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Information Processing Biases in Social Anxiety and Social Phobia

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Abstract

The current thesis is comprised of a review of the literature pertaining to information processing biases in social anxiety, and an empirical paper investigating the predictions made regarding one of these biases, a bias in the focus of external attention.

Following a general introduction to social phobia, the literature review explores cognitive models of anxiety and specific cognitive models of social anxiety and social phobia. Due to a wealth of previous research, the body of the review is focused on empirical research that has investigated one specific information processing bias in social anxiety, the allocation of attentional resources. Based on a critical evaluation of the current evidence base, unanswered questions in the literature are identified and suggestions for future research are proposed.

The empirical paper focuses on the allocation of external attention in social anxiety, using eye movement technology. The study compares individuals high and low in social anxiety regarding attentional biases and the potential mechanisms underlying these biases. Results of the study indicate that individuals high in social anxiety have greater attentional biases towards emotional faces, and that an important mechanism underlying these biases may be a difficulty disengaging from emotional stimuli. The results of the current study are discussed in relation to current theoretical models and empirical research, and clinical implications of the study are considered.

Keywords: Social Anxiety / Social Phobia, Attention Bias, Interpretation Bias

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Information Processing Biases in Social Anxiety and Social Phobia: A Critical

Review of Cognitive Models and Empirical Research

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(see Appendix A for 'Guide for Authors')

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Abstract

Social phobia is a common and debilitating mental health problem, which has been reported to significantly impact on individuals' quality of life. Cognitive models of social phobia predict that individuals with the disorder exhibit specific biases in the manner in which they process information in social situations. It has been predicted that individuals show enhanced self-focused attention and reduced processing of external cues, a tendency to focus this decreased external attention towards threatening cues, and a tendency to interpret ambiguous social information negatively.

Due to the theoretical and clinical importance of developing our understanding of social phobia, research studies have empirically tested the predictions made by cognitive models. The studies presented in the literature generally provide evidence supporting the predictions made by the cognitive models, but discrepancies exist and unresolved questions remain. It is important that future research continues to explore these information processing biases in social anxiety and social phobia, in order to increase our understanding of the disorder and aid in the development of more effective interventions.

Keywords: Social Anxiety / Social Phobia, Attention Bias, Cognitive Bias

1. Introduction

The aim of this paper is to review existing theories and research evidence relating to information processing biases in social anxiety and social phobia. The review will specifically focus on biases in attention, and will critically evaluate the methods used to investigate the predictions made by the cognitive models.

The review will begin with an overview and general introduction into social phobia, including diagnostic criteria, prevalence and the psychosocial impact of the disorder. Cognitive models of anxiety and specific cognitive models of social anxiety and social phobia will then be discussed, and a thorough review of empirical research examining the attentional biases predicted by these models will be presented. Although cognitive models predict biases in both attention and interpretation, only attention biases will be reviewed in detail due to the scope of the current review. The review will conclude with suggestions for future research, based partly on unresolved questions resulting from discrepancies within the current evidence base.

References for this review were compiled following a comprehensive literature search, using the Web of Knowledge / Web of Science database. Search terms included 'social phobia and cognitive models', 'cognition and social phobia', 'cognitive biases and social phobia', and 'attention and social phobia'. All of the listed searches were also conducted using the term 'social anxiety' instead of 'social phobia'. Other papers were also reviewed, based on references cited by the research papers identified in the literature search.

2. An Overview of Social Phobia

Social phobia is a mental health problem characterised by a marked and persistent fear of social or performance situations in which embarrassment may occur (American Psychiatric Association, 1994). As exposure to these situations provokes an anxiety response, individuals with social phobia either avoid their feared situations or endure them with dread. According to DSM-IV criteria (American Psychiatric Association, 1994), a diagnosis of social phobia is only appropriate if the avoidance, fear or anxious anticipation of encountering the social situation interferes significantly with the person's daily routine, occupational functioning or social life, or if the person is markedly distressed about having the phobia.

Reported prevalence rates of social phobia vary widely due to a number of factors, including discrepancies between the assessment measures used, and the diagnostic criteria and thresholds employed. A recent review of 43 epidemiological studies reported lifetime prevalence rates of social phobia in Western countries to be between 7 and 13% (Furmark, 2002). This study, and other similar review papers (e.g. Fehm, Pelissolo, Furmark, & Wittchen, 2005), indicate that although reported prevalence rates vary, social phobia is a remarkably common mental health problem, even when stringent diagnostic criteria are employed.

In addition to being a highly prevalent mental health condition, social phobia tends to persist without treatment, is often comorbid with other mental health problems, and has a significant impact on an individual's quality of life. Research papers that have reviewed the lifetime comorbidity of social phobia with other mental health problems have reported the comorbidity rate to be approximately 80%

(Merikangas & Angst, 1995; Lepine & Pelissolo, 1996; Sareen & Stein, 2000), and individual research papers have reported comorbidity rates as high as 92% (Faravelli et al., 2000). Social phobia is often reported to have especially high rates of comorbidity with major depression, other anxiety disorders and substance abuse problems (e.g. Brunello et al., 2000), and is reported to generally precede the development of the other disorders (Merikangas & Angst, 1995).

Social phobia is an extremely debilitating condition, as it impacts both directly and indirectly on sufferers, and significantly decreases their quality of life (Olatunji, Cisler, & Tolin, 2007). Direct impairments caused by social phobia specifically involve the quality of social interactions, but the indirect impairments are thought to be even more important (Kessler, 2003). In addition to the effect of social phobia on secondary mental health conditions, described previously, the disorder can also have indirect effects on individuals' physical health, their occupational functioning, and their motivation and ability to seek help (Kessler, 2003).

It has been suggested in the literature that social phobia is often under-recognised and under-treated (Sareen & Stein, 2000), and there are a number of potential reasons for this finding. Firstly, it is possible that difficulties in delineating social phobia from social anxiety and shyness impact on its detection by both individuals with the disorder and health professionals. The detrimental impact of social phobia on help-seeking behaviours (Kessler, 2003), and sufferers' decreased confidence regarding their interactions with others, are also likely to influence whether individuals' present to their general practitioners in the first instance.

Despite these difficulties in the recognition and detection of social phobia,

effective psychological and pharmacological treatments are available. Recent

evidence-based guidelines published by the British Association for

Psychopharmacology recommend SSRIs as the first-line pharmacological treatment

of social phobia (Baldwin et al., 2005), due to their efficacy, safety and tolerability.

Regarding psychological treatments of social phobia, cognitive-behavioural therapy

(CBT) is the most thoroughly studied approach, and its effectiveness has been

supported by a large number of empirical studies (e.g. Heimberg, 2002). In a recent

study, Davidson et al. (2004) compared SSRI treatment, group CBT, combined

treatment and placebo. Response rates of SSRI treatment and CBT were comparable

(50.9% and 51.7% respectively), and although all treatments were superior to

placebo, no additional benefits of combined treatment were reported.

In summary, social phobia is a common and debilitating mental health

problem, which is often co-morbid with other disorders. Although social phobia is

often not detected by health professionals, and tends to persist without treatment,

effective psychological and pharmacological treatments are available. It is therefore

of paramount importance that health professionals are able to recognise and

diagnose social phobia, and that efficacious treatments are made available to

sufferers. Future research has an important role to play in achieving this goal:

research studies must continue to empirically evaluate the theoretical models of the

disorder, which must then be refined based on the research evidence. This continued

collaboration between theory and research will further our current understanding

regarding the factors involved in the development and maintenance of social phobia,

and will aid in the development of more effective treatments.

3. Cognitive Models of Anxiety

The first cognitive model of emotional disorders was proposed by Aaron Beck in 1976. This schema model proposed that dysfunctional schemata influence how individuals attend to, interpret, and remember information (Beck, 1976). It was hypothesized that anxiety is characterised by increased sensitivity to threat, and that the activation of threat schema results in selective processing of threat-relevant information, including selective attention to external threat cues, a tendency to interpret information negatively and an increased memory for threatening information. This early model proposed that emotional disorders are characterised by biases in information processing mechanisms, and that only the content of these biases differ between the disorders. Considering social anxiety specifically, the model would predict that individuals with social phobia and social anxiety would selectively attend to socially threatening information, such as negative statements and facial expressions; would interpret social information more negatively; and would tend to remember the more negative aspects of their social interactions.

Williams, Watts, Macleod and Mathews (1988) revised Beck's model based on emerging research evidence, and proposed that different emotional disorders were associated with information processing biases that differed both in their content *and* the stage of information processing. It was posited that anxiety was characterised by biases in the earlier stages of information processing: attention and appraisal / interpretation. The Williams et al. (1988) model, presented in Figure 1, suggests that if the threat value of a stimulus (as determined by the 'affective decision mechanism') is sufficiently high, the 'resource allocation mechanism' allocates attention based on an individual's level of trait anxiety. It is therefore the

interaction between the threat value of a stimulus and the individual's level of trait anxiety that determines the allocation of attention: individuals high in trait anxiety will orient attention towards threat and individuals low in trait anxiety will orient attention away from threat (Williams et al., 1988). Although this model provided further insight into information processing in anxiety disorders, it received criticism due to the fact that it did not take into account evolutionary perspectives of anxiety. Evolutionary theories would predict that all individuals, regardless of trait anxiety, should orient attention towards threat if the threat is of sufficient severity, for the purposes of survival. In fact, evolutionary models emphasize the importance of detecting any potential threat as quickly as possible, in order to protect oneself from harm (e.g. Ohman, 1996).
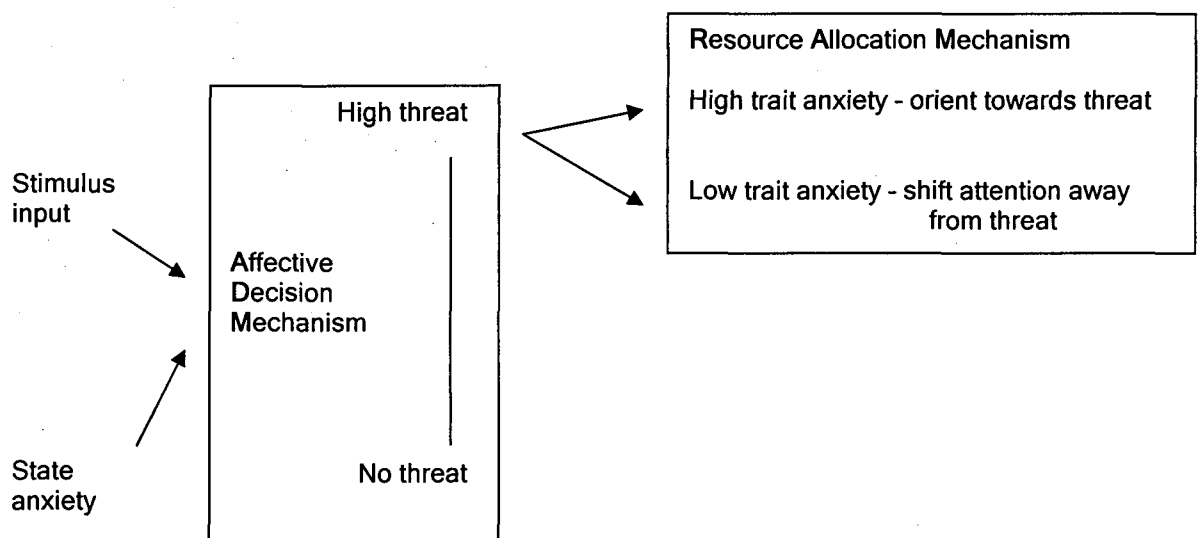
Figure 1. A Cognitive Model of Anxiety (Williams et al., 1988)

Taking the evolutionary perspective into account, Mathews and Mackintosh (1998) and Mogg and Bradley (1998) developed cognitive motivational models of anxiety disorders. Mathews and Mackintosh proposed that the interaction between

two opposing systems, the 'attentional control system' and the 'threat evaluation

system', determines the allocation of attentional resources (Mathews & Mackintosh,

1998). The authors suggested that when threat level (which is influenced by state

anxiety) is sufficiently high, the threat evaluation system becomes dominant and

attention is allocated to the threat. On the contrary, when threat level is low the

attentional control system is dominant, and attention remains allocated to the current

task. This model would predict that when a socially anxious individual enters a

social situation, his or her level of state anxiety increases, the threat evaluation

system becomes dominant, and attention is subsequently allocated towards potential

threat.

The model proposed by Mogg and Bradley (1998) also consisted of two

distinct systems, the 'valence evaluation system' and the 'goal engagement system',

see Figure 2.
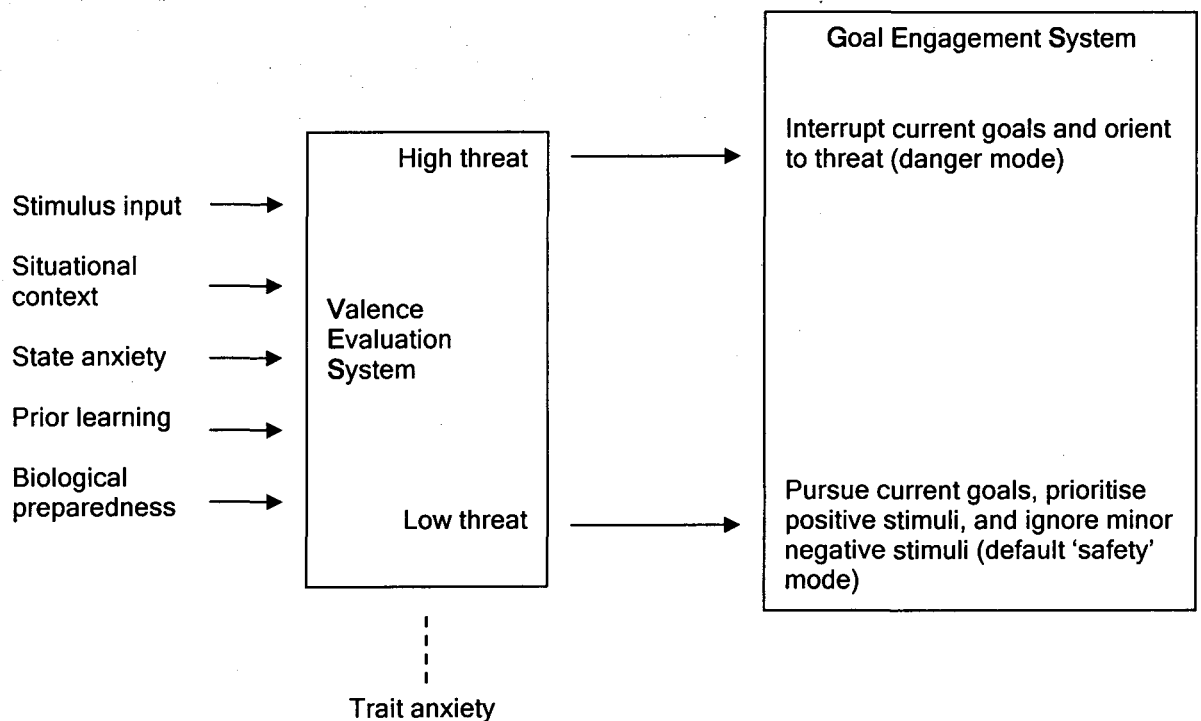
Figure 2. A Cognitive-Motivational Model of Anxiety (Mogg & Bradley, 1998)

The authors posited that the valence evaluation system (VES) assesses threat

value based on a number of factors (including stimulus input, state anxiety and prior

learning), and assigns a threat value to the stimulus. If the threat value is high,

current goals are interrupted and attention is allocated to the threat; if threat value is

low, current goals are pursued and attention is directed away from the mildly

negative stimuli. In contrast to the Mathews and Mackintosh (1998) model, Mogg

and Bradley (1998) proposed that the output from the VES is influenced by an

individual's level of trait anxiety, such that high trait anxious individuals have lower

thresholds for threat appraisal, which in turn influences their allocation of attention

towards the threat. Considering individuals with social anxiety, Mogg and Bradley's

model predicts that due to an increased level of trait anxiety, individuals have lower

thresholds for appraising social information as threatening, which subsequently

results in the allocation of attention towards the threat. This model therefore makes

specific predictions concerning both the negative interpretation of potentially

threatening information, and the allocation of attention towards it.

4. Cognitive Models of Social Anxiety and Social Phobia

Based on the general cognitive models of anxiety, specific cognitive models of

social anxiety and social phobia have been developed. In a recent paper, Clark and

McManus (2002) reviewed cognitive models of social anxiety, the predictions made

by these models, and recent experimental evidence evaluating these predictions.

Based on the collated information, the authors suggested that social phobia is

characterised by three phases of distorted information processing: anticipatory

processing, in-situation processing and post-event processing. Regarding in-situation

processing, it was suggested that individuals with social phobia interpret ambiguous social information in a negative fashion, detect negative (rather than positive) responses in others, exhibit reduced processing of external social cues in general, and also exhibit increased self-focused attention (Clark & McManus, 2002). Due to the scope of the current paper, and the general focus of the research base, only in-situation biases will be discussed in the current paper. For further information regarding anticipatory processing and post-event processing the reader is directed to Clark and McManus (2002).

The primary model discussed by Clark and McManus in their recent review was that of Clark and Wells (1995). In their model, Clark and Wells (1995) extended an earlier model of social phobia, proposed by Beck, Emery and Greenberg (1985). The model, presented in Figure 3, places particular emphasis on the attentional shift to internal information processing, and the strategies employed by individuals with social anxiety to reduce the risk of negative social evaluation.

Clark and Wells (1995) proposed that individuals with social phobia have dysfunctional assumptions concerning social situations, based on their early experiences, and that they therefore appraise social situations as threatening. Similar to Beck et al.'s (1985) model, the authors suggested that individuals with social phobia shift their attention inwards when entering a social situation, and that they monitor their anxiety symptoms closely, resulting in reduced processing of external information. Clark and Wells also proposed that individuals use these internal sensations to construct negative impressions of how they appear to others, and that they employ a range of behaviours that they believe will reduce the likelihood of

negative evaluation. These 'safety behaviours', such as rehearsing conversations and avoiding eye contact, can often have inverse effects, however, as they can make individuals appear more socially awkward and also prevent any disconfirmation of their negative beliefs about their social performance.

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                    │Perceived Social Danger│ - - -┘
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                         │Social Object│
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    │ Safety Behaviours│              │ Somatic and      │
    │                  │              │ Cognitive Symptoms│
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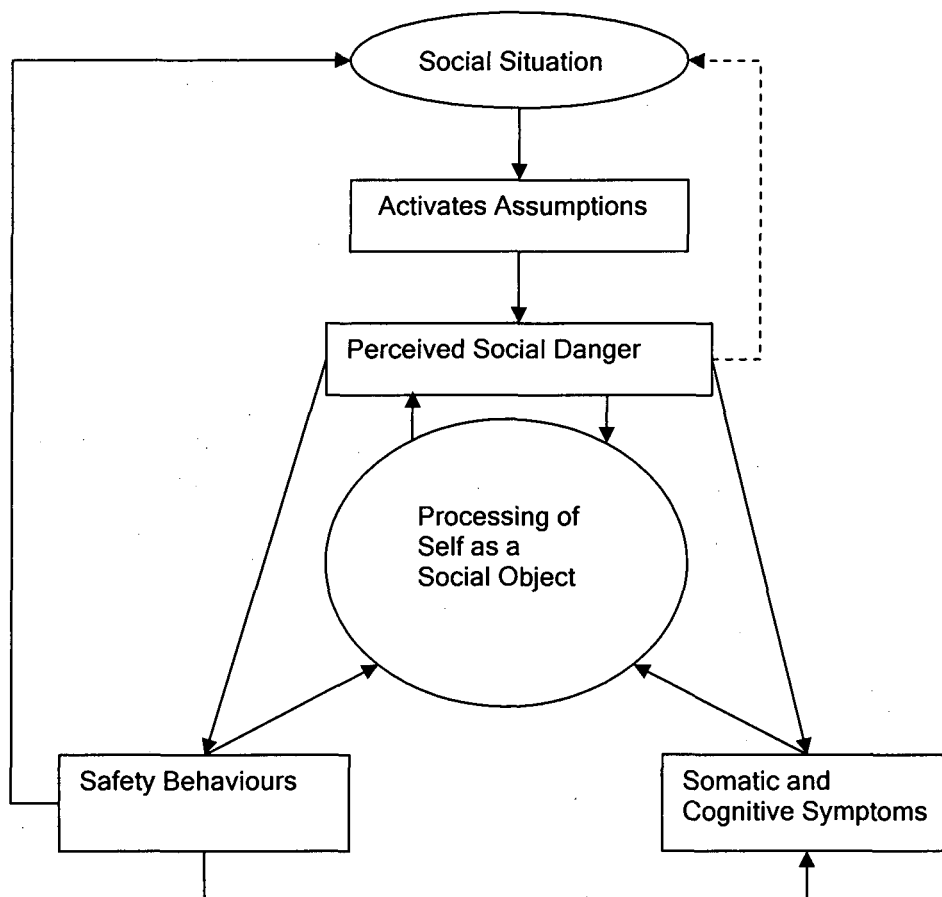
Figure 3. A Cognitive Model of Social Phobia (adapted from Clark & Wells, 1995)

Although the model emphasizes the shift in attention towards the self, which results in reduced attention towards external cues, the authors proposed that this limited external attention is biased towards detecting responses that can be interpreted negatively (Clark & Wells, 1995). This prediction is consistent with Mogg and Bradley's (1998) model of general anxiety, which would predict that

individuals with social anxiety allocate attention towards a stimulus following an appraisal of it as threatening.

Another cognitive model of social phobia that has been presented in the literature was proposed by Rapee and Heimberg (1997). The authors proposed a similar model to Clark and Wells, but also hypothesized that individuals with social phobia formulate distorted predictions of other people's expectations, which impact on their social anxiety. Rapee and Heimberg (1997) proposed that when entering social situations, individuals with social phobia form mental representations of their appearance and behaviour as (presumably) seen by others, and also simultaneously focus their attention onto these internal representations and any perceived threat in the external social environment. The authors describe this simultaneous focusing of attention as the equivalent of a 'multiple task paradigm', in which the individual must closely monitor potential external threat and simultaneously monitor the potentially threatening aspects of his or her supposed appearance (Rapee & Heimberg, 1997). The model therefore predicts that individuals with social phobia not only direct attention towards the self in social situations, but also scan the environment for signs of potential negative evaluation, detect these signs rapidly, and have difficulty disengaging attention from them.

It was hypothesized that individuals with social phobia compare their self-representation with a prediction of how they believe the audience expects them to perform; the discrepancy between the predicted audience expectation and the audience's (predicted) appraisal of the individual with social phobia is then used to determine the perceived likelihood of negative evaluation from the audience. This

expectation of negative evaluation further increases individuals' anxiety symptoms, which influences their mental representation and maintains their social phobia (Rapee & Heimberg, 1997).

In summary, the cognitive models of social phobia make a number of predictions regarding the manner in which individuals with social phobia and social anxiety process information. Clark and Wells (1995) predict that socially anxious individuals shift attention towards the self when entering social situations, and that this increased self-focused attention results in reduced processing of external cues. Rapee and Heimberg (1997) recognise this self-focus of attention, but also predict that although external attention is reduced, it is focused towards potential sources of threat in the environment. In addition, Rapee and Heimberg (1997) suggest that socially anxious individuals have difficulty disengaging from threatening stimuli once they have been detected. The cognitive models also predict that socially anxious individuals appraise social information more negatively. This interpretative bias was described in Beck, Emery, and Greenberg's (1985) model of social phobia, and is also implied in the later models by Clark and Wells (1995) and Rapee and Heimberg (1997).

Based on the theoretical cognitive models of social anxiety and social phobia, a large empirical research base investigating the predictions made by these models has emerged. Although researchers have extensively studied biases in both attention and interpretation, only attentional biases will be presented in the current review, due to the scope of the paper. For a comprehensive review of research

studies exploring biases in interpretation, readers are directed to Hirsch and Clark (2004).

5. Attention Biases in Social Anxiety

The cognitive models of social phobia propose that information processing biases strongly influence the development and maintenance of the disorder. One of the key information processing biases suggested by the models is the selective allocation of attention to internal and external social threat cues. The model proposed by Clark and Well's (1995) focuses primarily on the allocation of attention towards the internal self, whereas Rapee and Heimberg's model (1997) places equal importance on this self-focused attention and the tendency to selectively attend to potentially threatening information in the external social environment. Research studies that have explored attention biases in social anxiety and social phobia have therefore focused on these two distinct, yet inter-related, processes: self-focused attention and attention to external threat.

5.1 Attention to External Stimuli

Allocation of attention to external stimuli has been investigated using a number of different research paradigms, including modified Stroop tests, visual search tasks, modified visual probe tasks, exogenous cueing tasks, and more recently eye movement monitoring.

5.1.1. Emotional Stroop Paradigm

Early research into external attention allocation in social anxiety and social phobia primarily employed an adapted version of the Stroop test (Stroop, 1935). The stroop

test involves research participants being asked to name the colour of presented words as quickly as possible, whilst trying to ignore the content of the words; it was hypothesized that longer response times to colour name the words would indicate interference of word content, and therefore an attentional bias towards the content of that word. In order to explore attention allocation in social anxiety, researchers modified the original stroop test to include socially threatening words in addition to neutral or non-socially threatening words (Hope, Rapee, Heimberg & Dombeck, 1990; Mattia, Heimberg, & Hope, 1993; Maidenberg, Chen, Craske, Bohn, & Bystritsky, 1996).

Hope et al. (1990) presented participants with socially threatening, physically threatening and neutral words, and reported that individuals with social phobia were slower to colour name socially threatening words, indicating the preferential processing of these words. Similarly, Mattia et al. (1993) compared individuals with social phobia and healthy controls, and reported that individuals with social phobia displayed greater response latencies to all words and additional delays to respond to social threat words. These findings are consistent with the cognitive models of social phobia, which predict that external attention is preferentially allocated towards socially threatening information (e.g. Clark & Wells, 1995; Rapee & Heimberg, 1997).

In order to investigate the specificity of this attentional bias, researchers compared individuals with social phobia and individuals with other anxiety disorders, using disorder-related words. Maidenberg et al. (1996) compared individuals with social phobia, individuals with panic disorder and healthy controls,

and found that individuals with social phobia displayed longer response times to social threat words only, whereas those with panic disorder displayed longer response times for all threatening words. Similarly, researchers comparing individuals with social phobia and individuals with generalised anxiety disorder (GAD) reported a specific bias for social threat words in social phobia, but an attentional bias towards all emotional words in GAD (Becker, Rinck, Margraf, & Roth, 2001). These findings indicate that although other anxiety disorders such as panic disorder and GAD are associated with more general attentional biases for threat, social phobia is primarily associated with an attentional bias towards socially threatening words.

Despite the positive findings that have been reported using the modified stroop test, the paradigm has received criticism due to the ambiguity of the mechanism responsible for the delayed response latencies that have been observed (Williams, Mathews, & Macleod, 1996). Although studies have reported that increased response latencies indicate selective attention to the content of that particular word, a number of other explanations for the delay are possible. One viable explanation is that the response delay seen for socially threatening words is due to a preoccupation with the presented word and an inability to disengage from it. This idea is based on the assumption that individuals attend equally to all words, but that once they have focused their attention on socially threatening words they then find it more difficult to disengage from them in order to colour name the word. A recent meta-analysis of emotional stroop research supports this idea, as the authors conclude that the emotional stroop effect seems to rely on a slow disengagement process rather than a fast automatic bias (Phaf & Kan, 2007). It has also been

suggested that the delayed responses could be due to cognitive avoidance, as individuals with social phobia may try to suppress the meaning of socially threatening words and therefore take longer to respond to them (de Ruiter & Brosschot, 1994).

In summary, studies using the emotional stroop paradigm have generally reported increased response latencies to socially threatening words in social phobia. These results have been interpreted as evidence for selective attention towards social threat, as predicted by the cognitive models of the disorder. Due to criticism about the ambiguity of the mechanism underlying the stroop effect, however, more robust research paradigms have been developed, and results from emotional stroop experiments should be interpreted with some caution.

5.1.2. Visual Search Paradigm

Another paradigm that has been used to investigate selective attention in social anxiety is the visual search paradigm. In visual search tasks, participants are asked to detect target facial expressions or reactions in presented audiences as quickly as possible. Although this method assesses the detection of threatening stimuli more directly, it has not been extensively used by researchers, and this may be due to the fact that it does not assess naturally occurring selective attention, as participants are specifically asked to detect specific target stimuli.

Using a 'face-in-the-crowd' visual search paradigm, in which participants were asked to detect target facial expressions in crowds of distracter photos, Gilboa-Schechtman, Foa and Amir (1999) reported that individuals with social phobia

showed greater attentional biases for angry than happy faces in neutral crowds. Individuals with social phobia were also more distracted by emotional faces than neutral faces; these findings support an attentional bias towards emotional faces in individuals with social phobia. In a similar study, Eastwood et al. (2005) reported that individuals with social phobia exhibited a bias to become aware of negative faces more readily than positive faces; this bias was also detected in individuals with panic disorder, but not in healthy controls or those with obsessive compulsive disorder (OCD; Eastwood et al., 2005). On the contrary, Esteves (1999) did not report any significant difference in response bias between high and low socially anxious individuals using a similar methodology, but these null findings may be explained by the fact that the researcher used schematic facial expressions, as opposed to photographs, and also the fact that the sample consisted of individuals with sub-clinical levels of social anxiety.

Using more ecologically valid designs, in which participants are asked to detect reactions in video-taped and live audiences, contradictory findings have been reported. Veljaca and Rapee (1998) reported that when giving a speech to a live audience, high socially anxious individuals were more accurate at detecting negative behaviours, and low socially anxious individuals were more accurate at detecting positive behaviours. Similarly, Perowne and Mansell (2002) reported that individuals high in social anxiety selectively identified negative audience members during a speech task, in which two audience members displayed positive behaviours, two displayed negative behaviours and two displayed neutral behaviours. Although the socially anxious group selectively discriminated these 'negative' members, they were not more accurate in detecting their specific behaviours, and the authors

suggested that this may be due to a vigilant-avoidant pattern of attention. They hypothesized that high socially anxious individuals initially directed their attention towards the negative audience members, but subsequently avoided them for the duration of the speech, therefore making them no more accurate in discriminating their actual negative behaviours (Perowne & Mansell, 2002). The proposed vigilance-avoidance pattern of attention will be discussed in more detail in section 5.1.3 of the review.

On the contrary, an earlier study using 'live' video feedback failed to find evidence of enhanced detection of facial expressions in individuals high in social anxiety (Pozo, Carver, Wellens, & Scheier, 1991), but it is worth noting that this study was only concerned with the detection of changing facial expressions, rather than the behavioural responses that were included in the Veljaca and Rapee (1997) and Perowne and Mansell (2002) studies.

In summary, visual search studies generally support the prediction that social anxiety is associated with increased attention towards socially threatening material. It is important to bear in mind, however, that the mechanism being tapped by this paradigm is the ability to detect socially threatening material, and not selective attention towards it per se.

5.1.3. Modified Visual Probe Paradigm

A modified version of the visual probe paradigm has frequently been used to investigate attention processes in social anxiety and social phobia, as it circumvents many of the documented problems with the emotional stroop and visual search

paradigms. In the modified visual probe task, participants initially focus on a

fixation cross on a computer screen, which is then replaced by two stimuli (either

words or pictures) presented simultaneously. The stimuli remain on the screen for a

short time, typically 500ms, before being replaced by a probe in the previous

location of one of the stimuli. The participant is asked to respond to the probe as

quickly and accurately as possible; shorter reaction times indicate selective attention

towards the stimuli that had been presented in the location of the probe.

The modified visual probe task has a number of advantages over the

emotional stroop and visual search paradigms, primarily because it provides a more

direct, and less ambiguous, measure of selective attention. As stimuli are presented

simultaneously, the task directly assesses the allocation of visuo-spatial attention

when stimuli are in competition with one another, thus making it more ecologically

valid. In addition, as increased attention is indexed by *faster* reaction times to

probes, other processes such as cognitive avoidance and mental preoccupation,

which can *slow down* manual response times, can be discounted as possible

explanations for the effect (Bogels & Mansell, 2004). In contrast to the visual search

paradigm, participants are not asked to detect specific stimuli, and the visual probe

paradigm therefore provides a more direct measure of the natural allocation of

attentional resources.

Early studies using the modified visual probe paradigm in social anxiety

tended to use word pairs to assess selective attention. Asmundson and Stein (1994)

presented word pairs consisting of neutral, socially threatening and physically

threatening words to individuals with social phobia and healthy controls. They

reported that individuals with social phobia responded faster to probes following socially threatening words, but that this effect was not found for controls. Musa, Lepine, Clark, Mansell and Ehlers (2003) reported similar results in their sample of individuals with social phobia, and taken together these studies indicate that individuals with social phobia show an attentional bias towards socially threatening words, when they are presented alongside neutral or physically threatening words.

Horenstein and Segui (1997) report contradictory findings, however, as they did not find an attentional bias towards social threat words in their sample of individuals with social phobia. An attentional bias away from socially threatening words was observed, however, in their control participants, and it could therefore be argued that individuals with social phobia did display increased attention to socially threatening cues, relative to healthy controls. Another study using word pairs also reported contradictory findings, but this was in a sample of sub-clinically socially anxious individuals, as opposed to individuals with social phobia. Mansell, Ehlers, Clark and Chen (2002) failed to find an attentional bias towards social threat in a sample of highly socially anxious individuals presented with pairs of neutral and social-evaluative words.

A possible explanation for the finding by Mansell et al. (2002) is that the visual probe paradigm using word stimuli is not sensitive enough to detect biases in individuals with sub-clinical levels of anxiety. When individuals enter social situations, they are presented with visual information in the form of facial expressions and body language, not written words; it has therefore been suggested that it may be more ecologically valid to use facial expressions as stimuli in studies

investigating attentional processes. The results from a recent study by Pishyar,

Harris and Menzies (2004) provide support for this hypothesis. The authors

examined attention towards both words and faces in high and low socially anxious

individuals, and reported that although the high socially anxious group displayed an

attention bias towards negative faces, no effect was seen with word stimuli. This

lack of sensitivity could account for the contradictory findings reported by studies

using word pairs, as the visual probe paradigm using word pairs may be sensitive

enough to detect a bias in individuals with clinical social phobia, but not in

individuals with sub-clinical levels of social anxiety. The results from the study by

Pishyar et al. (2004) suggest that the sensitivity of visual probe paradigm can be

increased by using facial expressions as stimuli; many recent studies using the

modified visual probe paradigm have therefore utilised photographs depicting facial

expressions as stimuli.

The results of studies using the visual probe paradigm with facial

expressions initially appear somewhat contradictory, as selective attention both

towards and away from social threat have been reported. The different

methodologies employed by researchers, however, such as the nature of the

competing stimulus, may account for some of the discrepancies.

In studies that have paired faces with household objects, researchers have

reported an attentional bias *away from* faces, in individuals with social phobia

(Chen, Ehlers, Clark, & Mansell, 2002) and individuals high in social anxiety, but

only under conditions of social threat (Mansell, Clark, Ehlers,& Chen, 1999).

Studies that have paired neutral and emotional faces, however, have reported

attentional biases *towards* threatening faces in individuals high in social anxiety, at both pre-conscious (Mogg & Bradley, 2002) and conscious (Pishyar et al., 2004) levels of processing, and also in individuals with generalised social phobia (Mogg, Philippot, & Bradley, 2004).

Although these findings appear contradictory, it is possible that the discrepancies are due to the fact that the varying experimental designs tapped into different aspects of the cognitive models. It has been predicted that in general, socially anxious individuals exhibit reduced processing of external cues (Clark & Wells, 1995), and the results from Chen et al. (2002) and Mansell et al. (1999) support this prediction: when faces are paired with inanimate objects, socially anxious individuals will selectively attend to the objects due to a general decrease in the processing of external social cues. It is also predicted by cognitive models, however, that the (decreased) attention towards external social cues will be negatively biased (e.g. Rapee & Heimberg, 1997), and this prediction is supported by the findings from Mogg and Bradley (2002), Mogg et al. (2004), and Pishyar et al. (2004): when neutral facial expressions are paired with negative facial expressions, individuals with high levels of social anxiety will selectively attend to the negative expression.

Another explanation is that the studies may be assessing different stages of the attentional process, depending on the length of time that stimuli are presented on the screen. Due to the design of the visual probe paradigm, response time data only provides a snapshot of the attentional process, as only the focus of attention immediately before the presentation of the probe can be measured. Some studies

have attempted to investigate the time course of the attentional process, however, using different exposure durations within the same experiment. Mogg, Philipott and Bradley (2004) presented individuals with social phobia with face pairs for either 500ms or 1250ms and compared attention allocation at these two time points. The authors reported that individuals with social phobia displayed vigilance for angry faces when they were presented for 500ms, but that there was a non-significant reversal of this effect when the faces were presented for 1250ms (Mogg et al., 2004). Another recent study, using the visual probe paradigm with word pairs, has reported similar results. Vassilopoulos (2005) presented high and low socially anxious individuals with word pairs, which were displayed for two different durations; it was reported that highly socially anxious individuals displayed an attentional bias towards threat words at the shorter presentation time, and subsequent avoidance of these stimuli at the longer presentation time.

These findings are consistent with a suggestion in the literature that individuals may display a vigilant-avoidant pattern of attention to threatening cues. The vigilance-avoidance hypothesis suggests that anxious individuals are initially hypervigilant to threatening stimuli, but that this hypervigilance is followed by avoidance of the threat cues, which serves a defensive function (Mogg, Bradley, deBono, & Painter, 1997). Based on this hypothesis, it is possible that the contradictory findings reported are due to the varying experimental designs tapping into different stages of the vigilance-avoidance pattern of attention allocation. Although the visual probe studies by Mogg et al. (2004) and Vassilopoulos (2005) appear to provide some support for this hypothesis, the results should be interpreted with caution due to methodological limitations. As the studies used a visual probe

methodology, only snapshots of attention were measured, albeit at differing time points. It is therefore not possible to conclude that individuals attended to social stimuli initially and then avoided the stimuli, as it is possible that they had been attending to the social stimuli throughout the stimuli presentation and had only briefly disengaged their attention prior to stimulus off-set.

Due to these limitations of the visual probe paradigm in assessing attention across time, the vigilance-avoidance hypothesis has also been explored using eye movement technology, which will be discussed in greater detail in section 5.1.5 of the review. Another limitation of the visual probe paradigm is that it is limited in its ability to investigate the mechanisms underlying selective attention. Although shorter reaction times to probes following social cues indicate the allocation of attention towards them, it is not possible to determine if this focus of attention is due to enhanced detection of social stimuli, difficulty disengaging attention from them, or a combination of the two mechanisms. Exogenous cueing paradigms have therefore been employed by researchers recently in an attempt to disambiguate the mechanisms underlying selective attention.

5.1.4. Exogenous Cueing Paradigm

Exogenous cueing paradigms, based on an original attention task developed by Posner (1980), have been used to investigate delayed disengagement from threatening stimuli in high and low anxious individuals. During an exogenous cueing task individuals are presented with either threatening or neutral cues individually, in one of two locations. After the presentation of the cue, a target appears in either the location previously occupied by the cue (valid trials) or the

alternative location (invalid trials). Individuals are asked to respond as quickly as possible to the target, typically by classifying it. Delayed disengagement from cues is represented by longer reaction times to respond to invalidly cued targets in these trials, compared to other cue types.

Utilising this methodology, Fox, Russo, Bowles, and Dutton (2001) reported that individuals with high levels of self-reported anxiety took longer to respond to invalid targets following angry facial expression cues, but that this effect was not seen in those with low levels of anxiety. These results indicate that individuals high in anxiety had difficulty disengaging from angry expressions, compared to neutral or positive expressions, in order to respond to the target. Similar results have been reported from other studies, suggesting that individuals high in anxiety have difficulty disengaging from facial expressions depicting anger and happiness (Fox, Russo, & Dutton, 2002), and those depicting fear (Georgiou et al., 2005), as well as from threatening pictures (Yiend & Mathews, 2001).

One identified study has specifically investigated delayed disengagement in social phobia using an exogenous cueing paradigm (Amir, Elias, Klumpp, & Przeworski, 2003). The authors utilised a similar task to the ones described previously, using social threat words, neutral words and positive words as the cues. It was reported that individuals with social phobia showed longer response latencies to detect invalidly cued targets that followed social threat words, compared to controls. These results suggest that individuals with social phobia may have a specific difficulty disengaging from socially threatening material. Although the current evidence base regarding this issue is sparse, there appears to be emerging

support for the hypothesis that socially anxious individuals may have difficulty

disengaging from socially threatening stimuli. This research is consistent with

predictions made by Rapee and Heimberg's (1997) cognitive model of social

phobia, and certainly warrants further investigation.

Due to various methodological limitations, it is not possible to rectify the

discrepancies in the literature (regarding the mechanisms underlying selective

attention and the time course of attention allocation) using the paradigms discussed

previously. However, recent advances in eye movement technology allow

researchers to investigate overt attention patterns more directly, and research using

this technology has the potential to resolve many of the unanswered questions in the

current evidence base.

5.1.5. Eye Movement Studies

In recent studies, some researchers in the field have utilised eye movement

technology to further investigate the allocation of external attentional resources in

social anxiety. Eye movement technology makes it possible to directly track

individuals' eye gaze, and therefore their overt attention. Using this technology,

researchers can obtain more detailed information about attentional processes, as they

are able to measure the direction and duration of individual fixations, as opposed to

just the direction of attention at one predetermined time point.

Horley, Williams, Gonsalvez and Gordon (2003) presented individuals with

social phobia and healthy controls with photographs depicting happy, sad and

neutral facial expressions, and monitored visual scanpaths during face viewing. The

authors reported that individuals with social phobia made fewer fixations to facial features, especially the eyes, which indicated avoidance of these regions. In addition, individuals with social phobia also displayed hyper-scanning of non-features, compared to control participants. The authors subsequently extended this study to include angry faces, and reported that the hyper-scanning and eye avoidance was particularly prominent when individuals with social phobia were presented with angry faces (Horley, Williams, Gonsalvez, & Gordon, 2004).

Although Horley et al.'s (2003; 2004) studies provide useful information about the processing of facial expressions in social phobia, they were not designed to investigate selective attention to competing social cues. To investigate selective attention using eye movement technology, Garner, Mogg and Bradley (2006) displayed emotion-neutral face pairs and face-object pairs to individuals high and low in social anxiety, under threat and no-threat conditions. The authors reported that in the no-threat condition, all individuals oriented and maintained their gaze towards emotional faces, when they were paired with neutral faces. When the threat of an impending speech was included, however, the highly socially anxious group displayed faster orienting towards emotional faces, but they maintained their attention on these emotional faces for a shorter period of time (Garner et al., 2006). These findings suggest that under social threat conditions, individuals high in social anxiety display an attention pattern that is consistent with the vigilance-avoidance hypothesis, but that this pattern is not evident under less threatening conditions.

Although the use of eye movement technology is still in its infancy, the research to date provides promising indications regarding its potential to further the

current understanding of attentional patterns in social anxiety. Due to the novelty of

the approach, there are many unanswered questions and potential areas for further

research. The study by Garner et al. (2006) investigated attention towards emotional

faces, using happy and angry expressions as the emotional stimuli. It will be

important for future research to investigate attentional patterns using a greater

variety of emotional expressions, such as fear or disgust, in an attempt to clarify

whether individuals with social anxiety display attentional biases towards specific

emotions or all displays of emotionality. Additionally, due to the fact that eye

movement technology provides information about attention over time, it will be

feasible for future studies to increase the length of stimuli exposure and therefore

investigate patterns of attention over greater time periods.

Across the paradigms that have been used to investigate attention to external

stimuli in social anxiety and social phobia, research evidence generally supports the

predictions made by cognitive models of the disorder. Empirical studies have found

evidence of a general decrease in attention to external social cues, as predicted by

Clark and Wells (1995). Despite seemingly contradictory findings about the

allocation of this (decreased) attention to competing social cues, it has generally

been reported that socially anxious individuals selectively attend to threatening

social information in the presence of other social cues, although the mechanism

underlying this selective attention is unclear. It will be important for future studies to

continue examining attentional processes, using recently developed technologies, in

order to further our understanding of selective attention in social anxiety.

5.2. Self-Focused Attention

The previous section of the review focused on the allocation of attention to external

cues. The cognitive models of social phobia, however, propose that only a reduced

amount of attention is focused externally, due to an increase in self-focused attention

during social situations. Clark and Wells (1995) hypothesized that when entering a

social situation, individuals with social phobia shift their attention inwards, and

focus on their arousal level and anxiety symptoms, which they continue to monitor

closely throughout the interaction. Clark and Wells (1995) posited that this internal

focus of attention is associated with a reduced level of processing of external cues,

an increase in anxiety and negative thoughts, and also the construction of an image

of how the individual appears to others. The review will therefore now focus on

empirical research that has investigated self-focused attention in social anxiety and

social phobia. Although research studies investigating the proposed shift of

attentional resources towards the self will be presented, it is beyond the scope of the

review to discuss research into the subsequent effects of this self-focused attention

(see Spurr & Stopa, 2002).

Before presenting evidence concerning self-focused attention in social

anxiety and social phobia, it is important to describe two different aspects of self-

focused attention that have been investigated. Some research studies have

investigated *trait* self-focused attention, which has been described as a general

tendency to focus attention on aspects of the self during social situations. Other

studies, however, have investigated *state* self-focused attention, which has been

described as on the spot focusing of attention onto aspects of the self (Bogels &

Mansell, 2004).

Early studies investigated self-focused attention as a trait, primarily using the self-consciousness scale, developed by Fenigstein, Scheier, and Buss (1975); significant correlations between social anxiety and public self-consciousness were reported (Fenigstein et al., 1975; Hope & Heimberg, 1988). More recent studies have also reported higher levels of public self-consciousness in individuals with clinical social phobia, compared to healthy controls (Bruch and Heimberg, 1994), individuals with panic disorder (Saboonchi, Lundh, & Ost, 1999), and individuals with OCD and bulimia nervosa (Jostes, Pook, & Florin, 1999). Taken together, these studies support the prediction that social anxiety and social phobia are associated with increased self-focused attention, but a limitation of these studies is that they investigated self-focused attention as a general trait, as opposed to self-focused attention in specific social situations.

As the cognitive models of social phobia specifically predict an increase in self-focused attention when socially anxious individuals enter a social situation, recent research has begun to explore self-focused attention as a specific state, which is activated upon entering a social situation. Mellings and Alden (2000) investigated self-reported self-focused attention immediately following an unstructured social interaction with a confederate. The authors reported that individuals high in social anxiety reported experiencing a significantly greater degree of self-focused attention during the interaction than their low socially anxious counterparts. Although this study provides support for an increase in state self-focused attention in socially anxious individuals during social interactions, it relies on self-report data, collected after the interaction has taken place. To rectify these short-comings, some

researchers have measured self-focused attention directly, under conditions of social threat and no social threat (Pineles & Mineka, 2005; Mansell, Clark, & Ehlers, 2003). Pineles and Mineka (2005) assessed self-focused attention in high and low socially anxious individuals, using a visual probe task. The authors reported that individuals high in social anxiety displayed a bias towards cues of internal threat (heart rate information) during the task, but not towards external sources of threat (threatening faces). In a similar study, Mansell et al. (2003) simultaneously measured on-line attention to internal and external probes, under conditions of social threat and no social threat. The external probes were superimposed on pictures that were presented to participants, and the internal probes, which participants were led to believe were affected by their physiological arousal, were pulses on their fingertips. It was reported that compared to low socially anxious individuals, those high in social anxiety displayed an internal attentional bias, but only under conditions of social-evaluative threat (Mansell et al., 2003)

Taken together, the reviewed literature provides support for the hypothesis that social anxiety and social phobia are associated with increased self-focused attention in social situations. The studies by Mansell et al. (2003) and Pineles and Mineka (2005) also provide support for the suggestion that this self-focused attention impacts on the amount of attention allocated to external information, as both studies reported a preferential processing of internal information in individuals high in social anxiety.

In summary, the empirical research investigating attentional processes in social anxiety and social phobia generally supports the predictions made by the

cognitive models. It has been predicted that upon entering social situations, individuals with social phobia and high levels of social anxiety will exhibit enhanced self-focused attention and reduced processing of external social cues. In addition to the studies that have investigated these predictions separately, recent studies have begun to investigate self-focused attention and external attention simultaneously, and have reported findings which support the predictions (e.g. Pineles & Mineka, 2005; Mansell et al., 2003). Despite the fact that the amount of attention allocated externally is reduced, it has also been predicted by the cognitive models that this attention will be biased towards negative social information. Studies reported in the literature generally support this prediction, and recent advances in technology provide promising methods to continue exploring the competing hypotheses regarding attention patterns over time.

6. Potential Directions for Future Research

This literature review has focused on the current knowledge base regarding attention biases in social anxiety and social phobia. Although a substantial amount of literature regarding attention biases exists, there remain a number of areas that warrant further investigation.

Research studies have been conducted using both clinical samples of individuals with social phobia, and analogue designs (comparing individuals high and low in social anxiety). Analogue designs have a number of strengths, as they permit the use of complex experimental designs that require large numbers, and also allow for new tasks to be efficiently piloted (Stopa & Clark, 2001). Coupled with the fact that it is often difficult to recruit a sufficient sample of individuals with social

phobia in a short time frame, due to the impact of the disorder of help-seeking behaviours, analogue approaches usually form the first step in research investigating particular biases. It is therefore recommended that the unresolved questions highlighted throughout the literature review be explored in analogue samples, before being translated into clinical studies.

A specific area where further analogue designs could prove valuable is the continued exploration of the allocation of external attention using recently developed technology. Although attention biases towards threatening social stimuli in individuals high in social anxiety have been well established using visual probe studies, the mechanisms underlying these biases require further investigation. As eye movement technology can directly track eye movements over time, it will be possible for future studies to explore these mechanisms with accuracy and confidence.

While analogue designs are extremely beneficial in adding to the literature base, it is important that findings from these studies are replicated in clinical samples, to ensure that the results can be generalised. In addition to replicating analogue studies in clinical samples, however, it will also be important for future studies to include a control group consisting of equally anxious individuals with other anxiety disorders in order to explore the specificity of the biases to social phobia.

7. Conclusions

The empirical research studies reviewed in the current paper suggest that individuals with social anxiety and social phobia exhibit biases in the way in which they process information during social situations. The research generally supports predictions made by the cognitive models of social phobia, and provides evidence that during social interactions, socially anxious individuals display a tendency to focus attention internally, exhibit reduced processing of external social cues in general, and focus this reduced external attention on negative social cues.

There are some discrepancies in the literature, however, and unresolved questions remain. For example, questions still remain regarding the mechanisms underlying the finding from visual probe studies that individuals high in social anxiety selectively attend to threatening social cues. Additionally, there are discrepancies in the literature regarding the allocation of external attention over time; eye movement technology provides a useful methodology for investigating these areas further. Future research must continue to address these unresolved questions, in order to develop our current understanding of the processes involved in the development and maintenance of social anxiety and social phobia, and to inform the development of effective interventions.

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Attention to External Social Cues in Social Anxiety: An Exploration Using

Eye Movement Technology

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(see Appendix B for 'Guide to Authors')

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Abstract

The current study investigated the allocation of attention in social anxiety. A visual

probe task and concurrent eye movement technology were employed, in order to

investigate the allocation of attention to external social cues (neutral and emotional

faces), in individuals high and low in social anxiety.

The results of the study support the hypothesis that individuals high in social

anxiety have greater attentional biases towards emotional faces than those low in social

anxiety; eye movement data allowed the mechanisms underlying this attentional bias to

be explored. Results indicate that individuals high in social anxiety made significantly

more initial eye movements to facial stimuli, but that the proportion of eye movements

made to the emotional face did not differ between the two groups. Socially anxious

individuals did not attend to emotional faces faster than those low in social anxiety, but

they did maintain their gaze on emotional stimuli for significantly longer, consistent

with a delayed disengagement hypothesis. Individuals high in social anxiety also made

significantly more eye movements per trial, consistent with predictions that socially

anxious individuals scan the environment for potential threat.

The results of the current study are discussed with reference to cognitive models

of social anxiety and evidence from previous studies that have employed reaction time

and eye tracking measures of attention allocation.

1. Introduction

Social phobia, which is characterised by a marked and persistent fear of social and

performance situations (American Psychiatric Association, 1994), is estimated to have a

lifetime prevalence of between 7 and 13% of the population (Furmark, 2002). Social

phobia is often co-morbid with other mental health problems and has a significant

impact on an individual's quality of life (Olatunji, Cisler, & Tolin, 2007). Despite the

high prevalence and detrimental impact of the disorder, social phobia still remains

largely un-diagnosed and un-treated (Sareen & Stein, 2000), and it is possible that this

is partly due to the impact the disorder has on an individual's ability and willingness to

seek help (Kessler, 2003). As understanding a disorder is of paramount importance

when attempting to recognise and treat it, various models to explain social phobia have

been developed, and a substantial amount of research has been focused on empirically

testing predictions made by these clinically influential models.

Cognitive conceptualisations of anxiety predict that the maintenance of anxiety

disorders is influenced by biases in the ways in which individuals process information,

specifically how they interpret information and what they selectively attend to. The

most clinically influential model of social anxiety was proposed by Clark and Wells

(1995). Regarding the allocation of attentional resources, Clark and Wells suggested

that when individuals enter a social situation, they focus their attention inwards and

therefore show reduced processing of external information. The authors proposed that

individuals high in social anxiety focus on their internal symptoms of anxiety, and use

this information to construct a negative impression of how they appear to others, thereby increasing and maintaining their anxiety.

Another cognitive model of social phobia, proposed by Rapee and Heimberg (1997), also describes the development of a negative representation of how an individual perceives they appear to others, but also emphasizes that attention is concurrently allocated to monitoring potential threat in the external environment. The authors describe the process as similar to a multiple task paradigm, as the individual must simultaneously monitor internal and external stimuli, in order to detect any potential threat. Rapee and Heimberg (1997) predict that in addition to focusing on the self during social encounters, individuals high in social anxiety scan the environment for signs of negative evaluation, detect these signs rapidly, and have difficulty disengaging from them.

Based on the earlier cognitive models and emerging research, Clark and McManus (2002) suggested that social phobia and high levels of social anxiety are characterised by three phases of distorted information processing: anticipatory processing, in-situation processing and post-event processing. In an attempt to reconcile competing predictions from earlier models, Clark and McManus proposed that during social situations, socially anxious individuals interpret ambiguous social information in a negative fashion, exhibit increased self-focused attention and reduced processing of external cues in general, but focus the limited external attention onto potentially negative aspects of their environment (Clark & McManus, 2002).

In recent years the earlier cognitive models (Clark & Wells, 1995; Rapee & Heimberg, 1997) and recent cognitive formulations (Clark & McManus, 2002) have received considerable empirical evaluation (for reviews see Hirsch & Clark, 2004; Bogels & Mansell, 2004; Spurr & Stopa, 2002). However, attempts to examine the allocation of attention to external social cues in social anxiety have been mixed.

The allocation of external attention in social anxiety has been extensively researched using the modified visual probe paradigm. During modified visual probe tasks, individuals are initially instructed to focus on a fixation cross in the centre of a computer screen. This cross is then replaced by a stimulus pair, consisting of one critical stimulus and one control stimulus, which is displayed on the screen for a pre-determined time period, typically 500ms. After the stimulus pair disappears a probe is presented in the spatial location previously occupied by one of the stimuli; shorter reaction times to the probe are taken to indicate that the individual's attention had been focused on the stimulus presented in the location of the probe prior to stimulus off-set. As specific cognitive models of social anxiety and general models of attentional processing in anxiety (e.g. Mogg & Bradley, 1998) suggest that anxiety is characterised by biases in initial orienting to threat, visual probe studies have typically used short stimulus presentations (500ms) to index the participant's initial orienting.

Early studies using the visual probe paradigm tended to use word pairs as stimuli, and contradictory findings were reported: some studies reported attentional

biases to socially threatening words in individuals with social phobia (e.g. Asmundson & Stein, 1994), but other studies failed to find this bias in individuals high in social anxiety (e.g. Mansell, Ehlers, Clark, & Chen, 2002). A plausible explanation for this is that while negative word stimuli might convey sufficient threat to modulate initial attention orienting in socially phobic individuals, word stimuli convey less threat when compared to more ecologically social threat stimuli (e.g. emotional facial expressions), and may therefore not modulate initial orienting in those with sub-clinical levels of social anxiety. Indeed, the results from a recent study support this hypothesis, as the authors reported that although they found socially anxious individuals to display an attention bias towards negative facial expressions, no effect was found regarding negative word stimuli (Pishyar, Harris, & Menzies, 2004).

To date, visual probe research using facial expressions as stimuli has produced mixed results regarding the selective allocation of attention towards the external environment. Although some studies have reported attentional biases *towards* threatening faces in individuals high in social anxiety (Pishyar et al., 2004) and individuals with generalised social phobia (Mogg, Philippot, & Bradley, 2004) other studies have reported attentional biases *away from* emotional faces (positive and negative) in individuals with social phobia (Chen, Ehlers, Clark, & Mansell, 2002), and high socially anxious individuals under conditions of social evaluative threat (Mansell, Clark, Ehlers, & Chen, 1999).

One factor that might account for the equivocal findings concerns the nature of the control stimuli used . The studies that have provided evidence of attention away from faces (avoidance of faces) used household objects as the control stimuli (e.g. Chen et al., 2002), whereas studies demonstrating attention towards (vigilance for) negative facial expressions used neutral facial expressions as control stimuli (e.g. Mogg et al., 2004). It can therefore be argued that the allocation of attention is dependent on the nature of competing stimuli, such that socially anxious individuals will avoid facial expressions in preference for other stimuli if they have the opportunity to do so, but will preferentially attend to negative expressions if encouraged to select between competing social cues. These findings could be argued to tap into two different aspects of the revised cognitive model put forward by Clark & McManus (2002): socially anxious individuals avoid social cues if other stimuli are available, due to a motivation to avoid processing of external social cues, but will selectively attend to negative social cues when attending to competing social cues, consistent with a predicted negative bias in the allocation of attention to external social cues (Clark & McManus, 2002; Mogg & Bradley, 1998).

As noted earlier visual probe studies that employ short picture durations (e.g. 500 ms) have been proposed to index biases in *initial* orienting of attention. However, this assumption has recently been challenged in the literature. It has been suggested that it is not possible to determine if attentional biases reported by visual probe studies are due to initial orienting towards socially threatening cues, or difficulty disengaging from them. Fox, Russo, Bowles and Dutton (2001) argued that during visual probe tasks,

individuals may attend alternately to both presented stimuli, and may then subsequently dwell on the threatening stimulus once it has been detected, thereby leading to shorter reaction times to probes that appear in this location.

The proposal that attentional bias in anxiety is best characterised by a difficulty in disengaging from threatening stimuli, rather than a bias in initial orienting, has been explored using the exogenous cueing paradigm. In the task (which was adapted from an original attention task developed by Posner, 1980), threatening and neutral cues are presented individually in one of two spatial locations. After the presentation of each cue, a target is presented in either the same location as the cue (valid trials) or the opposite location (invalid trials). In order to respond to the target presented in invalid trials, individuals must disengage their attention from the cued location in order to shift attention and subsequently respond to the target. Therefore, longer reaction times to targets in invalid trials indicate difficultly disengaging from the previously presented cues.

Research utilising the exogenous cueing paradigm with individuals high in anxiety suggests that high anxious individuals have difficulty disengaging from emotional facial expressions (e.g. Fox, Russo, Bowles, & Dutton, 2001; Fox, Russo, & Dutton, 2002; Georgiou et al., 2005), and threatening pictures (Yiend & Mathews, 2001). Considering social anxiety specifically, it has been reported that individuals with social phobia showed longer response latencies to detect invalidly cued targets that followed social threat words, suggesting that individuals with social phobia may have a

specific difficulty disengaging from socially threatening material (Amir, Elias, Klumpp, & Przeworski, 2003).

Results from these cueing paradigm studies indicate that anxious individuals do have difficulty disengaging attention from threatening stimuli, and that this may be an important mechanism underlying the selective attention to threatening cues reported by visual probe studies. However, as the cueing paradigm is not able to investigate delayed disengagement and initial orienting simultaneously, it is not possible to determine if selective attention to threatening cues is due solely to delayed disengagement, or a combination of this effect and preferential initial orienting towards threat.

Although the visual probe and exogenous cueing paradigms have proved useful in profiling attentional biases in anxiety, the paradigms are limited in their ability to accurately disambiguate attentional orienting and disengagement, as they are not able to measure attention patterns over time. As attention is a dynamic phenomenon, assessing attention at fixed time points (e.g. 500ms in conventional probe tasks) provides an incomplete understanding of attention allocation over time.

There are conflicting theories in the literature regarding attention patterns, namely the vigilance-avoidance hypothesis and the delayed disengagement hypothesis. The vigilance-avoidance hypothesis stipulates that anxious individuals display an initial hypervigilance to threatening stimuli, which is followed by strategic avoidance of the threat cues in an attempt to reduce anxiety (Mogg, Bradley, deBono, & Painter, 1997).

In contrast, the delayed disengagement hypothesis suggests that once socially threatening cues have been detected, socially anxious individuals maintain their attention on them due to a difficulty with disengagement (e.g. Fox, Russo, & Dutton, 2002).

Recent studies have begun to investigate the hypothesized attention patterns using equipment designed to monitor eye movements. Eye movement monitoring allows researchers to directly track an individual's gaze, and a wealth of information can be extracted, including the direction of eye movements, the time taken to make fixations, and the duration of fixations. The ability to obtain such rich data concerning attention processes is extremely important, especially given the unresolved questions that currently remain in the literature regarding external attention in social anxiety.

As research utilising eye movement technology is still in its infancy, only one published study has been identified that investigated selective attention to external cues in social anxiety using this methodology. This study investigated the allocation of attention to face-face pairs and face-object pairs in individuals high and low in social anxiety, under conditions of social-evaluative threat and no social threat (Garner, Mogg, & Bradley, 2006). Under social threat conditions, socially anxious individuals were faster to orient towards emotional faces, but they maintained their attention on these emotional faces for a shorter period of time (Garner et al., 2006). These findings provide some support for models that suggest anxiety disorders are characterised by a vigilant-avoidant pattern of attentional bias.

One limitation of the study by Garner et al. (2006) was that the emotional expressions were limited to happy and angry expressions, and therefore no information is available to date regarding the pattern of attention allocation to other emotions. Additionally, the study only examined data from the first fixation and did not examine whether social anxiety groups differed in their allocation of overt attention beyond the first fixation. Indeed, it seems necessary for studies to examine attentional patterns over longer time periods in order to more directly test the vigilance-avoidance hypothesis and the contrasting prediction regarding delayed disengagement that has emerged following recent research findings (e.g. Fox, Russo, Bowles, & Dutton, 2001)

Given the recent advances in technology, and the unanswered questions that remain regarding the allocation of external attention in social anxiety, the current study aimed to explore patterns of attention to facial expressions in high and low socially anxious individuals, using a visual probe task and concurrent eye movement monitoring. In order to investigate patterns of attention over time, a visual probe task with two different stimulus presentation times (500ms and 2000ms) was used, the latter being longer than any presentation time (stimulus onset asynchrony; SOA) used in previously published studies. Additionally, to allow the investigation of attention to different facial expressions, the current study paired neutral faces with happy, angry and fearful faces. For the 2000ms SOA, attention patterns were investigated by recording the direction of the initial fixation, the latency to this fixation, the duration of this fixation, and the total number of fixations made during stimulus presentation. Only information relating to the

direction of the initial fixation and the latency to this fixation were extracted for the shorter 500ms trials. Although the primary outcome measures were obtained using eye movement technology, reaction time indices of attentional bias were also examined.

Based on the current theoretical conceptualisations and evidence base, the following hypotheses were generated regarding the allocation of attention:-

- Individuals high in social anxiety (SA) will show greater attentional biases for emotional faces than those low in SA (computed from reaction times in the visual probe task).

- Individuals high in SA will initially attend to the emotional stimuli more often than those low in SA.

- Individuals high in SA will orient to emotional stimuli faster than individuals low in SA.

- The duration of initial fixations to emotional stimuli will differ between those high and low in SA. Due to the competing hypotheses in the literature, individuals high in SA will either maintain their gaze for a significantly shorter period of time (based on the vigilance-avoidance hypothesis) or a significantly longer period of time (based on the delayed disengagement hypothesis) than those low in SA.

- Individuals high in SA will make a greater number of eye movements during stimuli presentation than those low in SA.

The current study received ethical approval from the School of Psychology Ethics Committee (see Appendix C).

2. Method

2.1. Design

The current study employed a mixed experimental design, consisting of both between-subjects and within-subjects independent variables (IVs). For the analysis of attentional bias scores (obtained from reaction time data), the between-subjects IV was group, which consisted of two levels (high social anxiety (HSA) and low social anxiety (LSA)), the within-subjects IV was the emotion of the critical stimulus (angry, fearful, happy), and the dependent variable was the attentional bias score. For the analyses investigating the direction, latency and duration of the first fixation, the between-subjects IV was group (HSA vs. LSA), and the within-subjects IVs were type of emotional face paired with a neutral face (angry, fearful, happy) and direction of fixation (towards emotional face vs. away from emotional face). Dependent variables were the percentage of eye movements to stimuli, the time taken to make the fixation and the duration of the fixation, for the direction, latency and duration analyses respectively. Direction and latency data were extracted from all trials (500ms SOA and 2000ms SOA), but duration data was only extracted from the 2000ms trials, due to the majority of initial fixations in the 500ms trials being terminated by stimuli off-set rather than by participants themselves.

The analysis investigating the number of fixations during stimuli presentation consisted of a between-subjects IV of group (HSA vs. LSA), and a within-subjects IV of the emotion of the critical stimulus (angry, fearful, happy). The dependent variable was the number of fixations made during stimuli presentation, for the 2000ms trials.

2.2. Participants

Participants were recruited from the University of Southampton student population, members of University staff, and colleagues and acquaintances of the researcher. Based on effect sizes obtained from Garner, Mogg and Bradley's (2006) study utilising eye movement monitoring in social anxiety, power calculations estimated that the required sample size for the current study would be between 12 and 22 participants per group (see Appendix D).

147 individuals completed a brief version of the Fear of Negative Evaluation scale (bFNE; Leary, 1983), to determine if they were eligible for the study (details below). Students from the University of Southampton obtained this questionnaire by either responding to an advertisement on the University 'Psychobook' website, which is specifically designed for research recruitment, or by completing one of the brief FNEs that were placed in their common room. Colleagues and acquaintances of the researcher, and University staff, were provided with a brief FNE by the researcher when they expressed an interest in participating. The brief FNE is a 12 item measure which has been shown to correlate highly with the full version of the FNE (Leary, 1983);

completion of the measure results in a score of between 12 and 60, with higher scores indicating higher levels of social anxiety.

In order to filter out individuals with moderate levels of social anxiety, only individuals scoring below thirty or above forty on the brief FNE were invited to take part in the study (consistent with previous studies that have screened using the brief FNE, e.g. Garner et al., 2006). Of the 147 individuals who completed the screening questionnaire, 43 scored below thirty and 57 scored above forty; all of these individuals were invited to take part in the study. Of the 100 individuals eligible for the study, 36 participants contacted the researcher and attended for the test session. There were no significant differences in terms of gender between those who were eligible but declined to take part and those who took part in the study ($\chi^2(1) = 1.50$, ns), but the group who were eligible and declined to take part had a significantly lower mean age ($t(93)=-3.80$, $p<.01$).

The high and low socially anxious groups were determined using the full-length version of the Fear of Negative Evaluation questionnaire (FNE; Watson & Friend, 1969), which was completed in standardised testing conditions. As pre-screening had already been implemented, a median split based on full FNE scores was employed to split the groups. Participants scoring nine and below were placed in the low socially anxious group and participants scoring greater than nine were placed in the high socially anxious group. Two participants who had scored above the screening cut-off for high social anxiety on the brief FNE subsequently moved to the low socially anxious group

after the median split; their data was therefore excluded from further analysis due to its unreliability. The high socially anxious (HSA) group therefore consisted of 17 participants (3 males and 14 females), aged between 18 and 28 years ($M = 21.53$ years; $SD = 3.12$ years), and the low socially anxious (LSA) group consisted of 17 participants (4 males and 13 females), aged between 18 and 29 years ($M = 22.59$ years; $SD = 4.06$ years). There were no significant differences between the two groups in terms of age ($t(32) = 0.85$, ns), years in education ($t(32) = -0.29$, ns), or gender ratio ($\chi^2(1) = 0.67$, ns).

2.3. Materials and Equipment

The facial expression stimuli used in the visual probe task comprised of black and white photographs of four male and four female models, obtained from the NimStim Face Stimulus set (Tottenham et al., in press). Each picture pair consisted of an emotional expression (the critical stimulus) paired with a neutral expression of the same model (the control stimulus). For each model, there were 3 emotion-neutral face pairs (angry-neutral, fearful-neutral, happy-neutral), which were each displayed at the two different SOAs (500ms and 2000ms). Additionally, the location of the critical stimulus was counterbalanced across trials, so that the critical stimulus appeared on both the right and left hand side of the screen, and each picture pair was presented twice. This resulted in a total of 24 trials for each model, and 192 experimental trials in total. The spatial location of the probe was also counter-balanced across the presented trials. During each of the trials, the pictures were presented side-by-side on the computer screen, 110mm apart. The task was presented using MEL version 2 software (Schneider, 1995), a Pentium 450MHz PC, a 15" VGA monitor, and a MEL version 2 response box.

To obtain eye movement data, Acq*Knowledge* 3.8.1. software was used in conjunction with BIOPAC MP150 hardware. The BIOPAC machine was linked to the computer presenting the visual probe task and the computer acquiring the eye movement data. 8mm silver-silver chloride (Ag-AgCl) electrodes, filled with conductive gel, were attached 1cm beyond the left and right outer canthi of the left and right eye respectively, and were connected to a BIOPAC electrooculogram amplifier (EOG100C). Direct current voltages were sampled every 1000ms and horizontal EOG traces were visually inspected throughout data collection for noise and deterioration in signal quality.

2.4. Self-Report Measures

All participants completed the following self-report measures during the test session.

The Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996)

The BDI-II is a 21 item questionnaire that assesses depressive symptomatology over the two weeks prior to completion. The BDI has been reported to have good reliability, with an alpha coefficient of .93 and test-retest reliability of .93 being reported (Beck, Steer, & Brown, 1996).

Liebowitz Social Anxiety Scale-Self Report version (LSAS-SR; Baker, Heinrichs, Kim, & Hofmann, 2002)

The Liebowitz Social Anxiety scale (LSAS; Liebowitz, 1987) is a measure used to assess the degree to which individuals fear and avoid specific social and performance

situations. Although the LSAS was originally developed as a clinician-rated measure, self-report versions of the measure (LSAS-SR) have recently been utilised by researchers. The LSAS-SR requires participants to rate each item on a four point Likert scale, considering both their anxiety regarding the situation (none, mild, moderate, severe) and their avoidance of the situation (never, occasionally, often, usually). The LSAS-SR has been reported to have excellent internal consistency (alpha coefficient = 0.95), good test-retest reliability (r=0.83), and high correlation with the clinician administered version (Baker et al., 2002).

Fear of Negative Evaluation Scale (FNE; Watson & Friend, 1969)

The FNE measures the degree to which individuals feel distress and apprehension at the prospect of being negatively evaluated by other people. The scale is reported to have satisfactory internal consistency (mean biserial correlation = .72) and good test-retest reliability (r = .78). This measure was included in the study as there is research evidence to 'support the use of a strategy in which high and low FNE groups are used as an analogue to study cognitive processes in social phobia' (Stopa & Clark, 2001).

Social Phobia Inventory (SPIN; Conner et al., 2000)

The SPIN was developed due to the fact that no previous self-report measures had assessed all aspects of social anxiety, namely fear, avoidance and physiological symptoms. This 17 item questionnaire measures these 3 aspects of social anxiety and has sound psychometric properties. Cronbach's alpha coefficients of between .82

and .94, and test-retest reliability correlations of between .78 and.89, have been reported,

depending on the groups studied (Conner et al., 2000).

Stait-Trait Anxiety Inventory – Form Y (STAI (Form Y); Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)

The STAI (Form Y) is a 40 item self-report questionnaire that differentiates between

temporary 'state' anxiety and general 'trait' anxiety. In the original validation studies,

the internal consistency of the measure was reported to be excellent, with median

coefficients of.93 and .90 being reported for the state and trait scales respectively.

Although the test-retest reliability of the trait questionnaire was good (coefficients

between .73 and .86), the test-retest reliability of the state questionnaire was poor

(median coefficient of .33). This low test-retest reliability was expected and desired,

however, as the scale aims to measure transitory state anxiety, which varies as a result

of situational factors (Spielberger et al.,1983).

2.5. Procedure

Following screening with the brief FNE, eligible participants were provided with an

information sheet (see Appendix E) via email, and were asked to contact the researcher

to arrange a convenient time for the test session if they were interested in taking part in

the study.

On arrival at the test session, participants were provided with another copy of

the information sheet and were given the opportunity to ask any questions, before

providing written consent to take part in the study (see Appendix F). Before beginning

the computer task, participants' visual acuity was measured to ensure that their vision

was within normal limits. The participants then completed the computer task (details

below), followed by the self-report measures described above.

EOG electrode contact sites were cleaned with surgical spirit and water, and

abraded to remove dead skin cells. The researcher then filled the electrodes with

conductive gel, and attached them to participants using adhesive collars. Participants

were seated one metre away from the computer screen and were asked to use the chin

rest provided, to eliminate head movements throughout the task. Participants were

provided with standardised verbal and written instructions concerning the completion of

the task, and were given the opportunity to ask any questions.

The computer task consisted of a visual probe task, pairing emotional faces

(angry, fearful, happy) with neutral faces. At the beginning of each trial, a fixation cross

appeared in the centre of the screen for one second, and participants were instructed to

look at this cross (to provide information about their focus of attention immediately

prior to the onset of the facial stimuli). After one second, the cross was replaced by

pictures of two faces, side-by-side, one of which depicted a neutral expression and the

other of which depicted an emotional expression. The stimuli remained on the screen

for either 500ms or 2000ms, before being replaced by a probe (vertical dots [:] or

horizontal dots [..]) in one of the spatial locations previously occupied by one of the

faces. The participants were instructed to respond as quickly and accurately as possible

to the probe, by pressing the corresponding button on the response box. During the task the participants' eye movements were monitored, using the eye movement equipment described previously. To ensure that participants were fully conversant with the procedure, they completed eight neutral-neutral practice trials before beginning the main task, which consisted of 192 experimental trials presented in a random order. Critical stimulus location (left, right), probe location (left, right) and probe type (vertical, horizontal dots) were counterbalanced across each emotion-neutral face-pair condition.

Participants subsequently completed two additional tasks within the test session; these tasks are not reported here due to the fact that they addressed different hypotheses to those examined in the current paper. Following the computer tasks, participants completed the self-report questionnaires described previously. Upon completion of the questionnaires, participants were verbally debriefed and also provided with a debriefing sheet (see Appendix G). Participants' travel to the test session was reimbursed and they were thanked for their participation.

2.6. Extraction and Preparation of Eye Movement Data

Eye movement data acquired by the Acq*Knowledge* software was extracted manually for each of the 192 trials completed by each participant. For each of the 500ms trials, information was extracted regarding the direction of the initial fixation (left or right) and the latency to this fixation (in milliseconds; ms). For each of the 2000ms trials, information was extracted regarding the direction of the initial fixation (left or right), the latency to this fixation (ms), the duration of this fixation (ms), and the direction and

duration of subsequent fixations until stimulus off-set. Data extraction was completely blind to the type of stimuli presented in each trial.

Trials where participants did not look at either face were coded as missing. Anticipatory eye movements (those occurring within 100ms after picture onset) were removed from the latency analysis, and fixation durations that were less than 100ms were removed from the duration analysis. Taking these factors into account, data was available from 73% of trials.

Analyses of the proportions of missing data revealed no significant differences as a function of the interaction between emotional expression, SOA or group. However, there was significantly more missing data in the 500ms SOA condition (32%) than the 2000ms SOA condition (23%), and significantly more missing data in the LSA group compared to the HSA group (consistent with the direction data reported in section 3.2 of the main text)[2].

The quality of the EOG trace obtained from one participant was extremely poor, and therefore no data could be extracted; this participant's data was removed from any further analysis.

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[2] *Note* – condition means for latency and duration dependent measures were only computed for individuals who provided 16 valid data-points per condition. This ensured group means were not unduly influenced by unstable indices of performance (e.g. unstable participant means based on a single data point).

3. Results

3.1. Group Characteristics

The demographic homogeneity of the groups has been described previously, but it is important to reiterate that the groups did not differ in terms of age, gender, or years in education. Regarding the self-report measures completed at the test session, Kolmogorov-Smirnov tests revealed that the distribution of scores for all measures did not differ significantly from normality (p values between .07 and .42 were computed). Independent samples t-tests were conducted to compare the mean scores for the high socially anxious (HSA) and low socially anxious (LSA) groups, on each of the measures administered (see Table 1 for a summary of means, standard deviations, t scores and p values).

Table 1.

Comparison between the High and Low Socially Anxious Groups on Self-Report Measures

	High Social Anxiety (N=17)		Low Social Anxiety (N=16)		T	p
	M	*SD*	*M*	*SD*		
BDI-II	12.88	8.96	3.31	2.21	*t*(18)*	<.01
STAI-S	39.59	12.29	28.50	5.01	*t*(21)*	<.01
STAI-T	46.18	9.19	30.31	4.87	*t*(25)*	<.01
FNE	24.65	4.91	4.50	3.08	*t*(31)	<.01
SPIN	22.71	13.21	6.44	4.11	*t*(19)*	<.01
LSAS	49.00	24.32	19.94	10.19	*t*(22)*	<.01

* Equal variances could not be assumed due to Levene's test sig. < .05.
Note. BDI-II = Beck Depression Inventory – Second Edition; STAI-S = State-Trait Anxiety Inventory – State scale; STAI-T = State-Trait Anxiety Inventory – Trait scale; FNE = Fear of Negative Evaluation scale; SPIN = Social Phobia Inventory; LSAS = Liebowitz Social Anxiety Scale.

The HSA group had significantly higher scores on all measures of social anxiety, generalised anxiety, and low mood, compared to the LSA group.

Kolmogorov-Smirnov tests revealed that the distributions for all reaction time data and eye movement dependent measures did not differ significantly from normality, and parametric statistical analyses have therefore been utilised throughout this section. Due to the complexity of the analysis, the results will be reported in turn, based on the hypotheses presented in the introduction.

3.2. Analysis of Reaction Time Data

Based on theoretical models and previous research, it was hypothesized that individuals high in social anxiety would have greater attentional biases for emotional faces than those low in social anxiety. Only reaction time (RT) data from the 500ms trials was analysed, as multiple fixations throughout the 2000ms trials would render the RT index at 2000ms ambiguous. Attentional bias indices were computed, to express the extent to which RTs were reduced to probes appearing in the location of emotional (cf. neutral) faces. RT biases were therefore calculated for each emotion by subtracting the mean RT for valid trials (when the critical stimulus and probe appeared in the same location) from the mean RT for invalid trials; larger positive values represent greater attentional biases towards the emotion and negative values represent attentional biases away from the emotion. Table 2 shows the mean attentional biases for each emotion, in high and low socially anxious participants.

Table 2

Attentional Biases Towards Emotional Faces

	High Social Anxiety (N=17)		Low Social Anxiety (N=16)	
	M	*SD*	*M*	*SD*
Attentional Bias to Angry	12.39	46.97	-14.49	32.57
Attentional Bias to Fearful	28.13	35.78	7.08	45.06
Attentional Bias to Happy	24.83	50.03	22.02	41.41

To investigate whether there were significant differences in the attentional biases towards different emotional expressions, and to explore any impact of social anxiety group, a 3 x 2 mixed design analysis of variance (ANOVA) was conducted. Within the ANOVA, emotion (angry, fearful, happy) was entered as a within-subjects variable, and group (HSA vs. LSA) was entered as a between-subjects variable.

There were no significant main effects of group ($F(1,31) = 3.83, p=.059$) or emotion ($F(2,62) = 3.02, p=.056$), and no significant interaction between the factors ($F(2,62) = 0.73, ns$). Although the main effects of group and emotion were not significant, results revealed trends for both factors. The trend regarding anxiety group indicated that individuals in the high social anxiety group had stronger positive attentional biases ($M=21.78$) towards the emotional faces than those in the low social anxiety group ($M=4.87$), Cohen's $d = 0.40$. Post hoc analyses (paired samples t-tests) on the emotion trend revealed significantly larger attentional biases for happy faces ($M=23.47$) compared to angry faces ($M=-0.64$), $t(32) = -2.43, p<.05, d=0.55$, but no

significant differences in attentional biases for happy faces compared to fearful faces ($t(32) = -0.56$, *ns*), or angry faces compared to fearful faces ($t(32) = -1.65$, *ns*).

3.3. Direction of Initial Fixation

It was hypothesized that individuals high in social anxiety would initially attend to the emotional stimuli more often than those low in social anxiety. The percentages of trials with eye movements towards and away from emotional faces, for each group, are presented in Table 3. The percentage is derived from the total number of trials in each condition, rather than the total number of eye movements made by each participant (as this would inflate eye movement bias scores when the number of actual fixations was low).

Table 3.

Percentage of Trials with Eye Movements Towards and Away from Emotional Faces

	High Social Anxiety (N=17)		Low Social Anxiety (N=16)	
	M	*SD*	*M*	*SD*
Towards Angry	47.89	11.33	38.48	19.00
Away from Angry	30.43	11.43	22.07	12.17
Towards Fearful	48.53	9.24	38.67	20.27
Away from Fearful	31.71	8.63	23.63	10.75
Towards Happy	44.49	11.04	36.13	17.42
Away from Happy	35.75	7.87	24.02	13.66

Note. Away from [Emotion] = Towards Neutral Expression; Total number of trials per pair = 64.

To investigate whether there were significant differences in the proportion of

initial eye movements towards and away from emotional expressions, and to explore

any impact of social anxiety group, a 3 x 2 x 2 mixed design ANOVA was conducted.

Within the ANOVA, emotion (angry, fearful, happy) and direction (towards vs. away)

were entered as within-subjects variables, and group (HSA vs. LSA) was entered as a

between-subjects variable. Results revealed a significant main effect of group ($F(1,31)$

= 5.30, $p<.05$, $d=1.46$), a significant main effect of direction ($F(1,31) = 84.48$, $p<.01$,

$d=1.14$), and a significant interaction between emotion and direction ($F(2,62) = 4.02$,

$p<.05$). However, results revealed no significant main effect of emotion ($F(2,62) = 1.40$,

ns), and no interactions between group and emotion ($F(2,62) = 0.68$, ns), or group and

direction ($F(1,31) = 0.01$, ns).

The significant main effect of group revealed that individuals in the HSA group

made significantly more initial eye movements ($M=79.6\%$) than individuals in the LSA

group ($M=61.0\%$), indicating that individuals high in social anxiety were more likely to

make an initial eye movement to either one of the stimuli. The significant main effect of

direction revealed that all individuals, regardless of social anxiety, were more likely to

initially attend to the emotional face ($M=42.4\%$) than the neutral face ($M=27.9\%$). Due

to the interaction between emotion and direction (see Figure 1), post hoc analyses were

conducted.

Paired samples t-tests revealed that participants were significantly more likely to

look towards angry ($t(32) = 7.56$, $p<.01$, $d=1.23$), fearful ($t(32) = 7.52$, $p<.01$, $d=1.30$),

and happy faces ($t(32) = 5.41$, $p<.01$, $d=0.84$), than they were to look towards the
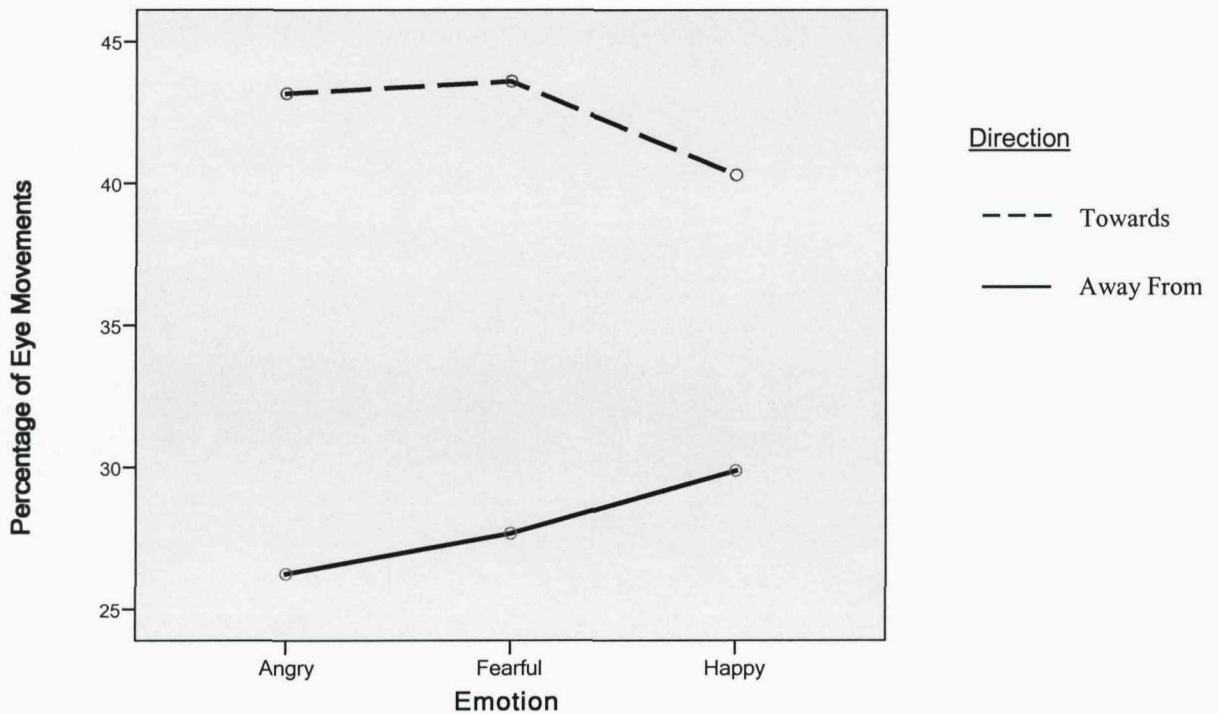
competing neutral facial expression.

Figure 1. Interaction between emotion of face and direction of eye movement

Repeated-measures ANOVAs revealed significant effects of emotion when the

initial fixation was directed both towards emotional faces ($F(2,64) = 3.25$, $p<.05$) and

away from emotional faces.($F(2,64) = 4.27$, $p<.05$). Considering fixations *towards*

emotional faces, paired samples t-tests revealed that individuals made significantly

more eye movements towards fearful faces compared to happy faces ($t(32) = 2.24$,

$p<.05$, $d=0.23$), but that there were no significant differences between the percentages

of fixations towards angry faces compared to fearful faces(t(32) =   -0.34, *ns*), or angry faces compared to happy faces(t(32) = 1.94, *ns*). Considering fixations *away from* emotional faces, paired samples t-tests revealed that individuals made significantly more eye movements away from happy faces than angry faces (t(32) = 2.72, p<.05, d=0.32), but that there were no significant differences between the percentages of fixations away from happy faces compared to fearful faces (t(32) = 1.81, *ns*), or fearful faces compared to angry faces(t(32) = 1.18, *ns*).

3.4. Latency to Initial Fixation

It was hypothesized that individuals high in social anxiety would orient towards emotional stimuli faster than individuals low in social anxiety. As the two different presentation times had different potential latency scores (between 100 and 400ms for the 500ms SOA, and between 100ms and 1900ms for the 2000ms SOA), the latency variances were examined using box plots. The box plots indicated that the variance of the latencies obtained for each SOA were not homogenous (thereby violating assumptions of ANOVA). Thus, latency analysis was conducted independently for each SOA. Table 4 shows the mean latencies to orient towards and away from emotional faces for each group, at the 500ms SOA.

Table 4.

Mean Latencies to Orient Towards and Away From Emotional Faces (500ms SOA)

	High Social Anxiety (N=17)		Low Social Anxiety (N=13)	
	M	*SD*	*M*	*SD*
Towards Angry	307.03	33.59	306.30	32.86
Away from Angry	273.73	52.95	279.40	50.85
Towards Fearful	306.16	50.18	299.58	37.74
Away from Fearful	280.79	53.01	300.20	51.00
Towards Happy	294.22	54.04	311.04	38.73
Away from Happy	282.00	41.69	294.69	54.31

Note. Away from [Emotion] = Towards Neutral Expression

To investigate whether there were significant differences in the latencies towards and away from emotional expressions, and to explore any impact of social anxiety group, a 3 x 2 x 2 mixed design analysis of variance (ANOVA) was conducted with emotion (angry, fearful, happy) and direction (towards vs. away) entered as within-subjects variables, and group (HSA vs. LSA) entered as a between-subjects variable. Results revealed only a significant main effect of direction ($F(1,28) = 18.35, p<.01,$ $d=0.41$), reflecting participants' longer latencies to look towards the emotional faces ($M=304.10$ms) than towards the competing neutral stimuli ($M=285.14$ms). There were no significant main effects of group ($F(1,28) = 0.32, ns$) or emotion ($F(2,56) = 0.41, ns$), and no significant interactions between any variables ($Fs(2,56)<1.50, ps>.23; F(1,28) = 1.14, p=.30$).

Identical analyses were conducted using latency data from the 2000ms trials, and results revealed no significant main effect of emotion ($F(2,58) = 0.50$, ns), group ($F(1,28) = 0.32$, ns), or direction ($F(1,29) = 0.26$, ns), and no interactions between any of the variables ($Fs(2,58)<0.51$, $ps>.60$; $F(1,29)=0.16$, $p=0.70$).

3.5. Duration of Initial Fixation

Due to the competing hypotheses in the literature, it was predicted that individuals high in social anxiety would maintain their attention on the emotional stimuli for either significantly *shorter* periods of time (vigilance-avoidance hypothesis) or significantly *longer* periods of time (delayed disengagement hypothesis) than those low in social anxiety. Data regarding the duration of the initial fixation were only extracted for the 2000ms SOA trials, as the majority of initial fixations in the 500ms trials were terminated by stimulus off-set rather than by the participants themselves. Mean durations for initial fixations towards and away from emotional expressions can be seen in Table 5.

Table 5.

Mean Duration of Initial Fixations to Emotional Faces and Neutral Faces

| | High Social Anxiety (N=17) | | Low Social Anxiety (N=14) | |
	M	SD	M	SD
Towards Angry	542.49	151.51	454.19	159.87
Away from Angry	402.19	124.82	391.57	152.24
Towards Fearful	539.89	177.70	481.44	130.83
Away from Fearful	401.24	130.27	395.25	130.21
Towards Happy	509.43	157.32	417.82	93.07
Away from Happy	465.97	164.71	418.81	163.18

To investigate whether there were significant differences in the duration of initial fixations to emotional and neutral expressions, and to explore any impact of social anxiety group, a 3 x 2 x 2 mixed design analysis of variance (ANOVA) was conducted with emotion (angry, fearful, happy) and direction (towards vs. away) entered as within-subjects variables, and group (HSA vs. LSA) entered as a between-subjects variable. Results revealed a significant main effect of direction ($F(1,29) = 18.23, p<.01, d=0.54$), reflecting participants' longer durations on emotional faces ($M=490.95$ms) than neutral faces ($M=412.51$ms), and a significant interaction between emotion and direction ($F(2,58) = 4.10, p<.05$). There were no significant main effects of group ($F(1,29) = 1.63, ns$) or emotion ($F(2,58) = 0.08, ns$), and no significant interaction between emotion and group ($F(2.58) = 0.50, ns$). However, the interaction between direction and group revealed a trend which warranted post hoc analysis ($F(1,29) = 2.51, p=.12$).

Regarding the interaction between emotion and direction (see Figure 2), post hoc paired samples t-tests revealed that participants fixated significantly longer on angry ($t(31) = 3.53$, $p<.01$, $d=0.69$) and fearful ($t(31) = 4.44$, $p<.01$, $d=0.79$) faces, compared to the competing neutral stimuli, but that this effect was not seen for happy facial expressions ($t(31) = 0.24$, ns). Repeated-measures ANOVAs revealed no significant main effects of emotion on fixation duration when the initial fixation was directed either towards emotional faces ($F(2,64) = 1.63$, ns) or away from emotional faces ($F(2,60) = 2.00$, ns).
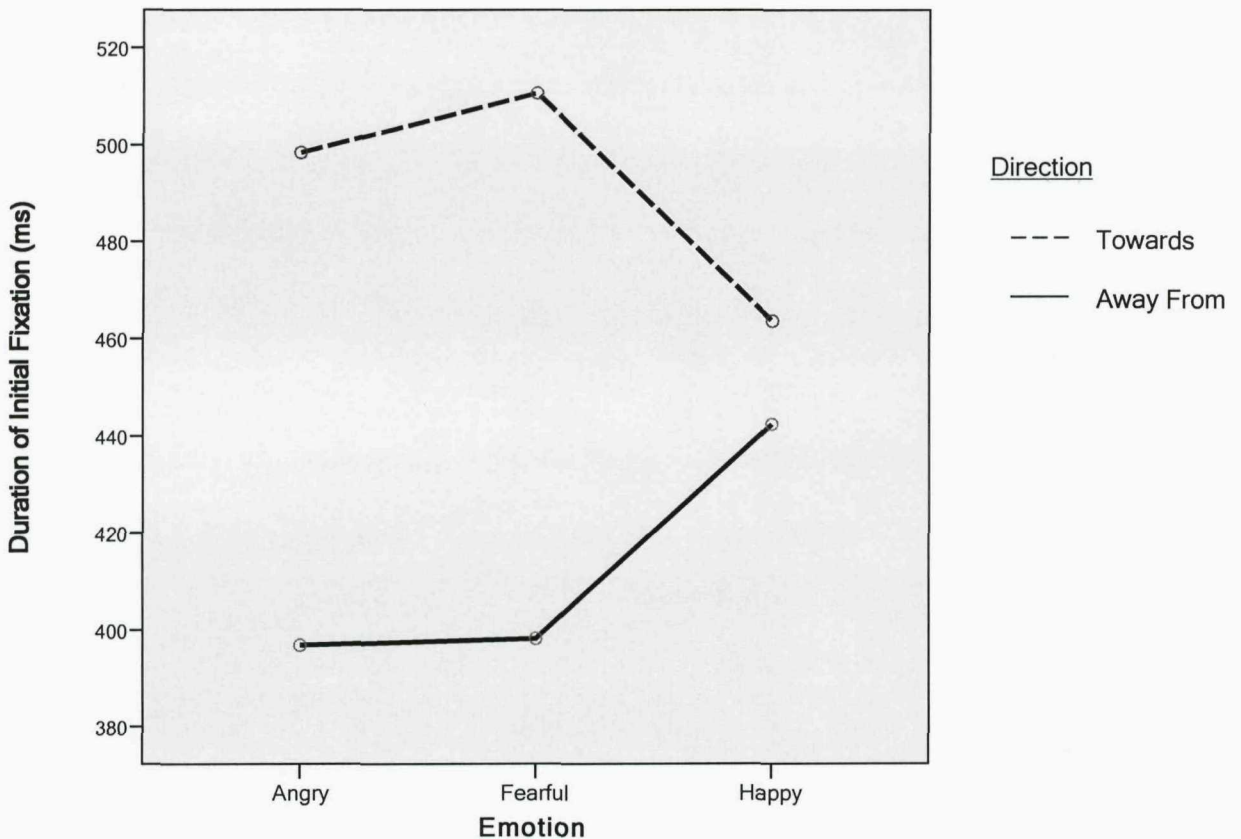

Figure 2. Duration of initial fixations (in ms) for each emotion x direction condition

Due to the observed trend regarding the interaction between group and direction, post hoc tests were conducted. Paired samples t-tests revealed that the HSA group spent significantly longer fixating on emotional faces (M=530.60ms) compared to competing neutral faces (M=423.13ms), t(16) = 5.47, p<.01, d=0.71, but that this effect was not found in the LSA group, t(15) = 0.85, ns. Independent samples t-tests revealed that the HSA group fixated significantly longer on emotional faces (M=530.60ms) than the LSA group (M=436.65ms), t(31) = 2.16, p<.05, d=0.55, but that there were no significant differences in fixation duration between the groups when the initial fixation was away from the angry face (towards the competing neutral face), t(31) = -0.38, ns.

3.6. Stability of External Attention

Based on the suggestion made by cognitive models that socially anxious individuals scan their environment for potential threat (e.g. Rapee & Heimberg, 1997), it was hypothesized that individuals high in social anxiety would make a greater number of eye movements during stimuli presentation. Data corresponding to all fixations made during stimuli presentation was only extracted for the 2000ms trials, as the majority of the 500ms trials consisted of only one fixation. Box plots displaying the distribution of the mean number of fixations per trial across the entire sample revealed an outlier in the LSA group (the individual's mean number of fixations per trial (4.23) was more than two standard deviations above the overall sample mean of 2.53); the individual's data was therefore excluded from further analysis. The mean number of fixations per trial for each group and each emotion-neutral pair type can be seen in Table 6.

Table 6.

Mean Number of Fixations per 2000ms trial

Pair Type	High Social Anxiety (N=17)		Low Social Anxiety (N=15)	
	M	*SD*	*M*	*SD*
Angry – Neutral	2.66	0.55	2.20	0.74
Fearful – Neutral	2.66	0.55	2.25	0.66
Happy – Neutral	2.77	0.57	2.26	0.67
All Pair Types	2.70	0.54	2.24	0.68

As the distribution of the mean number of fixations did not differ significantly from normal ($D(32) = 0.55$, *ns*), a 3 x 2 mixed design ANOVA was conducted, with emotion (angry, fearful, happy) as a within-subjects factor and group (HSA vs. LSA) as a between-subjects factor. Results revealed a main effect of group ($F(1,30) = 4.59$, $p<.05$, $d=0.58$), but did not reveal a main effect of emotion ($F(2,60) = 2.53$, *ns*), or an interaction between the variables ($F(2,60) = 0.83$, *ns*). The main effect of group revealed that individuals in the HSA made significantly more eye movements ($M=2.70$), per 2000ms trial, than those in the LSA group ($M=2.24$), regardless of the emotion displayed on the critical stimulus.

4. Discussion

The current study utilised a visual probe task and eye movement technology to explore predictions made by cognitive models of social anxiety regarding the allocation of attention to external cues. In order to explore predictions regarding the direction of

initial eye movements and the time taken to make these fixations, direction and latency data were recorded for all trials (500ms SOA and 2000ms SOA). Due to the inclusion of the 2000ms SOA in the study, it was also possible to explore the duration of these initial fixations, and patterns of attention allocation (frequency of eye movements) over time. By extracting information about attention over time, it was possible for the researcher to investigate the two competing theories that exist in the literature regarding the time-course of attentional patterns in social anxiety, the vigilance-avoidance hypothesis and the delayed disengagement hypothesis. Present findings will be discussed with reference to specific hypotheses in turn.

4.1. Analysis of Reaction Time Data

Based on previous research and cognitive models, it was predicted that individuals high in social anxiety (HSA group) would display greater attentional biases for emotional faces than those low in social anxiety (LSA group). The results of the current study partially support this hypothesis, as a trend towards this predicted effect was found. Although not significant at the .05 level, it was found that individuals high in social anxiety did display greater positive attentional biases to emotional faces than those low in social anxiety, and this trend had a medium effect size (d=0.40). The results of the current study also indicated that all participants had greater attentional biases for happy faces compared to angry faces, but this effect should be interpreted with caution due to the discrepancy between the two groups regarding their attentional bias for angry faces (the HSA group showed a positive bias and the LSA group showed a negative bias, resulting in the mean of the two groups being almost zero).

The finding that individuals high in social anxiety displayed greater attentional biases for emotional faces is consistent with previous research that has paired emotional faces with neutral faces (e.g. Pishyar, Harris, & Menzies, 2004). However, due to the limitations of the visual probe task, discussed earlier, it is not possible to determine if this observed attentional bias is due to individuals high in social anxiety preferentially processing emotional faces over neutral faces (i.e. initially attending to them), or due to a difficulty in disengaging from emotional faces once they have been attended to. The eye movement analyses therefore sought to investigate the mechanisms underlying the attentional bias observed.

4.2. Initial Orienting: Direction of Initial Fixation

Based on theoretical models of social anxiety and previous research findings, it was predicted that HSA individuals would initially attend to the emotional stimuli more often than those in the LSA group. The results of the current study do not support this hypothesis, as it was found that although all individuals were significantly more likely to attend to the emotional stimuli, this effect was not enhanced in the HSA group. Although there was no significant difference between the groups regarding the attentional bias for emotional faces, it is interesting to note that the HSA group were significantly more likely to make an eye movement to either one of the facial expression stimuli. These results suggest that high socially anxious individuals are more likely to attend to any social stimuli (emotional or neutral facial expressions) than those low in social anxiety, but that high and low socially anxious individuals do not differ in the

proportion of their eye movements that are directed towards emotional stimuli (cf. neutral stimuli).

Although unexpected, it could be argued that this finding is consistent with cognitive-motivational models of anxiety (e.g. Mogg & Bradley, 1998). Mogg and Bradley (1998) predict that anxious individuals have lower thresholds for perceiving threat, and also that if threat value is sufficiently high then attention will be disengaged from current tasks and allocated towards the source of potential threat. As individuals high in social anxiety are predicted to interpret ambiguous information more negatively, both of the presented stimuli (emotional and neutral faces) could have the potential to be interpreted as posing sufficient threat for high socially anxious individuals to allocate attention towards them. Individuals low in social anxiety, however, are less likely to interpret facial expressions as threatening, and therefore may be more able to focus attention on the current task, in which performance may be enhanced by not attending to the presented stimuli (i.e. focusing attention towards the middle of the screen during stimulus presentation to facilitate faster detection of the probe).

It is interesting to note that although a trend for greater positive attentional biases to emotional stimuli was found in the HSA group using reaction time data, the data regarding initial fixations did not find HSA individuals to be more likely to initially orient to the emotional stimuli. This is contrary to an assumption often made in the literature regarding preferential orienting being the mechanism underlying attentional biases reported in visual probe studies. This discrepancy between the RT data and the

initial eye movement data in the current study thus indicates that other mechanisms may have important roles in the selective attention to external social cues.

In summary, individuals high in social anxiety made significantly more eye movements towards social stimuli in the current study, but the proportion of initial fixations on emotional (cf. neutral) facial expressions did not differ between the HSA and LSA groups. All individuals were more likely to attend towards the emotional stimulus initially, regardless of the emotion displayed.

4.3. Initial Orienting: Latency to Initial Fixation

Based on theoretical models of social anxiety, it was predicted that individuals high in social anxiety would attend to emotional stimuli significantly faster than those low in social anxiety. The results of the current study do not support this hypothesis, however, as no differences between the HSA and LSA groups were found regarding the latencies to attend to emotional or neutral faces. The only significant finding was that all individuals took significantly longer to attend to emotional faces than they did to attend to neutral faces. This finding conflicts with predictions made by cognitive models, such as Rapee and Heimberg's (1997) suggestion that socially anxious individuals scan for potential threat in the environment and detect these signs rapidly.

Although this finding does not provide support for recent theoretical models, it is consistent with the only published eye movement study that investigated this prediction. Garner, Mogg, and Bradley (2006) also observed no difference between high

and low socially anxious individuals' speed to orient to social (relative to non-social) cues or to emotional (relative to neutral) face cues under conditions of low social-evaluative stress. However, when groups were subjected to a social stressor, individuals high in social anxiety did show significantly quicker latencies to attend to emotional stimuli (Garner et al., 2006). Thus it seems that that rapid detection of potentially threatening cues in social anxiety may be mediated by levels of state social anxiety.

4.4. Duration of Initial Fixation: Vigilance-Avoidance vs. Delayed Disengagement

The analysis of the duration of the initial fixations sought to clarify which of two competing hypotheses regarding the time course of attentional processes best characterises social anxiety. According to the vigilance-avoidance hypothesis, following an initial hypervigilance for socially threatening cues, individuals high in social anxiety will maintain their attention on these cues for significantly *shorter* lengths of time (e.g. Garner, Mogg, & Bradley, 2006). Conversely, according to the delayed disengagement hypothesis, individuals high in social anxiety will maintain their attention on socially threatening cues for significantly *longer*, due to a difficulty in disengaging from them (e.g. Fox, Russo, Bowles, & Dutton, 2001).

The results of the current study indicate that all individuals spent significantly longer fixating on emotional faces compared to neutral faces, particularly if the emotional expression depicted either anger or fear. Due to a trend towards a group by direction interaction, post hoc tests were conducted which suggested that individuals high in social anxiety fixated significantly longer on emotional faces than the LSA

group, and also significantly longer than they focused on competing neutral faces (an effect that was not found in the LSA group).

This finding is consistent with the delayed disengagement hypothesis, and also recent studies that have reported highly anxious individuals (e.g. Fox, Russo, Bowles, & Dutton, 2001) and individuals with social phobia (Amir, Elias, Klumpp, & Przeworski, 2003) to have difficulty disengaging covert attention from threatening cues. The finding is not consistent with the study by Garner et al. (2006), which found that high socially anxious individuals fixated on emotional stimuli quicker, and maintained their attention on these stimuli for significantly shorter periods of time, under conditions of high social-evaluative threat.

The results reported by Garner et al. (2006) are more consistent with the vigilance-avoidance hypothesis, and it is therefore proposed that the discrepant results are due to differences in levels of state anxiety between the studies. It is possible that under social threat conditions, when state anxiety is likely to be very high, individuals high in social anxiety will display a vigilant-avoidant pattern of attention to socially threatening cues, in an attempt to reduce their level of state social anxiety. Conversely, in situations where social threat is not elevated, and therefore levels of state anxiety are not as high, individuals high in social anxiety may have difficulty disengaging from social threat cues.

4.5. Stability of External Attention

Based on theoretical models that suggest socially anxious individuals will scan their environment for negative social cues (e.g. Rapee & Heimberg, 1997), it was predicted that individuals high in social anxiety would make significantly more eye movements during stimulus presentation than those low in social anxiety. The results of the current study support this prediction, as individuals high in social anxiety made significantly more eye movements during 2000ms trials than those low in social anxiety, regardless of the type of emotional expression that was presented as the critical stimulus. This finding is consistent with theoretical predictions that emphasise general hypervigilance in anxiety (Eysenck, 1992), and scanning of the environment for signs of impending negative evaluation in social anxiety (Rapee & Heimberg, 1997).

4.6. Limitations of the Study and Ideas for Future Research

Although the current study has contributed towards the resolution of some unanswered questions in the literature, a number of limitations of the study warrant consideration.

The availability of eye movement equipment made it possible to track attention processes over time, but the methodology is not without its flaws. Although the majority of EOG traces contained enough meaningful data to compute the dependent measures, most data files contained relatively high levels of missing data. While it is not clear whether task instructions or the concurrent collection of manual reaction times to classify probes might have encouraged strategic reluctance to make eye movements, this reduction in available data ultimately reduced the sensitivity of the study.

Although the present study was sufficiently powered to detect significant differences between groups, and recruited sample sizes are similar to those used in recent eye tracking studies, present findings (particularly statistical trends) require replication. It will be useful to initially replicate the study using analogue designs, particularly with individuals high in sub-clinical social anxiety subjected to a social-stress manipulation. It will also be important, however, for the study to be replicated in clinical samples of individuals with social phobia, relative to other anxiety disorders.

4.7. Clinical Implications

Research into attentional processes in social anxiety has significant implications for clinical practice. Although current cognitive behavioural treatments include elements of attention training, these tend to be focused on helping the individual to shift attention away from the self and focus attention on the external environment (e.g. Veale, 2003; Bogels, Mulkens, & DeJong, 1997). Although this attention training can be extremely beneficial for individuals with social phobia, research investigating *external* patterns of attention that may maintain anxiety could lead to improvements in these attentional components of treatment. For example, if further research confirms that social anxiety is partly maintained due to individuals having difficulty disengaging from negative social stimuli, techniques to reduce this maintenance of attention could be incorporated into current treatment packages. It is therefore of paramount importance that attentional biases in social anxiety and social phobia continue to be explored, in order to inform the development of these interventions.

4.8. Conclusions

The current study investigated the allocation of external attention in individuals high

and low in social anxiety, using a visual probe paradigm and eye movement technology.

Results indicated that individuals high in social anxiety had stronger positive attentional

biases to emotional faces (as measured by RTs) than those low in social anxiety, made

significantly more initial eye movements to either stimuli, and that both groups were

significantly more likely to initially attend to emotional faces. The two groups did not

differ significantly regarding the speed with which they attended to emotional and

neutral stimuli, and contrary to predictions both groups took longer to attend to

emotional faces than they did to attend to neutral faces.

Based on the advantages of using eye movement technology, a relatively novel

aim of the current study was to explore the maintenance of attention to different stimuli,

and also attention patterns over time. The results regarding the maintenance of attention

were consistent with the delayed disengagement hypothesis, as individuals high in

social anxiety maintained attention significantly longer on emotional stimuli than

neutral stimuli, and also for significantly longer than those low in social anxiety.

Consistent with a hyper-scanning hypothesis, individuals high in social anxiety were

also found to make significantly more fixations on facial stimuli during the 2000ms

trials.

The results of the current study provide important contributions towards the resolution of unanswered questions in the literature regarding external attention biases in social anxiety. However, it will be important for future studies to continue to utilise eye movement monitoring equipment to explore attentional biases further, in different conditions and in clinical social phobia.

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List of Appendices

Appendix A

Clinical Psychology Review Guide for Authors

CLINICAL PSYCHOLOGY REVIEW

Guide for Authors

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Abstract. A concise and factual abstract is required (not exceeding 200 words). This should be typed on a separate page following the title page. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separate from the article, so it must be able to stand alone. References should therefore be avoided, but if essential, they must be cited in full, without reference to the reference list.

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Appendix B

Behaviour Research and Therapy Guide for Authors

BEHAVIOUR RESEARCH AND THERAPY

An International Multi-Disciplinary Journal

Guide for Authors

For full instructions, please visit http://ees.elsevier.com/brat

Aims and Scope

Behaviour Research and Therapy encompasses all of what is commonly referred to as cognitive behaviour therapy (CBT). The major focus is on the following: experimental analyses of psychopathological processes linked to prevention and treatment; the development and evaluation of empirically-supported interventions; predictors, moderators and mechanisms of behaviour change; and dissemination of evidence-based treatments to general clinical practice. In addition to traditional clinical disorders, the scope of the journal also includes behavioural medicine. The journal will not consider manuscripts dealing primarily with measurement, psychometric analyses, and personality assessment.

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Corresponding author. Clearly indicate who is willing to handle correspondence at all stages of refereeing and publication, also post-publication. **Ensure that telephone and fax numbers (with country and area code) are provided in addition to the e-mail address and the complete postal address.**

Present/permanent address. If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Abstract. A concise and factual abstract is required (maximum length 200 words). The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separate from the article, so it must be able to stand alone. References should therefore be avoided, but if essential, they must be cited in full, without reference to the reference list.

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Appendix C

School of Psychology Ethics Committee Approval Letter

UNIVERSITY OF
Southampton
School of Psychology

28th April 2008

Confirmation of Ethical Approval

I hereby confirm that Caroline Gamble's study "Information Processing Biases in Anxiety" received ethical approval from the School of Psychology's ethics committee on 04th April 2007, reference CLIN/04/46.

Barbara Seiter

Academic Administrator
School of Psychology
Direct tel: +44 (0)23 8059 5578
email: bs1c06@soton.ac.uk

Appendix D

Power Calculation

<u>Power Calculation</u>

Considering two of the key findings from Garner, Mogg and Bradley's (2006) study[1],

effect sizes of between 0.60 and 0.81 were calculated, using the formula:

$$d = \frac{\text{Mean 1} - \text{Mean 2}}{\text{Pooled SD}}$$

Based on a desired power level of 0.8, Howell (2007) states that for an alpha level of

0.05, delta (in the following equation) must equal 2.80. Therefore, entering the

calculated effect sizes into the equation, it was possible to estimate the required sample

size for the current study.

$$N = (2.80 / d)^2$$

As effect sizes of 0.60 and 0.81 were obtained, it was calculated that the required

sample size for the current study would be between 12 and 22 participants per group.

---

[1] Effect sizes from Garner et al.'s (2006) were used, as it was the only published study that had investigated the allocation of external attention in sub-clinical social anxiety using eye movement monitoring

Appendix E

Information Sheet for Participants

Date: 20.8.07. Version 2

Information Processing Study (Control Participants)

Processing of Emotional Information in Anxiety
Information Sheet for Research Participants

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why we are conducting this research and what it will involve. Please take time to read the following information carefully and discuss it with family and friends if you wish. Do not hesitate to ask us if there is anything that is not clear, or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Who are we?
The research team consists of Rebecca Lee and Caroline Gamble (Trainee Clinical Psychologists), Dr Matt Garner (Lecturer in Psychology), Dr David Baldwin (Honorary Consultant Psychiatrist / Reader in Psychiatry) and Professors Karin Mogg and Brendan Bradley (Professors of Psychology). This research project is being undertaken by Rebecca and Caroline for their dissertations, as part of the Doctorate in Clinical Psychology training course.

What is the purpose of this study?
This study aims to develop a better understanding of the relationship between emotions, thinking and attention to different types of information. You have been chosen because we need to study the responses of a sample of the general population and compare these to the responses of people with high levels of anxiety and their non-anxious first degree relatives. Specifically, we are looking for volunteers who have not experienced, or required treatment for, psychiatric problems in the past.

Do I have to take part?
It is up to you to decide whether or not you wish to take part. If you do decide to take part you will be given this information sheet to keep and asked to sign a consent form. Your participation is voluntary and you may withdraw your participation at any time. If you are a student in the School of Psychology and you choose not to participate, there will be no consequences to your grade or to your treatment as a student in the School. If you have any questions please ask a member of the research team on your first meeting, or contact us at rjl205@soton.ac.uk or cjg105@soton.ac.uk.

What will happen to me if I decide to take part?
You will initially be asked to come for a screening interview to check your suitability for the study and this should take approximately 30 minutes.

If applicable, you will then be asked to return for another session, which will last between 75 and 90 minutes. In this testing session you will be asked to complete a number of computer tasks and questionnaires. One task will involve you looking at a series of faces on a computer screen and classifying the emotion shown on the face using the keypad. Another task will involve you observing a number of pictures of faces on the computer screen, and responding when you see a specific marker on the screen. During this task your eye movements will also be monitored.

The final computer task involves looking at pictures while sounds are presented through headphones. Throughout this task various physical responses (e.g. skin conductance, heart rate and muscle tension) will be measured. This will involve placing 6 small electrodes on your skin (2 electrodes on two of your fingers, 1 electrode on each wrist, and two electrodes just beneath one of your eyes). These electrodes have a comfortable plastic case and allow us to monitor changes in heart rate, muscle tension and skin conductance.

In addition, we will ask you whether we can take a sample of saliva from your mouth, which would allow us to look at small specific parts of your DNA (genes). We would only examine your DNA in order to see if you have a certain type of gene that has been shown to influence results on the computer tasks that you will be asked to complete. For this reason, we will be unable to give you any information about your DNA. Your sample is kept anonymous and once it has been tested it will be destroyed.

In approximately 8 weeks time we will invite you back to repeat the computer tasks described above. This will again take about 75-90 minutes.

Your travel expenses for all appointments will be reimbursed.

Will my taking part in this study be kept confidential?
All information that is collected about you during the course of the research will be kept strictly confidential and your name will not be used when analysing the data obtained. Personal information will not be released to or viewed by anyone other than researchers involved in this project.

What will happen to the results of the research?
A report of the findings of the study will be written and useful findings will be submitted for publication in scientific journals. Results of this study will not include your name or any other identifying characteristics.

A summary of the results will be made available on request.

Who is organising the research?
This study is being organised by the University of Southampton.

Who has reviewed the study?
The National Research Ethics Service (Oxford Panel C) and the University of Southampton School of Psychology Ethics Committee have both reviewed the study.

Who can I contact?
If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk, you can contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 8059 3995.

Appendix F

Consent Form

Participant Identification Number for this Study:

Statement of Consent

I _____ have read the attached information sheet.
[participant's name]

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐

3. I agree to have a saliva sample taken to obtain DNA for use in this research project only. I understand that my saliva sample and extracted DNA will be destroyed at the end of the study. I understand that non-agreement does not exclude me from completing the computer tasks/questionnaires. ☐

4. I agree to take part in the above study. ☐

_____   _____   _____
Name of Participant   Date   Signature

_____   _____   _____
Name of Researcher   Date   Signature

1 for participant; 1 for researcher

Appendix G

Debriefing Sheet

Participant Debriefing Sheet

Processing of Emotional Information in Anxiety

<u>Debriefing Sheet</u>

You have just taken part in a study designed to measure how mood affects what we notice and pay attention to, and how we interpret ambiguous information. We were interested to know how this was different when you were shown emotional pictures e.g. happy, angry or expressionless faces in the computer tasks.

Our mood can change from day to day, however, for some people, their thoughts or feelings may trouble them on a more regular basis. If you found any of the questions you were asked distressing, there are several sources of advice which are available and which may prove helpful in dealing with these feelings. These include Dr David Baldwin, Honorary Consultant Psychiatrist at the Department of Psychiatry and your General Practitioner.

We hope that our results will help us to better understand how mood affects attention and interpretation, and therefore also thinking and judgement. This in turn may be useful for the future development of strategies to help change the patterns of attention and interpretation that are thought to contribute to and maintain high levels of anxiety.

Please feel free to ask questions or make comments on any aspect of this study.

Thank you for your help.

If you have any further questions please contact Rebecca Lee (rjl205@soton.ac.uk) or Caroline Gamble (cjg105@soton.ac.uk).

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