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Cognitive Biases and Vulnerability to Emotional Distress and

Intrusive Thoughts

Deborah L.A. Joy

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Thesis Abstract

The value of information processing bias measures as predictors of emotional distress and intrusive thoughts in response to stress is reviewed. Three cognitive models of anxiety and relevant research on pre-attentive, attentional and interpretative biases for negative information in anxiety are discussed. Recent studies suggest that these measures may better predict vulnerability to emotional distress than traditional questionnaire measures of anxiety-proneness (e.g., MacLeod & Hagan, 1992). Prospective studies exploring cognitive predictors of intrusive thoughts are reviewed focusing mainly on thought suppression. No study has yet examined whether cognitive biases predict intrusive thoughts. An empirical study is then reported that aims to extend previous research in two ways. Firstly, the range of information-processing bias measures is extended to include an attention deployment task capable of assessing both initial vigilance toward, and subsequent avoidance of, threatening stimuli. Secondly, outcome measures are extended to include both emotional distress and short- and long-term measures of intrusive thoughts. Distressing film excerpts were used as a stressor. Findings were that attentional avoidance of threat (at 1500 ms exposures) and initial attentional bias (emotional Stroop) correlated with emotional distress and intrusive thoughts respectively, on certain outcome measures. This was independent of questionnaire measures. Trait anxiety and thought suppression questionnaire measures were also correlated with some of the emotional and intrusive thought outcome measures independently of other measures. Further research is required before firm conclusions can be made about the role of cognitive biases in mediating vulnerability to emotional distress.

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This work is dedicated to my late grandfather John T. Joy.

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Disclaimer Statement

I the undersigned confirm that the work that I have presented as my thesis is entirely my own work. Reference to, quotation from, and discussion of the work of any other person has been correctly acknowledged within the work in accordance with the University guidelines for production of a thesis.

Signed: █████████████████████

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Cognitive Predictors of Emotional Distress and Intrusive Thoughts in Response to

Stress: A Review of the Literature

Deborah L.A. Joy

University of Southampton

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(see Appendix A for Notes to Contributors)

Address for correspondence

Deborah Joy, Department of Psychology, University of Southampton,
Southampton, SO17 1BJ, United Kingdom (Telephone: +44-2380-595321; Fax:
+44-2380-592588).

Abstract

This paper draws together research on cognitive factors that predict individual vulnerability to emotional distress and intrusive thoughts in response to stress. Discussion focuses on three key theoretical perspectives from the anxiety literature and information processing bias research that has stemmed from these models. Specifically, the relationship between pre-attentive threat bias, attentional threat bias, interpretative bias and anxiety are examined in turn. Key studies examining information-processing bias measures as predictors of emotional vulnerability are then reviewed. These studies do not investigate intrusive thoughts. Thus, other research examining cognitive predictors of intrusive thoughts following stress and the related area of thought suppression is then reviewed. Future research could consider the capacity of information processing bias measures to predict not only emotional distress, but also intrusive thoughts, in response to stress. Future research might also extend the range of information processing bias measures used.

Introduction

Individuals commonly report a range of different emotions and cognitive phenomena when distressed. Affective states include anxiety, sadness, guilt, shame and anger. Cognitive phenomena include unintended, unpleasant thoughts and images. Clearly, individual differences in emotional vulnerability exist. Some individuals become upset following apparently innocuous experiences, whilst others appear relatively unaffected in the face of extreme stress. Thus, individuals differ in the extent to which they are negatively affected by horrific media images, the prospect of invasive medical procedures or traumatic childhoods. This variation in vulnerability extends also to the development of psychiatric syndromes. Not everybody becomes clinically anxious or depressed, or develops Post Traumatic Stress Disorder (PTSD) under stressful circumstances. A key research objective is to determine who is most vulnerable to develop such difficulties and why.

To date, the emotional vulnerability literature has focused on personal historical factors (e.g., psychiatric history or history of trauma exposure) and personality traits (e.g., neuroticism and trait anxiety). More recently, the ideas and methods of cognitive psychology have been applied to the understanding of information processing biases in emotional disorders. In the field of anxiety this approach has yielded some promising research suggesting that information processing bias measures may better predict emotional vulnerability than traditional questionnaire measures (MacLeod & Hagan, 1992). Information processing biases and their relationship to emotional vulnerability form one focus of this review.

Thoughts associated with emotional distress are commonly described as intrusive and unwanted. Rachman (1981) defines intrusive unwanted thoughts as interrupting ongoing activity, attributed to an internal origin, difficult to control and sometimes accompanied by subjective discomfort. Intrusive thoughts can be classified according to form (e.g., images, impulses and memories), content (e.g., loss or failure) and process (e.g., uncontrollability; Clark & Purdon, 1995). According to Tallis (1999), intrusive thinking is highlighted in a number of disorders. Intrusive thoughts take the form of re-experiencing in PTSD, obsessions in Obsessive-Compulsive Disorder (OCD) and worry in Generalised Anxiety Disorder (GAD). Intrusive thoughts also occur in depression and have similar content and form to those found in PTSD (Reynolds & Brewin, 1998, 1999). To date, few researchers have examined factors that predict vulnerability to intrusive thoughts following stressful experiences. One body of research has examined thought suppression as a mechanism that may increase the experience of intrusive thoughts.

This review explores three key theoretical perspectives relevant to the study of information processing biases. These are theories of anxiety disorders and comprise, Beck's schema theory (e.g., Beck, Emery & Greenberg, 1985; Beck, Rush, Shaw & Emery, 1979), Williams, Watts, MacLeod and Mathews' (1988, 1997) integrative theory and Mogg and Bradley's (1998) cognitive motivational theory[1]. Information processing bias research in anxiety is then discussed, concluding with a review of these methods applied to the prediction of emotional

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[1] Whilst it is acknowledged that PTSD frameworks relate specifically to negative emotional and cognitive responses to stressful events, theoretical perspectives and research in this area are lacking in the extent to which they consider cognitive bias vulnerability factors. In diagnostic systems, PTSD is defined as an anxiety disorder. Furthermore, information processing bias research is firmly

vulnerability. Next, Horowitz's (1986) information processing theory is outlined as a theoretical perspective on intrusive thoughts following stressful experiences. Experimental, prospective research examining cognitive predictors of vulnerability to intrusive thoughts and the thought suppression literature is then reviewed. Finally, future research and clinical implications are discussed.

Cognitive Models of Anxiety

Davison and Neale (1990) state that:

The focus of cognitive psychology is on how people (...) *structure* their experiences, how they make sense of them, transforming environmental stimuli into information that is usable (...) How do we filter this overwhelming input, put it into words or images, form hypotheses, and arrive at a perception of what is out there? (p. 49).

Theories that apply cognitive approaches to the understanding of emotional disorders have become increasingly refined. They encompass different aspects of information processing including, attention, interpretation and memory.

Beck's Schema Model (Beck et al.,1985; Beck et al., 1979).

Beck et al. (1985, 1979) postulate that anxiety and depression are initiated and maintained by schema-based processes. Schemata are stable cognitive structures comprising beliefs about the world, self and future. They are thought to pervade all aspects of information processing and storage (e.g., memory, selective

rooted in the anxiety disorder literature. This literature review is therefore based within the broader theoretical area of anxiety.

attention, interpretation). According to Beck, anxiety states are characterised by information processing biased according to schemata associated with threat and harm. Beck's model of depression is similar, but the schemata concern themes of loss and failure. However, contrary to Beck's theory, research has failed to reliably demonstrate similar information processing biases in anxiety and depression. Thus, there is evidence for schema-related attentional bias in anxiety, but not depression (e.g., Mogg, Bradley & Williams, 1995). Furthermore, there is little consistent evidence of schema-congruent memory biases in anxiety, whilst there is evidence for such processes in depression (e.g., Mogg, Mathews & Weinman, 1987).

The Integrative Model (Williams et al., 1988, 1997)

Williams et al.'s (1988, 1997) theory proposes that different mechanisms underlie anxiety and depression. The cognitive basis of anxiety states will be examined here. Williams et al. (1988, 1997) proposed a two-stage model of the processing of emotional material in anxiety. The first stage (originally labelled the Affective Decision Mechanism in the 1988 model) operates at a pre-attentive[2] level and involves the associative 'tagging' of stimuli with a threat value. This tagging process is mediated by 'threat input units'. The degree of threat attached to a stimulus is thought to reflect a combination of factors including prior learning, biological pre-wiring and state anxiety.

The second stage is labelled the Resource Allocation Mechanism. Here, trait anxiety determines whether processing resources are allocated towards or away from the threatening stimulus. In particular, high trait anxious individuals

will tend to allocate processing resources toward threat stimuli at the pre-attentive and attentional level. Low trait anxious individuals will tend to direct their attention away from threat stimuli at the pre-attentive and attentional level.

When the activation of threat input units is low, the attentional differences between high and low trait anxious individuals are less apparent. However, with increasing activation of threat input units, the high trait anxious individual will increasingly allocate processing resources toward the threat, whilst the low trait anxious individual will increasingly allocate processing resources away from the threat. Thus, state and trait anxiety interact to produce attentional biases (the interaction hypothesis). These attentional biases may maintain or reduce anxiety states.

Mogg and Bradley (1998) argue that the interaction hypothesis generates counter-intuitive predictions regarding response to severely threatening stimuli. Thus, it would seem disadvantageous for low trait anxious individuals to avoid processing extremely threatening stimuli as this might impede optimal threat management.

Cognitive Motivational Theory (Mogg & Bradley, 1998)

Mogg and Bradley (1998) also posit a two-stage system. The first stage (Valence Evaluation System) provides an analysis of stimulus threat value based on stimulus features, past experience, evolutionary preparedness and interoceptive information. State anxiety is also involved at this level and affects threat perception. Trait anxiety reflects the reactivity of the Valence Evaluation System to incoming threat. Accordingly, high trait anxious individuals are more likely to

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[2] Pre-attentive refers to processing that takes place outside of awareness (i.e., pre-conscious).

appraise incoming stimuli as threatening than low trait anxious individuals. Output from the Valence Evaluation System subsequently feeds into a Goal Engagement System. This system controls the allocation of processing resources toward external goals and stimuli. Where the Valence Evaluation System has tagged a stimulus with a high threat value, the Goal Engagement System interrupts ongoing activity, in order to allocate processing resources toward the threat stimuli. Low threat value outputs will be ignored or inhibited. Hence, processing resources will not be allocated toward them and pursuit of ongoing goals will be maintained. Finally, when no threat value is assigned to a stimulus there is no pre-attentive or attentional bias. The relationship between subjective judgements of threat and both pre-attentive and attentional bias is therefore curvilinear, irrespective of trait anxiety. This differs from Williams et al.'s (1997) model where threat appraisal and processing bias are interactive products of state and trait anxiety.

According to Mogg and Bradley (1998), individual differences in pre-attentive and attentional bias result from the effect of increased trait anxiety producing lower subjective thresholds for threat appraisal. Thus, high trait anxious individuals are more likely to perceive threat in relatively innocuous stimuli than low trait anxious individuals. Mogg and Bradley argue that attentional bias is not necessarily a measure of anxiety-proneness as it should be demonstrable in low trait anxious individuals under circumstances of high threat. However, attentional bias for mild threat stimuli may indicate anxiety vulnerability as it reflects a lowered threat appraisal threshold.

Information Processing Biases: Experimental Techniques

Various methods have been developed to investigate cognitive processes in anxiety. Three experimental techniques are described below, as they have been widely used to investigate cognitive biases in anxiety, and also to predict emotional responses to stressful events. The techniques are the emotional Stroop task, the visual attention deployment task and the homophone task.

Emotional Stroop Task

The original Stroop (1935) task involved participants naming the ink colour that colour words were printed in as quickly and accurately as possible. Participants generally take longer to ink colour name colour words that represent a different colour to the ink. For example, the word red printed in blue ink. The emotional Stroop is a variant of this task where the word stimuli are a mixture of emotionally relevant and neutral words. Threat-related (e.g., cancer, embarrassed), depression-related (e.g., failure), positive (e.g., happy) and neutral words (e.g., armchair) have been used. The proposed mechanism behind increased colour naming latencies for emotional words is a tendency to allocate greater processing resources toward concern-related material (Williams et al., 1997). This attentional bias interferes with reaction time performance.

Early methodologies presented word lists in batches on cards. More recently, words have been presented individually, in random order, on coloured backgrounds, on computer screens. This latter method has allowed for more detailed analysis of Stroop phenomena including subliminal (pre-attentive) and supraliminal (attentional) biases.

Visual Attention Deployment Tasks

Visual attention deployment tasks (also known as visual probe tasks) involve the simultaneous visual presentation of stimulus pairs (words or pictures). Critical stimulus pairs consist of a neutral stimulus paired with a threatening stimulus. Following stimulus presentation, probes are randomly presented in the same spatial location as one of the preceding stimuli. Participant reaction times (RTs) to press a button in response to the probe (i.e., its spatial location) are measured. The rationale for the task is that people respond faster to visual probes that appear in an attended, rather than an unattended, region of a visual display. Thus, attentional bias toward threat is demonstrated on neutral-threat stimulus pair trials by faster RTs to probes located in the same position as a threat stimulus, compared with RTs to probes located in the position of the neutral stimulus. Conversely, attentional bias away from threat is reflected by increased latencies for probes replacing threat words compared to neutral words. Studies have differed, with some presenting probes on a proportion of trials (e.g., MacLeod & Mathews, 1988) and others presenting probes on every trial (e.g., Mogg, Bradley & Hallowell, 1994). A disadvantage of the former method is that there is increased likelihood of probe occurrence following critical stimulus pairs. This is because studies using this method have included 96 critical stimulus pairs and 240 neutral pairs, with a probe occurring after 96 trials (48 of these being critical trials). Attention deployment tasks measure allocation of visual attention more directly than the emotional Stroop.

Homophone Task

The homophone task aims to measure interpretative bias. Word lists including negative and neutral words are presented aurally. Embedded in the list are same-sounding words that can be spelt in ways that denote either a negative or a neutral meaning (e.g., berry / bury). Higher proportions of negatively spelt homophones are considered indicative of a negative interpretation bias (e.g., Mathews, Richards & Eysenck, 1989).

Information Processing Biases in Anxiety

The following section reviews research on anxiety-related information processing biases in clinical and non-clinical samples. Studies examining information-processing bias measures as predictors of emotional vulnerability are then reviewed.

The Relationship between Anxiety and Attentional Bias toward Threat

The emotional Stroop has been widely used to investigate attentional bias in clinical anxiety. The association with increased colour-naming latencies for concern-related words in clinical anxiety samples compared to non-clinical samples is particularly robust (Williams et al., 1997). This effect has been shown for trauma-related words in PTSD (e.g., Cassiday, McNally & Zeitlin, 1992; Foa, Feske, Murdock, Kozak & McCarthy, 1991; Thrasher, Dalgliesh & Yule, 1994), spider-related words in spider phobia (e.g., Watts, McKenna, Sharrock & Tresize, 1986) and threat-related words in panic disorder (e.g., McNally et al., 1994) and GAD (e.g., Mogg, Mathews & Weinman, 1989). However, some studies have found more general biases. For example, Mogg, Bradley, Williams and Mathews

(1993) found a bias for negative words (threat and depression) rather than anxiety-related words (threat only) in GAD patients. This may have resulted from different word presentation methodologies. Mogg, Bradley et al.'s study used a computerised, randomised, serial word presentation version of the emotional Stroop. Other studies have used a blocked word list format (e.g., Mogg et al., 1989). Mogg, Bradley et al. suggest that this latter format may allow more elaborate processing of word meaning, thus increasing the likelihood of a specific bias.

The concern-related attentional bias appears to differentiate anxiety from depression. Thus, it does not seem to occur in clinically depressed participants (e.g., Mogg, Bradley & Williams, 1995). This contradicts Beck et al.'s (1985, 1979) theory where both anxious and depressed individuals should show attentional bias to concern-related information.

Concern-related attentional biases are less clear-cut in non-clinical groups. Some studies have demonstrated greater colour-naming interference for threat-related words compared to neutral words in high trait anxious non-clinical samples (e.g., Mogg & Marden, 1990; Mogg, Mathews, Bird & MacGregor-Morris 1990; Richards & Millwood, 1989). However, Martin, Williams and Clark (1991) found no difference between low, medium and high trait anxious non-clinical participants on threat word colour-naming latencies. They also investigated the effects of patient status on latencies by comparing their high trait anxious subjects with clinically anxious subjects who had equivalent state and trait anxiety levels. They found interference on both positive and negative words in the clinical group but not the non-clinical group.

Martin et al. (1991) suggested that the non-clinical high trait anxious might be able to strategically override attentional bias tendencies whilst the clinically anxious cannot. However, Williams, Mathews and MacLeod (1996) suggest that this is contentious as Martin et al.'s non-clinical high trait anxious group may have been unrepresentative as their Stroop performance ran contrary to hypothesis. Comparison of this group of high trait anxious individuals with a clinical sample may have therefore been unreliable. However, subsequent studies (e.g., MacLeod & Rutherford, 1992; Mogg, Kentish & Bradley, 1993) have also failed to associate high trait anxiety with attentional bias for threat.

Evidence surrounding the attentional bias of low trait anxious individuals is inconsistent. MacLeod Mathews and Tata (1986) used an attention deployment task and supported Williams et al.'s (1988, 1997) proposition that low trait anxious individuals shift attention away from threat stimuli. However, Mogg, Mathews and Eysenck (1992) found that the attentional trend of non-anxious patients was better described as 'indifferent' rather than avoidant. In addition, due to comorbidity and a degree of symptom overlap between anxiety and depression (e.g., Clark & Watson, 1991), the study of a specific disorder can be difficult to achieve. MacLeod et al. (1986) point out that their results do not necessarily pertain specifically to GAD as their GAD patients were also significantly more depressed than controls. This may also apply to Mogg et al.'s (1992) study where depression was also elevated in the GAD group compared to controls.

Most of the preceding studies assessed attentional bias with verbal stimuli. However, McNally (1995) questions the assumption that word-invoked attentional bias mechanisms are the same as those responsible for the provocation and maintenance of anxiety states. On the other hand, it can be argued that word

stimuli can give a clear indication of mechanisms involved in anxiety, as words have relatively low threat value. In any case, Mogg et al. (2000) used high threat pictorial stimuli in an attention deployment paradigm with high and low trait anxious participants. They argued that their pictorial stimuli of mutilated bodies had greater threat valence than previous studies that used words and faces. They predicted that given the increased threat valence of their stimuli, even low trait anxious individuals would exhibit a bias toward these scenes, compared to mild threat and neutral pictorial stimuli. This hypothesis was confirmed in two experiments suggesting that the finding was reliable. Furthermore, the predicted effect remained even when the effects of depression were controlled. This runs contrary to interaction hypothesis predictions concerning low trait anxious individuals (Williams et al., 1988, 1997), but is consistent with Mogg and Bradley's (1998) theory.

Pre-Attentive Bias

Williams et al. (1988, 1997) postulated that anxiety-related processing biases occur at both conscious and pre-conscious (or pre-attentive) levels. Computerised emotional Stroop and attention deployment tasks have enabled the study of pre-attentive biases. Such studies present stimuli very rapidly (e.g., 20 ms or less) followed by a mask consisting of a nonsense letter string. Awareness checks are performed to ensure that participants are not consciously aware of the presence or absence of word stimuli on masked trials.

Increased colour-naming interference on subliminally presented negative (threat and depression) words has been found in clinically anxious patients compared to control groups (Bradley, Mogg, Millar & White 1995; Mogg, Bradley,

Millar & White, 1995; Mogg, Bradley et al., 1993). Attention deployment studies have found evidence of pre-attentive bias for negative words in GAD participants compared to controls (Mogg, Bradley & Williams, 1995) and for threat words (depression words were not included) in high trait anxious participants (Mogg, Bradley & Hallowell, 1994). However, MacLeod and Rutherford (1992) did not find pre-attentive bias for threat in non-clinical high trait anxious individuals compared to low trait anxious individuals in conditions of low stress.

A number of reviews (e.g., Mathews & MacLeod, 1994; Mogg & Bradley, 1999) have concluded that pre-attentive processing biases are less content-specific than those that occur when awareness is allowed. Thus, pre-attentive biases tend to be valence- rather than content-specific (i.e., found for negative words generally rather than for threat words in particular). Studies have also confirmed that pre-attentive processing biases in clinical anxiety are different from those in clinical depression. However, Bradley et al. (1995) found no interference effects in GAD patients with a concurrent depression diagnosis. Similarly, Mogg, Bradley et al. (1993) found no interference effects in a clinically depressed group (in spite of similar anxiety levels to the anxious group).

Summary

In line with the theories of Beck et al. (1985, 1979), Williams et al. (1988, 1997) and Mogg and Bradley (1998), clinically anxious individuals tend to shift their attention toward threat stimuli which are available to conscious awareness (MacLeod et al., 1986; Mogg et al., 1992), and also to negative information presented at a pre-attentive level (e.g., Mogg, Bradley et al., 1993). However, attentional and pre-attentive threat biases have not been demonstrated in those with

comorbid depression (e.g. Bradley et al., 1995). This contradicts Beck's theory but concurs with Williams et al.'s theory, which suggests that attentional and pre-attentive threat biases are anxiety-specific.

Attentional bias is less clear-cut in non-clinical high trait anxious individuals. Evidence regarding the prediction that low trait anxious individuals shift their attention away from threat stimuli is also inconsistent. However, more threatening stimuli (i.e., pictures of severely injured people) seem to give clearer results, producing attentional bias in high trait anxious participants and, to a lesser extent, in low trait anxious participants (Mogg et al., 2000).

Pre-attentive biases have also been shown in high trait anxious non-clinical samples and seem to be valence- (e.g., negative) rather than content- (e.g., threat) specific (e.g., Mogg & Bradley, 1999). Pre-attentive bias may not always occur in such individuals (e.g., at times of low stress; MacLeod & Rutherford, 1992).

The Relationship between State and Trait Anxiety and Attentional Bias toward Threat

Knowledge of the relative involvement of state and trait anxiety in selective processing of threat helps clarify whether such biases are enduring vulnerability factors, or are transient and mood state dependent (MacLeod & Rutherford, 1992). To date, this research has produced conflicting results in clinically anxious samples. Mathews and MacLeod (1985) found that attentional bias for threat words correlated directly with state, not trait, anxiety in a group comprising GAD and non-clinical participants. Conversely, a replication of this study (Mogg et al., 1989) found attentional bias correlated with trait, not state anxiety. Both these studies used card versions of the emotional Stroop. MacLeod (1990) suggested

that these inconsistent findings may result from the difficulty in statistically separating the effects of state and trait anxiety in clinically anxious samples, where both state and trait anxiety are often elevated.

The relative effects of state and trait anxiety on attentional bias have been examined in non-clinical samples. One research strategy involves measurement of attentional bias under conditions of low stress, when participants' state anxiety is low, and again at a time of stress when state anxiety is high. High stress conditions have included naturally occurring stressors such as University examinations (MacLeod & Mathews, 1988; MacLeod & Rutherford, 1992) and laboratory-based stressors such as the solution of difficult and insoluble anagrams (Mogg, Kentish & Bradley, 1993; Mogg et al., 1990). Studies have employed different attentional bias measures, namely, the emotional Stroop (e.g., MacLeod & Rutherford, 1992; Mogg, Kentish et al., 1993) and attention deployment tasks with word stimuli (MacLeod & Mathews, 1988; Mogg, Bradley & Hallowell, 1994). Results have differed, although some patterns have emerged according to method of attentional bias measurement and stressor type.

Mogg et al. (1990; Experiment 1) used the modified Stroop and a laboratory-induced stressor. They found that trait, not state, anxiety was associated with an attentional bias for general threat words. However, this was not replicated in a second experiment using an attention deployment task. On the other hand, both experiments found that stress experience, irrespective of trait anxiety, was associated with significantly greater attentional bias for threat words.

Another Stroop study monitored examination stress effects and examined pre-attentive and attentional bias for general and examination-threat words (MacLeod & Rutherford, 1992). Attentional bias for general-threat words was

associated with increases in state anxiety, irrespective of trait anxiety. However, another study of similar design used an attention deployment task instead of the emotional Stroop and found trait, not state, anxiety was most strongly associated with attentional bias for general threat (MacLeod & Mathews, 1988). Both studies found an interactive effect of state and trait anxiety on attentional bias (in line with Williams et al., 1997). However, this interaction was found for examination-related threat words that were presented for 500 ms and available to awareness in one study (MacLeod & Mathews, 1988), and for general-threat words that were masked (i.e., pre-attentive) in the other study (MacLeod & Rutherford, 1992).

Two methodological variations may explain inconsistencies between study findings. Firstly, attentional bias measurement has varied. Emotional Stroop task effects (e.g., used by MacLeod & Rutherford, 1992) might not result from attentional bias. Thus, it is assumed that colour-naming interference occurs as a result of threatening stimuli capturing attentional resources. However, other mechanisms may explain impaired reaction times. For example, slower reaction times might result from negative affect intensification following threat word exposure in high trait anxious participants. Hence, such individuals may process neutral and threatening words to the same degree, but respond more slowly due to increases in negative affect (e.g., MacLeod et al., 1986). The attention deployment task may be superior to the emotional Stroop as it measures attentional bias more directly by requiring participants to actually shift attention in order to complete the task.

Secondly, Mogg et al. (1990) suggested that the time course of the stressor might explain the differences between their findings and MacLeod and Mathews' (1988) findings. They hypothesised that following acute stress (e.g., laboratory-

induced) all people show attentional bias for threat. However, under more prolonged stress (e.g., examinations), low anxious individuals may develop stress management strategies (e.g., orient away from threat-related information).

Mogg, Bradley & Hallowell (1994) used an attention deployment task to compare the effects of acute and prolonged stress on attentional bias in a non-clinical sample. The acute stressor was an impossible mock 'intelligence test'. The prolonged stressor was impending University examinations. High trait anxious participants shifted attention toward general and concern-related threat words under prolonged, not acute stress. Low trait anxious participants shifted attention away from these threat words under prolonged, not acute stress. The latter findings were obtained when the stimuli were presented supraliminally (i.e., available to conscious awareness). This concurred with Mathews and MacLeod's (1988) finding of a state-trait anxiety interaction producing attentional bias for threat under prolonged stress and Mogg et al.'s (1990) failure to find an interaction effect under acute stress conditions. Finally, contrary to Mogg et al. (1990), Mogg, Bradley and Hallowell (1994) did not find an effect of stress on attentional bias. They suggest that methodological differences may partly account for this. Thus, in the latter study, probes appeared after every word pair irrespective of word type. In the Mogg et al. (1990) study, probes did not appear after each word pair and were more likely to occur following critical (threat-neutral) stimulus pairs. Thus, stressed participants may have detected this and developed a strategy for attending to threat words.

Whilst stressor duration formed one difference between the laboratory and examination stress conditions, the former is also experimentally contrived whilst

the latter occurs naturally.   Naturally occurring stressors are more ecologically valid and may better represent processing mechanisms in response to stress.

A further study included an attention deployment task with threat and neutral words presented for 500 ms to a non-clinical sample (Mogg, Bradley, de Bono & Painter, 1997). High state, but not trait, anxiety was associated with initial orientation toward threat.   Conversely, low state, but not trait, anxiety was associated with a non-significant trend toward initial avoidance of threat.   The authors caution that their study was not designed to assess the relative effects of state and trait anxiety. Thus, participants were not selected on the basis of anxiety scores, yielding fewer participants with extreme trait anxiety scores.

Egloff and Hock (2001) attempted to clarify the relative effects of state and trait anxiety without directly manipulating state anxiety. They hoped that use of a sufficiently large sample (121 participants), would yield sufficient variation in state and trait anxiety to enable measurement of their relative effects.   Participants completed a trait anxiety measure followed by an emotional Stroop task. Finally, they retrospectively rated their state anxiety during the task.   Egloff and Hock concluded that attentional bias resulted from an interaction between state and trait anxiety (concurring with Williams et al., 1997). Thus, where individuals were high in trait anxiety, state anxiety and Stroop interference were positively correlated. However, for individuals with low trait anxiety, the increase in state anxiety was associated with decreased attentional bias. A limitation of this study is that trait anxiety measurement may have primed emotional Stroop responses toward negative themes.

The relative effects of state and trait anxiety have not yet been examined using higher threat stimuli (e.g., pictorial stimuli). More powerful stimuli may

clarify these effects. Furthermore, pictorial stimuli may be more ecologically valid than verbal stimuli.

Summary

The issue of the relative involvement of state and trait anxiety in attentional and pre-attentive bias is not entirely resolved. However, the balance of evidence suggests that their relationship is complex and that both may be involved in the processing of threat information in certain circumstances. It is currently unclear whether this effect is interactive (e.g., Williams et al., 1988, 1997) or additive (e.g., Mogg & Bradley, 1998). The latter may be clarified with stimuli of greater threat value.

Time Course of Attentional Bias

Researchers have suggested that anxiety is maintained by avoidance following initial vigilance to threat (e.g., Mogg et al., 1987). Whilst avoidance may reduce initial discomfort, it also maintains anxiety by preventing habituation, or more realistic stimulus evaluation. The attention deployment task has been used to investigate whether vigilance-avoidance patterns occur in attentional bias. Initial threat vigilance is assessed using stimulus exposures of around 500 ms (i.e., short enough to capture initial allocation of attention). Avoidance is subsequently measured via response to probes on trials where stimulus pairs are exposed for around 1500 ms. Exposure durations of around 1500 ms allow for multiple shifts in attention and hence use of avoidance strategies can occur. Stimuli have included words (Mogg et al., 1997), emotional faces (Bradley, Mogg, Falla & Hamilton,

1998) and high threat pictorial scenes (Mogg, Bradley, Miles & Dixon, 2002). All of these studies used non-clinical samples.

Mogg et al. (1997) and Bradley et al. (1998) found no evidence for a vigilance-avoidance pattern. However, Bradley et al. reported a non-significant trend toward threat faces at the longer stimulus exposure duration (1250 ms) in high trait anxious individuals, compared to non-vigilance in low trait anxious participants. They argue that this is not entirely consistent with the view that threat vigilance is maintained across time, as continued vigilance associated with high trait anxiety would presumably result in a significant difference from low trait anxious individuals. Bradley et al. therefore suggest that vigilance diminishes over time in high trait anxious individuals.

Mogg et al. (2002) used pictures of highly threatening scenes (e.g., mutilated bodies) to assess the vigilance-avoidance hypothesis. They argued that pictures are more powerful elicitors of anxiety than words and are sufficiently complex to warrant extended processing over time. They found that high trait anxiety was associated with increased initial vigilance for high threat scenes (i.e., exposure durations of 500 ms). High trait anxiety was not associated with subsequent threat avoidance. However, when the group was split into high, medium and low blood-injury fear, the vigilance-avoidance hypothesis was supported. Thus, individuals who reported high blood-injury fear showed a pattern of vigilance for high threat scenes presented at 500ms and subsequent avoidance of high threat scenes presented at 1500ms duration. Further analysis showed that trait anxiety predicted initial vigilance better than blood injury fear. Mogg et al. noted that the stronger association between avoidance at 1500 ms with blood-injury

fear rather than trait anxiety underlines the importance of individual concerns in threat avoidance.

Interpretative Bias

Following Beck et al.'s (1985, 1979) model of anxiety, Eysenck, MacLeod and Mathews (1987) and Mathews et al. (1989) argue that anxious individuals will be biased toward threatening interpretations of ambiguous stimuli. For example, an anxious individual will be more likely to interpret a small skin blemish as possible skin cancer than simply a harmless blemish. Eysenck et al. (1987) presented homophones with both threatening and non-threatening meanings (e.g. bury or berry) to 16 participants. Higher trait anxiety was associated with the spelling of homophones according to their threatening meaning. State anxiety was not associated with interpretative bias. This study was limited by its small sample size. Furthermore, the sample was not described, so it is unclear whether individuals with a history of clinical anxiety were excluded.

Mathews et al. (1989) also found that negative interpretative bias was stronger in generally anxious individuals compared to non-clinical controls matched for age, gender and verbal intelligence. However, the relationship between trait anxiety and interpretative bias was less clear. Thus, there was a strong, but not quite statistically significant, association between interpretative bias and trait anxiety in the clinically anxious and control groups. However, these variables were not associated in a group of recovered anxious participants. Social desirability measures suggested that the recovered group were not merely attempting to present themselves in a favourable light, or comply with perceived experimental demands.

Mogg, Bradley, Miller et al. (1994) conducted a series of studies to clarify the relationship between state and trait anxiety and interpretative bias in non-clinical samples. In experiment one, groups of high and low trait anxious participants were randomly allocated to either a low or a high stress condition. The high stress condition involved completion of a very difficult "practice IQ test". The low-stress condition involved four minutes relaxation. The homophone task was subsequently completed. Results indicated no relationship between state or trait anxiety and interpretative bias. However, participants may have been primed toward threatening homophone interpretations as the anxious mood measure was administered beforehand. This confound may have obscured differences between low and high trait anxious individuals. Findings also suggested that interpretative bias was associated with social desirability. Thus, individuals whose social desirability scores indicated a higher need for social approval produced fewer threatening homophone interpretations.

Mogg, Bradley, Miller et al. (1994; Experiment Two) subsequently examined the relationship between state anxiety, trait anxiety and social desirability in a larger non-clinical sample. State anxiety was not manipulated, selection was based on trait anxiety scores and mood measures were administered after the homophone task. Trait anxiety was significantly associated with interpretative bias and there was a strong, but not significant, relationship between interpretative bias and state anxiety. There was no relationship between social desirability and interpretative bias. Interpretative bias was significantly associated with trait anxiety but not state anxiety when social desirability was controlled. These findings were not entirely consistent with the findings from experiment one. Mogg, Bradley, Miller et al. conducted a third experiment that suggested that

anxious participants initially respond to the homophone task with an interpretative bias but subsequently realise that spellings are ambiguous and alter their response pattern. Thus, trait anxiety was associated with interpretative bias independently of social desirability in the first half of the homophone task. However, high social desirability was associated with a reduction in threat spellings in the second half of the homophone task.

MacLeod and Cohen (1993) have criticised the homophone task for not differentiating between interpretative bias and response bias effects. The latter relates to participants apprehending both spellings of the homophone but choosing to respond either with the threatening or non-threatening option.

Summary

High trait anxiety and interpretative bias seem to be related in the clinically anxious (Mathews et al., 1989), and non-clinical samples (Mogg, Bradley, Miller et al., 1994). Social desirability appears to be associated with anxiety and homophone interpretative bias over time. Individuals with greater need for social approval may be less willing to give negative responses. However, this effect may only emerge when an awareness of homophone ambiguity has developed and response strategies are subsequently altered. Response bias effects (e.g., MacLeod & Cohen, 1993) are difficult to rule out.

Information Processing Bias Measures as Predictors of Emotional Vulnerability

Many researchers have suggested that pre-attentive, attentional and interpretative biases represent anxiety vulnerability factors (e.g., MacLeod et al., 1986; Mogg & Bradley, 1998; Williams et al., 1988). MacLeod and Hagan (1992)

first tested this in relation to prediction of emotional response to stress. They also hypothesised that attentional bias measures would better predict emotional vulnerability than traditional questionnaire measures.   MacLeod and Hagan administered the emotional Stroop task to 31 women awaiting colposcopy at a local hospital. Threat and matched non-threat words were presented in subliminal and supraliminal conditions. Participants also completed questionnaire measures of depression and state and trait anxiety. Fifteen women from the initial sample were subsequently diagnosed with cervical pathology and underwent laser surgery. Eight weeks after the initial assessment and colposcopy, these women retrospectively rated the extent to which the diagnosis had affected their mood. Pre-attentive threat bias was significantly associated with initial state and trait anxiety.   More importantly, pre-attentive bias predicted the level of general emotional distress, anxiety and depression which women reported post-diagnosis, whereas measures of initial supraliminal threat bias, depression, state and trait anxiety did not.   Moreover, the predictive power of the pre-attentive bias index remained even when the effects of initial depression, state and trait anxiety were partialled out. Thus, pre-attentive threat bias was a more sensitive predictor of emotional vulnerability than anxiety and depression questionnaire measures.

Van den Hout, Tenney, Huygens, Merckelbach and Kindt (1995) argued that MacLeod and Hagan's (1992) participants were already under stress due to the diagnostic uncertainty prior to colposocopy. Thus, the initial pre-attentive bias might have therefore only been present as a result of elevated state anxiety, pre-colposcopy. This proposal seems supported by the aforementioned findings of MacLeod and Rutherford (1992), who found that pre-attentive bias was associated with an interaction between state and trait anxiety. Thus, pre-attentive bias only

occurred in high trait anxious subjects when under stress. Van den Hout et al. therefore conducted a study to assess whether pre-attentive threat bias, measured at a time of no stress, would predict emotional vulnerability. Healthy students completed the emotional Stroop, state and trait anxiety measures and an emotional vulnerability questionnaire. The latter questionnaire asked participants to estimate their emotional response and the emotional response of other people in a variety of hypothetical stressful situations. In line with MacLeod and Hagan's study, pre-attentive bias was significantly associated with trait anxiety and was the only significant predictor of self-reported emotional vulnerability. Whilst hypothetical rating of emotional vulnerability may be less accurate than reports of actual emotional response, the concurrence with MacLeod and Hagan's findings suggests reliability.

Pury (2002) aimed to replicate MacLeod and Hagan (1992) and Van den Hout et al.'s (1995) findings using a real-life stressor and assessing information processing biases at a time of low stress. She also measured interpretative bias (homophone task). Thus, attentional and interpretative bias, trait anxiety, depression and current mood state were assessed in students at a time of low stress (early in the semester). Examination period emotional distress was then assessed by telephone interview. In line with MacLeod and Hagan, pre-attentive threat bias (as measured in the subliminal condition of the emotional Stroop task) predicted stress-related anxiety symptoms. However, it did not predict depressive symptoms or general distress. The homophone task significantly predicted negative affect during examination week. These predictive relationships remained significant even when the effects of initial positive and negative affect, trait anxiety and depression were partialled out.

Pury (2002) suggests that timing of emotional response measurement may explain why pre-attentive bias only predicted anxiety in her study, whilst it predicted anxiety, depression and general distress in MacLeod and Hagan's (1992) study. In MacLeod and Hagan's study, stress response was measured when participants may have been responding to themes of loss as well as threat (i.e., a life-threatening diagnosis). In Pury's study, participants were assessed during a stressful period but prior to receiving their examination results when issues of loss (e.g., examination results below expectation) may have prevailed.

One weakness of these predictive studies is the measurement of emotional distress outcome. MacLeod and Hagan (1992) and Pury (2002) both used retrospective ratings of emotional distress. The former study asked for these ratings over previous weeks and the latter over the last few days. Such a retrospective rating might be less accurate than assessment of how individuals currently feel. Finally, neither study used repeated measures to assess change in emotional distress (i.e., pre- versus post-stress). An alternative design could administer the emotional distress measure both before and after, or during, the stressor experience. Importantly, each study used a correlational methodology, preventing inference of causality.

MacLeod, Rutherford, Campbell, Ebsworthy and Holker (2002) addressed the causality question by manipulating pre-attentive and attentional bias in a sample of undergraduate students with mid-range trait anxiety scores. Modified versions of the attention deployment task were used to induce attentional biases toward negative word stimuli in one half of the group, and toward neutral word stimuli in the other half of the group. Following attentional training, participants completed the stressful task of attempting a mixture of difficult and insoluble

anagrams whilst being filmed for 'class demonstration purposes'. Mood state was monitored across bias training and before and after the anagram task.

The training phase successfully induced attentional biases at the conscious awareness level, but not at the pre-attentive level (i.e., when the words were briefly presented and masked). Attentional bias training did not modify mood state but did modify subsequent emotional vulnerability following stress. Whilst all participants reported increased anxiety and depression following the stress task, the group who had been trained to attend to negative cues showed a trend (just failing to achieve significance) toward greater increase in stress-induced negative affect, compared to the neutral training bias group. Moreover, attentional training modified both anxiety and depression to a similar degree. As this effect just failed to achieve significance, MacLeod et al. (2002) conducted a second experiment.

The original experimental procedure was modified in two ways for the replication study. Firstly, as the original study failed to induce pre-attentive biases, all training trials in the second study were presented supraliminally in an attempt to strengthen the attentional biases. Secondly, emotional reactivity to the stressor was measured before and after attentional training. Prior to attentional bias training, both groups showed similar elevations in anxiety and depression in response to the stressor. However, after attentional training, elevation of negative affect in response to the stressor was significantly attenuated in the neutral attentional bias group, compared to the negative attentional bias group. Furthermore, correlational analysis showed that those who developed the strongest attentional biases toward negative information following attentional training, experienced greater negative affect (a composite of anxiety and depression) in response to the stressful task. Finally, attentional training appeared to modify stress response on the anxiety and

depression scales to a similar degree. This seems to run contrary to the literature that suggests that attentional bias toward negative information is a characteristic of anxiety vulnerability rather than vulnerability to depression. MacLeod et al. (2002) point out that this may result from the use of simple visual analogue scales rather than more sophisticated questionnaires that are better able to distinguish these two mood states. However, MacLeod et al.'s finding is consistent with MacLeod and Hagan (1992) and Van den Hout et al. (1995) who found that pre-attentive bias predicted general dysphoria, anxiety and depression in response to stress.

Summary

Numerous studies have demonstrated negative pre-attentive, attentional and interpretative biases in anxiety disorders. These biases have also been associated with high trait anxiety in some non-clinical samples. However, some studies and theorists suggest that state and trait anxiety interact in order to determine these biases (e.g., Williams et al., 1997).

Recent research has addressed the hypothesis that information-processing biases are associated with emotional vulnerability. To date, pre-attentive bias for threat has predicted emotional distress in response to stressful events (e.g., MacLeod & Hagan, 1992; Pury, 2002). Interpretative bias measures have also predicted negative affect following stress (Pury, 2002). Furthermore, these studies suggest that pre-attentive and interpretative biases better predict emotional distress than traditional questionnaire measures.

Vulnerability to Intrusive Thoughts

In the preceding section, studies examining cognitive predictors of anxiety and emotional distress were reviewed. These studies have addressed predictions from general models of anxiety (e.g., Williams et al., 1997). In this next section, a theory of stress response (information-processing theory; Horowitz, 1986) is discussed. Subsequently, research examining the prediction of a highly specific correlate of emotional distress, namely, unwanted intrusive thoughts is reviewed. This includes a review of the thought suppression literature. The link between stressful experience, emotional distress and intrusive thoughts is particularly clear in PTSD and Acute Stress Disorder (ASD). Thus, some of the research discussed below comprises traumatised samples or studies which have aimed to reproduce PTSD phenomena in an analogue design (Davies & Clark, 1998a). However, due to space limitations predictors of PTSD and ASD (as disorders comprising intrusive thoughts and emotional distress) are not exhaustively reviewed. Furthermore, many PTSD predictor studies do not employ prospective designs comprising pre-trauma measurement of predictor variables. Moreover, many of these studies focus on non-cognitive predictors such as demographic variables and the dimensions of the trauma (e.g., Epstein, Fullerton & Ursano, 1998; Mayou, Bryant & Duthie, 1993). This review is concerned with the relationship between individual premorbid cognitive processing characteristics and individual stress responses.

A Theoretical Perspective on Intrusive Thoughts Following Stress

Horowitz (1986) argues that, "evocation of a stress state requires that the person register and interpret incoming stimuli as cues of threat" (p. 88).

Registration and interpretation vary between individuals, as do coping styles. Thus, individuals possess varying degrees of vulnerability to adverse psychological responses to stressful experiences.

Horowitz defines a stressful experience as, "one that is not fully in accord with a person's usual inner working models" (p. 93). The mismatch between the stressful experience and the individual's inner model invokes a 'completion tendency' to resolve these inconsistencies. Thus, attempts are made to assimilate new information with the existing inner model. Emotional distress sometimes arises when the inconsistencies between the old working model and new information are recognised. The system attempts to moderate distress in order to prevent the individual becoming overwhelmed. Thus, the assimilative process is intermittently terminated. This process of assimilation and its interruption corresponds to intrusive thoughts and their avoidance. According to Horowitz, these processes occur both consciously and unconsciously.

Horowitz (1986) argues that the processing of stress-related information is a priority. It therefore remains in an active memory store where it can be easily accessed for further processing when more urgent demands have been dealt with. The meaning of the recently acquired information and / or the meaning of the pre-existing models is gradually altered. Emotional disorders result when information processing breaks down and partially processed information remains stuck in active memory. This type of assimilative process following exposure to stress is often referred to as emotional processing (e.g., Rachman, 1980). The achievement of assimilation is seen as a necessary condition of post-stress adjustment.

In sum, Horowitz (1986) indicates that individual differences in attentional and interpretative bias may result in differing vulnerability to emotional distress

and intrusive thoughts following stressful experiences. However, he does not elaborate on the relationship between cognitive biases and emotional vulnerability.

Predictors of Intrusive Thoughts Following Stress

Horowitz and colleagues (e.g., Horowitz, Becker & Moskowitz, 1971; Wilner & Horowitz, 1975) pioneered research into the role of stress in the development of unwanted, intrusive thoughts. They used the paradigm of exposing participants to films that evoked emotions such as fear, anger and depression. Content analysis of non-clinical participants' immediate post-film thought verbalisations revealed at least one film-related intrusive thought in most participants. In addition, intrusive thoughts were significantly more prevalent following stressful rather than emotionally neutral films. This effect was also demonstrated in clinical samples (Horowitz, Becker, Moskowitz & Rashid, 1972). Horowitz concluded that the experience of intrusive thoughts following stressful experience reflects a general response tendency in humans.

Horowitz and his colleagues also demonstrated that not everyone experiences intrusive thoughts to the same extent, following identical stressor exposure. Thus, psychiatric patients (with neuroses and personality disorders) responded to a traumatic film with significantly more intrusive thoughts than non-psychiatric participants (Horowitz, Becker & Malone, 1973). A significant decrease in positive affect (happiness, pleasantness and interest) and a significant increase in negative affect (sadness, anger, disgust, contempt, surprise, fear, pain and nervousness) also occurred in both groups.

Davies and Clark (1998a) have taken Horowitz's paradigm and conducted the only study to prospectively examine variables that might predict individual

vulnerability to intrusive thoughts. Predictor variables were, depression, state and trait anxiety, neuroticism, extroversion, thought suppression tendencies, ability to form anxious mental imagery, self-ratings of proneness to intrusive cognitions and beliefs about vulnerability to fire. Participants then viewed real-life footage of an office block fire, where several people are seen to die. Participants were asked to imagine themselves as bystanders at the scene of the fire. Short-term (immediately after the film) and long-term (the seven days following film exposure) measures of intrusive thoughts were subsequently taken. The fire film was associated with an increase in short-term negative mood and this was the most consistent predictor of intrusions. Thus, change in depression and anger predicted short- and long-term intrusions respectively. Overall, individuals with greater post-film negative affect and a self-reported tendency to suppress unpleasant thoughts reported more intrusive thoughts in the short-term, than those without this combination of features. On the other hand, beliefs about being at risk from fire predicted long-term intrusions. Finally, self-rated proneness to intrusions also predicted intrusions in both the short- and long-term. Notably, no traditional questionnaire measure predicted intrusive thoughts. Causal relationships between predictors and intrusive thoughts cannot be inferred from this correlational study.

Summary

Horowitz (1986) argues that the experience of intrusive thoughts following stress is a universal human response tendency. His research suggests that individuals are differentially susceptible to intrusive thoughts following stress. However, whilst suggesting that information processing biases may be associated with cognitive vulnerability, Horowitz does not elaborate on the nature of these

biases.   One study prospectively explored predictive variables and found that thought suppression predicted short-term intrusive thoughts following stress exposure (Davies & Clark, 1998a).   There is a considerable literature on thought suppression and its effect on intrusive thought frequency.   This will be briefly discussed next.

Thought Suppression

Wegner, Schneider, Carter and White (1987; Experiments 1 and 2) first identified the paradoxical effects of thought suppression.   Participants were randomly assigned to an initial suppression or an initial expression condition. Thus, half of the participants were asked to suppress thoughts of a white bear for five minutes.   In the second phase they were asked to try to think of a white bear (expression).   In the initial expression condition an expression period was followed by a suppression period.   All participants verbalised their stream of consciousness and rang a bell whenever they had a white bear thought.   No participant was able to completely suppress white bear thoughts.   Furthermore, between subjects analyses revealed that those who initially suppressed white bear thoughts experienced significantly more white bear thoughts in the subsequent expression condition, than participants initially encouraged to express white bear thoughts.   This latter effect was labelled the rebound effect.   In the second experiment a third experimental group was given a focused distraction task (think of a red Volkswagen).   This group had a similar number of white bear thoughts in their expression phase, to those in the initial expression group, but significantly fewer than the initial suppression group.

Subsequent research has modified Wegner et al.'s (1987) original paradigm. Thus, participants in the expression condition have been instructed to simply verbalise all of their thoughts rather than try to think of the target stimuli (e.g., Davies & Clark, 1998b). Some have replicated the rebound effect of thought suppression using emotionally neutral stimuli (e.g., Clark, Ball & Pape, 1991) and unpleasant stimuli (Davies & Clark, 1998b), whilst others have failed to replicate the rebound effect using neutral stimuli (e.g., Davies & Clark, 1998b) and emotionally salient stimuli (e.g., Mathews & Milroy, 1994; Muris, Merckelbach, Van den Hout & De Jong, 1992; Roemer & Borkovec, 1994).

In contrast to Wegner et al. (1987) and Clark et al. (1991) some researchers have found support for an initial enhancement effect, and not a rebound effect. The initial enhancement effect refers to an initial increase in particular thoughts during the suppression period (Lavy & Van den Hout, 1990; Merckelbach, Muris, Van den Hout & de Jong, 1991). Initial enhancement has been found when non-clinical participants are instructed to suppress personally-relevant negative intrusive thoughts by using distraction techniques in the laboratory (Salkovskis & Campbell, 1994). This effect has also been demonstrated in naturalistic settings over longer time spans, when participants are simply asked to suppress thoughts. Here, the suppression group also reported significantly greater discomfort associated with the target thoughts than the other two groups (Trinder & Salkovskis, 1994).

Purdon (1999) concludes that in general, studies have failed to provide evidence of a rebound effect in depression (e.g., Roemer & Borkovec, 1994) and worry-related thoughts (e.g., Mathews & Milroy, 1994). Furthermore, variation in study methodologies may explain the inconsistency in results found across studies. In addition, few studies used clinical samples. Purdon argues that suppression of

thoughts with more intense, personal meaning needs investigation. She also argues that studies need to better recreate the conditions under which natural thought suppression attempts might occur. To achieve this latter objective, traumatic content films (e.g., a film of an actual office block fire) and neutral content films (e.g., a film of polar bears) have been used to induce intrusive thoughts. Davies and Clark (1998b) used suppression and 'think anything' conditions and participants verbalised film-related thoughts. Suppression of traumatic film thoughts resulted in an initial decrease in film-thought frequency compared to controls, followed by a rebound effect in the subsequent expression phase. The suppression of white bear thoughts also resulted in an immediate decrease effect but no subsequent rebound. Contrary to Trinder and Salkovskis (1994), suppression was not associated with increased unpleasantness or discomfort surrounding film thoughts for either film type. Harvey and Bryant (1998b) found a rebound effect but no initial enhancement effect for thoughts related to humorous, violent and neutral films in a non-clinical sample.

Harvey and Bryant (1998a) extended research to encompass real-life trauma-related thoughts, fulfilling Purdon's (1999) requirement of thoughts with intense, personal meaning. Acute Stress Disorder (ASD) and non-ASD participants, who had all been injured in road traffic accidents (RTAs), were randomly allocated to either a suppression or a non-suppression group. Three, five-minute phases followed where the non-suppression participants were instructed to think about anything and to press a button whenever they had a trauma-related thought. The suppression group did the same but were instructed to suppress trauma-related thoughts in the second phase. The ASD group overall reported higher anxiety, thought frequency and tendency to suppress thoughts than

the non-ASD group. Also, non-suppression ASD participants reported comparable thought suppression levels to the non-ASD participants in the suppression condition. Overall, neither ASD nor non-ASD participants were able to completely suppress their thoughts, although the non-ASD group were more successful. The rebound effect was observed in the suppression group (comprised of ASD and non-ASD participants). However, rebound effects were not separately examined in the ASD and non-ASD groups. Furthermore, there was a higher frequency of intrusive thoughts in the ASD group. It is therefore possible that the rebound effect arose from the ASD participants and not the group as a whole. Overall, Harvey and Bryant's (1998a) study provides some evidence for a rebound effect of thought suppression following trauma. However, it is unclear whether this effect occurs in ASD sufferers or non-clinical samples following real-life stress or both.

Guthrie and Bryant (2000) conducted a similar study to Harvey and Bryant (1998a). However, the suppression and non-suppression periods lasted 24 hours each. All 40 participants had been injured in traumatic events and half fulfilled ASD diagnostic criteria. ASD participants reported more intrusive thoughts than non-ASD participants across each experimental phase. Interestingly, no significant effects were found for suppression. However, this may have resulted from failure to comply with instructions, as participant ratings of attempted thought suppression did not differ significantly between the suppression and non-suppression phases. Finally, ASD participants engaged in more thought suppression than non-ASD participants, irrespective of instructions. Guthrie and Bryant suggest that this may reflect a general tendency toward avoidant coping in ASD. However, their study does not permit inference of causality. Hence, it is unclear whether ASD leads to

the use of particular thought strategies or whether they are an ASD vulnerability factor.

Thought suppression can be construed as a form of avoidant coping (Guthrie & Bryant, 2000). Other studies suggest that avoidant coping is associated with increased intrusive thoughts in RTA victims (Bryant & Harvey, 1995), adult burn survivors (Warren Lawrence, Fauerbach & Munster, 1996) and PTSD sufferers (Amir et al., 1997). Although these studies suggest that avoidant coping is associated with poor psychological outcome following extreme stress, it is unclear whether this was a pre-morbid characteristic of those who adjusted less successfully.

One prospective study investigated the relationship between prior emotional health, cognitive styles of responding to negative moods (rumination and distraction) and emotional response (depression and some PTSD symptoms) to a real-life stressor (Nolen-Hoeksema & Morrow, 1991). Ruminative response style was defined as, "the tendency to purposely focus on one's moods and the implications of these moods" (p.119). The measures had coincidentally been obtained from a large student sample 14 days prior to an earthquake.

Pre-quake depression, exposure to greater stress during the earthquake, increased ruminative tendencies and lower use of distraction accounted for 50 per cent of the variance in depression scores ten days after the earthquake. At seven weeks, only ruminative response style was predictive of depression. Similarly, pre-quake PTSD exposure to greater stress during the earthquake, increased ruminative tendencies and lower use of distraction accounted for 47 per cent of the variance in PTSD scores ten days after the earthquake. However, only pre-quake PTSD predicted PTSD symptoms at 7 weeks. A subset of the sample showed a decrease

in depressive and PTSD symptoms post-earthquake. This sample were characterised by a tendency to distract rather than ruminate on moods.

This study suggests that rumination is predictive of poor outcome. Rumination, by definition, appears to be the opposite of avoidant coping or thought suppression. Limitations of this study include the lack of validation of the PTSD measure. Thus, the PTSD symptoms were extracted from the depression measure. Furthermore, they did not form a complete assessment of PTSD symptoms.

Summary

Evidence for the paradoxical effects of attempted thought suppression is mixed. Thus, studies differ as to whether or not thought suppression produces thought rebound or initial enhancement effects. However, thought suppression has predicted a short-term measure of intrusive thoughts following an unpleasant film (Davies & Clark, 1998a) and appears to feature in adverse stress responses (e.g., ASD; Harvey & Bryant, 1998a).

Future Research Directions

An extensive literature has demonstrated negative attentional, pre-attentive and interpretative biases in clinical anxiety (e.g., Williams et al., 1988, 1997). These information-processing biases have also been shown in individuals with high trait anxiety. However, these effects have not always proved reliable (e.g., Martin et al., 1991). Recent research has used these cognitive bias measures to predict emotional vulnerability in response to stressful events (e.g., MacLeod & Hagan, 1992). Furthermore, these measures may be more accurate predictors than

traditional self-report measures. Whilst this research is extremely promising, a number of areas need to be addressed.

Firstly, predictive studies to date have retrospectively rated emotional distress in response to stress. No study has assessed current mood state. Moreover, actual measurement of change in emotional state as measured by direct comparison of pre- and post-stressor distress measures has not been made. Future research could therefore explore the relationship of pre-attentive, attentional and interpretative bias measures to currently rated emotional state and change in emotional state.

Secondly, predictive studies have not used attention deployment tasks to measure attentional bias. Such tasks are useful, as they constitute a more direct measure of attentional processes. In addition, stimuli with higher threat valence and potentially greater ecological validity (e.g., pictorial stimuli) can be incorporated into such tasks.

Thirdly, research is now focusing on the time course of attentional processes in response to threatening stimuli. Such research has suggested a vigilance-avoidance pattern over time. For example, Mogg et al. (2002) suggest that initial vigilance toward threatening information is predicted by trait anxiety. This exposure to threat increases emotional arousal and provokes avoidance in some individuals in an attempt to reduce this uncomfortable emotional arousal. Avoidance may serve to maintain anxiety states, as habituation, or the opportunity to learn that a feared stimulus is not objectively threatening, is compromised. It might be hypothesised that individuals who show avoidance of threatening information, (after initial orienting towards it), will be vulnerable to emotional distress following stressor exposure.

A fourth future research area relates to the prediction of intrusive thoughts. Whilst, intrusive thoughts are associated with emotional distress following stressful events (e.g. Davies & Clark, 1998a), individual susceptibility to such cognitive phenomena has scarcely been explored. In particular, it has been suggested that information-processing biases may underpin individual susceptibility to intrusive thoughts (Horowitz, 1986). However, anxiety disorder theories and prediction paradigms (e.g., MacLeod & Hagan, 1992; Pury, 2002) have not yet examined vulnerability to intrusive thoughts following stress exposure.

Finally, a related area is thought suppression. This literature provides mixed evidence for the notion that tendency to suppress thoughts leads to a paradoxical increase in these unwanted thoughts. No study has compared the predictive capacity of information processing bias measures with that of thought suppression questionnaires in relation to intrusive thoughts following stress.

Clinical Implications

One implication of this research lies in the measurement of emotional vulnerability. Should information processing bias measures continue to emerge as more accurate measures of emotional vulnerability, then clinical practice might seek to incorporate such measures instead of traditional questionnaire measures.

Accurate prediction of emotional and cognitive vulnerability could lead to screening prior to planned stressful experiences. A key example is in the area of physical health where individuals undergo stressful medical diagnostic and intervention procedures that sometimes have life-threatening implications. Emotionally and cognitively vulnerable individuals might be identified and offered prophylactic psychological intervention.

Conclusion

This review has considered the theoretical and research literature behind anxiety-related information processing biases. Information processing biases include pre-attentive bias, attentional bias and interpretative bias for negative information. Recent research has suggested that these measures might predict emotional vulnerability in response to stressful events more accurately than traditional questionnaire measures (e.g., MacLeod & Hagan, 1992).

The prediction of intrusive thoughts is a related but less explored area. Horowitz (1986) argues that intrusive thoughts, as well as emotional distress, form a general human response tendency to stress. This review has considered prospective research that has aimed to predict intrusive thoughts following stress (e.g., Davies & Clark, 1998a). It is argued that great benefit would be derived from applying information processing bias research to the prediction of intrusive thoughts. Thought suppression is an often-cited mechanism behind the maintenance of intrusive thoughts (e.g., Wegner et al., 1987). Research into the comparative predictive ability of thought suppression measures and information processing measures is also recommended.

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Pre-Stressor Cognitive Correlates of Post-Stress Emotional Distress and Intrusive

Thoughts

Deborah Joy

University of Southampton

Address for correspondence

Deborah Joy, Department of Psychology, University of Southampton,

Southampton SO17 1BJ, United Kingdom (Telephone: +44-2380-595321; Fax:

+44-2380-595588).

Abstract

Research based on cognitive theories of anxiety (e.g., Williams, Watts, MacLeod & Mathews, 1997) suggests that pre-attentive bias for threatening information (MacLeod & Hagan, 1992) and negative interpretative bias (e.g., Pury, 2002) are associated with emotional distress in response to stress, independently of questionnaire measures of anxiety-proneness. The present study extends the range of processing bias measures to include both initial vigilance and subsequent attentional avoidance responses to pictorial threat stimuli. The proposal that pre-stress information processing biases are associated with intrusive thoughts following stress (e.g., Horowitz, 1986) is also tested for the first time. Fifty undergraduates completed information processing (pre-attentive, attentional and interpretative bias) and questionnaire (trait anxiety, thought suppression and blood-injury fear) measures, prior to stressor exposure. The stressor comprised excerpts from a war movie and war documentaries (both containing blood-injury themes). The main findings were that (i) pre-stress attentional bias for negative information (emotional Stroop) was associated with the long-term measure of intrusive thoughts (i.e., over a one-week period), and (ii) pre-stress threat avoidance (when stimuli were presented for longer exposure durations) was associated with immediate emotional distress in response to the war movie. These findings were independent of the effects of other measures administered. Trait anxiety scores were associated with emotional distress in response to the war documentary. Trait anxiety and thought suppression were also associated with intrusive thoughts in the week following film viewing. These associations were mostly independent of the other measures although trait anxiety and thought suppression were associated. This study suggests that both information processing bias and questionnaire measures are correlates of emotional and cognitive vulnerability.

Introduction

Anxiety, depression, general negative affect (e.g., Clark & Watson, 1991) and intrusive unwanted thoughts are different aspects of distress and tend to co-occur following unpleasant experiences (e.g., Davies & Clark, 1998a). Numerous researchers have speculated that individual differences in the processing of threat information may mediate vulnerability to emotional distress following stressful experiences (e.g., MacLeod, Mathews & Tata, 1986; Williams, Watts, MacLeod & Mathews, 1988, 1997). This may also apply to intrusive thoughts (e.g., Horowitz, 1986). Nevertheless, information-processing research has only recently been applied to the prediction of emotional distress (e.g., MacLeod & Hagan, 1992) and has never been applied to the prediction of intrusive thoughts. Information-processing research incorporates novel measurement techniques that may be less prone to response-bias and social desirability effects than self-report measures. Such research is not only of theoretical importance, but also may lead to useful clinical applications. For example, improved detection of cognitive factors underlying emotional vulnerability could lead to screening prior to stressful events (e.g., medical procedures) and psychological interventions to prevent adverse and potentially chronic emotional reactions.

One influential anxiety theory proposes that highly anxious individuals allocate processing resources toward threat, whereas low anxious individuals orient processing resources away from threat, and that these biases operate at both pre-conscious and conscious levels of processing (Williams et al., 1988, 1997). Cognitive-motivational theory (Mogg & Bradley, 1998) argues that all individuals orient toward stimuli with high threat value. However, differences between high and low trait anxious individuals lie in their evaluation of threat. Thus, anxiety

vulnerable individuals will be more likely to judge a mildly unpleasant stimulus as threatening, and are consequently more likely to attend to it. These theories argue that these processes are specific to anxiety, with depression characterised by a different set of biases. According to these models, cognitive biases in anxiety play an important role in underlying vulnerability to anxiety, in particular, pre-attentive and attentional biases (Williams et al., 1997) and evaluative or interpretative biases for threat (Mogg & Bradley, 1998).

Several studies have used a computerised version of the emotional Stroop task to assess pre-attentive and attentional bias (e.g., Bradley, Mogg, Millar & White, 1995; Mogg, Bradley, Williams & Mathews, 1993). The emotional Stroop involves presentation of a series of emotionally relevant (e.g., negative) and neutral words on a background colour strip. Participants are required to ignore the word and name the background colour as quickly and accurately as possible. Attentional bias is indicated by increased reaction time latencies on emotional words relative to neutral words. Words can be presented subliminally (pre-attentive) via rapid replacement of the word with a nonsense letter string mask. Supraliminal (attentional) presentation is unmasked. It is argued that reaction time performance is slowed by selective processing of the threatening stimuli (e.g., MacLeod & Hagan, 1992).

In line with Williams et al. (1988, 1997) and Mogg and Bradley (1998), pre-attentive and attentional biases toward threatening and generally negative stimuli have been demonstrated in clinically anxious individuals (see Williams et al., 1997 for a review). There is also evidence for pre-attentive bias in non-clinical high trait anxious individuals (e.g., Bradley et al., 1995; Mogg, Bradley & Hallowell, 1994). In addition, some studies have found attentional biases in non-

clinical high trait anxiety samples (e.g., Mogg & Marden, 1990) whilst others have not (e.g., Martin, Williams & Clark, 1991). It has been suggested (e.g., MacLeod & Hagan, 1992) that non-clinically high trait anxious individuals may be able to negate this automatic processing bias by using conscious strategies, which is why the anxiety-related bias is not always found when stimuli are available to awareness. Contrary to Williams et al. (1997), evidence for avoidance of threat in pre-attentive and attentional processes in the low trait anxious is weak (e.g., Mogg, Mathews & Eysenck, 1992).

In the first information processing predictor study (MacLeod & Hagan, 1992), 31 women awaiting colposcopy completed pre-attentive and attentional threat bias measures using the emotional Stroop task, together with depression and state and trait anxiety questionnaires. Fifteen of these women were subsequently diagnosed with cervical pathology and completed a post-diagnostic mood questionnaire. The index of pre-attentive bias for threat was the only significant predictor of general emotional distress, anxiety and depression post-diagnosis. Furthermore, the predictive power of the pre-attentive bias measure remained even when initial depression, state and trait anxiety were statistically controlled. Thus, pre-attentive bias for threat was a more sensitive measure of emotional vulnerability than these questionnaires. These findings were replicated in a non-stressed, non-clinical sample (Van den Hout, Tenney, Huygens, Merckelbach & Kindt, 1995). This suggested that the findings were reliable and not an artefact of pre-colposcopy elevations in state anxiety.

Cognitive models of anxiety, (e.g., cognitive-motivational theory, Mogg & Bradley, 1998), also predict that anxiety-prone individuals will tend to interpret ambiguous information in a threatening manner. Thus, an anxious individual will

be more likely to interpret a small skin blemish as possible skin cancer than simply a harmless blemish. Research has found that high trait anxiety is associated with a negative interpretative bias in clinically anxious (Mathews, Richards & Eysenck, 1989) and non-clinical samples (Mogg, Bradley, Miller et al., 1994). Pury (2002) examined whether interpretative bias, as well as pre-attentive and attentional bias are predictive of emotional distress. Participants were University students assessed several weeks prior to examinations, (low stress period) and then re-assessed for emotional distress during the examination period. Again, pre-attentive bias (as assessed in the subliminal condition of the modified Stroop task) predicted examination period anxiety. However, contrary to MacLeod and Hagan (1992) and Van den Hout et al. (1995), pre-attentive bias did not predict depression or general distress. In addition, interpretative bias predicted negative affect during examination week. Once more, these predictive relationships remained significant when initial positive and negative affect, trait anxiety and depression were partialled out of analyses. Pury suggests that MacLeod and Hagan's participants were responding to themes of loss as well as threat (i.e., a life-threatening diagnosis). In Pury's study emotional distress was measured prior to receipt of examination results. Issues of loss (achievement below expectation) may not yet have arisen.

Whilst these correlational studies do not demonstrate causality, they strongly suggest that pre-attentive bias and interpretative bias are useful markers of emotional vulnerability. Notably, predictive studies to date have rated emotional distress retrospectively. Pre-attentive bias and interpretative bias may therefore be predicting a negative recall or reporting bias. One aim of the present study is to test the strength of pre-attentive, attentional and interpretative biases as correlates

of emotional state following exposure to stress.   A second aim is to include outcome measures of intrusive thoughts as a correlate of emotional distress.

The vigilance-avoidance hypothesis (e.g., Mogg, Mathews & Weinman, 1987) is consistent with cognitive-motivational theory (Mogg & Bradley, 1998). This proposes that anxiety is associated with initial vigilance to threat followed by subsequent avoidance of threat, which serves to minimise discomfort.   However, avoidance may maintain anxiety, as stimulus re-appraisal and habituation are prevented following sensitisation to threat.   Initial studies did not support the avoidance component of the vigilance-avoidance hypothesis (Bradley, Mogg, Falla & Hamilton, 1998; Mogg, Bradley, De Bono & Painter, 1997).   However, the threat stimuli (words and angry faces) may not have been sufficiently threatening to induce attentional avoidance (Mogg, Bradley Miles & Dixon, 2002).   Mogg et al. (2002) therefore used high-threat pictorial stimuli with blood injury themes (e.g., mutilated bodies) and found evidence for a vigilance-avoidance pattern. Initial vigilance was associated with trait anxiety, whilst subsequent avoidance was associated with blood injury fear.   This suggests that avoidance may be triggered when threat stimuli are highly aversive and relate to an individual's specific concerns.   The current study also includes measures of attentional vigilance and avoidance to assess their relationship to post-stress distress and intrusive thoughts.

A number of studies have associated thought suppression with an increase in intrusive thoughts about the to-be-suppressed stimulus.   This paradoxical effect has been shown in relation to unpleasant, or personally-relevant, negative stimuli during periods of suppression (e.g., Trinder & Salkovskis, 1994), and in periods of thought expression following an initial suppression period (Davies & Clark, 1998b).   This latter effect is termed 'thought rebound' (e.g., Wegner, Schneider,

Carter & White, 1987). Thought suppression has been examined in individuals who have experienced real-life traumatic stress. The clearest finding to emerge is that individuals who have greater difficulty adjusting to trauma, (i.e., those who develop Acute Stress Disorder; ASD), tend to suppress unpleasant thoughts compared to those who do not develop ASD (Guthrie & Bryant, 2000; Harvey & Bryant, 1998). The only prospective experimental study to examine the prediction of intrusive thoughts, found that self-reported tendency to suppress unpleasant thoughts, predicted intrusive thoughts that occurred immediately after watching an unpleasant film (Davies & Clark, 1998a). The current study includes a measure of thought suppression.

The present study also includes a paradigm developed by Davies and Clark (1998a) to study pre-stressor correlates of intrusive thoughts following stress. Thus, in line with Davies and Clark, participants completed a range of measures before being exposed to a film stressor. In the present study the film stressor consists of two short excerpts (one fiction, one documentary) showing scenes of violence and death. Participants then indicated short-term, film-related intrusive thoughts by pressing a button each time they had an intrusive thought. Long-term intrusive thoughts were measured using a diary completed over the following seven days and a questionnaire. The present study not only includes similar measures of intrusive thoughts to the Davies and Clark study, but also includes information processing bias baseline measures to correlate with reported thought frequency following stressor exposure.

In line with MacLeod and Hagan (1992) and Pury (2002), the present study uses a version of the emotional Stroop task (Bradley et al., 1995; Mogg et al., 1993). Following Pury, the homophone task is also included to measure negative

interpretative bias. This involves auditory presentation of word lists comprising negative and neutral words (e.g., Eysenck, MacLeod & Mathews, 1987). Embedded in the list are words that can be spelt in ways denoting either a negative or a neutral meaning (e.g., bury/berry). Higher proportions of negatively spelt homophones are considered indicative of a negative interpretative bias.

The present study also employs a pictorial attention deployment task similar to that used by Mogg et al. (2000), to investigate initial vigilance and subsequent avoidance of threat cues. Here picture pairs are presented on a computer screen. Critical stimulus pairs consist of a neutral picture paired with a threatening picture. Following presentation of the pictures, a probe is randomly presented in the same spatial location as one of the preceding stimuli. Participant reaction times (RTs) to press a button in response to the probe are measured. The rationale for the task is that people respond faster to visual probes that appear in an attended, rather than an unattended, region of a visual display. Thus, attentional bias toward threat is demonstrated on neutral-threat picture pair trials by faster RTs to probes located in the same position as the threat pictures compared with RTs to probes located in the position of the neutral pictures. Conversely, attentional bias away from threat is reflected by increased latencies for probes replacing threat cues compared to neutral cues. Initial orienting is assessed on short duration trials (500ms) as previous research indicates this duration is sensitive to the initial shift of attention in response to the pictures (Bradley, Mogg & Millar, 2000). Subsequent attentional bias is assessed on longer duration trials (1500ms) because this exposure time allows multiple shifts of attention between the stimuli and so it is more likely to reflect whether attention is maintained on threat pictures, or whether there is avoidance of them, subsequent to initial orienting. Finally,

questionnaire measures of thought suppression tendencies, blood injury fear (relevant to the unpleasant film content) and trait anxiety are also included as pre-stressor measures.

The main aim of the present study is to assess the association between measures taken before stressor exposure (information processing bias and questionnaire measures) and emotional distress and intrusive thoughts measured following exposure to a stressor. Following cognitive models of anxiety (Mogg & Bradley, 1998; Williams et al., 1997), emotional distress and intrusive thoughts following the film will be associated with higher levels of pre-attentive bias for negative information (masked emotional Stroop), initial attentional biases (unmasked emotional Stroop, 500 ms condition of attention deployment task), interpretative bias for negative information (homophone task) and by greater avoidance strategies (1500 ms condition of attention deployment task).

It is also expected that emotional distress and intrusive thoughts will be associated with self-report measures of trait anxiety, stressor-relevant fear (blood-injury fear) and thought suppression tendencies. However, it is hypothesised that the cognitive bias measures will be more strongly associated with emotional distress and thoughts, than these self-report measures.

Method

Participants

University Ethics Committee approval was obtained (Appendix B). Participants were recruited via an advertisement in the Psychology department and participated in exchange for credits or money. Normal colour vision was a requirement. For ethical reasons, the advertisement warned that participation

involved exposure to unpleasant pictorial and film stimuli. Participants gave written informed consent (Appendix C) and comprised 50 undergraduate volunteers (82% female). Participant ages ranged from 18-45 with a mean age of 21.04 years (SD = 4.98 years).

Materials

Information Processing Measures

1. The homophone task was based on Mathews et al. (1989). The word lists (taken from Mathews et al., 1989) contained three word categories comprising: (i) Fourteen homophones (e.g., die/dye, bury/berry); 14 threat-related words (e.g., harm, ignored) and (iii) 28 neutral words (e.g., month, blanket). Four word orders were randomly generated and were digitally recorded onto compact disc at a rate of one word every five seconds. A standard 10-word practice list of neutral words prefixed each of the four word lists. The stimulus words were played on a Panasonic RX-DS5 portable stereo CD player. The stimulus words, instruction sheet and response sheet are located in Appendix D.

2. Emotional Stroop task. There were four stimulus word categories that comprised: (i) Twenty anxiety-relevant words associated with social threat (e.g., ridicule, embarrassed); (ii) 20 anxiety-relevant words associated with physical threat (e.g., coffin, coronary); (iii) 20 depression-relevant words (e.g., discouraged, gloom) and (iv) 40 categorised neutral words that were household terms (e.g., cleaning, doorbell). Categories were matched according to word length and frequency of word occurrence in the English language and were those used by Mogg et al. (1993). All words (Appendix E) were presented in the masked condition and the unmasked condition. A Pentium II PC, 14" colour monitor,

microphone and MEL response box and software (Micro Experimental Laboratory; Schneider, 1988) were used. The MEL response box centre key was labelled 'middle'.

3. Attention deployment task. All picture stimuli were a subset of those used by Mogg et al (2002). They consisted of 32 high threat colour pictures taken from the International Affective Picture System (Lang, Bradley & Cuthbert, 1995) which depicted themes of actual human and animal mutilation, injury and disease. These pictures were paired with 32 neutral, non-threatening pictures matched as far as possible for colour, content and arousal ratings based on norms provided by Lang et al. (1995). An additional 32 pairs of neutral pictures were used as fillers. There were 64 picture pairs in total in the main task. Eighteen additional neutral picture pairs were used for practice and buffer trials. Each picture was presented on a computer screen in indexed 256 colour palette. Each picture was 86 mm x 66 mm, with a distance of 26 mm between their inner edges. The computer and response box equipment were those used for the emotional Stroop. The response box had two keys marked with : and .. to correspond with the different probe types.

Questionnaire Predictor Measures

1. The trait version of the State-Trait Anxiety Inventory (STAI-T; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983; Appendix F) is a valid and reliable measure of trait anxiety (Spielberger et al., 1983).

2. The White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994; Appendix G) is a 15-item questionnaire that measures the tendency to suppress thoughts. It has high internal consistency and good test-retest reliability. The WBSI

correlates with measures of obsessive thinking, depression, anxiety (Wegner & Zanakos, 1994) and intrusive thoughts following experimentally directed thought suppression (Muris, Merckelbach & Horselenberg, 1996).

3. The Blood Injury Fear subscale (BI-Fear; Appendix H) from the Fear Questionnaire (Marks & Mathews, 1979) is a reliable five-item scale measuring blood-injury fear.

Intrusive Thought Outcome Measures

1. Short-term intrusive thoughts measurement was based on Davies and Clark (1998a). A computer program randomly generated two-figure numbers on the computer screen at four-second intervals. This was to provide participants with a non-demanding standardised activity. Participants record film-related intrusive thought and image frequency by pressing the space bar on the computer keyboard.

2. A diary was devised to measure long-term intrusive thoughts (Appendix I). Columns were labelled according to the days of the week. The first day of the week that the participant was due to complete the diary was highlighted in bold print. Rows indicated different kinds of intrusive thoughts. These were, unpleasant thoughts and images, dreams, reminders of the film and its content (other than reminders due to keeping the diary) and strong feelings. The following instructions were printed at the top of the diary sheet:

> Please try to complete this diary every day. I would like you to record your best estimate of the number of times each day that you have experienced each of the following types of experiences as a result of watching the war films.

3. The Impact of Event Scale (IES; Horowitz, Wilner & Alvarez, 1979) intrusion subscale was modified (Appendix J). The original IES has good reliability and validity and has been used extensively to measure response to life stress and trauma. The response scale was modified from four points to seven to increase sensitivity. The amended instructions read:

Below is a list of comments made by people after unpleasant experiences. Please read each item, indicating how frequently these comments were true for you as a result of watching the war film DURING THE PAST SEVEN DAYS. If they did not occur during that time, please mark the 'not at all' column.

Emotional Distress Outcome Measures

1. Profile of Mood States (POMS; McNair, Lorr & Droppleman, 1971; Appendix K). Six items with the highest factor loadings from each of the anxiety, depression and anger subscales were selected to measure change in emotional state over time. Participants were asked to rate how they felt 'right now' on a 5 point scale (0 = not at all, 4 = extremely).

2. Post-film ratings (Appendix L). This consisted of three ratings. The first was an emotional distress rating which was a 115mm line with anchor points of 0, (not at all distressing), on the left-hand side of the line and 100, (extremely distressing), on the right-hand side of the line. The following interim anchor points (a little, moderately, and quite a bit) were spaced evenly between the extreme-value anchor points. The point at which participants marked the line was measured and a distress score was calculated by dividing the distance between the left-hand side of the line and the participant's mark, by the total length of the line. This

score was multiplied by 100 to give a percentage. A second item requested estimation of the percentage of time spent not attending to the film. This was to check whether any individuals showed high levels of film avoidance. A forced choice (yes / no) response format was provided. Finally, a third item enquired as to whether or not the participant had seen the film before. Where the response was yes, a subsequent item requested indication of how long ago the film had been seen.

Supplementary Measures

1. Screening measure. The short version of the Beck Depression Inventory (short-BDI; Beck & Beck, 1972) measures depressive symptoms and comprises 13 items from the original BDI (Beck, Ward, Mendelson, Mock & Erbaugh, 1961). It is reliable and valid (Beck & Beck, 1972) and was included for ethical reasons to exclude severely depressed individuals (scores greater than 15). The self-harm / suicide item was excluded in line with Pury (2002), leaving a 12-item version. See Appendix M for the modified questionnaire.

2. The 10-item version of the Marlowe-Crowne Social Desirability Scale (SDS; Strahan & Gerbasi, 1972; Appendix N) measures defensiveness. High defensiveness may lead to less reliable self-report. This measure was included to check whether high defensiveness affected outcome.

The Films

The first film was a four-minute segment from the opening scenes of a war film (Saving Private Ryan, Spielberg, 1998). The second film lasted for four

minutes and contained excerpts from real-life news footage from the Vietnam War (CBS Inc, 2000). Participants were seated approximately 1.8 metres from the television screen. Film excerpts were piloted on six psychology postgraduates who completed the post-film emotional distress scales. The mean distress ratings for the war film excerpt and Vietnam excerpts were 64.67 ($\underline{SD}$ = 18.31, range = 40-89) and 72 ($\underline{SD}$ = 24.50, range = 69-96) respectively. This suggested that the films were distressing to watch. The films were shown on a 20" screen Sony Trinitron combination TV/video unit.

Procedure

Each participant sat at a table approximately one metre from the computer screen in a semi-darkened room. Written informed consent was obtained and the homophone task instruction and response sheets were given to each participant. Participants were instructed to write down each word that they heard. A 10-word practice list was played followed by one of the four word orders.

The emotional Stroop task followed. Participants wore a small microphone to detect their vocal responses. Instructions were presented on the computer screen. There were 32 practice trials (16 masked and 16 unmasked) presented in random order. These were followed by 200 experimental trials presented in a new random order for each participant. Half of these trials were masked and half were unmasked. Each trial began with the 500 ms presentation of a fixation box (16 x 40 mm) in the centre of the screen. Stimulus words were presented immediately afterwards in white uppercase letters on a black background with a red, green or blue colour strip (5 x 110 mm) either side of the word.

In the unmasked condition, the stimulus word remained on screen until the participant's verbal response was detected. The colour background remained for 14 ms. In the masked condition, the word was replaced after 14ms by a length-matched nonsense letter string mask (e.g. JKDSEF) in white uppercase letters. The mask was displayed until the participant responded. The colour strip remained on screen for the same duration (14ms) in the masked and unmasked trials. Participants were requested to ignore the words and masks and name the background colour as quickly and as accurately as possible. The microphone detected verbal reaction times and the experimenter recorded participant responses (i.e., blue, green, red or no response). Participants controlled the onset of each trial by pressing the 'middle' key on the MEL response box.

An awareness check was conducted next to ensure that the Stroop masking procedure had prevented conscious awareness of the words. Six practice trials comprised three trials with words presented prior to the mask, and three with no word presented prior to the mask. Following practice, 30 trials were presented in a new random order for each participant. Fifteen contained no word prior to the mask. The remaining 15 comprised three each of social threat, physical threat and depression words and six of the categorised neutral (household) words that had appeared in the main colour-naming task. Word presentation was identical to that of the masked colour-naming trials reported above. Participants were instructed to use the response box to indicate 'yes' if they thought that there was a word prior to the mask and 'no' if they did not.

The POMS (Time One), shortened-BDI, WBSI and BI-Fear scale were then administered. These measures were not taken at the very beginning of the experiment to avoid priming the homophone and emotional Stroop tasks with

words with threat and depression-related themes (e.g., Mogg, Bradley, Miller et al., 1994). The attention deployment task then followed. Each trial commenced with the presentation of a fixation cross for 1000 ms in the centre of the screen. The picture pair was then displayed for either 500 or 1500 ms. Immediately after picture pair presentation one of the two probe types appeared (.. or :) and remained on screen until the participant responded. Inter-trial intervals varied between 500 ms and 1750 ms. An 18 trial practice was followed by the main experimental task which consisted of 192 trials. The experimental task was divided evenly into two blocks with a rest break in the middle. The two experimental trial blocks commenced with two buffer trials. Written instructions were displayed on the computer screen. Participants were instructed to place their left index finger on the top response key and their right index finger on the bottom response key of the MEL response box. Each key corresponded to one of the probe types (.. or :). Participants were instructed to respond by pressing the response key that corresponded to the displayed probe, as quickly as possible, whilst avoiding errors.

The 128 trials with threat-neutral picture pairs had an equal number of trials in combinations of conditions of exposure duration (500 ms or 1500 ms), probe type (: or ..), probe location (left or right) and threat picture location (left or right). Each threat-neutral picture pair was presented four times. To reduce task length, each of the 32 neutral picture pairs (fillers) were displayed twice with equal numbers of each probe type, probe location and exposure duration across the entire set. Trials were presented in a new random order for each participant.

Following the attention deployment task the POMS was re-administered (Time Two). The POMS was repeated at this stage to monitor possible mood change following the attention deployment task which contained unpleasant

images. Participants were then seated in front of the television and were instructed to 'imagine that you are actually witnessing the events portrayed in the film'. The fictional war film excerpt was shown first followed by the Vietnam War excerpts. After each film, participants completed the post-film distress and avoidance rating scales and recorded whether or not they had seen the films previously. Participants then completed a third POMS (Time Three).

The on-line short-term intrusion task was then administered. A 10 trial practice task was followed by the four-minute (60 trial) experimental task and the following instructions were presented on computer screen:

You will see a series of 2-figure numbers (e.g. 59). Please read each number out loud when it appears. There is no need to make any special effort to either think about or not to think about the unpleasant pictures and films you have seen. However, I would like you to press the space bar whenever a thought, image or sound related to the images comes to mind.

Each number stimulus was 7mm high and was presented for 1000 ms with a 3000 ms gap between each number.

The STAI-Trait and SDS were then administered. Finally, each participant was provided with a diary sheet and the modified IES intrusion subscale. The experimenter discussed with each participant how he or she could incorporate diary completion into his or her daily routine. Arrangements were made for the return of the diary and IES. Participants were then provided with a debrief letter (Appendix O) and advised that full debrief information (Appendix P) could be obtained when all study data had been collected.

Data Preparation

Information Processing Measures

1. Homophone task. All homophone trials with incorrect spellings were excluded (4% of trials). Of the remaining trials, a further 2% were excluded as they comprised both negative and neutral homophone spellings. Following, Mathews et al. (1989) an interpretative bias score was calculated by dividing the total number of correct negative spellings by the total number of correct homophone spellings. This figure was multiplied by 100 to give a percentage score.

2. Emotional Stroop. Data from trials with errors were discarded (less than 1%). Reaction times (RTs) ranged from 15 ms to 7304 ms. Box and whisker plots were used to identify extreme outlying RTs. Extreme values were more than three box-lengths from the 75th percentile, where the box-length is the inter-quartile range. Consequently, latencies shorter than 200 ms and greater than 1500 ms were removed from the data set. Latencies greater than two standard deviations above each participant's mean were also removed. The total mean percentage of removed outlying data was 5%.

Interference indices were calculated separately for subliminal and supraliminal negative words by subtracting each participant's mean control-word response latencies from their mean negative-word response latencies[1].

3. Attention deployment task. Data from trials with errors were discarded

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[1]This followed Bradley et al. (1995) and Mogg et al. (1993) who found anxiety-related subliminal and supraliminal biases for negative words rather than anxiety-related words alone. The combination of word categories provides a larger number of trials for statistical analysis. Similarly, in the present study, a similar pattern of results is obtained for interference indices for negative words and for indices for anxiety-related words only. The latter are not reported due to space limitations.

(mean percentage of errors was 3%). RTs ranged from 303 ms to 4345 ms. RT data were then explored using box and whisker plots and extreme outlying values were removed (latencies greater than 1200 ms). Latencies greater than two standard deviations above each participant's mean were also excluded. The mean percentage of excluded outlying data was 6%.

Attentional bias scores were calculated separately for each participant from critical trials (where a threat-neutral picture pair was presented) for the 500 ms and 1500 ms presentation conditions. The scores were obtained by subtracting the mean RT when the probe was presented in the same location as the threat picture, from the mean RT when the probe was in the same position as the neutral picture. A positive bias score suggests attentional bias toward the threatening stimulus. A negative bias score suggests avoidance of the threatening stimulus.

Normality Checks

Questionnaire, diary and information processing bias scores were inspected for normality and subjected to the One-Sample Kolmogorov-Smirnov Test ($p <$ .05). The POMS depression and anger subscales (Times One, Two and Three) were positively skewed and failed the Kolmogorov-Smirnov test. Log transformations were computed to bring the distributions of these scores closer to normality. Pearson's correlations were performed on the transformed POMS anxiety, anger and depression subscales at Time One (baseline, before probe task), Time Two (after probe task) and Time Three (after films). Correlations indicated that anxiety, anger and depression were significantly correlated with each other at each time point. The r values ranged from 0.38-0.75 (ps < .01). As a result, the raw anxiety, anger and depression data were added together to provide a negative

affect score for each time point. A negative affect change index was calculated by subtracting each participant's Time One negative affect score (baseline) from their Time Three negative affect score (post-film). The negative affect change index was inspected for normality and the index passed the One-Sample Kolmogorov-Smirnov Test ($p < .05$) indicating the distribution did not differ significantly from normality.

Results

Two participants failed to return the diary and modified IES intrusion subscale. Furthermore, short-term intrusion task data from one participant were excluded as this person misunderstood the task. As a result, analyses of these tasks contained missing data. No participant exceeded the BDI severe depression cut-off, so no exclusions were made on this basis.

Descriptive Statistics

Table 1 displays the mean scores and standard deviations for each pre-stressor and outcome measure. The mean film distress ratings suggest that participants found both films distressing (overall mean = 74%, corresponding to 'quite a bit distressing'). Likewise, the mean avoidance ratings were low, (overall mean estimate of avoidance = 8%) suggesting that participants attended to the majority of film content.

Insert Table 1 about here

The majority of participants had seen Private Ryan before (60%) and only one participant (2%) had seen the documentary footage before.

The POMS negative affect scale was analysed to assess change over time using a repeated measures ANOVA with one within-subjects variable of Time (One, Two and Three). There was significant change over time ($\underline{F}$(2,98) = 22.60, $\underline{p}$ < .01). Post hoc paired t-tests were conducted with the Bonferroni correction applied. The revised alpha level was .01. There was no significant difference between Time One (baseline, before attention deployment task) and Time Two (pre-films) negative affect ($\underline{t}$(49) = 1.67 ($\underline{p}$ > .05). The difference between Time One and Time Three (post-films) negative affect was significant ($\underline{t}$(49) = 5.11 ($\underline{p}$ < .01). The difference between Time Two and Time Three negative affect was also significant ($\underline{t}$(49) = 6.10 ($\underline{p}$ < .01)   Visual inspection of the means (Table 1) indicated that scores rose over time.

Awareness Check

The mean percentage of masked emotional Stroop trials with correct responses was 48% ($\underline{SD}$ = 10.90). Binomial tests showed that only one participant scored significantly above chance (i.e., 50%). Overall, this suggests that participants were unable to detect the words on the masked trials. Furthermore, analyses of the subliminal Stroop bias scores were re-run with the above-chance awareness check performer excluded and results were not significantly affected.

Pre-Stressor Correlates of Post-Stressor Intrusive Thoughts and Emotional Distress

Pearson's Correlations were calculated to examine relationships between questionnaire and information processing bias pre-stressor measures and intrusive thought and emotional change indices[2]. Correlations are displayed in Table 2. The supraliminal negative word index (SUPNEG in Table 2) correlated positively with the diary measure ($r = 0.31$, $p < .05$). None of the other information processing bias measures were correlated with the negative affect change measure, short-term intrusions measure, diary measure or the modified IES intrusion subscale.

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Insert Table 2 about here

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The longer duration (1500 ms) attention deployment task measure (AD1500) was significantly negatively correlated with emotional distress ratings following the first war film ($r = -0.31$, $p < .05$). This suggested that individuals who avoided the high threat pictures at 1500 ms experienced significantly greater emotional distress in response to the first film. No other information processing bias measure was significantly correlated with the emotional distress outcome measures.

Of the questionnaire measures, trait anxiety was significantly and positively correlated with the diary ($r = 0.36$, $p < .05$), modified IES intrusion subscale ($r = 0.59$, $p < .01$) and film two distress rating ($r = 0.37$, $p < .01$). The WBSI was significantly positively correlated with the diary ($r = 0.44$, $p < .01$), modified IES

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[2] People who have scored 8 or more out of the maximum score of 10 on the Social Desirability Scale have been excluded in other studies (e.g., Mogg et al., 2000). One participant scored 8 on this scale in the present study, analyses were also run with this participant excluded. The significance of the results was not affected.

intrusion subscale ($\underline{r} = 0.49$, $\underline{p} < .01$) and film one distress rating ($\underline{r} = 0.34$, $\underline{p} < .05$). The blood injury fear scale was not significantly associated with any outcome measure[3].

Partial Correlation Analyses of Significant Findings

Partial correlations were calculated[4] to examine whether the significant correlations between pre-stressor and outcome variables remained significant when the effects of other significant pre-stressor measures were controlled for (see Table 3). Thus, the supraliminal negative bias was associated with more negative thoughts on the diary, independently of trait anxiety and thought suppression. Similarly, the relationship between the longer duration (1500ms) attention deployment measure (AD1500) and emotional distress rating after the first film, remained significant whilst controlling the effects of thought suppression.

Trait anxiety and the supraliminal negative information bias index were separately partialled out of the correlation between the thought suppression questionnaire and the diary as they were different types of measure (i.e., questionnaire and information processing bias measures). The relationships remained significant with either measure partialled out of the analysis. The relationship between thought suppression and the modified IES intrusion subscale was no longer significant when trait anxiety was partialled out. Thought suppression and emotional distress following the first film remained significantly

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[3] To compare results with MacLeod and Hagan (1992) correlations were calculated between pre-stressor measures and Time Three POMS negative affect scores. The WBSI was significantly correlated with negative affect ($\underline{r} = 0.43$, $\underline{p} < .01$) and the STAI-T was significantly correlated with negative affect ($\underline{r} = 0.44$, $\underline{p} < .01$). There were no other significant results.

[4] Multiple regression analyses (enter method) revealed the same findings.

correlated when the effects of trait anxiety and the longer duration (1500 ms) attention deployment measure were separately partialled out. The relationship between trait anxiety and the modified IES intrusion subscale remained significant with thought suppression partialled out. Finally, the relationship between trait anxiety and the diary measure remained significant with the supraliminal negative information bias index partialled out, but not when thought suppression tendencies were partialled out.

Insert Table 3 about here

In sum, all but two of the main pre-stressor-outcome measure correlations remained significant when other significant variables were partialled out. The first exception was that the relationship between trait anxiety and intrusive thoughts in the week following the films was not independent of thought suppression. The second exception was that the relationship between thought suppression and the modified IES intrusion subscale was not independent of trait anxiety.

The Relationship Between Information Processing and Questionnaire Pre-Stressor Measures

Correlations between the pre-stressor information processing measures and questionnaires are displayed in Table 4. No information processing bias measure was significantly correlated with a questionnaire measure. This suggests that these measures are independent of each other.

The trait anxiety questionnaire was significantly correlated with both the blood injury fear questionnaire and the thought suppression questionnaire. There were no other significant correlations between questionnaire measures.

Insert Table 4 about here

The Relationship Between Intrusive Thought and Emotional Distress Measures

Pearsons correlations were calculated between the emotional distress and intrusive thought measures taken immediately after film exposure (Table 5). The measures were the negative affect change index, film one and film two emotional distress ratings and the short-term intrusive thoughts measure. The emotional distress measures were all significantly inter-correlated. In addition, the correlations between the short-term intrusive thought measure and the film one and film two emotional distress ratings only just failed to achieve significance. This suggested a trend for the co-occurrence of film-related intrusive thoughts and emotional distress immediately after viewing the films.

Insert Table 5 about here

Finally, the long-term intrusive thought measures (diary and modified IES intrusion subscale) were significantly correlated with each other ($r = 0.64$, $p < .01$). This suggested that they both measured a similar phenomenon.

Discussion

The present study yielded four main findings. Firstly, the emotional Stroop supraliminal negative information bias index was significantly correlated with the diary measure. This correlation remained significant when the effects of other variables that were significantly correlated with the diary (trait anxiety and thought suppression) were partialled out of analyses. This suggests that the supraliminal negative information Stroop index is associated with intrusive thoughts independently of these questionnaire measures.

This finding supports the hypothesis that attentional bias for negative information is associated with subsequent intrusive thoughts following exposure to stress. This fits with the theories of Williams et al. (1997) and Mogg and Bradley (1998) who suggest that attentional bias for negative information (including threat) is an emotional vulnerability factor. Intrusive thoughts are a cognitive correlate of emotional distress in response to stress (Horowitz, 1986).

The supraliminal negative information bias index was not significantly correlated with trait anxiety. This finding is not unusual in non-clinical samples (e.g., Martin et al., 1991). However, in spite of this, the supraliminal emotional Stroop index was significantly associated with intrusive thoughts. Consideration of the mechanisms thought to underlie emotional Stroop interference provides a clear rationale for this measure being associated with intrusive thoughts. It is often argued that emotional Stroop interference arises from the individual's inability to suppress negative material. Hence, negative words distract certain individuals' attention away from the competing colour-naming task. Likewise, it can be argued that the experience of intrusive thoughts relates to an inability to suppress negative material. This may also explain why attentional bias measured using the 500 ms

pictorial deployment task was not associated with intrusive thoughts. Unlike the emotional Stroop, the attention deployment task does not require that participants ignore any information. Instead, they are free to attend to either threat or neutral images without disadvantage to their task performance, as the probes appear after the neutral and threatening pictures with equal probability. Thus, it cannot be argued that the attention deployment task requires suppression of negative material in the same way that the emotional Stroop task does.

The second main finding was that strategic avoidance of threat was correlated with greater emotional distress following the war movie excerpt. Thus, individuals who tried to avoid pictures of mutilated bodies on the longer exposure duration (1500 ms) of the attention deployment task, were more likely to experience distress after viewing a film containing similar graphic imagery. This relationship remained significant even when the effect of thought suppression (also significantly associated with film one distress) was partialled out of the analysis. This finding suggests two possibilities. Firstly, individuals who use avoidance strategies (whether consciously or unconsciously) may be more prone to distress. Secondly, those experiencing more distress when looking at the pictures may use strategic avoidance as a mood-repair strategy. This concurs with the second part of the vigilance-avoidance hypothesis (e.g., Mogg et al., 1987) and other theories (e.g., Foa & Kozak, 1986) that suggest that avoidance perpetuates or increases distress via prevention of habituation or more realistic stimulus appraisal.

Surprisingly, the avoidance measure was not associated with distress in response to the second film. One possibility is that participants had begun to habituate to the distressing images by the time that they viewed the second film. Although the mean distress scores for the two films are similar and thus do not

appear to fit with this explanation, it can be argued that the measures of film-related distress are limited. Firstly, participants may have been affected by both demand and social desirability effects. Thus, participants may have realised that they were supposed to find the films distressing and also may not have wished to appear heartless in response to the graphic imagery of the second film (including a scene depicting a cold-blooded murder). The scales may have also been prone to a ceiling effect whereby finer points of high emotional distress were difficult to portray using the scale. In sum, the differential emotional impact of the films is not clarified by the present study.

The third main finding was that trait anxiety was significantly associated with film two distress and the longer-term intrusive thought measures (modified IES intrusion subscale and diary). The association between trait anxiety and the IES remained significant when thought suppression was partialled out. The association between trait anxiety and the diary measure of intrusive thoughts lost its significance when thought suppression was partialled out, but retained its significance when the supraliminal negative Stroop index was partialled out. Again, this finding concurs with the notion of trait anxiety as an emotional vulnerability factor. Past research (Pury, 2002) has found that trait anxiety is associated with negative affect during stressful events such as examinations. However, other research (MacLeod & Hagan, 1992; Van den Hout et al., 1995) has not found that trait anxiety is associated with anxiety, depression or general distress following real or imagined stressful events. MacLeod and Hagan's study differed from the present study in that it measured pre-attentive bias at a time when participants' state anxiety was high (prior to a stressful medical examination). The present study assessed pre-attentive bias at a time when most participants were not

likely to be under additional stress. The present study also differed from Van den Hout et al.'s study. The latter assessed emotional response estimates to a variety of hypothetical scenarios whilst the present study examined actual emotional response to a stressor (in line with Pury's, 2002, study).

A related point is that different (although theoretically related) measures were associated with the level of distress produced by the two different films. Thus, the supraliminal negative Stroop index (e.g., Mogg et al., 1993) and the State-Trait Anxiety Inventory (Spielberger et al., 1983) were significantly correlated with emotional distress ratings after viewing Saving Private Ryan and the Vietnam War news footage respectively. This suggests that some caution need be applied in drawing conclusions about the reliability of the correlation between these measures and the emotional impact of the films. However, this difference may be explained by the types of films used. The first film (the war movie) was particularly graphic and contained high blood-injury content whereas the second film (documentary) had far less graphic content. A further difference between the two films is that the first film is not real (although based on typical World War II events) whilst the latter is real. The differential effects of this are not clarified in the present study.

The fourth main finding is that the thought suppression questionnaire was associated with both of the long-term intrusive thought measures (diary and modified-IES) and film one distress. Furthermore, the correlation between the thought suppression inventory and diary remained significant even when the effects of trait anxiety and the supraliminal negative Stroop index (which were also significantly correlated with the diary) were partialled out of the analysis. Likewise, the relationship between thought suppression and distress after the first

film remained significant when trait anxiety and the supraliminal negative Stroop index were partialled out. Conversely, the relationship between the thought suppression index and the modified impact of event intrusion subscale lost its significance when the effects of trait anxiety were statistically controlled.

Overall, these findings suggest that thought suppression, which can be construed as a form of cognitive avoidance, is a strong correlate of both intrusive thoughts and emotional distress. This finding fits with previous research that has found a link between thought suppression and intrusive thoughts following stress (Davies & Clark, 1998a) and concurs with findings that those who have greater difficulty adjusting to trauma (i.e., individuals who develop Acute Stress Disorder; ASD), tend to suppress unpleasant thoughts compared to those who do not develop ASD (Guthrie & Bryant, 2000; Harvey & Bryant, 1998). As ASD includes symptoms of emotional distress as well as intrusive thoughts, it would seem that the thought suppression inventory may be of particular use in detecting individuals who are prone to adverse responses following stress. However, it should be borne in mind that the ASD studies have not assessed premorbid thought suppression tendencies. Thus, it cannot be concluded that thought suppression is a vulnerability factor for this disorder.

Of related interest, the thought suppression and trait anxiety questionnaires were significantly correlated with each other. Furthermore, some of the partial correlational analyses suggested that these two questionnaires did not always have independent effects. These two measures can be construed as theoretically related in that thought suppression (as a form of avoidance) may perpetuate anxiety. Future research might further explore this relationship.

None of the other study hypotheses were supported. Firstly, the pre-attentive negative bias measure (subliminal condition of the emotional Stroop) was not associated with emotional distress or intrusive thoughts. The lack of association between pre-attentive negative bias (including threat word stimuli) and emotional distress is particularly surprising as previous research has shown the relationship to be reliable (e.g., MacLeod & Hagan, 1992; Pury, 2002; Van den Hout et al., 1995). Also, this does not fit with predictions from theory (e.g., Williams et al., 1997). Of related interest was the finding that pre-attentive bias was not significantly correlated with trait anxiety.

There are two possible explanations for this finding. Firstly, in the present study, the colour strip on the emotional Stroop extended to the edge of each side of the screen. Previous studies (e.g., Bradley et al., 1995; Mogg et al., 1993) used a cardboard mask so that participants could only see colour close to the fixation box where the words were presented. The present study did not include such a mask, making it possible for participants to conduct the task more efficiently by attending to one side of the fixation box and thus avoiding distraction by the words and masks. However, this does not entirely fit with the theory-based finding that the supraliminal Stroop was a significant correlate of long-term intrusive thoughts. Whilst it may have been more difficult for participants to avoid attending to words presented to conscious awareness (supraliminal condition), it seems unlikely that participants switched between strategies for subliminal and supraliminal trials. A second more plausible explanation is that the subliminal Stroop condition was ineffective, as the exposure latencies may have been too brief for even subliminal processing for the majority of participants. Determination of individual subliminal perceptual thresholds may have provided a more robust and reliable measure of

pre-attentive bias for negative information (e.g., Lundh, Wikstrom, Westerlund & Ost (1999).

Contrary to theory (e.g., Williams et al., 1997), attentional bias measured using the emotional Stroop and 500 ms pictorial attention deployment task, was not associated with emotional response to stress. This counter-theoretical finding had been found in other studies (e.g., MacLeod & Hagan, 1992; Pury, 2002; Van den Hout et al., 1995) and is consistent with other research on attentional bias in non-clinical samples (Martin et al., 1991). Thus, Martin et al. suggest that some non-clinically high trait anxious individuals may be able to strategically override attentional bias for threat. An alternative explanation for this inconsistency relates to a possible weakness in the psychometric properties of the emotional Stroop task. Kindt, Bierman and Brosschot (1996) found poor convergent validity for the supraliminal emotional Stroop task and the card version of the Stroop in a non-clinical undergraduate sample. They also found that both versions only had moderate test-retest reliability. It is therefore possible that the emotional Stroop task is unreliable in non-clinical samples such as those used in the majority of emotional vulnerability studies (e.g., MacLeod & Hagan, 1992; Pury, 2002; Van den Hout et al., 1995).

The homophone task interpretative bias index was not associated with emotional distress or intrusive thoughts. The former finding runs contrary to theory (e.g., Mogg & Bradley, 1998) and previous research (Pury, 2002). However, a number of factors might explain this lack of association. Firstly, the emotional distress outcome measures in the present study differed to those used by Pury. The present study incorporated a negative affect change index (comprising anger, anxiety and depression scores), as well as a visual analogue scale for rating

post-film emotional distress. Pury found the homophone task was associated with general negative affect measured by the Positive and Negative Affect Scale (PANAS; Watson, Clark & Tellegen, 1988). General negative affect is composed of factor analytically derived variables that are common to both anxiety and depression (e.g., Clark & Watson, 1991). The measures used in the present study were more general and may have not been sufficiently sensitive to achieve the same result as Pury.

The homophone task is also prone to a number of criticisms. MacLeod and Cohen (1993) point out that it can be affected by response bias. Thus, participants might consider both word meanings but select which to report. A further difficulty with this task is that of spelling ability. Incorrect spellings had to be excluded as it was not clear in such cases, which variant of the word was being used. Given that there were only 14 homophones in the entire task, such exclusions may have reduced task sensitivity. Furthermore, participants who were less confident in their spelling ability may have opted to record the word version that they could spell most easily.

The present study used the homophone task in an attempt to replicate the findings of Pury (2002). However, other measures of interpretative bias exist (for example, the Rapid Serial Visual Presentation (RSVP) technique, MacLeod & Cohen, 1993) that are less prone to response bias effects and do not depend on spelling ability. Future studies investigating interpretative bias as a correlate of emotional and cognitive vulnerability might use such a method.

Finally, the blood injury fear scale was not significantly associated with any outcome measure. However, this is a highly specific measure and to better test the strength of association between this measure and the outcome measures it

would be necessary to ensure that the sample contained sufficient numbers of individuals with high and low blood injury fear.

None of the measures in the present study were significantly correlated with intrusive thoughts immediately after the film. Davies and Clark (1998a) conducted the only other intrusive thought predictor study using this measure. They found that thought suppression (measured by a visual analogue scale) and some other non-cognitive predictors, were significantly correlated with intrusive thoughts immediately after viewing a stressful film. The present study's failure to replicate this and other theory-driven predictions suggests that this measure is unreliable. Further evaluation of the short-term intrusive thought measure would be advisable. Furthermore, future studies might use alternative measures of thought frequency such as post-film thought verbalisation (e.g., Horowitz, Becker & Moskowitz, 1971).

No pre-stressor measure was significantly correlated with the POMS negative affect change index suggesting that this measure is not sufficiently sensitive. On the other hand, the post-film emotional distress rating scales were associated with some of the pre-stressor measures. It is possible that the breadth of the question 'How distressing did you find the film?' allowed for a more individualised interpretation of distress than did rating of specific emotion words in the POMS scales.

Other factors might explain why the current study differed to previous studies testing associations between cognitive bias measures and distress following stressor exposure. Previous studies have used real-life (MacLeod & Hagan, 1992; Pury, 2002) and imagined stressors (Van den Hout et al., 1995). These stressors would have all had some personal relevance to the participants. On the other hand,

the current study used war films. Such films are likely to lack personal relevance for most people in this country of the age group studied. Furthermore, television is a medium that most of the participants would be familiar with. Participants may have been more desensitised to images presented in this form, or they may have developed coping strategies specific to this medium. These strategies may not be those used to respond to real-life stressors.

This was the first study to use a modified version of the IES intrusion subscale for such purposes. The use of such a measure seemed justified as it correlated with the diary measure. However, the diary measure may have been more sensitive as it was associated with more of the hypothesised pre-stressor variables.

The results of this study could lead to more detailed elaboration of theory relating to emotional and cognitive vulnerability. This study suggests that cognitive pre-stressor variables (supraliminal Stroop, difficulty suppressing negative information) relate to subsequent cognitive vulnerability following stress. This has not yet been explicitly stated in theory.

Overall, the present study does not clearly show that information processing measures taken prior to stressor exposure are more strongly associated with emotional distress and intrusive thoughts following stress than traditional questionnaire measures. Where cognitive bias measures (e.g., attentional avoidance over longer exposure durations and supraliminal Stroop) were associated with some of the outcome measures, these outcome measures (e.g., diary intrusive thoughts and film one distress) were also associated with some of the questionnaire measures. In either case, the associations with both cognitive bias and questionnaire measures remained significant when other variables were

partialled out. Furthermore, this study did not reliably replicate the findings of other emotional vulnerability research (e.g., MacLeod & Hagan, 1992) suggesting that improvements may need to be made to some of the information processing measures. Moreover, many of the theory-driven predictions in the present study were not supported suggesting that results should be interpreted with some caution until replication is achieved. Finally, whilst some of the correlations achieved statistical significance, the majority only accounted for a small proportion of the variance. These findings may therefore have little meaning in clinical terms.

Future research should firstly use improved measures. In the current study it is suggested that the subliminal Stroop could benefit from individualised thresholds. Also, alternative measurement of interpretative bias, emotional distress and intrusive thoughts might be preferable. The use of a stressor that is more relevant to participants' lives might also enhance future study validity as well as providing greater emotional and cognitive impact. Finally, further research is needed to refine information-processing bias measures and test their value as predictors of emotional and cognitive vulnerability before they are used in clinical practice.

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Table 1

Mean Information Processing Bias and Questionnaire Scores

	M	SD
Pre-stressor measures		
Subliminal negative Stroop bias index[a]	-2.35	15.45
Supraliminal negative Stroop bias index[a]	0.69	16.72
Attention deployment threat index (500ms)[a]	11.71	27.27
Attention deployment threat index (1500ms)[a]	- 6.10	31.40
Homophone interpretative bias index[a]	83.92	10.69
STAI-Trait Anxiety[a]	43.70	9.50
WBSI[a]	47.16	11.69
Blood Injury Fear Scale[a]	12.92	6.80
Intrusive thought outcome measures		
Short-term intrusion task[b]	16.36	14.34
Diary[c]	13.79	14.32
Modified IES Intrusion subscale[c]	9.50	7.00
Emotional distress change measures		
POMS negative affect (time one)[a]	7.94	6.67
POMS negative affect (time two)[a]	9.42	9.76
POMS negative affect (time three)[a]	14.22	11.90
POMS negative affect change index [a]	6.28	8.70
Film distress and avoidance ratings		
Film one distress[a]	70.06	24.49
Film one avoidance[a]	9.48	11.74
Film two distress[a]	78.84	20.02
Film two avoidance[a]	5.72	7.68

Note. STAI = State-Trait Anxiety Inventory; WBSI = White Bear Suppression Inventory; POMS = Profile of Mood States; IES = Impact of Event Scale.
[a]n = 50. [b]n = 49. [c]n = 48.

Table 2

Pearson Correlations Between Pre-Stressor Measures and Intrusive Thought and Emotional Distress Outcome Measures (r values)

	INT[a]	DIARY[b]	IES[b]	POMS negative affect change[c]	Film 1 distress[c]	Film 2 distress[c]
SUBNEG	-0.13	-0.09	-0.04	0.14	0.01	0.04
SUPNEG	-0.20	0.31*	0.18	0.11	-0.10	-0.11
AD500	-0.09	-0.06	-0.21	-0.24	-0.05	-0.06
AD1500	-0.08	-0.20	-0.19	-0.11	-0.31*	-0.14
HOM	-0.14	0.13	0.21	0.12	0.01	0.13
STAI-T	0.25	0.36*	0.59**	0.27	0.27	0.37**
WBSI	0.23	0.44**	0.49**	0.25	0.34*	0.28
BIFEAR	0.21	0.26	0.19	0.10	0.03	0.22

Note. SUBNEG = Subliminal negative Stroop bias; SUPNEG = Supraliminal negative Stroop bias; AD500 = Attention deployment threat index (500 ms); AD1500 = Attention deployment threat avoidance index (1500 ms); HOM = Homophone interpretative bias index; STAI-T = State Trait Anxiety Inventory (Trait subscale); WBSI = White Bear Suppression Inventory; BIFEAR = Blood Injury Fear Scale; INT = Short-term intrusion task; DIARY = Diary measure; IES = Modified Impact of Event Intrusion subscale; POMS = Profile of Mood States. [a]n = 49. [b]n = 48. [c]n = 50.

* $p < .05$. (two-tailed). ** $p < .01$. (two-tailed)

Table 3

Partial Correlations Between Significant Pre-Stressor and Outcome Variables

Pre-stressor	Outcome variable	R	Variables partialled out
Cognitive bias			
SUPNEG	Diary[a]	0.42**	WBSI, STAI-T
AD1500	Film one distress[b]	-0.31*	WBSI
Self report			
WBSI	Diary[a]	0.29*	STAI-T
WBSI	Diary[a]	0.51**	SUPNEG
WBSI	IES[a]	0.21	STAI-T
WBSI	Film one distress[b]	0.34*	STAI-T
WBSI	Film one distress[b]	0.34*	AD1500
STAI-T	IES[a]	0.43*	WBSI
STAI-T	Diary[a]	0.40**	SUPNEG
STAI-T	Diary[a]	0.14	WBSI

Note. SUPNEG = Supraliminal negative Stroop bias; AD1500 = Attention deployment threat avoidance index (1500 ms); WBSI = White Bear Suppression Inventory; STAI-T = State Trait Anxiety Inventory (Trait subscale); IES = Modified Impact of Event Intrusion subscale.

[a]n = 48. [b]n = 50.

* p < .05. (two-tailed). ** p < .01. (two-tailed).

Table 4

Pearson Correlations Between Questionnaire and Information Processing Pre-Stressor Measures (n = 50)

	SUBNEG	SUPNEG	AD500	AD1500	HOM	STAI-T	WBSI
SUBNEG	-	-	-	-	-	-	-
SUPNEG	-0.11	-	-	-	-	-	-
AD500	-0.10	0.08	-	-	-	-	-
AD1500	-0.04	-0.18	0.09	-	-	-	-
HOM	0.11	0.11	-0.11	0.03	-	-	-
STAI-T	0.06	-0.08	-0.02	-0.07	0.00	-	-
WBSI	0.05	-0.10	-0.12	-0.06	0.22	0.60**	-
BIFEAR	-0.08	0.01	-0.11	-0.03	-0.15	0.35*	0.08

Note. SUBNEG = Subliminal negative Stroop bias; SUPNEG = Supraliminal negative Stroop bias; AD500 = Attention deployment threat index (500 ms); AD1500 = Attention deployment threat index (1500 ms); HOM = Homophone interpretative bias index; STAI-T = State Trait Anxiety Inventory; WBSI = White Bear Suppression Inventory; BIFEAR = Blood Injury Fear Scale.

* $p < .05$. (two-tailed). ** $p<.01$. (two-tailed).

Table 5

Pearson Correlations between the Emotional Distress and Intrusive Thought Outcome Measures Taken Immediately After Viewing the Films

	INT[a]	Film one distress[b]	Film two distress[b]
NEGAFF	0.19	0.45**	0.44**
Film one distress	$0.27^{\dagger}$	-	-
Film two distress	$0.26^{\dagger\dagger}$	0.67**	-

Note. NEGAFF = Negative affect change index; INT = short-term intrusion task.

[a]n = 49. [b]n = 50.

† p = .06. (two-tailed). †† p = .07. (two-tailed).

* p < .05. (two-tailed). ** p < .01. (two-tailed).

List of Appendices

Appendix A

Notes to contributors – Cognition and Emotion

COGNITION AND EMOTION

Aims and Scope *of Cognition and Emotion*

Cognition and Emotion is devoted to the study of emotion, especially to those aspects of emotion related to mental processes. The Journal aims to bring together work on emotion undertaken by researchers in cognitive, social, clinical, and developmental psychology, neuropsychology, and cognitive science; it also welcomes psychologically orientated submissions from those in philosophy, the humanities, anthropology, sociology, and other social sciences. Examples of topics appropriate for the Journal include emotional appraisals; effects of emotion or mood on cognition and motivation; the nature of emotional experience; self-regulation of emotion or mood; social, historical, or cultural aspects of emotion; and the nature of particular emotions or emotionality in general. *Cognition and Emotion* publishes theoretical papers, original research reports and literature reviews. Submissions can be considered for expedited publication as brief reports.

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Appendix B

Southampton University ethical approval
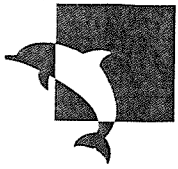
31 October 2001

Deborah Joy
Department of Clinical Psychology
University of Southampton
Highfield, Southampton
SO17 1BJ

Dear Deborah,

Re: **Information processing predictors of analogue post-traumatic intrusive thoughts and emotions**

The above titled application - which was recently submitted to the departmental ethics committee, has now been given approval.

Should you require any further information, please do not hesitate in contacting me on 023 8059 3995. Please quote reference CLIN/2001/01.

Yours sincerely,

Kathryn Smith
Ethical Secretary

cc. Janet Turner

Appendix C

Information sheet and consent form

Information Sheet

My name is Deborah Joy. I am a Trainee Clinical Psychologist based at the University of Southampton.

I am requesting your participation in a study looking at the relationship between thought processes such as attention and concentration. This will involve you completing some questionnaires, carrying out some simple computer tasks and watching two short films.

All of the information that you provide will be kept confidential. Information that you give and any results that are reported from this study will not include your name or any other identifying characteristics.

The films are about war. One carries a 15 certificate and the other contains images equivalent to those broadcast on news programmes. They contain some images that some individuals may find distressing.

Your participation is voluntary and you may withdraw your participation at any time without giving a reason. If you have any questions please ask them now.

Signature   Date

Name

Statement of Consent

I _____have read the above informed consent form.
(*Participant's name*)

I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. I understand that data collected as part of this research project will be treated confidentially, and that published results of this research project will maintain my confidentiality. In signing this consent letter, I am not waiving my legal claims, rights, or remedies. A copy of this consent letter is offered to me.

(Circle Yes or No)

I give consent to participate in the above study.   Yes   No

Signature   Date

Name (*Participant's name*)

I understand that if I have questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 80593995.

Appendix D

Homophone stimulus words, instructions and response sheet

Practice	Neutral	Threat	Homophone
Pencil	Month	Harm	Die/Dye
Shoe	Blanket	Hazard	Slay/Sleigh
Telephone	Survey	Disabled	Foul/Fowl
Plant	Deed	Disease	Moan/Mown
Fabric	Mobile	Inferior	Groan/Grown
Coffee	Signet	Insecure	Liar/Lyre
Salt	Flannel	Infirm	Bore/Boar
Window	Rake	Mortality	Pain/Pane
Bird	Regard	Scorned	Weak/Week
Caravan	Poodle	Inquest	Skull/Scull
	Avenue	Ignored	Tease/Teas
	Playmate	Hearse	Bury/Berry
	Spade	Foolish	Guilt/Gilt
	Clog	Opposed	Flu/Flew
	Radish		
	Putty		
	Stag		
	Beads		
	Melon		
	Rabbit		
	Tadpole		
	Curve		
	Skater		
	Willow		
	Petal		
	Mint		
	Silver		
	Trades		

Instruction Sheet

You will hear a series of words presented at five second intervals. Please write down each word that you hear on the sheet provided.

There is a practice task first to help you get used to the task.

Please ask any questions now or at the end of the practice task. The entire task will take five minutes.

Thank you for your help.

Practice Task

1_____

2_____

3_____

4_____

5_____

6_____

7_____

8_____

9_____

10_____

Experimental Task

1_____

2_____

3_____

4_____

5_____

6_____

7_____

8_____

9_____

10_____

11_____

12_____

13_____

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51_____

52_____

53_____

54_____

55_____

56_____

End of Task

Appendix E

Emotional Stroop stimulus words

Social Threat	Physical Threat	Depression	Categorised Neutral
Despised	Assaulted	Blame	Bathroom
Disgrace	Bleeding	Desolate	Carpet
Embarrassed	Cancer	Despair	Cutlery
Hostile	Collapse	Desperate	Domestic
Insulted	Emergency	Discouraged	Doorbell
Offended	Fatal	Dismal	Duster
Ridicule	Harmed	Drained	Garage
Shy	Infectious	Dread	Groceries
Silly	Injured	Gloom	Indoor
Unfriendly	Killer	Grief	Linoleum
Blunder	Accident	Helpless	Mattress
Foolish	Attacked	Hopeless	Properties
Hated	Coffin	Melancholy	Radiator
Idiotic	Coronary	Misery	Scrubbed
Intimidated	Funeral	Mournful	Seated
Scorn	Hazard	Pitiful	Shelf
Sneer	Incurable	Sadness	Staircase
Timid	Lethal	Sorrow	Tapestry
Unpopular	Mutilated	Tormented	Teacup
Useless	Unwell	Wretched	Toaster
			Bucket
			Bungalow
			Cleaning
			Cooking
			Cupboard
			Drawer
			Flannel
			Floorboards
			Heater
			Mantelpiece
			Matchbox
			Polished
			Recipe
			Sponge
			Spoon
			Tablecloth
			Tenant
			Toothbrush
			Torch
			Ventilated

Appendix F

State Trait Anxiety Inventory – Trait version

SELF-EVALUATION QUESTIONNAIRE
STAI Form Y-2

Name: _____ Date: _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

ALMOST NEVER   SOMETIMES   OFTEN   ALMOST ALWAYS

		1	2	3	4
21.	I feel pleasant	①	②	③	④
22.	I feel nervous and restless	①	②	③	④
23.	I feel satisfied with myself	①	②	③	④
24.	I wish I could be as happy as others seem to be	①	②	③	④
25.	I feel like a failure	①	②	③	④
26.	I feel rested	①	②	③	④
27.	I am "calm, cool, and collected"	①	②	③	④
28.	I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29.	I worry too much over something that really doesn't matter	①	②	③	④
30.	I am happy	①	②	③	④
31.	I have disturbing thoughts	①	②	③	④
32.	I lack self-confidence	①	②	③	④
33.	I feel secure	①	②	③	④
34.	I make decisions easily	①	②	③	④
35.	I feel inadequate	①	②	③	④
36.	I am content	①	②	③	④
37.	Some unimportant thought runs through my mind and bothers me	①	②	③	④
38.	I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39.	I am a steady person	①	②	③	④
40.	I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

Appendix G

White Bear Suppression Inventory (Wegner & Zanakos, 1994)

WBSI

Please circle the number that most closely corresponds to the extent to which you agree or disagree with the following statements.

1. There are things I prefer not to think about.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

2. Sometimes I wonder why I have the thoughts I do.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

3. I have thoughts that I cannot stop.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

4. There are images that come to mind that I cannot erase.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

5. My thoughts frequently return to one idea.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

6. I wish I could stop thinking of certain things.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

7. Sometimes my mind races so fast I wish I could stop it.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

8. I always try to put problems out of mind.

| 1 | 2 | 3 | 4 | 5 |
| Strongly Disagree | | | | Strongly Agree |

9. There are thoughts that keep jumping into my head.

1	2	3	4	5
Strongly Disagree				Strongly Agree

10. Sometimes I stay busy just to keep thoughts from intruding on my mind.

1	2	3	4	5
Strongly Disagree				Strongly Agree

11. There are things that I try not to think about.

1	2	3	4	5
Strongly Disagree				Strongly Agree

12. Sometimes I really wish I could stop thinking.

1	2	3	4	5
Strongly Disagree				Strongly Agree

13. I often do things to distract myself from my thoughts.

1	2	3	4	5
Strongly Disagree				Strongly Agree

14. I often have thoughts that I try to avoid.

1	2	3	4	5
Strongly Disagree				Strongly Agree

15. There are many thoughts that I have that I don't tell anyone.

1	2	3	4	5
Strongly Disagree				Strongly Agree

Thank you for completing this questionnaire.

Appendix H

Blood Injury Fear Scale

FEAR QUESTIONNAIRE

Choose a number from the scale below to show how much you would avoid each of the situations listed below because of fear or other unpleasant feelings. Then write the number you chose in the box opposite each situation.

0	1	2	3	4	5	6	7	8

Would not avoid it	Slightly avoid it	Definitely avoid it	Markedly avoid it	Always avoid it

Injections or minor surgery.................................. ☐

Hospitals... ☐

Sight of blood... ☐

Thought of injury or illness................................ ☐

Going to the dentist.. ☐

Appendix I

Diary

Please try to complete this diary every day. I would like you to record your best estimate of the number of times each day that you have experienced each of the following types of experience as a result of watching the war films.

	Monday (Start here)	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Unpleasant thoughts or images.							
Dreams.							
Been reminded of the film or its content (apart from being reminded by the need to complete the diary).							
Strong feeling.							

Thank you for completing this form.

Appendix J

Modified Impact of Event Scale intrusion subscale

Modified Impact of Event Scale

Below is a list of comments made by people after unpleasant experiences. Please read each item, indicating how frequently these comments were true for you as a result of watching the war films DURING THE PAST SEVEN DAYS. If they did not occur during that time, please mark the 'not at all' column.

	Not at all		Very Occasionally		A few times		Very Often
I had waves of strong feelings about it.	0	1	2	3	4	5	6
Other things made me think about it.	0	1	2	3	4	5	6
I thought about it when I didn't mean to.	0	1	2	3	4	5	6
Pictures about it popped into my mind.	0	1	2	3	4	5	6
Reminders brought back feelings about it.	0	1	2	3	4	5	6
I had trouble falling asleep or staying asleep, because of pictures or thoughts about it that came into my mind.	0	1	2	3	4	5	6
I had dreams about it.	0	1	2	3	4	5	6

Appendix K

Profile of Mood States

Below is a list of words that describe feelings people have. Please read each word carefully.
Circle one of the numbers beside each word to indicate HOW YOU FEEL RIGHT NOW,
THAT IS AT THIS MOMENT.

	Not at all	A little	Moderately	Quite a bit	Extremely
Hopeless	0	1	2	3	4
Restless	0	1	2	3	4
Resentful	0	1	2	3	4
Tense	0	1	2	3	4
Spiteful	0	1	2	3	4
Miserable	0	1	2	3	4
Lonely	0	1	2	3	4
Worthless	0	1	2	3	4
Anxious	0	1	2	3	4
Annoyed	0	1	2	3	4
On edge	0	1	2	3	4
Sad	0	1	2	3	4
Furious	0	1	2	3	4
Uneasy	0	1	2	3	4
Grouchy	0	1	2	3	4
Discouraged	0	1	2	3	4
Nervous	0	1	2	3	4
Angry	0	1	2	3	4

Thank you for your help.

Appendix L

Post-film distress rating form

1. Please rate how distressing you found this film excerpt by putting a mark on the line, as appropriate.

0_____100

Not at all   A little   Moderately   Quite   Extremely
distressing   a bit   distressing

2. Please estimate the percentage of time that you were **not** attending to the film.

_____%

3. Have you seen this film before?   **YES / NO**   (Please circle).

4. If yes, when.

Thank you for your help.

Appendix M

Shortened Beck Depression Inventory with suicide item removed

Instructions: This is a questionnaire. On the questionnaire are groups of statements. Please read the entire group of statements in each category. Then pick out the one statement in that group which best describes the way you feel today, that is, *right now!* Circle the number beside the statement you have chosen. If several statements in the group seem to apply equally well, circle each one.

Be sure to read the statements in each group before making your choice.

A.
3   I am so sad or unhappy that I can't stand it.
2   I am blue or sad all the time and I can't snap out of it.
1   I feel sad or blue.
0   I do not feel sad.

B.
3   I feel that the future is hopeless and that things cannot improve.
2   I feel I have nothing to look forward to.
1   I feel discouraged about the future.
0   I am not particularly pessimistic or discouraged about the future.

C.
3   I feel I am a complete failure as a person.
2   As I look back on my life, all I can see is a lot of failures.
1   I feel I have failed more than the average person.
0   I do not feel like a failure.

D.
3   I am dissatisfied with everything.
2   I don't get satisfaction out of anything anymore.
1   I don't enjoy things the way I used to.
0   I am not particularly dissatisfied.

E.
3   I feel as though I am very bad or worthless.
2   I feel quite guilty.
1   I feel bad or unworthy a good part of the time.
0   I don't feel particularly guilty.

F.
3   I hate myself.
2   I am disgusted with myself.
1   I am disappointed in myself.
0   I don't feel disappointed in myself.

G.
3   I have lost all of my interest in other people and don't care about them at all.
2   I have lost most of my interest in other people and have little feeling for them.
1   I am less interested in other people than I used to be.
0   I have not lost interest in other people.

H.

3   I can't make any decisions at all anymore.

2   I have great difficulty in making decisions.

1   I try to put off making decisions.

0   I make decisions about as well as ever.

I

3   I feel that I am ugly or repulsive-looking.

2   I feel that there are permanent changes in my appearance and they make me look unattractive.

1   I am worried that I am looking old or unattractive.

0   I don't feel that I look any worse than I used to.

J

3   I can't do any work at all.

2   I have to push myself very hard to do anything.

1   It takes extra effort to get started at doing something.

0   I can work about as well as before.

K

3   I get too tired to do anything.

2   I get tired from doing anything.

1   I get tired more easily than I used to.

0   I don't get any more tired than usual.

L

3   I have no appetite at all anymore.

2   My appetite is much worse now.

1   My appetite is not as good as it used to be.

0   My appetite is no worse than usual.

Thank you for your help.

Appendix N

Social Desirability Scale

PERSONAL REACTION INVENTORY

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is True or False as it pertains to you personally, then circle that answer.

(1) I like to gossip at times.   TRUE   FALSE

(2) There have been occasions when I took   TRUE   FALSE
     advantage of someone.

(3) I am always willing to admit it when I   TRUE   FALSE
     make a mistake.

(4) I always try to practice what I preach.   TRUE   FALSE

(5) I sometimes try to get even with people   TRUE   FALSE
     rather than forgive and forget.

(6) At times, I have really insisted on   TRUE   FALSE
     having things my own way.

(7) There have been occasions when I felt   TRUE   FALSE
     like smashing things.

(8) I never resent being asked to return a   TRUE   FALSE
     favour.

(9) I have never been irritated when people   TRUE   FALSE
     expressed ideas very different from my
     own.

(10) I have never deliberately said something   TRUE   FALSE
     that hurt someone's feelings.

Appendix O

Short debrief form

Thank you for taking part in this study.

If you have any concerns following your participation in this study, please contact me either by email (dlaj@soton.ac.uk) or by leaving a message at the Department of Clinical Psychology (tel: 023 80 595321).

I will be happy to supply full details about the purpose of the study as soon as the results are in. It is estimated that the results will be ready in the next couple of months. Please contact me at this time using the above contact details.

Yours sincerely

Deborah Joy
Trainee Clinical Psychologist

Appendix P

Long debrief form

Debriefing

Title: Information Processing Predictors of Analogue Intrusive Thoughts and Emotions

Researcher: Deborah Joy

Contact details: e.mail – <u>dlaj@soton.ac.uk</u>
                         Telephone:.07876 765661 (day)

This study aims to examine the relationship between individual information processing styles and the experience of intrusive thoughts and negative emotions following exposure to unpleasant events. It is quite natural to experience these intrusive thoughts and emotions. For example, it is common to experience unwanted thoughts and image after watching a sad movie. These thoughts and images may also be associated with negative emotions such as sadness and anxiety. The intensity of these thoughts and images naturally diminishes and ceases over time, depending on the specific circumstances.

The videos that you saw during the experiment are unpleasant and may produce negative emotions and intrusive thoughts and images in some individuals. These are quite normal and should have faded gradually.

Past research suggests that some individuals may be more vulnerable to the experience of emotional distress following unpleasant experiences than others. Research also shows that some individuals demonstrate a bias toward attending to threatening or unpleasant information. It has been suggested that this bias occurs relatively automatically and predicts the experience of emotional distress after stressful events (Macleod and Hagan, 1992). Until now, research has not been conducted to see if this also applies to intrusive thoughts.

If you require any further information, or if you have any concerns about the study, please contact me (Debbie Joy) on the contact details outlined above.

Thank you very much for your participation in this study.