your protocol entitled “An Exploration of the Role of Processing Styles in Generalized Anxiety”.

Details of the approval are as follows:

Ref No.: 12-2009/12374
Approval Period: December 2009 to December 2010
Authorised Personnel: Assoc Prof Caroline Hunt, Miss Sophia Drysdale

The HREC is a fully constituted Ethics Committee in accordance with the National Statement on Ethical Conduct in Research Involving Humans-March 2007 under Section 5.1.29

The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Research Involving Humans. We draw to your attention the requirement that a report on this research must be submitted every
12 months from the date of the approval or on completion of the project, whichever occurs first. Failure to submit reports will result in withdrawal of consent for the project to proceed.

**Chief Investigator / Supervisor’s responsibilities to ensure that:**

(1) All serious and unexpected adverse events should be reported to the HREC as soon as possible.

(2) All unforeseen events that might affect continued ethical acceptability of the project should be reported to the HREC as soon as possible.

(3) The HREC must be notified as soon as possible of any changes to the protocol. All changes must be approved by the HREC before continuation of the research project. These include:
   - If any of the investigators change or leave the University.
   - Any changes to the Participant Information Statement and/or Consent Form.

(4) All research participants are to be provided with a Participant Information Statement and Consent Form, unless otherwise agreed by the Committee. The Participant Information Statement and Consent Form are to be on University of Sydney letterhead and include the full title of the research project and telephone contacts for the researchers, unless otherwise agreed by the Committee and the following statement must appear on the bottom of the Participant Information Statement. 
   **Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, University of Sydney; on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).**

(5) Copies of all signed Consent Forms must be retained and made available to the HREC on request.

(6) It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.

(7) The HREC approval is valid for four (4) years from the Approval Period stated in this letter. Investigator are requested to submit a progress report annually.

(8) A report and a copy of any published material should be provided at the completion of the Project.

Yours sincerely,

[Signature]
Associate Professor Ian Maxwell  
Chairman  
Human Research Ethics Committee

cc: Sophia Drysdale, Room 310, School of Psychology, Griffith Taylor Building – A19  
Email: Sophia@psych.usyd.edu.au

Encl.  
Approved Online Study Advertisement for Study 1  
Approved Participant Invitation  
Approved Online Study Advertisement for Study 2  
Approved Online Study Advertisement for Study 3  
Approved Participant Information Statement – Study 1  
Approved Participant Information Statement – Study 2  
Approved Participant Information Statement – Study 3  
Approved Participant Consent Form  
Approved Questionnaires – Study 1  
Approved The Perceived Modes of Processing Inventory (PMPI)  
Approved The Rational-Experiential Inventory (REI)  
Approved The Meta-cognitions questionnaire (MCQ)  
Approved The Depression Anxiety and Stress Scale (DASS)  
Approved The Generalised Anxiety Disorder Questionnaire – IV (GADQ-IV)  
Approved Examples of Threatening Pictorial Stimuli  
Approved Threatening and Neutral Word Stimuli  
Approved Homophone spelling task of threatening/neutral words (Study 2)  
Approved Reasoning Tasks: Study 3  
Approved Probabilistic Reasoning Task  
Approved Inductive Reasoning Task  
Approved Debrief Sheets
Ref: IM/AS

16 February 2010

Associate Professor Caroline Hunt
School of psychology
The University of Sydney
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Dear Associate Professor Hunt

Title: An Exploration of the Role of Processing Styles in Generalized Anxiety
Protocol No.: 12374

Your request to modify the above application was considered by the Human Research Ethics Committee (HREC) Executive at its meeting on 12 February 2010 and the following has been approved:

1. Study 2 and 3 of the project are to be amended. Participants who score high/low on the DASS or GADQ-IV will be recruited through the mass screening procedure administered at the beginning of each academic year by the School of Psychology. Participants will participate in a 2-Part study that takes a total of 3 hours over 2 testing sessions, with 3 credit points being given for participation.

2. Combining study 2 and 3 will require only 50 participants, rather than the 100 initially approved.

The Committee found that there were no ethical objections to the modifications and therefore recommends approval to proceed.

Chief Investigator / Supervisor's responsibilities to ensure that:

1. All serious and unexpected adverse events should be reported to the HREC within 72 hours for clinical trials/interventional research.

2. All unforeseen events that might affect continued ethical acceptability of the project should be reported to the HREC as soon as possible.

3. All changes to the protocol must be approved by the HREC before continuation of the research project.

4. All research participants are to be provided with a Participant Information Statement and Consent Form, unless otherwise agreed by the Committee. The following statement must appear on the bottom of the Participant Information Statement: Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); + 61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).

5. Copies of all signed Consent Forms must be retained and made available to the HREC on request.
6. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.

7. A report and a copy of any published material should be provided at the completion of the Project.

Please do not hesitate to contact the Human Ethics Office should you require further information or clarification.

Yours sincerely

[Signature]

Associate Professor Ian Maxwell
Chair
Human Research Ethics Committee

cc: Sophia Drysdale, Sophia@psych.usyd.edu.au

Encl. Approved Online study advertisement
   Approved Participant Information Statement (Study 1)
   Approved Participant Information Statement (2nd testing session)
   Approved Participant Consent Form
   Approved Debriefing Statement (part 1)
   Approved Debriefing Statement (part 2)
### RECRUITMENT

**Online Study Advertisement**

An exploration of the role of processing styles in generalised anxiety

#### 2-Part Study

Both parts should be scheduled at the same time, and the second part should be scheduled to occur a week after the first part. The second part may be scheduled to occur at any time, other than immediately after the first part, that is within the range of acceptable dates.

#### Abstract

3hrs credit. You will be asked to complete a series of questionnaires, categorise threatening/neutral pictures, undertake a short spelling task, play a short game of chance and complete eye tracking tasks that examine your responses to threatening/neutral pictures.

This is a 2-part study.

#### Description

Study will take place over 2 days. You need to attend BOTH sessions to receive credit. This research is investigating the relationship between cognitive styles, worry and generalised anxiety. The study will be held in room 503 of the Griffith-Taylor building (opposite Manning).

#### Eligibility Requirements

- Normal or corrected to normal colour vision.
- A high level of English proficiency.

#### Sign-Up Restrictions

Must NOT have signed up or completed ANY of these studies:

- An exploration of the role of processing styles in generalised anxiety PART 1: Questionnaire only study (Inactive)

#### Duration

120 minutes (Part 1)
60 minutes (Part 2)

#### Credits

- 0 Credits (Part 1)
- 3 Credits (Part 2)
- (3 Credits total)

#### Researchers

SOPHIA DRYSDALE
Email: sophia@psych.usyd.edu.au
Associate Professor Caroline Hunt
Email: caroline@psych.usyd.edu.au

#### Participant Sign-Up Deadline

24 hours before the study is to occur

#### Study Status

Visible to participants (approved)
Active study (appears on list of available studies)

#### Human Res Ethics Com Approval Code

PENDING
APPENDIX B

PARTICIPANT INFORMATION SHEETS AND CONSENT FORMS

Study 1:

The University of Sydney
School of Psychology
Faculty of Science

ABN 15 211 833 464

Sophia Drysdale / Ass. Prof. Caroline Hunt
MSc Student
Ph.D.
M.Psychol. (clinical)
Clinical Training Director

Room 164
Transient Building F12
University of Sydney
NSW 2006
AUSTRALIA

Telephone: 02 9351 8446
Facsimile: 02 9351 9233

Email:
sophia@psych.usyd.edu.au
caroline@psych.usyd.edu.au
Web: www.usyd.edu.au

An Exploration of the Role of Processing Styles in Generalized Anxiety

PARTICIPANT INFORMATION STATEMENT

1) What is the study about?

This research is investigating the relationship between cognitive styles, worry and generalised anxiety.

2) Who is carrying out the study?

This study is being conducted by Sophia Drysdale (as the basis of the degree of Master of Science/Doctor of Philosophy) at The University of Sydney under the supervision of Associate Professor Caroline Hunt.

3) What does the study involve and how much time will it take?

This is a 2-Part study. If you agree to participate in this study, you will be asked to complete five tasks which we anticipate will take around 120 minutes. The tasks will include:

a. An online questionnaire.

b. Categorising threatening/neutral pictures as fast as possible by pressing one of two buttons on a key board.

c. Asking you to spell a list of words that you hear.
d. Examining the way you respond to threatening and neutral faces by tracking your eye movements.

Some of the images used in this study are unpleasant and may cause distress. You are free to withdraw at any stage. Participation in this research will take about 70 minutes.

4) Can I withdraw from the study?

Being in this study is completely voluntary and you are not under any obligation to participate. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalise or affect you in any way. Signing and submitting an informed consent form is an indication of your consent to participate in the study. Once you have submitted your consent form and participated in the research your responses cannot be withdrawn.

5) Will anyone else know the results?

You will be requested to provide an email address so that we can match your responses from the first part of this study to those you give in Part 2 of this study. Once you have completed participation in this study, your email address will be destroyed and the data will be coded so that the data that you provided will be completely anonymous. The program of research will be submitted for the requirements of the Master of Science/Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report (only group data will be reported).

6) Will the study benefit me?

While we intend that this research should also further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?

It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?

If you would like to know more at any stage, please feel free to contact Sophie Drysdale on (02) 9351 7479, sophie@psych.usyd.edu.au or Associate Professor Caroline Hunt on (02) 9351 5448, carolina@psych.usyd.edu.au

9) What if I have a complaint or concern?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@usyd.edu.au (Email).

Processing style and anxiety

Page 2 of 2
An Exploration of the Role of Processing Styles in Generalized Anxiety

PARTICIPANT INFORMATION STATEMENT

1) What is the study about?
This research is investigating the relationship between cognitive styles, worry and generalised anxiety.

2) Who is carrying out the study?
This study is being conducted by Sophia Drysdale (as the basis of the degree of Master of Science/Doctor of Philosophy) at The University of Sydney under the supervision of Associate Professor Caroline Hunt.

3) What does the study involve and how much time will it take?
If you agree to participate in this study, you will be asked to complete three tasks which we anticipate will take no more than an hour (60mins). The tasks will include:

a. Answering questions (multi-choice) about the way you explain, predict and reach conclusions with restricted or limited information.

b. A game of chance where you will be asked to choose jelly beans from one of two containers.

c. An eye tracking task which will examine the way you respond to threatening and neutral faces.

4) Can I withdraw from the study?
Being in this study is completely voluntary and you are not under any obligation to consent to complete the research. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalise or affect you in any way. Signing and submitting an informed consent form is an indication of your consent to participate in the study. Once you have submitted your consent form and participated in the research your responses cannot be withdrawn.

5) Will anyone else know the results?
You will be requested to provide an email address so that we can match your responses to those you gave in Part 1 of this study. Once you have completed participation in this study, your email address will be destroyed and the data will be coded so that the data that you provided will be completely anonymous. The program of research will be submitted for the requirements of the Master of Science/Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report (only group data will be reported).

6) Will the study benefit me?

While we intend that this research should also further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?

It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?

If you would like to know more at any stage, please feel free to contact Sophie Drysdale on (02) 9351 7479, sophia@psych.usyd.edu.au or Associate Professor Caroline Hunt on (02) 9351 5448, caroline@psyh.usyd.edu.au

9) What if I have a complaint or concern?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 6176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@usyd.edu.au (Email).
PARTICIPANT CONSENT FORM

I, .................................................................................................................. [PRINT NAME], give consent to my participation in the research project:

An Exploration of the Role of Processing Styles in Generalized Anxiety

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher(s).

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or the University of Sydney now or in the future.

4. I understand that my involvement is strictly confidential and no information about me will be used in any way that reveals my identity.

5. I understand that being in this study is completely voluntary – I am not under any obligation to consent.

6. I understand that I can stop participating at any time if I do not wish to continue.

Signed: ..............................................................................................................

Name: ..............................................................................................................

Date: ..............................................................................................................
APPENDIX C

DEBRIEF SHEETS

Debrief for Participation (PART 1)

The University of Sydney

School of Psychology
Faculty of Science

Debriefing Statement:

An Exploration of the Role of Processing Styles in Generalized Anxiety: PART 1

Thank you very much for participating in this study. Previous research has shown that anxiety is related to biases of attention, interpretation, and memory. The tasks that you just took part in consisted of:

1) **Online Questionnaire**: you completed a set of questionnaires, two of which measured cognitive processing style: the Rational Experiential Inventory (Epstein & Pacini, 1999), and the Perceived Modes of Processing Inventory (Dume & D'Zurilla, 1999). You were also given questionnaires that are used to screen individuals with anxiety and depression, and to examine levels of worry.

2) **Homophone spelling task**: homophones are words that sound the same but are spelt differently e.g., “sleigh/slay”. Previous research has found that anxious individual show an interpretation bias; they predominantly spell the threatening, as opposed to neutral, version of the word (e.g., Mathews, Richards & Eyres, 1989; Blanchette & Richards, 2003).

3) **Implicit Association Test (IAT)**: Greenwald, McGhee, & Schwartz, (1998); measured your automatic associations (by measuring the time that it took you to classify stimuli into different categories) between threatening/neutral pictures and yourself. Research has found panic disorder and social phobia to be related to biased automatic associations in memory (Teachman, 2005; and Teachman, Smith-Jank & Saporto, 2007).

4) **Modified probe detection task**: you were shown threatening/neutral faces and your eye movements were tracked which allowed us to examine your attention processes. Past research has shown that anxious individuals attention is biased toward threat/faces (MacLeod, Mathews & Tata, 1985; Bradley et al., 1997; Mogg, Miller & Bradley, 2000). There were some conditions in this task where threatening faces were presented beyond conscious awareness; this was necessary in order to measure your attention that is beyond conscious awareness (implicit attention).

We did not tell you before your participation in the research exactly what we were measuring, or the exact intent of some of the tasks. The reason for this is that there is some evidence that suggests that people’s behaviour can be changed when they are told the intent behind the task. For example, in the spelling task, if the true intent had been revealed it would not be possible to distinguish whether you may have a bias to interpret ambiguous words positively/negatively.

One area of research that has not received much attention concerns the potential impact of a person’s cognitive processing style on the development, and maintenance of anxiety. There are at least two partially independent modes of thought that contribute to individual processing style: the rational system (RS) that operates at the conscious level, and the preconscious experiential system (ES) (Epstein et al., 1992; Kirkpatrick & Epstein, 1992). Whilst there is extensive research examining individual cognitive biases in relation to anxiety, one area of research that has not received much attention concerns the potential relationship between these biases, how they may relate to anxiety, and the potential impact of a person’s cognitive processing style. This is an exploratory study that will help us to understand the pattern of cognitive biases and how these relate to processing style and whether or not an individual suffers from excessive worry and anxiety. By investigating this relationship further, we hope to gain insights into whether it would be beneficial to study processing style in more depth with clinically anxious participants. Ultimately it has the potential to increase our knowledge and understanding of generalized anxiety so that more effective treatment programs can be tailored for individuals suffering from generalized anxiety disorder.

Processing style and anxiety

1 of 2
If any aspects of this study have raised any issues that you wish to discuss further, please contact either Associate Professor Caroline Hunt at the School of Clinical Psychology (see details below) or, alternatively, please feel free to make use of one of the following free services:

**Lifeline**  
Phone: 13 11 14

**Counselling Service (USVU)**  
Phone: (02) 9257 8433

Because some of the questionnaires in this study are used to screen for generalized anxiety disorder and depression, we are obliged to make contact with people whose scores indicate referral to support services may be warranted. Associate Professor Caroline Hunt will email these people, asking them to contact her so that she can discuss the implications of their scores, and support resources that are available to them. Though it is recommended, these people are under no obligation to make an appointment with Associate Professor Hunt.

If you wish to know the results of this study, or wish to discuss it further, please contact either Sophia Drysdale or Associate Professor Caroline Hunt using the details below.

Thank you again for your time.

Sophia Drysdale (MSc Student)  
sophia@psych.usyd.edu.au

Associate Professor Caroline Hunt  
caroline@psych.usyd.edu.au  
(02) 9251 5446
Debrief for Participation (PART 2)

The University of Sydney

Debriefing Statement

An Exploration of the Role of Processing Styles in Generalized Anxiety: PART 2

Thank you very much for participating in this research that is investigating the relationship between inhibition, rational reasoning ability, processing style and anxiety. The tasks that you just took part in consisted of:

1) **Anti-saccade task** (Hallett, 1978; see Hutton & Ettinger, 2006, for a review of research): this measures (by tracking your eye movements) your ability to inhibit your reflexive responding, and control your attention to threatening/neutral faces. Previous research has found that highly anxious participants are less able to inhibit and control their attentional responses when threatening faces are presented (see Derakshan & Eysenck, 2009; & Derakshan et al., 2009).

2) **Reasoning tasks**: you completed three tasks measuring different types of reasoning. The jelly bean game investigated your probabilistic reasoning ability; choosing from the smaller container has a higher chance of resulting in the drawing of a red bean, and thus represents a higher level of probabilistic reasoning ability. Using this task research has shown that high probabilistic reasoning ability is related to a rational processing style (Kirkpatrick & Epstein, 1992; Denes-Raj & Epstein, 1994). You also completed two other reasoning tasks that asked you to answer a series of questions about the way that they arrive at conclusions, and how you explain and predict events with limited information. Responding to these tasks tends to either be analytical or heuristic-based (inappropriate over-generalised responses), and has been found to be related to individual processing style (Markovits & Nantel, 1989; Sä, West & Stanovich, 1990; Stanovich & West, 1996; Fong, Kranz, & Nisbett, 1996; and Nisbett & Ross, 1980).

One area of research that has not received much attention concerns the potential impact of a person’s cognitive processing style on the development and maintenance of anxiety. There are at least two partially independent models of thought that contribute to individual processing style: the rational system (RS) that operates at the conscious level and the preconscious experiential system (ES) (Epstein et al., 1992; Kirkpatrick & Epstein, 1992). This is an exploratory study that will help us to understand how processing style might be related to whether or not an individual can engage their RS (and inhibit their ES) in order to apply rational reasoning in threatening situations. By investigating this relationship we hope to gain insight into whether it would be beneficial to study processing style in more depth with clinically anxious participants. Ultimately it has the potential to increase our knowledge and understanding of generalized anxiety so that more effective treatment programs may be tailored for individuals suffering from generalised anxiety disorder.

If any aspects of this study have raised any issues that you wish to discuss further, please contact either Associate Professor Caroline Hunt at the School of Clinical Psychology (see details below) or, alternatively, please feel free to make use of one of the following free services:

**Lifeline**
Phone: 13 11 14

**Counselling Service (USYD)**
Phone: (02) 8627 8433

If you wish to know the results of this study, or wish to discuss it further, please contact either Sophia Drysdale or Associate Professor Caroline Hunt using the details below.

Thank you again for your time.

Sophia Drysdale (MSc Student)  
sophie@psych.usyd.edu.au

Associate Professor Caroline Hunt  
caroline@psych.usyd.edu.au
(02) 9351 5446
HUMAN RESEARCH ETHICS COMMITTEE
REQUEST FOR MODIFICATION

1. Principal Investigator: Associate Professor Caroline Hunt
   Department: School of Psychology
   Address: Room 153, Clinical Psychology Unit, School of Psychology, K01 Mackie Building, University of Sydney, Sydney, NSW, 2006, Australia.

2. Project Title: An Exploration of the Role of Processing Styles in Generalized Anxiety.

3. HREC Approval No.: 12-2009/12374

4. Names of Students/Co-Investigators: Sophia Drysdale

5. Project Description:
   Please provide a one paragraph lay summary of your original project
   
   There is extensive evidence for the existence of two (dual) information processing systems: an experiential system and a rational system (see Evans et al., 2008 for a review). This study will employ Epstein’s (1983, 1990, 1991) dual process theory, Cognitive Experiential Self Theory (CEST), to determine if cognitive processing style (in general as well as in anxious situations) is related to anxiety. A further aim is to investigate whether or not processing style plays a role in the relationship between worry and generalised anxiety.

6. Any previously approved minor amendments? X Yes □ No
   If YES, please briefly outline
   
   Ethical approval was granted to use a mass screening procedure and to conduct this research as a 2-Part study (3-hours, 3 credit points). These changes have allowed us to minimise the number of participants required and will produce greater consistency within the data collected. Approval was also granted to alter the stimuli used in two of the tasks as the expected level of anxiety was not being achieved. Lastly, approval was given to alter one of the tasks from a spelling test to a reaction time task. This last change was necessary as participants were determining the intention behind the spelling task.

7. Nature of and reasons for amendment(s)
   Please provide details of the changes you propose to make to the project and explain why they are necessary. Please justify any increase in sample size.
The reason for applying for an amendment is to: 1. Request a time extension to this project; 2. Alter the time and credit point allocation for participants; 3. Add a new measure of generalised anxiety; and 4. Request permission to administer a prescreen questionnaire. See below for explanations for each of these amendments:

1. Due to the previous modifications required to the project, testing of participants has been delayed. Therefore, we require additional time in order to undertake testing and gather data.

2. The previous modifications have significantly reduced the testing time for Part 1 of this study. Since the last modifications, participation in Part 1 is currently taking, on average, one hour and fifteen minutes yet participants are receiving two credit points (for two hours of participation) for this aspect of the study. It is proposed to reduce the time of Part 1 to one hour and a half and to award participants 1.5 credit points. This should be ample time, even with the addition of the new measure.

3. The addition of a further generalised anxiety questionnaire (see Appendix A for details) is required to help clarify those suffering from generalised anxiety. Currently there appears to be a discrepancy between the two measures being employed and a further measure is appropriate to more accurately identify the low anxious from high anxiety participants.

4. Permission has been granted to use the mass testing procedure to determine high from low anxious participants. However, due to the demand to use mass testing procedures it is not guaranteed that the prescreen questions for this study will be included. As a result of this, so as to not lose the opportunity to screen participants and therefore later test them, it is proposed to incorporate a prescreen component to the study. Participants will receive 0.25 of a credit point for this participation. See Appendix A for prescreen questions. See Appendix C for participant information, advertisement and debrief for the proposed prescreen.

8. Adding New Staff Member / Student / Research Assistant

Table:

<table>
<thead>
<tr>
<th>Name</th>
<th>Associate Professor Louise Sharpe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: (e.g: Mr, Ms, Dr, Associate Professor)</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Faculty/Department/School/Centre/Institution</td>
<td>Clinical Psychology Unit</td>
</tr>
<tr>
<td>Address</td>
<td>School of Psychology, Brennan MacCallum Building (A18), The University of Sydney, NSW 2006 Australia</td>
</tr>
<tr>
<td>Telephone Number</td>
<td>+61 2 9351 1455</td>
</tr>
<tr>
<td>Facsimile Number</td>
<td>+61 2 9351 7328</td>
</tr>
<tr>
<td>Email Address</td>
<td><a href="mailto:louise.sharpe@sydney.edu.au">louise.sharpe@sydney.edu.au</a></td>
</tr>
<tr>
<td>Position (ie lecturer, PhD student)</td>
<td>Associate Professor, Clinical Research Director</td>
</tr>
<tr>
<td>Qualifications (if PhD indicate field of study)</td>
<td>PhD Psychology</td>
</tr>
<tr>
<td>Role in the project</td>
<td>Associate Supervisor</td>
</tr>
<tr>
<td>Has the new staff member received a copy of the approved application?</td>
<td>X Yes ☐ No</td>
</tr>
</tbody>
</table>
Signature of new staff member

Signature

LOUISE CHARPE

Print Name

25 / 11 / 10

Date

9. Removing Staff Member / Student / Research Assistant
   If YES, provide the following (If more than one, please copy this page)

   □ Yes    X No

   Name
   Faculty/Department/School/Centre/Institution
   Position (ie lecturer, PhD student)
   Role in the project
   Date of Departure

   □ Yes    X No

   Possible inconveniences or risks to subjects:
   If Yes, please outline any inconvenience or possible risks that the changes you
   propose may create for participants (eg changes to confidentiality provisions, physical
   or psychological risks, increased time commitments etc).

   □ Yes    X No

   Actions to be taken by researchers to reduce risks:
   If Yes, please provide details of any additional actions and / or support that you will
   need to provide to participants as a result of the proposed changes.
12. Expected date of implementation of amendments to research:

Date: N/A

13. Time Extension

If Yes, state new finishing date

Date: December 2012

14. Whether funding arrangements for the research been affected by the changes

X Yes ☐ No

15. Implications for compliance with legislative requirements:

☐ Yes X No

Please check current legislation and related requirements, if appropriate – including, for example Privacy Act 1998 (please refer to Guidelines under Section 95 of the Privacy Act produced by the NHMRC) and Children and Young Persons Act 1999.

16. Attach copies of amended surveys, questionnaires or interview questions

X Yes ☐ No

See Appendix A, B and C

17. Attach copies of the amended advertisement, participant information statement and consent form.

Participants need to be advised of changes to procedures, time commitments, etc. You will need to update the participant information statement to reflect the changes

X Yes ☐ No

See Appendix B and C
18. Details of other permission or approvals required as a result of your proposed changes

None

19. Other Amendments
If you require an additional title to be added to the HREC Database (Grant for application)

Title:

Granting Body:

20. Declaration of Researchers

Signature of Chief Investigator: ____________________________ Date: 24/11/10

Signature of Student/Co-Investigators: ____________________________ Date: 25/11/10

Signature of Student/Co-Investigators: ____________________________ Date:

Signature of Student/Co-Investigators: ____________________________ Date:

Signature of Student/Co-Investigators: ____________________________ Date:

Signature of Student/Co-Investigators: ____________________________ Date:

Signature of Head of Faculty/Department/School: ____________________________ Date:

Modification Form
18. Details of other permission or approvals required as a result of your proposed changes

None

19. Other Amendments
   If you require an additional title to be added to the HREC Database (Grant for application)

   Title:

   Granting Body:

20. Declaration of Researchers

   Signature of Chief Investigator: ____________________________ Date: __________
   Signature of Student/Co-Investigators: ______________________ Date: __________
   Signature of Student/Co-Investigators: ______________________ Date: __________
   Signature of Student/Co-Investigators: ______________________ Date: __________
   Signature of Student/Co-Investigators: ______________________ Date: __________

   Signature of Head of Faculty/Department/School: ____________ Date: __________
**APPENDIX A:**
**PRESCREEN QUESTIONS: Depression Anxiety and Stress Scale**

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

*The rating scale is as follows:*

0 Does not apply to me at all
1 Applied to me at some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of the time
3 Applied to me very much, or most of the time

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I found myself getting upset by quite trivial things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I was aware of dryness of my mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I couldn't seem to experience any positive feeling at all</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>I just couldn't seem to get going</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I tended to over-react to situations</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>I had a feeling of shakiness (e.g., legs going to give way)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>I found it difficult to relax</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I found myself in situations that made me so anxious I was most relieved when they ended</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I felt that I had nothing to look forward to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I found myself getting upset rather easily</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>I felt that I was using a lot of nervous energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I felt sad and depressed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I found myself getting impatient when I was delayed in any way (e.g., lifts, traffic lights, being kept waiting)</td>
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</tr>
<tr>
<td>15</td>
<td>I had a feeling of faintness</td>
<td></td>
<td></td>
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<tr>
<td>16</td>
<td>I felt that I had lost interest in just about everything</td>
<td></td>
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</tr>
<tr>
<td>17</td>
<td>I felt I wasn't worth much as a person</td>
<td></td>
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<tr>
<td>18</td>
<td>I felt that I was rather touchy</td>
<td></td>
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<tr>
<td>19</td>
<td>I perspired noticeably (e.g., hands sweaty) in the absence of high temperatures or physical exertion</td>
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<tr>
<td>20</td>
<td>I felt scared without any good reason</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>21</td>
<td>I felt that life wasn't worthwhile</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
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<td>----------------------------------------------------------------</td>
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<tr>
<td>22</td>
<td>I found it hard to wind down</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>23</td>
<td>I had difficulty in swallowing</td>
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<tr>
<td>24</td>
<td>I couldn't seem to get any enjoyment out of the things I did</td>
<td></td>
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<tr>
<td>25</td>
<td>I was aware of the action of my heart in the absence of physical exerion (e.g., sense of heart rate increase, heart missing a beat)</td>
<td></td>
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<tr>
<td>26</td>
<td>I felt down-hearted and blue</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>27</td>
<td>I found that I was very irritable</td>
<td></td>
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<tr>
<td>28</td>
<td>I felt I was close to panic</td>
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<tr>
<td>29</td>
<td>I found it hard to calm down after something upset me</td>
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<tr>
<td>30</td>
<td>I feared that I would be &quot;thrown&quot; by some trivial but unfamiliar task</td>
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<tr>
<td>31</td>
<td>I was unable to become enthusiastic about anything</td>
<td></td>
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<tr>
<td>32</td>
<td>I found it difficult to tolerate interruptions to what I was doing</td>
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<tr>
<td>33</td>
<td>I was in a state of nervous tension</td>
<td></td>
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<tr>
<td>34</td>
<td>I felt I was pretty worthless</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>35</td>
<td>I was intolerant of anything that kept me from getting on with what I was doing</td>
<td></td>
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</tr>
<tr>
<td>36</td>
<td>I felt terrified</td>
<td></td>
<td></td>
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<tr>
<td>37</td>
<td>I could see nothing in the future to be hopeful about</td>
<td></td>
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<tr>
<td>38</td>
<td>I felt that life was meaningless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>I found myself getting agitated</td>
<td></td>
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<tr>
<td>40</td>
<td>I was worried about situations in which I might panic and make a fool of myself</td>
<td></td>
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<tr>
<td>41</td>
<td>I experienced trembling (e.g., in the hands)</td>
<td></td>
<td></td>
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<tr>
<td>42</td>
<td>I found it difficult to work up the initiative to do things</td>
<td></td>
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</tr>
</tbody>
</table>
Proposed Additional Generalised Anxiety Questionnaire:

**PENN STATE WORRY QUESTIONNAIRE**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If I don’t not have enough time to do everything, I don’t not worry about it</td>
</tr>
<tr>
<td>2</td>
<td>My worries overwhelm me</td>
</tr>
<tr>
<td>3</td>
<td>I do not tend to worry about things</td>
</tr>
<tr>
<td>4</td>
<td>Many situations make me worry</td>
</tr>
<tr>
<td>5</td>
<td>I know I should not worry about things, but I just cannot help it</td>
</tr>
<tr>
<td>6</td>
<td>When I am under pressure I worry a lot</td>
</tr>
<tr>
<td>7</td>
<td>I am always worrying about something</td>
</tr>
<tr>
<td>8</td>
<td>I find it easy to dismiss worrisome thoughts</td>
</tr>
<tr>
<td>9</td>
<td>As soon as I finish one task, I start to worry about everything else I have to do</td>
</tr>
<tr>
<td>10</td>
<td>When there is nothing more I can do about a concern, I do not worry about it any more</td>
</tr>
<tr>
<td>11</td>
<td>I never worry about anything</td>
</tr>
<tr>
<td>12</td>
<td>I have been a worrier all my life</td>
</tr>
<tr>
<td>13</td>
<td>I notice that I have been worrying about things</td>
</tr>
<tr>
<td>14</td>
<td>Once I start worrying I cannot stop</td>
</tr>
<tr>
<td>15</td>
<td>I worry all the time</td>
</tr>
<tr>
<td>16</td>
<td>I worry about projects until they are all done</td>
</tr>
</tbody>
</table>
APPENDIX B. Amended Participant Information Statement and Advertisement for Part 1 (all other information e.g., debrief is the same)

THE UNIVERSITY OF
SYDNEY

ABN 15 211 513 464

Sophia Drysdale / Ass. Prof. Caroline Hunt
DCPVMSc Student / Ph.D.
M.Psychol. (clinical)
Clinical Training Director

Discipline of Psychology
School of Psychology
Faculty of Science
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Facsimile: +61 2 5351 5223
Email: sdry2707@uni.sydney.edu.au
caroline.hunt@sydney.edu.au
Web: http://www.ussyd.edu.au

An Exploration of the Role of Processing Styles in Generalized Anxiety

PARTICIPANT INFORMATION STATEMENT: PART 1

1) What is the study about?
This research is investigating the relationship between cognitive styles, worry and generalised anxiety.

2) Who is carrying out the study?
This study is being conducted by Sophia Drysdale (as the basis of the degree of Master of Science/Doctor of Philosophy) at The University of Sydney under the supervision of Associate Professor Caroline Hunt.

3) What does the study involve and how much time will it take?
This is a 2-Part study. If you agree to participate in this study, you will be asked to complete four tasks which we anticipate will take around 90 minutes. The tasks will include:

a. An online questionnaire.
b. Categorising threatening/neutral pictures as fast as possible by pressing one of two buttons on a key board.
c. Asking you to listen to a list of words and respond whether they are related or unrelated to other words presented on a computer screen.
d. Examining the way you respond to threatening and neutral faces by tracking your eye movements.

Some of the images used in this study are unpleasant and may cause distress. You are free to withdraw at any stage.

4) Can I withdraw from the study?
Being in this study is completely voluntary and you are not under any obligation to participate. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalise or affect you in any way. Signing and submitting an informed consent form is an indication of your consent to participate in the study. Once you have submitted your consent form and participated in the research your responses cannot be withdrawn.

5) Will anyone else know the results?
You will be requested to provide an email address so that we can match your responses from the first part of this study to those you give in Part 2 of this study. Once you have completed participation in this study, your email address will be destroyed and the data will be coded so that the data that you provided will be completely anonymous. The program of research will be submitted for the requirements of the Master of Science/Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report (only group data will be reported).

6) Will the study benefit me?
While we intend that this research should also further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?
It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?
If you would like to know more at any stage, please feel free to contact Sophia Drysdale on (02) 9351 7479, sdry2707@uni.sydney.edu.au or Associate Professor Caroline Hunt on (02) 9351 5446, caroline.hunt@sydney.edu.au

9) What if I have a complaint or concern?
Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@usyd.edu.au (Email).
Online Study Advertisement for Part I:

An exploration of the role of processing styles in generalised anxiety

2-Part Study  Both parts should be scheduled at the same time, and the second part should be scheduled to occur a week after the first part. The second part may be scheduled to occur at any time, other than immediately after the first part, that is within the range of acceptable dates.

Abstract  2.5hrs credit. You will be asked to complete a series of questionnaires, categorise threatening/neutral pictures, undertake a word classification task, play a short game of chance and complete eye tracking tasks that examine your responses to threatening/neutral pictures. This is a 2-part study.

Description  Study will take place over 2 days. You need to attend BOTH sessions to receive credit. This research is investigating the relationship between cognitive styles, worry and generalised anxiety. The study will be held in room 233 of the Griffith-Taylor building (opposite Manning).

Eligibility Requirements  Normal or corrected to normal colour vision. A high level of English proficiency.

Duration  90 minutes (Part 1)

Credit  60 minutes (Part 2)

Credits  2.5 Credits total

Researchers  SOPHIA DRYSALE
Email: sophia@psych.usyd.edu.au
Associate Professor Caroline Hunt
Email: caroline@psych.usyd.edu.au

Participant Sign-Up  24 hours before the study is to occur

Deadline

Human Res Ethics Com Approval Code  PENDING
PARTICIPANT INFORMATION STATEMENT:

An Exploration of the Role of Processing Styles in Generalized Anxiety: Pre-screen

PARTICIPANT INFORMATION STATEMENT

1) What is the study about?
This research will allow us to pre-screen appropriate participants to participate in an investigation of the relationship between cognitive styles, worry and generalised anxiety.

2) Who is carrying out the study?
This study is being conducted by Sophia Drysdale (as the basis of the degree of Master of Science/Doctor of Philosophy) at The University of Sydney under the supervision of Associate Professor Caroline Hunt.

3) What does the study involve and how much time will it take?
If you agree to participate in this study, you will be asked to fill out a brief questionnaire over the web which will take about 10 minutes. You may also, at a later date, be asked if you are willing to participate in other research which further investigates cognitive styles. This will involve completing various tasks that examine the way in which you think about things, as well as exploring the way that you attend to information and your unconscious associations to pictures. If you are invited back, you will need to attend the School of Psychology at the University of Sydney.

4) Can I withdraw from the study?
Being in this study is completely voluntary and you are not under any obligation to consent to complete the questionnaire. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalise or affect you in any way. Submitting a completed questionnaire is an indication of your consent to participate in the study. Once you have submitted your questionnaire your responses cannot be withdrawn.

5) Will anyone else know the results?
All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. You will be requested to provide an email address so that we can email you a
debrief sheet, and invite you to participate in further research into cognitive styles. Once you have completed participation in the study(s), your email address will be destroyed and the data will be coded so that the data that you provided will be completely anonymous. The program of research will be submitted for the requirements of the Master of Science/Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report.

6) Will the study benefit me?

The study will benefit you by providing 0.25 of a credit towards your Psychology 1 final mark.

While we intend that this research should also further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?

It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?

If you would like to know more at any stage, please feel free to contact Sophia Drysdale sdy2707@uni.sydney.edu.au or Associate Professor Caroline Hunt on (02) 9351 5445, caroline.hunt@sydney.edu.au

9) What if I have a complaint or concern?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@syu.edu.au (Email).
Debriefing Statement

An Exploration of the Role of Processing Styles in Generalized Anxiety: Pre-screen

Thank you very much for participating in this research. You completed a pre-screen questionnaire which measured your level of anxiety, depression and stress: The Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995). It is necessary to pre-screen participants to ensure that appropriate participants are selected in order to reduce the number of participants required for this research.

One area of research that has not received much attention concerns the potential impact of a person’s cognitive processing style on the development, and maintenance of anxiety. There are at least two partially independent modes of thought that contribute to individual processing style: the rational system (RS) that operates at the conscious level, and the preconscious experiential system (ES) (Epstein et al., 1992; Kirkpatrick & Epstein, 1992). This is an exploratory study that will help us to understand how processing style might be related to excessive worry and anxiety. By investigating this relationship further, we hope to gain insight into whether it would be beneficial to study processing style in more depth with clinically anxious participants. Ultimately it has the potential to increase our knowledge and understanding of generalized anxiety so that more effective treatment programs can be tailored for individuals suffering from generalised anxiety disorder.

If questions in this study have raised any issues that you wish to discuss further, please contact either Associate Professor Caroline Hunt at the School of Clinical Psychology (see details below) or, alternatively, please feel free to make use of one of the following free services:

- Lifeline
  Phone: 13 11 14

- Counselling Service (USYD)
  Phone: (02) 8627 5433

Because this questionnaire is used to screen for anxiety, generalized anxiety and depression, we are obliged to make contact with people whose scores indicate referral to support services may be warranted. These people will be emailed and sent a sheet with relevant information. If you receive an email and attached sheet you are strongly advised to seek help and support through one of the contacts supplied. Though it is recommended, those contacted are under no obligation to make an appointment or seek support.

If you wish to know the results of this study, or wish to discuss it further, please contact either Sophia Drysdale or Associate Professor Caroline Hunt using the details below. Thank you again for your time.

Sophia Drysdale (MSc Student)

sdry2707@uni.sydney.edu.au

Sophia Drysdale / Ass. Prof. Caroline Hunt
CCP/MSc Student / Ph.D.
M Psychol (clinical)
Clinical Training Director

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NSW 2006 AUSTRALIA
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Facsimile: +61 2 9351 5223
Email: sdry2707@uni.sydney.edu.au
caroline.hunt@sydney.edu.au
Web: http://www.wood.edu.au/
ADVERTISEMENT FOR PRE-SCREEN:

Study Name

An exploration of the role of processing styles in generalised anxiety: Pre-screen Questionnaire

Abstract
This research is investigating the relationship between cognitive styles, worry and generalised anxiety.

Description
Participants will be invited to complete a pre-screen questionnaire about their mood (10 minutes) to determine eligibility to participate in Part 1 and 2 of the study ‘An exploration of the role of processing styles in generalised anxiety’. If you meet the requirements you will be invited back to participate in Study 2 or 3. Both Study 2 and 3 are follow-on studies that further examine processing style and generalised anxiety.

Web Study
This is an online study. Participants are not given the study URL until after they sign up.

Website
[View Study Website]

Pre-screen Restrictions
No Restrictions - [View/Modify Restrictions]

Duration
10 minutes

Credits
0.25 Credits

Researchers
Sophia Drysdale
Email: sophia@psych.usyd.edu.au

Caroline Hunt
Email: caroline@psych.usyd.edu.au

Participant Sign-Up Deadline
0 hours before the study is to occur
APPENDIX B

Participant Information and Consent Statement and Debrief Form: Study 1

PARTICIPANT INFORMATION STATEMENT
(preceded online questionnaire)

An Exploration of the Role of Processing Styles in Generalized Anxiety

1) What is the study about?

This research will allow us to investigate the relationship between cognitive styles, worry and generalised anxiety.

2) Who is carrying out the study?

This study is being conducted by Sophia Drysdale (as the basis of the degree of Master of Science/Doctor of Philosophy) at The University of Sydney under the supervision of Associate Professor Caroline Hunt.

3) What does the study involve and how much time will it take?

If you agree to participate in this study, you will be asked to fill out questionnaires over the web, which will take about 30 minutes. You may also, at a later date, be asked if you are willing to participate in other research, which further investigates cognitive styles. This will involve completing various tasks that examine the way in which you think about things, as well as exploring the way that you attend to information and your unconscious associations to pictures. If you are invited back, you will need to attend the School of Psychology at the University of Sydney for approximately 60 to 70 minutes.

4) Can I withdraw from the study?

This study is completely voluntary and you are not under any obligation to consent to complete the questionnaire. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalize or affect you in any way. Submitting a completed questionnaire is an indication of your consent to participate in the study. Once you have submitted your questionnaire your responses cannot be withdrawn.

5) Will anyone else know the results?

You will be requested to provide an email address so that we can email you a debrief sheet. You will also be asked permission for us to email you an invitation to participate in Study 2
or 3 of this project. Once you have completed participation in the study(s), your email address will be destroyed and the data will be coded so that your participation in this study will be completely anonymous. The program of research will be submitted for the requirements of the Master of Science/Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report (only group data will be presented).

6) Will the study benefit me?

While we intend that this research should further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?

It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?

If you would like to know more at any stage, please feel free to contact Sophia Drysdale on (02) 9351 7479, sophia@psych.usyd.edu.au or Associate Professor Caroline Hunt on (02) 9351 5446, caroline@psyh.usyd.edu.au

9) What if I have a complaint or concern?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@usyd.edu.au (Email).
DEBRIEFING STATEMENT

An Exploration of the Role of Processing Styles in Generalized Anxiety

Thank you very much for participating in this research. You completed a set of questionnaires, two of which measured cognitive processing style: the Rational Experiential Inventory (Epstein & Pacini, 1999), and the Perceived Modes of Processing Inventory (Burns & D’Zurilla, 1999). You were also given questionnaires that are used to screen individuals with anxiety and depression, and to examine levels of worry.

One area of research that has not received much attention concerns the potential impact of a person’s cognitive processing style on the development, and maintenance of anxiety. There are at least two partially independent modes of thought that contribute to individual processing style: the rational system (RS) that operates at the conscious level, and the preconscious experiential system (ES) (Epstein et al., 1992; Kirkpatrick & Epstein, 1992). This is an exploratory study that will help us to understand how processing style might be related to excessive worry and anxiety. By investigating this relationship further, we hope to gain insight into whether it would be beneficial to study processing style in more depth with clinically anxious participants. Ultimately it has the potential to increase our knowledge and understanding of generalized anxiety so that more effective treatment programs can be tailored for individuals suffering from generalised anxiety disorder.

If questions in this study have raised any issues that you wish to discuss further, please contact either Associate Professor Caroline Hunt at the School of Clinical Psychology (see details below) or, alternatively, please feel free to make use of one of the following free services:

Lifeline
Phone: 13 11 14

Counselling Service (USYD)
Phone: (02) 8627 8433

Because some of the questionnaires in this study are used to screen for generalized anxiety disorder and depression, we are obliged to make contact with people whose scores indicate referral to support services may be warranted. Associate Professor Caroline Hunt will email these people, asking them to contact her so that she can discuss the implications of their scores, and support resources that are available to them. Though it is recommended, these people are under no obligation to make an appointment with Associate Professor Hunt.

If you wish to know the results of this study, or wish to discuss it further, please contact either Sophia Drysdale or Associate Professor Caroline Hunt using the details below.

Sophia Drysdale (MSc Student) 
sophia@psych.usyd.edu.au

Associate Professor Caroline Hunt 
caroline@psych.usyd.edu.au
(02) 9351 5446

Thank you again for your time.
APPENDIX C

Participant Information and Consent Statement, and Debrief Form:

Studies 2-4

An Exploration of the Role of Processing Styles in Generalized Anxiety

PARTICIPANT INFORMATION STATEMENT: PART 1

1) What is the study about?
This research is investigating the relationship between cognitive styles, worry and
generalised anxiety.

2) Who is carrying out the study?
This study is being conducted by Sophia Drysdale (as the basis of the degree of
Doctor of Philosophy) at The University of Sydney under the supervision of Associate
Professor Caroline Hunt.

3) What does the study involve and how much time will it take?
This is a 2-Part study. If you agree to participate in this study, you will be asked to
complete four tasks, which we anticipate will take around 90 minutes. The tasks will
include:

   a. An online questionnaire.
b. Categorizing threatening/neutral pictures as fast as possible by pressing one of two buttons on a keyboard.

c. Asking you to listen to a list of words and respond whether they are related or unrelated to other words presented on a computer screen.

d. Examining the way you respond to threatening and neutral faces by tracking your eye movements.

Some of the images used in this study are unpleasant and may cause distress. You are free to withdraw at any stage.

4) Can I withdraw from the study?
Being in this study is completely voluntary and you are not under any obligation to participate. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalize or affect you in any way. Signing and submitting an informed consent form is an indication of your consent to participate in the study. Once you have submitted your consent form and participated in the research your responses cannot be withdrawn.

5) Will anyone else know the results?
You will be requested to provide an email address so that we can match your responses from the first part of this study to those you give in Part 2 of this study. Once you have completed participation in this study, your email address will be destroyed and the data will be coded so that the data that you provided will be completely anonymous. The program of research will be submitted for the requirements of the Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report (only group data will be reported).

6) Will the study benefit me?
While we intend that this research should also further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?
It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?
If you would like to know more at any stage, please feel free to contact Sophia Drysdale on (02) 9351 7479, sdry2707@uni.sydney.edu.au or Associate Professor Caroline Hunt on (02) 9351 5446, caroline.hunt@sydney.edu.au

9) What if I have a complaint or concern?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@usyd.edu.au (Email)
An Exploration of the Role of Processing Styles in Generalized Anxiety

PARTICIPANT INFORMATION STATEMENT: PART 2

1) What is the study about?

This research is investigating the relationship between cognitive styles, worry and generalised anxiety.

2) Who is carrying out the study?

This study is being conducted by Sophia Drysdale (as the basis of the degree of Doctor of Philosophy) at The University of Sydney under the supervision of Associate Professor Caroline Hunt.

3) What does the study involve and how much time will it take?

If you agree to participate in this study, you will be asked to complete three tasks, which we anticipate will take no more than an hour (60mins). The tasks will include:

   a. Answering questions (multi-choice) about the way you explain, predict and reach conclusions with restricted or limited information.
   b. A game of chance where you will be asked to choose jelly beans from one of two containers.
   c. An eye tracking task that will examine the way you respond to threatening and neutral pictures.

4) Can I withdraw from the study?

Being in this study is completely voluntary and you are not under any obligation to consent to complete the research. During the research you are free to withdraw at any stage. Withdrawing from participation will not penalize or affect you in any way.
Signing and submitting an informed consent form is an indication of your consent to participate in the study. Once you have submitted your consent form and participated in the research your responses cannot be withdrawn.

5) Will anyone else know the results?

You will be requested to provide an email address so that we can match your responses to those you gave in Part 1 of this study. Once you have completed participation in this study, your email address will be destroyed and the data will be coded so that the data that you provided will be completely anonymous. The program of research will be submitted for the requirements of the Doctor of Philosophy and reports will be submitted for publication, but individual participants will not be identifiable in such a report (only group data will be reported).

6) Will the study benefit me?

While we intend that this research should also further the existing knowledge and understanding of the relationship between cognitive processing styles, worry and generalised anxiety, it may not be of direct benefit to you.

7) Can I tell other people about the study?

It is important that you do not discuss the details of this experiment with fellow students as this may impact upon the outcome of the study.

8) What if I require further information?

If you would like to know more at any stage, please feel free to contact Sophia Drysdale on (02) 9351 7479, sdry2707@uni.sydney.edu.au or Associate Professor Caroline Hunt on (02) 9351 5446, caroline.hunt@sydney.edu.au

9) What if I have a complaint or concern?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on (02) 8627 8176 (Telephone); (02) 8627 8177 (Facsimile) or human.ethics@usyd.edu.au (Email).
PARTICIPANT CONSENT FORM

I, .............................................................................[PRINT NAME], give consent to my participation in the research project

TITLE: An Exploration of the Role of Processing Style in Generalised Anxiety:
PART 1

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher(s).

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or the University of Sydney now or in the future.

4. I understand that my involvement is strictly confidential and no information about me will be used in any way that reveals my identity.

5. I understand that being in this study is completely voluntary – I am not under any obligation to consent.

Signed: ........................................................................................................................................

Name: ........................................................................................................................................

Date: ........................................................................................................................................
Debriefing Statement:

An Exploration of the Role of Processing Styles in Generalized Anxiety: PART 1

Thank you very much for participating in this study. Previous research has shown that anxiety is related to biases of attention, interpretation, and memory. The tasks that you just took part in consisted of:

1) **Online Questionnaire**
   You completed a set of questionnaires, two of which measured cognitive processing style: the Rational Experiential Inventory (Epstein & Pacini, 1999), and the Perceived Modes of Processing Inventory (Burns & D’Zurilla, 1999). You were also given questionnaires that are used to screen individuals with anxiety and depression, and to examine levels of worry.

2) **Homophone word task**
   Homophones are words that sound the same but are spelt differently e.g., “sleigh/slay”. Previous research has found that anxious individual show an interpretation bias for threatening words when resolving ambiguity; they perceive homophones to be related to threat predominantly more than being related to the neutral version of the word (e.g., Mathews, Richards & Eysenck, 1989; Blanchette & Richards, 2003).

3) **Implicit Association Test** (IAT; Greenwald, McGhee, & Schwartz, 1998)
   This measured your automatic associations (by measuring the time that it took you to classify stimuli into different categories) between threatening/neutral pictures and yourself. Research has found panic disorder and social phobia to be related to biased automatic associations in memory (Teachman, 2005; and Teachman, Smith-Janik & Saporito, 2007).

4) **Modified probe detection task**
   You were shown threatening/neutral faces and your eye movements were tracked which allowed us to examine your attention processes. Past research has shown that anxious individuals attention is biased toward threaten faces (MacLeod, Mathews & Tata, 1986; Bradley et al., 1997; Mogg, Miller & Bradley, 2000). There were some conditions in this task
where threatening faces were presented beyond conscious awareness; this was necessary in order to measure your attention that is beyond conscious awareness (implicit attention).

We did not tell you before your participation in the research exactly what we were measuring, or the exact intent of some of the tasks. The reason for this is that there is some evidence that suggests that people’s behaviour can be changed when they are told the intent behind the task. For example, in the homophone word task, if the true intent had been revealed it would not be possible to distinguish whether you may have a bias to interpret ambiguous words positively/negatively.

One area of research that has not received much attention concerns the potential impact of a person’s cognitive processing style on the development, and maintenance of anxiety. There are at least two partially independent modes of thought that contribute to individual processing style: the rational system (RS) that operates at the conscious level, and the preconscious experiential system (ES) (Epstein et al., 1992; Kirkpatrick & Epstein, 1992). Whilst there is extensive research examining individual cognitive biases in relation to anxiety, one area of research that has not received much attention concerns the potential relationship between these biases, how they may relate to anxiety, and the potential impact of a person’s cognitive processing style. This is an exploratory study that will help us to understand the pattern of cognitive biases and how these relate to processing style and whether or not an individual suffers from excessive worry and anxiety. By investigating this relationship further, we hope to gain insight into whether it would be beneficial to study processing style in more depth with clinically anxious participants. Ultimately it has the potential to increase our knowledge and understanding of generalized anxiety so that more effective treatment programs can be tailored for individuals suffering from generalised anxiety disorder.

If any aspects of this study have raised any issues that you wish to discuss further, please contact either Associate Professor Caroline Hunt at the School of Clinical Psychology (see details below) or, alternatively, please feel free to make use of one of the following free services:

**Lifeline**
Phone: 13 11 14

**Counselling Service (USYD)**
Phone: (02) 8627 8433

Because some of the questionnaires in this study are used to screen for generalized anxiety disorder and depression, we are obliged to make contact with people whose scores indicate referral to support services may be warranted. Associate Professor Caroline Hunt will email these people, asking them to contact her so that she can discuss the implications of their scores, and support resources that are available to them. Though it is recommended, these people are under no obligation to make an appointment with Associate Professor Hunt.

If you wish to know the results of this study, or wish to discuss it further, please contact either Sophia Drysdale or Associate Professor Caroline Hunt using the details below.

Thank you again for your time.

Sophia Drysdale (Ph.D Student)  
sdry2707@uni.sydney.edu.au  
(02) 9351 5446

Associate Professor Caroline Hunt  
caroline.hunt@sydney.edu.au
PARTICIPANT CONSENT FORM

I, ..................................................................................[PRINT NAME], give consent to my participation in the research project

TITLE: An Exploration of the Role of Processing Style in Generalised Anxiety: PART 2

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or the University of Sydney now or in the future.

4. I understand that my involvement is strictly confidential and no information about me will be used in any way that reveals my identity.

5. I understand that being in this study is completely voluntary – I am not under any obligation to consent.

Signed: ...............................................................................................................

Name: ...............................................................................................................

Date: ...............................................................................................................
Debriefing Statement

An Exploration of the Role of Processing Styles in Generalized Anxiety: PART 2

Thank you very much for participating in this research that is investigating the relationship between inhibition, rational reasoning ability, processing style and anxiety. The tasks that you just took part in consisted of:

1) **Antisaccade task** (Hallett, 1978; see Hutton & Ettinger, 2006, for a review of research): this measures (by tracking your eye movements) your ability to inhibit your reflexive responding, and control your attention to threatening/neutral images. Previous research has found that highly anxious participants are less able to inhibit and control their attentional responses when threatening images are presented (see Derakshan & Eysenck, 2009; & Derakshan et al., 2009).

2) **Reasoning tasks**: you completed three tasks measuring different types of reasoning. The jellybean game investigated your probabilistic reasoning ability; choosing from the smaller container has a higher chance of resulting in the drawing of a red bean, and thus represents a higher level of probabilistic reasoning ability. Using this task research has shown that high probabilistic reasoning ability is related to a rational processing style (Kirkpatrick and Epstein, 1992; Denes-Raj & Epstein, 1994). You also completed two other reasoning tasks that asked you to answer a series of questions about the way that they arrive at conclusions, and how you explain and predict events with limited information. Responding to these tasks tends to either be analytical or heuristic-based (inappropriate over-generalised responses), and has been found to be related to individual processing style (Markovits & Nantel, 1989; Så, West & Stanovich, 1999; Stanovich & West, 1998; Fong, Krantz, & Nisbett, 1986; and Nisbett & Ross, 1980).

One area of research that has not received much attention concerns the potential impact of a person’s cognitive processing style on the development and maintenance of anxiety. There are at least two partially independent modes of
thought that contribute to individual processing style: the rational system (RS) that operates at the conscious level and the preconscious experiential system (ES) (Epstein et al., 1992; Kirkpatrick & Epstein, 1992). This is an exploratory study that will help us to understand how processing style might be related to whether or not an individual can engage their RS (and inhibit their ES) in order to apply rational reasoning in threatening situations. By investigating this relationship we hope to gain insight into whether it would be beneficial to study processing style in more depth with clinically anxious participants. Ultimately it has the potential to increase our knowledge and understanding of generalized anxiety so that more effective treatment programs may be tailored for individuals suffering from generalised anxiety disorder.

If any aspects of this study have raised any issues that you wish to discuss further, please contact either Associate Professor Caroline Hunt at the School of Clinical Psychology (see details below) or, alternatively, please feel free to make use of one of the following free services:

<table>
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<tr>
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<tbody>
<tr>
<td>Phone: 13 11 14</td>
<td>Phone: (02) 8627 8433</td>
</tr>
</tbody>
</table>

If you wish to know the results of this study, or wish to discuss it further, please contact either Sophia Drysdale or Associate Professor Caroline Hunt using the details below.

Thank you again for your time.

Sophia Drysdale (PhD Student)  
sdry2707@uni.sydney.edu.au

Associate Professor Caroline Hunt  
caroline.hunt@sydney.edu.au  
(02) 9351 5446
APPENDIX D

Questionnaires: Study 1, 2, 3, 4

DEMOGRAPHIC QUESTIONNAIRE

What is your gender?  female ☐  male ☐  No answer ☐

How old are you? ____________________ (or tick here if >40 ☐)

What is your Major(s):
☐ Arts Degree
☐ Science Degree
☐ Commerce Degree
☐ Law Degree
☐ Other

What is your predominant Ethnicity:
☐ Indigenous Australian
☐ Australian
☐ Maori
☐ New Zealander
☐ Pacific Islander (e.g., Fijian, Samoan)
☐ Melanesian (e.g., Papua New Guinean, Solomon Islander)
☐ North-Western European (e.g., UK, Irish, German)
☐ Southern and Eastern European (e.g., Italian, Macedonian, Polish, Russia)
☐ North African and Middle Eastern (e.g., Turkish, Iranian, Egyptian)
☐ South-East Asian (e.g., Vietnamese, Indonesian)
☐ North-East Asian (e.g., Chinese, Korean)
☐ Southern and Central Asian
☐ North American
☐ Central and Southern American
☐ Sub-Saharan African (e.g., South Africa, Zimbabwean)
☐ No Answer

Is English your first Language?  yes ☐  no ☐

What language do you speak at home?

____________________________________

As part of this study you will need to answer the following questionnaire. This survey will take approximately 30 minutes and should be completed in one go.
### Perceived Modes of Processing Inventory (PMPI)

Below is a series of statements that describe the way some people think, feel, and act when faced with situations, which cause them WORRY in their daily lives. A situation that causes you to feel worried is any situation that involves uncontrollable negative and emotional thoughts and images about events that you are afraid might happen in the future. They are situations in which you attempt to avoid possible negative events and outcomes or in which you prepare for the worst often by engaging in ‘What if…’ thinking (for example “What if I fail”).

Please read each statement carefully, and then select the number from the scale below that best describes the extent to which you feel the statement is true of you. Consider yourself as you TYPICALLY cope with situations which cause you worry in your life.

1= Not at all true of me  
2= Slightly true of me  
3= Moderately true of me  
4= Very true of me  
5= Extremely true of me

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To cope, I usually go with my instincts rather than trying to reason things out. (EP)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>I often think about the situations that make me worry and then try to find new ways to resolve them. (RP)*</td>
<td></td>
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<tr>
<td>3</td>
<td>My feelings usually determine how I will cope. (EP)</td>
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<tr>
<td>4</td>
<td>I usually try to cope with a situation that causes me to worry by breaking it down into smaller parts and dealing with them one at a time. (RP)*</td>
<td></td>
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<tr>
<td>5</td>
<td>When I am trying to decide how to cope, I usually go with my “gut” feeling. (EP)</td>
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<tr>
<td>6</td>
<td>When I am attempting to cope, I depend a great deal on my feelings to help me find the best way to cope. (EP)</td>
<td></td>
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<tr>
<td>7</td>
<td>I am often aware of how to cope with situations in which I feel worried even before I review all its aspects. (AP)*</td>
<td></td>
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<tr>
<td>8</td>
<td>I usually think of as many alternative ways of coping as possible before I decided what I am going to do. (RP)</td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>If an approach works I use it again and again so I don’t have to come up with a new one for each situation I face that causes me to worry. (AP)</td>
<td></td>
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<tr>
<td>10</td>
<td>I’ve had enough experience to just know what I need to do to cope most of the time without trying to figure it out every time. (AP)</td>
<td></td>
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<tr>
<td>11</td>
<td>Before trying to cope, I usually decide on a specific goal so that I know exactly what I should try to do. (RP)</td>
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<tr>
<td>No.</td>
<td>Statement</td>
<td>Rating</td>
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<tr>
<td>12</td>
<td>“Gut” feelings are more important to me than logic and evidence when I have to cope. (EP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The right way to cope usually comes to mind almost immediately. (AP)</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>14</td>
<td>Rather than spend my time trying to think of how to cope, I prefer to use my emotional hunches. (EP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>I usually try to get all the facts that I can before deciding how to cope. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>16</td>
<td>I usually set aside enough time to think things through carefully and figure out what is the best thing to do. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
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</tr>
<tr>
<td>17</td>
<td>I typically figure out the way to cope swiftly. (AP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18</td>
<td>Instead of acting on the first idea that comes to mind, I carefully consider all my options. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>19</td>
<td>Before I attempt to cope, I think of all my options and carefully consider the pros and cons of each one. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>20</td>
<td>Emotions are usually more useful than thoughts for coping (EP)</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>21</td>
<td>I quickly do the right thing when coping because I’ve often faced almost the same thing before. (AP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>I usually do what feels right. (EP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>23</td>
<td>Most of the time, I use the same method to cope. (AP)</td>
<td>1 2 3 4 5</td>
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<tr>
<td>24</td>
<td>When I am attempting to cope, one of the first things I do is gather as many facts about the situation as possible so that I will be able to understand what it is all about. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
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</tr>
<tr>
<td>25</td>
<td>I rely mostly on my past experience to find a way to cope. (AP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>I usually put a lot of mental effort into figuring out what is the best thing to do. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>I trust my emotions to guide how I should cope. (EP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>28</td>
<td>I usually stick to the “facts” and try to use a logical approach to cope. (RP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>29</td>
<td>I rarely need to mull things over; how to cope usually becomes quickly apparent. (AP)</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>30</td>
<td>When I am attempting to cope I can usually trust my “gut” feelings to tell me what to do. (EP)</td>
<td>1 2 3 4 5</td>
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For me, deciding how to cope takes a lot of time and mental effort. (RP)

When a situation occurs in which I start to worry I know right away what I need to do to cope with it. (AP)*

*Change to original wording from ‘stressful’ to a derivative of ‘worry’.

RP = Rational Processing, EP = Emotional Processing, AP = Automatic Processing

### Rational-Experiential Inventory (v.1999)

Please read each statement carefully, and then select the number from the scale below that best describes the extent to which you feel the statement is typically true of you.

The rating scale is as follows:

1= Definitely not true of me  2=Slightly true of me  3= Moderately true of me  4= Very true of me  5= Definitely true of me

<p>| 1 | I try to avoid situations that require thinking in depth about something, (re-) | 1 2 3 4 5 |
| 2 | I am not very good at solving problems that require careful logical analysis, (ra—) | 1 2 3 4 5 |
| 3 | I don't like to have to do a lot of thinking, (re-) | 1 2 3 4 5 |
| 4 | Thinking is not my idea of an enjoyable activity, (re—) | 1 2 3 4 5 |
| 5 | Thinking hard and for a long time about something gives me little satisfaction. (re-) | 1 2 3 4 5 |
| 6 | I don't reason well under pressure, (ra—) | 1 2 3 4 5 |
| 7 | I enjoy thinking in abstract terms, (re) | 1 2 3 4 5 |
| 8 | Using logic usually works well for me in figuring out problems in my life, (ra) | 1 2 3 4 5 |
| 9 | Knowing the answer without having to understand the reasoning behind it is good enough for me. (re-) | 1 2 3 4 5 |
| 10 | I usually have clear, explainable reasons for my decisions, (ra) | 1 2 3 4 5 |
| 11 | I like to rely on my intuitive impressions, (ee) | 1 2 3 4 5 |
| 12 | I believe in trusting my hunches, (ea) | 1 2 3 4 5 |
| 13 | Intuition can be a very useful way to solve problems, (ee) | 1 2 3 4 5 |
| 14 | I trust my initial feelings about people, (ea) | 1 2 3 4 5 |
| 15 | I don't like situations in which I have to rely on intuition, (ee-) | 1 2 3 4 5 |</p>
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<tbody>
<tr>
<td>16</td>
<td>I think it is foolish to make important decisions based on feelings, (ee—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>I generally don't depend on my feelings to help me make decisions, (ee-)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>My snap judgments are probably not as good as most people's, (ea-)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>I tend to use my heart as a guide for my actions, (ee)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>I suspect my hunches are inaccurate as often as they are accurate, (ea—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>21</td>
<td>I'm not that good at figuring out complicated problems, (ra—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>22</td>
<td>I enjoy intellectual challenges, (re)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>23</td>
<td>I enjoy solving problems that require hard thinking, (re)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>I am not a very analytical thinker, (ra—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>25</td>
<td>Reasoning things out carefully is not one of my strong points, (ra—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>26</td>
<td>I prefer complex problems to simple problems, (re)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>27</td>
<td>I am much better at figuring things out logically than most people, (ra)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>28</td>
<td>I have a logical mind, (ra)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>29</td>
<td>I have no problem thinking things through carefully, (ra)</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>30</td>
<td>Learning new ways to think would be very appealing to me, (re)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>31</td>
<td>I don't have a very good sense of intuition, (ea—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>32</td>
<td>Using my gut feelings usually works well for me in figuring out problems in my life, (ea)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>33</td>
<td>I often go by my instincts when deciding on a course of action, (ee)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>34</td>
<td>When it comes to trusting people, I can usually rely on my gut feelings, (ea)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>35</td>
<td>If I were to rely on my gut feelings, I would often make mistakes, (ea—)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>36</td>
<td>I think there are times when one should rely on one's intuition, (ee)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>37</td>
<td>I don't think it is a good idea to rely on one's intuition for important decisions, (ee-)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>38</td>
<td>I hardly ever go wrong when I listen to my deepest gut feelings to find an answer, (ea)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>39</td>
<td>I would not want to depend on anyone who described himself or herself as intuitive, (ee-)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>40</td>
<td>I can usually feel when a person is right or wrong, even if I can't explain how I know, (ea)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
* The name of the subscale to which each item belongs appears in parentheses, ee = Experiential Engagement; ea = Experiential Ability; re = Rational Engagement; ra = Rational Ability. A minus sign (—) with a scale name denotes reverse scoring.

**Depression Anxiety and Stress Scale (DASS)**

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

*The rating scale is as follows:*

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Did not apply to me at all</td>
</tr>
<tr>
<td>1</td>
<td>Applied to me to some degree, or some of the time</td>
</tr>
<tr>
<td>2</td>
<td>Applied to me to a considerable degree, or a good part of time</td>
</tr>
<tr>
<td>3</td>
<td>Applied to me very much, or most of the time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Statement</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I found myself getting upset by quite trivial things</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>2</td>
<td>I was aware of dryness of my mouth</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>3</td>
<td>I couldn't seem to experience any positive feeling at all</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>4</td>
<td>I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>5</td>
<td>I just couldn't seem to get going</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>6</td>
<td>I tended to over-react to situations</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>7</td>
<td>I had a feeling of shakiness (e.g., legs going to give way)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>8</td>
<td>I found it difficult to relax</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>9</td>
<td>I found myself in situations that made me so anxious I was most relieved when they ended</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>10</td>
<td>I felt that I had nothing to look forward to</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>11</td>
<td>I found myself getting upset rather easily</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>12</td>
<td>I felt that I was using a lot of nervous energy</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>13</td>
<td>I felt sad and depressed</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>14</td>
<td>I found myself getting impatient when I was delayed in any way (e.g., lifts, traffic lights, being kept waiting)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>15</td>
<td>I had a feeling of faintness</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>16</td>
<td>I felt that I had lost interest in just about everything</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>17</td>
<td>I felt I wasn't worth much as a person</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>18</td>
<td>I felt that I was rather touchy</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Rating Scale</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>19</td>
<td>I perspired noticeably (e.g., hands sweaty) in the absence of high</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td></td>
<td>temperatures or physical exertion</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>I felt scared without any good reason</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>21</td>
<td>I felt that life wasn't worthwhile</td>
<td>0 1 2 3</td>
</tr>
</tbody>
</table>

**Reminder of rating scale:**
0  Did not apply to me at all  
1  Applied to me to some degree, or some of the time  
2  Applied to me to a considerable degree, or a good part of time  
3  Applied to me very much, or most of the time  

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>I found it hard to wind down</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>23</td>
<td>I had difficulty in swallowing</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>24</td>
<td>I couldn't seem to get any enjoyment out of the things I did</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>25</td>
<td>I was aware of the action of my heart in the absence of physical exertion</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td></td>
<td>(e.g., sense of heart rate increase, heart missing a beat)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(A)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>I felt down-hearted and blue</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>27</td>
<td>I found that I was very irritable</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>28</td>
<td>I felt I was close to panic</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>29</td>
<td>I found it hard to calm down after something upset</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>30</td>
<td>I feared that I would be &quot;thrown&quot; by some trivial but</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td></td>
<td>unfamiliar task</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(A)</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>I was unable to become enthusiastic about anything</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>32</td>
<td>I found it difficult to tolerate interruptions to what I was doing</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>33</td>
<td>I was in a state of nervous tension</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>34</td>
<td>I felt I was pretty worthless</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>35</td>
<td>I was intolerant of anything that kept me from getting on with</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td></td>
<td>what I was doing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(S)</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>I felt terrified</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>37</td>
<td>I could see nothing in the future to be hopeful about</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>38</td>
<td>I felt that life was meaningless</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>39</td>
<td>I found myself getting agitated</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>40</td>
<td>I was worried about situations in which I might panic and make</td>
<td>0 1 2 3</td>
</tr>
</tbody>
</table>
Generalized Anxiety Disorder Questionnaire (GADQ-IV)

1. Do you experience excessive worry?  Yes ____  No ____
2. Is your worry excessive in intensity, frequency, or amount of distress it causes?  Yes ____  No ____
3. Do you find it difficult to control your worry (or stop worrying) once it starts?  Yes ____  No ____
4. Do you worry excessively and uncontrollably about minor things such as being late for an appointment, minor repairs, homework, etc.?  Yes ____  No ____
5. Please list the most frequent topics about which you worry excessively and uncontrollably:
   a. _______________________________
   b. _______________________________
   c. _______________________________
   d. _______________________________
   e. _______________________________
   f. _______________________________
6. During the last six months have you been bothered by excessive and uncontrollable worries more days than not?  Yes _____  No_____

IF YES, CONTINUE. IF NO, SKIP REMAINING QUESTIONS.

7. During the past six months, have you often been bothered by any of the following symptoms? Place a check next to each symptom that you have had more days than not:
   ____ Restlessness or feeling keyed up or on edge
   ____ Irritability
   ____ Difficulty falling/staying asleep or restless/unsatisfying sleep
   ____ Being easily fatigued
___ Difficulty concentrating or mind going blank
___ Muscle tension

8. How much do worry and physical symptoms interfere with your life, work, social activities, family, etc.? Circle one number:

<table>
<thead>
<tr>
<th>None</th>
<th>Mildly</th>
<th>Moderately</th>
<th>Severely</th>
<th>Very Severely</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

9. How much are you bothered by worry and physical symptoms (how much distress does it cause you)? Circle one number:

<table>
<thead>
<tr>
<th>No distress</th>
<th>Mild distress</th>
<th>Moderate distress</th>
<th>Severe distress</th>
<th>Very severe distress</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**PENN STATE WORRY QUESTIONNAIRE**

Enter the number that best describes how typical or characteristic each item is of you, marking the number next to the item.

The rating scale is as follows:

1=Not at all typical  2=Slightly typical  3=Somewhat typical
4=Typical  5=Very typical

Please choose the appropriate response for each item:

1. If I do not have enough time to do everything, I do not worry about it
2. My worries overwhelm me
3. I do not tend to worry about things
4. Many situations make me worry
5. I know I should not worry about things, but I just cannot help it
<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>When I am under pressure I worry a lot</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>7</td>
<td>I am always worrying about something</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>8</td>
<td>I find it easy to dismiss worrisome thoughts</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>9</td>
<td>As soon as I finish one task, I start to worry about everything else I have to do</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>10</td>
<td>When there is nothing more I can do about a concern, I do not worry about it any more</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>11</td>
<td>I never worry about anything</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>12</td>
<td>I have been a worrier all my life</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>13</td>
<td>I notice that I have been worrying about things</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>14</td>
<td>Once I start worrying I cannot stop</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>15</td>
<td>I worry all the time</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>16</td>
<td>I worry about projects until they are all done</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
Inductive Reasoning – Statistical Reasoning Problems

(see: Stanovich, & West, 1998; Fong, Krantz, & Nisbett, 1986; and Nisbett, & Ross, 1980).

1. It is the first week of the winter term. Henry has signed up for five classes, but plans to take only four. Three of the classes he knows he wants, so he must decide between the other two. Past student course evaluations indicate that Course A is better taught. However, Henry attended the first meeting of both classes and found that Course B seemed to be better. What do you think the Henry should do?

   Circle One:

   a. He should definitely take Course A.
   b. He should probably take Course A.
   c. He should probably take Course B.
   d. He should definitely take Course B.

2. The Caldwells had long ago decided that when it was time to replace their car they would get what they called "one of those solid, safety-conscious, built-to-last Swedish" cars -- either a Volvo or a Saab. When the time to buy came, the Caldwells found that both Volvos and Saabs were expensive, but they decided to stick with their decision and to do some research on whether to buy a Volvo or a Saab. They got a copy of Consumer Reports and there they found that the consensus of the experts was that both cars were very sound mechanically, although the Volvo was felt to be slightly superior on some dimensions. They also found that the readers of Consumer Reports who owned a Volvo reported having somewhat fewer mechanical problems
than owners of Saabs. They were about to go and strike a bargain with the Volvo dealer when Mr. Caldwell remembered that they had two friends who owned a Saab and one who owned a Volvo. Mr. Caldwell called up the friends. Both Saab owners reported having had a few mechanical problems but nothing major. The Volvo owner exploded when asked how he liked his car. "First that fancy fuel injection computer thing went out: $400 bucks. Next I started having trouble with the rear end. Had to replace it. Then the transmission and the clutch. I finally sold it after 3 years at a big loss." What do you think the Caldwells should do?

Circle One:

a. They should definitely buy the Saab.
b. They should probably buy the Saab.
c. They should probably buy the Volvo.
d. They should definitely buy the Volvo.

3. David L. was a senior in high school on the East Coast who was planning to go to university. He had compiled an excellent record in high school and had been admitted to his two top choices: a small liberal arts college and an Ivy League university. David had several older friends who were attending the liberal arts college and several who were attending the Ivy League university. They were all excellent students like himself and had interests similar to his. The friends at the liberal arts college all reported that they liked the school very much and that they found it very stimulating. The friends at the Ivy League university reported that they had many complaints on both personal and social grounds and on educational grounds.

David initially thought that he would go to the small liberal arts college and since he could visit only one school he went there for a day. However, he did not like what he saw at the private liberal arts college: Several people whom he met seemed
cold and a professor he met with briefly seemed abrupt and uninterested in him. These things about the liberal arts college campus turned him off. Please say which school you think David should go to.

*Circle One:*

a. He should definitely go to the liberal arts college.

b. He should probably go to the liberal arts college.

c. He should probably go to the Ivy League university.

d. He should definitely go to the Ivy League university.

4. The admissions committee of the psychology department of a Midwestern university was considering which 10 of 30 applicants to admit to their graduate program. The department keeps records on the performance of all its graduate students and relates this performance score to all kinds of background information about the students. There was a debate on the admissions committee about whether to admit a particular student from Maynard College. The student's scores on the GRE and his GPA were marginal. Almost all students previously admitted to the department had higher scores. The student's letters of recommendation were very good, but none of the writers of the letters were personally known to any admissions faculty. One member of the admissions committee argued against admission, pointing out that department records show those students who graduate from small, nonselective colleges like Maynard perform at a level substantially below the median of all graduate students in the program. This argument was countered by a committee member who noted that 2 years ago the university had admitted a student from Maynard who was now among the three highest ranked students in the department. What do you think the committee should do?

*Circle One:*
a. They should definitely admit the student.

b. They should probably admit the student.

c. They should probably not admit the student.

d. They should definitely not admit the student.

5. The superintendent of schools was urging the school board to make a shift to a new "augmented learning" curriculum. He cited a study of 120 school systems that had recently begun to try the augmented learning curriculum and 120 school systems that had a curriculum similar to the district's current one. The "augmented learning" school systems, he said, were producing students who scored half-a-year ahead of the students in the other systems on objective tests of reading, mathematics, and science. Of the 120 school systems which had changed to "augmented learning", 85 had shown improved skills for students in the system vs only 40 with improved skills in the 120 systems which had not changed. One of the school board members took the floor to argue against the change. This board member cited the fact that she had three nephews who were doing poorly in a neighboring school district that used the "augmented learning" curriculum. She said that the boys had all been tested and found to have very high intelligence and learning aptitude. Therefore, the problem could be due to the curriculum and thus it would be a mistake for the board to adopt the "augmented learning" curriculum. What do you think the school board should do?

Circle One:

a. They should definitely adopt the "augmented learning" program.

b. They should probably adopt the "augmented learning" program.

c. They should probably not adopt the "augmented learning" program.

d. They should definitely not adopt the "augmented learning" program.
6. Kevin, a graduate student in sociology, decided to do a research project on "factors affecting performance of major league baseball players". One finding that interested Kevin concerned the 350 married players in the league. About 68% of these players improved their performance after getting married, while the remaining 32% had equal or poorer performance. At a social hour sponsored by the Office of the Commissioner of Major League Baseball, he mentioned his finding to a staff member of the office. The staff member listened to Kevin's results and then said, "Your study is interesting but I don't believe it. I'm sure that baseball performance is worse after a marriage because the ball player suddenly has to take on enormous responsibilities: taking care of his spouse and children. Plus the factor of being stressed by having to be on the road so much of the time and therefore away from the family. The player will no longer be able to devote as much time to baseball as before he was married. Because of this he will lose that competitive quality that is necessary for good performance in baseball." Who do you think is right about the effects of marriage on performance, Kevin or the staff member.

*Circle One:*

a. It's highly likely that Kevin is right.

b. Kevin is probably right.

c. The staff member is probably right.

d. It's highly likely that the staff member is right.
Deductive Reasoning: Syllogisms

(see: Markovits & Nantel, 1989; Sá, West & Stanovich, 1999)

1. Premises: Inconsistent 1 (P,Q)
   All things that are smoked are good for the health.
   Cigarettes are smoked.
   Conclusion:
   Cigarettes are good for the health.
   *a. Conclusion follows logically from premises.
   b. Conclusion does not follow logically from premises.

2. Premises: Consistent 2 (NP,NQ)
   All things made of wood can be used as fuel.
   Gasoline is not made of wood.
   Conclusion:
   Gasoline cannot be used as fuel.
   a. Conclusion follows logically from premises.
   * b. Conclusion does not follow logically from premises.

3. Premises: Neutral 3 (Q,P)
   All lapitars wear clothes.
   Podips wear clothes.
   Conclusion:
   Podips are lapitars.
   a. Conclusion follows logically from premises.
   * b. Conclusion does not follow logically from premises.

4. Premises: Consistent 4 (NQ,NP)
   All nuts can be eaten.
Rocks cannot be eaten.

**Conclusion:**

Rocks are not nuts.

*a. Conclusion follows logically from premises.*

*b. Conclusion does not follow logically from premises.*

5. **Premises:** Inconsistent 2 (NP,NQ)

   All unemployed people are poor.

   Rockefeller is not unemployed.

   **Conclusion:**

   Rockefeller is not poor.

   a. Conclusion follows logically from premises.

   *b. Conclusion does not follow logically from premises.*

6. **Premises:** Consistent 3 (Q,P)

   All guns are dangerous.

   Rattlesnakes are dangerous.

   **Conclusion:**

   Rattlesnakes are guns.

   a. Conclusion follows logically from premises.

   *b. Conclusion does not follow logically from premises.*

7. **Premises:** Inconsistent 4 (NQ,NP)

   All things with four legs are dangerous.

   Poodles are not dangerous.

   **Conclusion:**

   Poodles do not have four legs.

   *a. Conclusion follows logically from premises.*
b. Conclusion does not follow logically from premises.

8. **Premises:** Neutral 1 (P,Q)

All ramadions taste delicious.
Gumthorps are ramadions.

**Conclusion:**
Gumthorps taste delicious.

*a.* Conclusion follows logically from premises.

*b.* Conclusion does not follow logically from premises.

9. **Premises:** Inconsistent 3 (Q,P)

All living things need water.
Roses need water.

**Conclusion:**
Roses are living things.

*a.* Conclusion follows logically from premises.

*b.* Conclusion does not follow logically from premises.

10. **Premises:** Neutral 4 (NQ,NP)

All selacians have sharp teeth.
Snorlups do not have sharp teeth.

**Conclusion:**
Snorlups are not selacians.

*a.* Conclusion follows logically from premises.

*b.* Conclusion does not follow logically from premises.

11. **Premises:** Consistent 1 (P,Q)

All fish can swim.
Tuna are fish.
Conclusion:

Tuna can swim.

*a. Conclusion follows logically from premises.

b. Conclusion does not follow logically from premises.

12. Premises: Neutral 2 (NP,NQ)

All hudon are ferocious.

Wampets are not hudon.

Conclusion:

Wampets are not ferocious.

a. Conclusion follows logically from premises.

*b. Conclusion does not follow logically from premises.

13. Premises: Neutral 3 (Q,P)

All opprobines run on electricity.

Jamtops run on electricity.

Conclusion:

Jamtops are opprobines.

a. Conclusion follows logically from premises.

*b. Conclusion does not follow logically from premises.

14. Premises: Consistent 4 (NQ, NP)

All things that are alive drink water.

Televisions do not drink water.

Conclusion:

Televisions are not alive.

*a. Conclusion follows logically from premises.

b. Conclusion does not follow logically from premises.
15. **Premises: Consistent 2 (NP,NQ)**

   - All bats have wings.
   - Hawks are not bats.

   **Conclusion:**
   - Hawks do not have wings.

   a. Conclusion follows logically from premises.
   * b. Conclusion does not follow logically from premises.

16. **Premises: Inconsistent 1 (P,Q)**

   - All mammals walk.
   - Whales are mammals.

   **Conclusion:**
   - Whales walk.

   *a. Conclusion follows logically from premises.
   
   b. Conclusion does not follow logically from premises.

17. **Premises: Consistent 3 (Q,P)**

   - All large things need oxygen.
   - Mice need oxygen.

   **Conclusion:**
   - Mice are large things.

   a. Conclusion follows logically from premises.
   * b. Conclusion does not follow logically from premises.

18. **Premises: Inconsistent 2 (NP,NQ)**

   - All African countries are hot.
   - Canada is not an African country.

   **Conclusion:**
Canada is not hot.

a. Conclusion follows logically from premises.

* b. Conclusion does not follow logically from premises.

19. **Premises**: Inconsistent 4 (NQ,NP)

All things that move love water.

Cats do not love water.

**Conclusion**:

Cats do not move.

*a. Conclusion follows logically from premises.*

b. Conclusion does not follow logically from premises.

20. **Premises**: Neutral 1 (P, Q)

All tumpers lay eggs.

Sampets are tumpers.

**Conclusion**:

Sampets lay eggs.

*a. Conclusion follows logically from premises.*

b. Conclusion does not follow logically from premises.

21. **Premises**: Inconsistent 3 (Q, P)

All things that have a motor need oil.

Automobiles need oil.

**Conclusion**:

Automobiles have motors.

a. Conclusion follows logically from premises.

* b. Conclusion does not follow logically from premises.

22. **Premises**: Neutral 4 (NQ, NP)
All snapples run fast.
Alcomas do not run fast.

**Conclusion:**
Alcomas are not snapples.
* a. Conclusion follows logically from premises.
b. Conclusion does not follow logically from premises.

23. **Premises:** Consistent 1 (P, Q)
All birds have feathers.
Robins are birds.

**Conclusion:**
Robins have feathers.
* a. Conclusion follows logically from premises.
b. Conclusion does not follow logically from premises.

24. **Premises:** Neutral 2 (NP, NQ)
All argomelles are kind.
Magsums are not argomelles.

**Conclusion:**
Magsums are not kind.
a. Conclusion follows logically from premises.
* b. Conclusion does not follow logically from premises.
International Affective Picture System picture codes

(Lang et al., 1999; see: Mogg et al., 2004)

High threat-neutral pairs: 2053-7320; 3010-4510; 3030-1440; 3053-2040; 3060-7283; 3071-7330; 3080-7410; 3100-4500; 3102-7390; 3110-5626; 3120-2600; 3130-2160; 3140-4530; 3150-5510; 3170-2050; 3400-8280; 3550-2500; 6230-5300; 6313-4599; 6510-2650; 6570-5201; 9040-1600; 9140-1590; 9252-4533; 9400-7550; 9410-8460; 9420-2360; 9570-7040

Mild threat-neutral pairs: 1270-5760; 1280-1910; 1930-5660; 2100-2000; 2110-2210; 2661-7282; 2691-8350; 2700-2370; 3280-2840; 6000-5800; 6010-7710; 6200-7090; 6610-7035; 6800-7000; 6940-7570; 7361-8130; 9001-5780; 9010-7500; 9110-7060; 9120-5250; 9160-1810; 9230-7501; 9404-7510; 9440-1710; 9440-1710; 9452-8490; 9490-5830; 9621-8170; 9622-5700

Antisaccade Task Instructions

Welcome to the experiment. In this experiment you will be presented with a number of different images. These images will vary in arousal (neutral, mild threat and high threat). Here are some examples of the pictures that you may see:

High arousal may depict mutilations or graphic injuries

Mild arousal may be images of dangerous animals

Low arousal may depict objects like a watch

Warning: due to the nature of the images used you may be exposed to highly disturbing pictures. If you have any questions about the pictures presented please ask now. Remember: your participation is voluntary and you may stop participating at any
time without penalty. At the beginning of each trial you will be required to focus on a white dot in the middle of the screen. A picture will appear then the dot will change to an instructional cue which will be green, meaning you will have to look at the image, or red which means you will have to look away from the image (this was visually depicted for participants). You will be required to focus on the black dot until a picture is presented. DO NOT MOVE YOUR EYES FROM THE DOT UNTIL IT CHANGES COLOUR. Once the dot changes colour you will need to make a quick eye movement either towards the picture (following a green dot) or away from the picture (following a red dot). If you have any questions about the experiment please ask them now.

During the practice trials, when a response was incorrect the following message was presented:

**INCORRECT. Remember a red dot means to look away from the picture whilst a green dot means you should look at the picture. Press any button to continue.**
APPENDIX G

Procedural Information: Modified dot probe task Study 4

Instructions

Welcome to the experiment. In this experiment you will be shown pairs of faces. These will be followed by the presentation of a small white dot to the left or right of a central fixation cross, in the position previously held by one of the two faces. The aim of this experiment is to identify the location of the target dot as quickly as possible by looking at the target dot and pressing either: The LEFT button of the target dot appears on the left OR the RIGHT button if the target dot appears on the right. Throughout each trial a white cross will be presented in the center of the screen (visual depiction). Please look at this fixation cross at the start of each trial. Please keep your head still during each trial and use your eyes to look towards the target dot. If you have any questions about the experiment please ask now. Each block of trials will begin with a calibration of the eyetracker.
Ekman and Freisen (1976) pictures used:

Angry faces:

MEN: EM5-14; PE2-21; WF3-1; GS2-8; JJ3-12
WOMEN: A1-14; C2-12; SW4-9; JM5-3; MF2-5; MO2-13; NR2-7

Neutral faces:

MEN: EM2-4; PE2-4; WF2-5; GS1-4; JJ3-4
WOMEN: A1-2; C2-3; SW3-3; JM1-9; MF1-2; MO1-5; NR1-3

Eight ER40 FACES were used to create the four mask and two trial face pairs

The ER40 FACES are black and white images [acquired under the protocol explained in the following paper:


These faces has been used to construct the Penn Emotion Recognition Test - 40 Faces version (ER40). There is text copied below that serves as a filename key by which you may identify the gender, emotional expression and intensity of the face within each respective image file in this set. Please refer to this when trying to identify images.

The Erwin images are black and white images of male and female actors making mild and extreme neutral, happy and sad facial expressions. The demographics of each actor in this set can be found in the "Facial Emotion Files"
To access our 2D facial emotional stimuli, please visit the following URL:

http://www.med.upenn.edu/bbl/downloads/2Dfaces/faces

ER-40 and PERT96 File Key

The stimulus files for the ER-40 and PERT96 are labeled ABC##_###.jpg

A is either F or M to indicate gender
B is the emotion either A for Anger, F for Fear, H for Happy, N for Neutral, or S for Sad (or D for Disgust - PERT96 only)
C is the intensity, either X for mild or Z for extreme

We have two sets of 2D facial emotional stimuli available on our website:

Black and White images [acquired under the protocol explained in the following paper: Erwin et. al. (1992) Facial emotion discrimination: I. Task construction and behavioral findings in normal subjects. Psychiatry Research 42, 231-240.]

APPENDIX H

Procedural Information: Crossmodal homophone task Study 4

List of the Stimuli

Words taken from Blanchette and Richards (2003), and Mathews, Richards and Eysenck (1989)

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APPENDIX I

Study 4 Moderation Analyses with worry/GAD symptoms as the Outcome Variables

Descriptive statistics for centered and un-centered variables can be found in Table AI1 and bivariate correlations for centered variables in Table AI2. To test the moderating role of attentional control on the relationship between attentional bias and worry/GAD symptoms, a multiple moderated regression analysis (Aiken & West, 1991) was performed for each attentional bias calculation (see: Table AI3- AI8). The predictor variables were mean centered to minimize multicollinearity and arrive at correct beta weights and an interaction term was computed by multiplying the centered predictors (Aiken & West, 1991). In the first step of the model attentional bias and attentional control (at various stimulus presentation times) served as predictor variables with worry/GAD symptom scores (PSWQ/GADQ-IV) acting as the outcome variable. The second step of the regression included an interaction term that was constituted from attentional bias scores and attentional control scores – that was also entered as a predictor variable.
Table A1 1: Descriptive statistics for centered and un-centered variables

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Note: \( N = 58 \)

Table A1 2: Bivariate correlations for centered variables

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<tr>
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<td>-.035</td>
<td>.910**</td>
<td>.176</td>
<td>.261**</td>
<td>.017</td>
<td>.027</td>
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<td>1</td>
<td>.269**</td>
<td>.311**</td>
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<td>.895**</td>
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<td>.003</td>
<td>.000</td>
<td>.311**</td>
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<td>.920**</td>
<td>-.436**</td>
<td>.024</td>
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<td>-.011</td>
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</table>

Note: \( N = 58 \)

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).
Table AI 3: Regression Analyses of High and Low Attentional Control and Attentional bias at 16ms with Worry/GAD symptoms as the Outcome Variables

<table>
<thead>
<tr>
<th>Predictor</th>
<th>PSWQ</th>
<th>GADQ-IV</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
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<tr>
<td>Attention bias 16ms</td>
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<td>.957</td>
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<td>-.158</td>
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<td>ΔR²</td>
<td>.016</td>
<td>.033</td>
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<tr>
<td>F</td>
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<td>.926</td>
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<tr>
<td><strong>Step 2</strong></td>
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<tr>
<td>Attention bias 16ms</td>
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<td>-.120</td>
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<td>Att. bias16ms x att.control</td>
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<td>.003</td>
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<td>.662</td>
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</table>

Note: N = 58. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; * p < .05

Table AI 4: Regression Analyses of High and Low Attentional Control and Attentional bias at 33ms with Worry/GAD symptoms as the Outcome Variables

<table>
<thead>
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<th>Predictor</th>
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<th>GADQ-IV</th>
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</thead>
<tbody>
<tr>
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<td>β</td>
<td>t</td>
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<td><strong>Step 1</strong></td>
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<td></td>
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<tr>
<td>Attention bias 33ms</td>
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<td>-1.105</td>
</tr>
<tr>
<td>Attentional control high_low</td>
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<td>.088</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.022</td>
<td>.002</td>
</tr>
<tr>
<td>F</td>
<td>.610</td>
<td>.042</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
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<td></td>
</tr>
<tr>
<td>Attention bias 33ms</td>
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<td>-1.739</td>
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<td>Attentional control high_low</td>
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<td>.142</td>
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<td>Att.bias33ms x att.control</td>
<td>.447</td>
<td>1.402</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.034</td>
<td>.030</td>
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<tr>
<td>F</td>
<td>1.070</td>
<td>.588</td>
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</table>

Note: N = 58. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; * p < .05
Table AI 5: Regression Analyses of High and Low Attentional Control and Attentional bias at 100ms with Worry/GAD symptoms as the Outcome Variables

<table>
<thead>
<tr>
<th>Predictor</th>
<th>PSWQ</th>
<th>GADQ-IV</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attention bias 100ms</td>
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<td>.997</td>
</tr>
<tr>
<td>Attentional control high_low</td>
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<td>-.106</td>
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<tr>
<td>∆R²</td>
<td>.018</td>
<td>.012</td>
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<tr>
<td>F</td>
<td>.497</td>
<td>.325</td>
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</tbody>
</table>

| **Step 2**                    |      |        |      |      |
| Attention bias 100ms          | .118 | .418   | -.001| -.002|
| Attentional control high_low  | -.014| -.104  | -.047| -.346|
| Att.bias100ms x att.control   | .017 | .062   | .116 | .409 |
| ∆R²                           | .000 | .003   |
| F                             | .327 | .269   |

Note: N = 58. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; * p < .05

Table AI 6: Regression Analyses of High and Low Attentional Control and Attentional bias at 200ms with Worry/GAD symptoms as the Outcome Variables

<table>
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<th>Predictor</th>
<th>PSWQ</th>
<th>GADQ-IV</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attention bias 200ms</td>
<td>-.164</td>
<td>-1.209</td>
</tr>
<tr>
<td>Attentional control high_low</td>
<td>-.034</td>
<td>-.250</td>
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<tr>
<td>∆R²</td>
<td>.026</td>
<td>.007</td>
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<tr>
<td>F</td>
<td>.731</td>
<td>.193</td>
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</tbody>
</table>

| **Step 2**                    |      |        |      |      |
| Attention bias 200ms          | -.134| -.441  | .291 | .955 |
| Attentional control high_low  | -.033| -.242  | -.019| -.138|
| Att.bias200ms x att.control   | -.034| -.112  | -.240| -.792|
| ∆R²                           | .000 | .011   |
| F                             | .483 | .337   |

Note: N = 58. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; * p < .05
Table AI 7: Regression Analyses of High and Low Attentional Control and Attentional bias at 500ms with Worry/GAD symptoms as the Outcome Variables

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<th>GADQ-IV</th>
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<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
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<tr>
<td><strong>Step 1</strong></td>
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<td></td>
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<tr>
<td>Attention bias 500ms</td>
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<td>-.937</td>
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<td>Attentional control high_low</td>
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<td>.028</td>
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<tr>
<td>ΔR²</td>
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<td>.017</td>
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<td>F</td>
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<td>.464</td>
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<td><strong>Step 2</strong></td>
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<tr>
<td>Attention bias 500ms</td>
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<td>-.405</td>
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<tr>
<td>Attentional control high_low</td>
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<td>.027</td>
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<td>Att.bias500ms x att.control</td>
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<td>-.081</td>
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<td>ΔR²</td>
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<td>.002</td>
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<td>F</td>
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<td>.345</td>
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</table>

Note: N = 58. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; * p < .05

Table AI 8: Regression Analyses of High and Low Attentional Control and Attentional bias at 1500ms with Worry/GAD symptoms as the Outcome Variables

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<td>β</td>
<td>t</td>
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<td>F</td>
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<td>.133</td>
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<td><strong>Step 2</strong></td>
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<td>Attention bias 1500ms</td>
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<td>.062</td>
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<td>F</td>
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</table>

Note: N = 58. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalised Anxiety Disorder Questionnaire – IV; * p < .05
## APPENDIX J

Table AJ 1: Correlations of symptom and processing style measures, reasoning tasks, attentional control, interpretation bias task conditions and dotprobe attentional bias calculations

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<td>-.095</td>
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</tbody>
</table>

Note: N = 94. PSWQ = Penn State Worry Questionnaire; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; PMPI-E = Perceived Modes of Processing – Experiential scale; PMPI-R = Perceived Modes of Processing – Rational scale; REI-E = Rational Experiential Inventory – Experiential scale; REI-R = Rational Experiential Inventory – Rational scale; Total Reas = total reasoning score; Subj.Prob = subjective probability score; Att.Control = attentional control; Interpret.N = interpretation bias neutral context; Interpret.U = interpretation bias unrelated context; Interpret.E = interpretation bias emotional context; Att.bias = attentional bias. Note: N = 87. **p < 0.01; *p < 0.05