The Effectiveness of Cognitive Bias Modification on Increasing Positive Cognitive Biases and Reducing Social Anxiety

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Abstract

As the prevalence and impact of social anxiety disorder continues to adversely affect both individuals and society, treatments such as cognitive behavioural therapy and pharmaceuticals are more heavily depended on than ever. However, due to the costs and inaccessibility plaguing both methods, new treatments within the last decade have been introduced as alternatives, including cognitive bias modification (CBM). The current research was comprised of two studies. The first tested for a valid single session CBM-interpretation technique by administering a single session to high versus low anxiety and training versus control groups to establish an effective version of the more promising interpretation based CBM intervention, that was then used in study two. In study two, CBM-attention, CBM-interpretation, and a control task were administered digitally to groups of high versus low anxiety participants to test whether single session CBM could effectively reduce cognitive biases and anxiety symptoms, and, whether an interpretation oriented CBM model was more effective in reducing anxiety compared to an attention orientated model. The results of study one showed CBM-interpretation produced marginally more positive interpretation bias and lower anxiety compared to a control group, however, the effect was not significant. In study two, the results revealed no significant effect of CBM on promoting positive cognitive biases or reducing anxiety when compared to a control group, although, the fact that there was no significant difference between high and low trait anxiety groups in levels of state anxiety suggests some successful anxiety reduction training may have occurred.

Keywords: cognitive bias modification, interpretation, attention, Social anxiety disorder.

Introduction to Social Anxiety Disorder

Deriving from the maladaptive expression of humans' natural fear of situations, objects, and events, anxiety disorders are now considered to be the most pervasive class of mental disorder (Stein & Stein, 2008). In particular, social anxiety disorder (SAD) is considered to be in the top ten chronic disorders regarding objective measures such as absences from work, with an estimated lifetime prevalence rate of 12.1% in America (Kessler et al., 2005) and 6.7% in Europe (Fehm et al., 2005). The Diagnostic and Statistical Manual for Mental Disorders describes SAD as the persistent fear of social or performance situations where the possibility of scrutiny from others is present (American Psychiatric Association, 2013). Individuals with SAD fear that they will say or do something perceived as embarrassing, either through their own actions or through showing anxiety related symptoms, both of which, they fear, may lead to negative evaluation from others (Bögels et al., 2010) Common concerns expressed by sufferers of SAD regarding anxiety related symptoms include a fear of blushing, sweating or stuttering during sentences, whilst behaviour related fears include being perceived as stupid, unlikable or boring (Stein & Stein, 2008). Due to this persistent fear of peer evaluation, individuals with SAD often avoid social situations altogether, or endure them with intense distress.

The existence of SAD is associated with dysfunctions at both the individual and social level, being linked to poor social functioning and adjustment to work (Schneier et al., 1992; Katzelnick, 2001), lower academic and professional performance (Bruch et al., 2003), lower reported quality of life (Hambrick et al., 2003), and high comorbidity with other mental health disorders (Magee et al., 1996). In addition, individuals with SAD also suffer from impairments in their relationships, including those with friends (Davila & Beck, 2002), family (Schneier et al., 1994) and romantic relationships (Sparrevohn & Rapee, 2009).

There are several reasons SAD is considered to be such a chronic mental illness with a serious social and economic burden in society. Research suggests SAD is highly prevalent (Furmark et al., 1999), has an early onset in adolescents (Kessler et al., 2005), and is associated with high unemployment figures and academic underachievement (Magee et al., 1996). Without treatment, those suffering from SAD have been associated with a severely lower quality of life (Fehm et al., 2005). In addition, it is estimated that the total annual cost of SAD amounts to $385 million dollars per one million inhabitants in the United States, whilst the total projected annual cost of anxiety related mental disorders in England is estimated at £14.2 billion by 2026 (McCrone et al., 2008).

Indeed, the adverse effects of social anxiety are not exclusively reserved for the clinically anxious population. The effect of subclinical social anxiety on the individual has been deemed to parallel those previously found in SAD (Crişan et al., 2016). Such effects can range, based on the severity of social anxiety, from mildly unpleasant experiences, such as behavioural inhibition when exposed to social situations, to a crippling fear of negative evaluation, behavioural avoidance and even panic-like symptoms (Rapee, 1995). Indeed, an increase in social anxiety has been linked to dysfunctions at multiple levels of life (Clark & Wells, 1995; Mathews & MacLeod, 2005; Rapee & Heimberg, 1997). Subjective social experiences reported when exposed to a social situation are characterised by feelings of inferiority (Gilbert, 2000), high negative effect and low self-efficacy (Kashdan & Roberts, 2004). In addition, increased social anxiety typically malforms at the cognitive level, leading to an individual showing increased self-focused attention (Mellings & Alden, 2000) during social situations and displaying a negative interpretation bias (Huppert et al., 2003). Alarmingly, as many as 20% of the general population report social anxiety symptoms at a subclinical level, which have been shown to adversely impact individual functioning in

multiple facets of life (Merikangas et al., 2002; Stein et al., 1994) and decrease overall quality of life (Fehm et al., 2008).

One of the most influential models developed to explain the psychopathological processes that prevent one from disconfirming the maladaptive beliefs characteristic of SAD was proposed by Clark and Wells (1995). They suggested that four psychopathological processes exist, all of which exacerbate the symptoms of SAD. The first refers to the process in which individuals with SAD focus their attention on comprehensive observations and detailed monitoring of themselves. This process subsequently leads to an enhanced awareness of feared anxiety responses, disrupts their ability to construct a valid construal of their own and other people's behaviour, and produces an internally biased negative self-impression. The second process describes how individuals with SAD use a variety of safety behaviours in social situations to help alleviate the risk of rejection. For example, one may rehearse an answer to a question within a group multiple times before feeling comfortable with speaking aloud for the group to hear. The third process alludes to the overestimation that individuals with SAD employ when judging how negatively others evaluate their performance. Finally, the fourth process proposed in Clark and Well's model of SAD suggests that both prior to and after a social situation, individuals with SAD think about the event in great detail, focus on past failures and construct negative portrayals of themselves. In addition, Clark and Wells (1995) suggest that through detailed assessment a therapist can extrapolate a client's current assumptions and core beliefs to modify the experience of an individual with SAD and help reduce anxiety related symptoms.

Existing Treatments

Given how costly and pervasive SAD is to society, it is imperative that treatments are available to help tackle this issue. Such treatments do exist, in the form of empirically

supported psychotherapies (cognitive behavioural therapy; CBT) and pharmacological

treatments (Blanco et al., 2003; Heeren et al., 2015), which are recommended under clinical

diagnosis of social anxiety disorder (NICE 2014). Under such recommendations of NICE,

CBT should be offered as the primary treatment option for SAD (Mayo-Wilson et al., 2014).

CBT can be described as the implementation of different techniques, such as applied

relaxation, cognitive restructuring, social skills training, and exposure (Acarturk et al., 2009),

applied in various combinations, to teach individuals the behavioural and cognitive skills

necessary to function effectively in situations that provoke SAD symptoms and reduce SAD

severity (Stein & Stein, 2008). In the event an individual turns down CBT, NICE

recommends treatment be offered in the form of pharmaceuticals, and specifically, selective

serotonin reuptake inhibitors (SSRIs; Mayo-Wilson, 2014). Classed as the pharmaceutical

treatment of choice for SAD (Ruscio et al., 2008), SSRIs provide key areas of the brain with

serotonin by slowing its uptake through affecting neuronal pumps for 5-HT (Vaswani et al.,

2003). Research has shown that both treatment types are effective in treating SAD (Stein &

Stein, 2008; Fedoroff & Taylor, 2001).

However, whilst effective treatments are available, research shows many individuals

fail to access treatment due to a number of reasons, including a shortage of staff members

qualified to conduct complex psychological interventions (Cooper, 2014), significant waiting

times of over a year for 12% of people and over three months for 54% (Mind, 2013), an

inability to afford treatment, and concerns over side effects (Gunter & Whittal, 2010).

Furthermore, only 15% of those that enquire about treatment actually undertake it (Olfson et

al., 2000). In light of this research, the lack of accessible treatment highlights the importance

of developing new, more widely available treatments to reduce the impact of SAD on

individuals and society. Indeed, the last decade has produced a multitude of newly founded

techniques designed to be more accessible and effective as treatments for SAD (Liu et al., 2017). One such treatment developed is cognitive bias modification (CBM).

Cognitive Bias Modification

Cognitive theories posit that a tendency to preferentially process negatively valanced information is a vital mechanism in the development of SAD (Beck, 2008; Beck & Clark, 1997; Clark & Wells, 1995; Eysenck, 2014). The result of these negative cognitive biases in turn magnifies the frequency, intensity and variety of further negative thoughts relating to the biases, which subsequently have detrimental effects on emotions and SAD symptoms (Clark & Steer, 1996). Therefore, as a result of these negative cognitive biases, individuals with SAD selectively attend to and process threat-relevant information in the environment (Beard, 2011). This negative cognitive bias can be classified into three main broad categories: attention bias, interpretation bias, and memory bias (Beard, 2011; Hertel & Mathews, 2011).

Attention bias refers to the tendency for individuals to selectively attend to threatening stimuli, despite said stimuli being irrelevant to current goals and being in competition with other non-threatening stimuli within the environment (Beard, 2011). Interpretation bias, on the other hand, refers to the tendency for individuals to interpret ambiguous cues in a negative or self-deprecating way (Beard, 2011). Finally, memory bias is characterised by individuals with anxiety disorders showing improved memory for threatening information (Koster et al., 2009). However, evidence for the effect of memory bias on anxiety is far more mixed (Hertel & Mathews, 2011), with Tran et al. (2011) even suggesting that memory bias is linked to interpretation bias, and altering interpretation bias has a direct impact on memory bias. Therefore, this study focused on attention and interpretation bias as the key cognitive components.

In a scenario where an individual with SAD is speaking within a group, they will likely attend to threatening stimuli (attention bias), such as facial expressions of anger or disgust, instead of more neutral facial expressions. Such an individual is also more likely to then interpret (interpretation bias) these previously attended to negative stimuli as being indicative of the conversation partner's anger/disgust with the speaker (themselves) rather than the conversation topic or something unrelated. Due to the overflow of information versus cognitive resources available to adequately process it, negative attention and interpretation biases leads to the development of a vicious cycle in which perceived threatening stimuli are preferentially attended to and ambiguous stimuli are experienced as threatening (Beard, 2011). Thus, the goal of CBM is to directly reduce these cognitive biases, and to achieve this across a broad scale to increase availability.

CBM works under the assumption that negative cognitive biases invariably lead to an increased risk of developing SAD (Beck, 2008; Mathews & MacLeod, 2005). Two key features of CBM work to alter these cognitive biases. The first aspect of CBM works to directly change the specific cognitive biases known to characterise SAD or the personality traits associated with a vulnerability to SAD itself (Koster et al., 2009). This could therefore involve a CBM technique focused on reducing a patient's cognitive bias towards threatening stimuli and attuning this cognitive bias towards more neutral stimuli, or a technique directly targeting their interpretation bias by training a patient to interpret emotionally ambiguous stimuli as more positive or more neutral, to promote a positive bias. The second key feature of CBM refers to the method in which the treatment is administered; whereby the method of manipulating the targeted cognitive bias is not done through direct instruction, but rather, by the individual extensively practicing a cognitive task in order to encourage and generate the desired cognitive change (Koster et al., 2009). For example, a treatment may require patients to repeatedly complete missing word stems that resolve ambiguous social scenarios such as a

crowds' reaction to your speech or a classes response to your answer to a question. The word stems would be designed to resolve the ambiguity of the social situations in either a positive or neutral manner, which would therefore elicit more positive interpretation bias. The key here is that in actively completing word stems that positively resolve previously ambiguous social situations, the patient may be more likely to adopt and generate this positive interpretation bias towards ambiguous stimuli in the future.

The result of these key features means that CBM is designed to alter cognitive biases in a more implicit, pragmatic way as opposed to a more explicit process of other psychotherapies (Beard, 2011). Research has peaked over the last decade into the efficacy of CBM in treating SAD (Jones & Sharpe, 2017). Indeed, some of the first evidence for the efficacy of CBM-attention (CBM-A) and CBM-interpretation (CBM-I) demonstrated not only that it was in fact possible to induce an attention bias towards threatening stimuli in non-anxious individuals on a similar level to that of already observably anxious individuals (MacLeod et al., 2002; Browning et al., 2010; Krebs et al., 2010; Colin et al., 2007; Eldar et al., 2008), but in addition, that it is possible to train individuals to interpret ambiguous situations in either a more threatening or more positive manner (Grey & Mathews, 2000; Mackintosh et al., 2006; Mathews & Mackintosh, 2000). This evidence suggested that it was indeed possible to target, and subsequently change, cognitive biases within non-anxious individuals, which paved the way for research to diverge its focus towards the clinically anxious populations to test how effective a treatment CBM could be. From this, studies have shown that CBM is effective in reducing anxiety levels within anxious individuals, when presented with stressful situations. For example, a meta-analysis by Hakamata et al. (2010) reviewed studies comparing CBM-A to control conditions. They found a medium effect size for CBM-A on overall anxiety and a larger effect size on clinical patients specifically. Similarly, Amir et al. (2009) found that CBM-A training achieved a 50% reduction in those

who met the clinical diagnosis of generalised social phobia compared to a control (14%). Another study of note was conducted by Schmidt et al. (2009), who found that using a CBM-A training technique led to 72% of participants no longer meeting the DSM-IV criteria for social anxiety disorder (11% for the control group) at a four-month follow-up. All the aforementioned research therefore provides highly promising results for the prospect of CBM-A as a potential treatment for anxiety.

Although research into CBM-I is slightly less developed (Brosan et al., 2011), Mathews et al. (2007) found that CBM-I training, in which participants were trained to select benign meanings of emotionally ambiguous scenarios, achieved a reduction in trait anxiety in anxious patients after just four sessions. Furthermore, Salemink et al. (2009) achieved the same reduction in state and trait anxiety over an eight-session period. In addition to these reductions in state and trait anxiety, Steinman and Teachman (2010) administered CBM-I on participants with high levels of anxiety sensitivity and found that not only did the treatment lead to reductions in negative interpretation and increases in positive interpretations, but results also showed participants displayed lower anxiety sensitivity in response to a physical stressor. In regard to the clinical effectiveness of CBM-I, Steinman and Teachman (2014) administered CBM-I training on a group of participants that reported being high in fear of heights and found once again fewer negative and more positive interpretations related to heights after treatment as well as reductions in acrophobic anxiety and avoidance, when compared to a control, that were present at a 1-month follow up. A particular note of interest within this study was that symptom improvements via CBM-I were considered to be as large as changes achieved in groups receiving exposure therapy. For an overview of the effectiveness of CBM-I, several meta-analyses have provided promising data for bias changes and improvements in anxiety symptoms, one of which was conducted by Hallion and Ruscio (2011), who found that CBM-I training was associated with large effects on interpretation

bias changes, and small to medium effects on changes in anxiety symptoms. Whilst further meta-analyses have supported these positive findings on CBM-I training (Hertel & Mathews, 2011; MacLeod & Mathews, 2012), Menne-Lothmann et al. (2014) highlighted results are far more mixed, and Cristea et al. (2015) went as far as claiming both CBM-A and CBM-I treatments lacked effectiveness.

Whilst from the studies above it is clear CBM has the potential to be an effective treatment for anxiety, there seems to be a clear consensus that these results are merely promising data, and the actual correlations are quite low (Jones & Sharpe, 2017). Liu et al. (2017) go as far as describing the treatment as promising, yet state a more holistic and effective variation of CBM is required before the treatment can rival the success rates of other more effective psychotherapies and pharmaceuticals, particularly as the reduction in clinical anxiety symptoms was low. Specifically, the evidence gap within the CBM field pertains to an inconsistency in reliably and effectively improving both cognitive biases and anxiety symptoms, with numerous studies concluding that research should focus on developing procedures that more "reliably induce bias modification" (Jones & Sharpe, 2017) and that more effectively improve anxiety related symptoms (Liu et al. (2017). As such, it seems imperative that researchers focus on modifying existing CBM procedures and developing new, more effective versions of CBM treatments in order to bridge this gap.

One clear advantage of CBM compared to say, cognitive behavioural therapies, is that CBM programmes are typically digital software that can be administered simply, succinctly, and flexibly via online applications that can be opened by participants, and do not require any kind of supervision. Given the practical nature of CBM, it is of no surprise that along with testing for more effective variations of CBM treatments, researchers have already begun testing the effectiveness of CBM administered via web-based training. For example, Hoppitt et al. (2014) administered a two-week web-based CBM-I programme designed as a

preventative tool for "real-life stress" and found that participants reported significantly lower social evaluative fear compared to a control group, and that these effects were maintained 4 weeks after treatment. Alongside this reduction, the CBM-I group also showed greater reductions in state anxiety at the four-week follow-up period. Although this study recorded no significant impact on trait anxiety and positive or negative affect, Hoppitt et al. (2014) suggested that this was likely due to the specificity of training materials chosen which were designed to specifically focus on socially evaluative situations relating to social evaluative fear itself. They posit that, should emotional concerns related to other domains have been touched upon within the training materials, a more general effect on trait anxiety and positive and negative effect may have been found. In addition, Salemink et al. (2009) found the CBM-I training achieved significantly higher positive interpretation bias alongside reductions in anxiety related symptoms in high anxiety participants compared to a control. These studies highlight not only how effective online CBM-I can be, both generally and when tailored to a specific anxiety related cue (in this case real life stress), but also shows how much potential a more holistic version of CBM-I has in achieving even greater improvements in overall anxiety. These effects are not exclusive to CBM-I either; See et al. (2009) administered a web based CBM-A procedure and found that the treatment effectively induced attentional avoidance of negative information. In addition, the same CBM-A procedure also reduced trait anxiety scores and weakened state anxiety responses to a natural stressor. Once again, this study shows that the effect of the CBM-A procedure itself on attention bias and anxiety still applies even when administered online.

For a broader assessment of web based CBM, Zhang et al. (2019) conducted a meta-analysis that reviewed all relevant web based CBM studies and their effectiveness for treating psychiatric disorders. The review identified 22 studies that fulfilled the inclusion criteria, of which 9 studies were focused on social anxiety disorder. Of the nine studies, two reported

effective bias modification and reductions in anxiety scores (Sportel et al., 2013; Brettschnieder et al., 2015), two reported significant reductions in social anxiety symptoms but no bias changes (Boettcher et al., 2013; Neubauer et al., 2013), and four reported no evidence of bias modification (Boettcher et al., 2013; Carlbring et al., 2012). In line with much of the literature on CBM, this review highlights the fact that we may be on the cusp of establishing an effective anxiety treatment capable of being the most flexibly administrable to date. However, also in line with the literature to date, the results are inconsistent between studies, to the point where even some studies such as Sportel et al.'s (2013), who reported bias changes, only reported minimal bias changes. It is therefore clear that more research is required in order to establish a consistently effective and generally accepted CBM treatment.

One additional note of interest was found by Liu et al. (2017), who found that when conducting a meta-analysis on CBM studies, CBM-I was more effective at reducing anxiety than CBM-A. The explanation for this finding may stem from previous research that suggests CBM-A and CBM-I may not be entirely separate cognitive mechanisms, but may in fact interact to a far greater extent than previously considered (Amir et al., 2010; White et al., 2011). Indeed, Liu et al. (2017) suggests cognitive mechanisms are interactive by nature, an idea that stems from Neisser (1967), who proposed that cognitive processes are cyclical, and therefore mutually reinforce one another. The result of this means that, due to this interactive relationship between cognitive processes, both attentional and interpretational tests may influence related mechanisms that affect SAD symptoms, and therefore, it seems both attention training and interpretation training may in fact indirectly cross over and also affect their counterparts. Liu et al. (2017) posit that CBM-I may be the more promising of the two regarding its influence on attention bias, which could make it a more effective treatment that may improve both attentional and interpretational biases to ultimately have a greater impact on improving SAD symptoms. One study that demonstrated this effect was conducted by

Amir et al. (2010), who found that using an interpretation modification programme led to decreases in attention biases displayed by participants. Indeed, there is evidence from the literature to suggest that CBM-I may be more effective in modifying various forms of biases (Liu et al., 2017; Amir et al., 2010; White et al., 2011), and although it is certainly too early to definitively define it as such, may be the more holistic of the bias modification techniques. Coupled with this, another key reason it may be beneficial to focus on interpretation bias is that it may in fact be a more effective treatment in general. To this end, Jones and Sharpe (2017) conducted a study focused on meta-analyses of CBM techniques and found that CBM-I was not only able to more effectively target the desired cognitive bias changes, but also achieved longer lasting effects in treating cognitive biases compared to CBM-A. However, the significance of the effects was yet again questioned (Jones & Sharpe, 2017). Indeed, Hallion and Ruscio (2011) agree that future research should focus on the more promising CBM-I as a treatment for SAD.

In order to go a step further and improve the already previously designed CBM-I techniques, we not only adopted advice from prior research extracts, but also used our own discretion to improve certain aspects of the treatment. One such aspect was highlighted by Beard (2011), who suggested that focusing on the meaning of thoughts related to the disorder in question may be vital in creating a more successful treatment. Regarding our study, this technique was implemented by not only focusing on the content of thoughts (e.g., people are laughing, therefore I am embarrassed), but also, interpreting the meaning of the socially anxious thought. This involved a select few additional ambiguous sentences which reinforced the fact that having thoughts symptomatic of social anxiety disorder is not abnormal and does not make the participant "crazy", but rather, it is an entirely "normal" cognitive process that can be treated. Furthermore, we adopted suggestions from Hallion and Ruscio (2011), who concluded that future research would benefit from making the valance of the ambiguous cues

specific to the disorder in question. Therefore, we ensured that the cues we used were specific to social anxiety disorder. One final modification we made compared to more traditional CBM practices was to create a single session CBM program that was shorter in length. Many CBM treatments used in research were either longer in session time or multi-session treatments. The aim of adjusting this CBM technique to be a short, single session treatment was to increase the wider accessibility of it and to test whether a single session treatment could still be effective.

Overall, given the research focused on both CBM-A and CBM-I, it would seem the next step in CBM literature would be to not only refine a new CBM treatment that can more reliably and effectively treat cognitive biases and social anxiety, but also to test whether the benefits of CBM can be translated to digital administrations, which, if done effectively, would revolutionise the accessibility of social anxiety treatment. Furthermore, there is a small indication that focusing on an interpretation style CBM programme specifically could yield more efficient and effective results to treat social anxiety in analogue samples. Therefore, testing the effectiveness of both CBM-A and CBM-I in treating SAD symptoms could be vital to understanding whether they potentially influence different cognitive biases, and if so, to what extent.

The Current Research

In the current study, we aimed to contribute to the vast array of literature focused on finding the most effective treatment for social anxiety. People with high levels of social anxiety tend to preferentially process negatively valanced information, which leads to a magnification in the frequency, intensity, and variety of negative thoughts. This preference for negatively valanced information is posited to derive from two key negative cognitive biases: a tendency to selectively attend to threat-relevant information in the environment and

a tendency to interpret ambiguous cues within the environment as negative or self-deprecating. Due to an excess of information compared to a limited number of cognitive resources available to adequately process information, people with such negative cognitive biases experience higher levels of social anxiety. The key to treating social anxiety may be in developing an effective CBM technique that can successfully reduce the intensity of negative cognitive biases and promote positive cognitive biases related to attention and interpretation bias. In addition, it is vital that CBM techniques are designed to be widely accessible, which may include harnessing features such as online applicability and shorter treatment lengths. This research is comprised of two studies.

In study one, a new, valid single session version of CBM-I was created and tested among a high versus low anxiety population to ensure that it effectively targeted an individual's interpretation bias and reduced state anxiety. This CBM-I training group was compared with a control group, in which an equal number of positive and negative interpretation scenario resolutions were provided to ensure that no interpretation bias training would occur. The use of this control comparator allowed for the effect of CBM-I training to be compared to a group that underwent similar test conditions, without the presence of any direct interpretation bias training. Study one was conducted in order to test the following hypotheses:

1.   The CBM-I training group will achieve a significant increase in positive interpretation bias compared to a control group.

2.   CBM-I will achieve a significant reduction in anxiety symptoms compared to a control.

In study two, an online version of the CBM-I intervention validated in study one was tested along with online versions of a single session CBM-A intervention and a control,

among high versus low anxiety participants, to test whether the respective CBM intervention effectively induced positive cognitive biases and whether either intervention was more successful in reducing anxiety. Both the CBM-I and CBM-A training groups were compared with a control group, in which participants read a passage of text about a fictional character called Sally, and subsequently answered questions concerning details contained within the short story of Sally's day. The key here was that the exercise did not evoke any kind of bias training, which allowed the effects of CBM-I and CBM-A training to be directly compared to a group with no such bias training. Study two was conducted in order to test the following hypotheses:

1.   Online CBM training will achieve significant increases in positive cognitive biases compared to a control group.

2.   Online CBM training will achieve a significant reduction in anxiety symptoms compared to a control.

3.   CBM-I will achieve a greater reduction in anxiety symptoms than CBM-A

Method

Participants and Design

Nineteen undergraduate students from the University of Kent, ranging from 18 to 54 years of age ($M = 21.58$, $SD = 7.91$) took part in this study. Of the sample, 12 participants were female (63.16%), and seven were male (36.84%). Participant's reported trait anxiety, calculated via mean BFNE scores, was $M = 3.45$, $SD = 0.897$. Participation in this study was voluntary, with compensation for participation consisting of course credits that were required as part of their Research Participation Scheme.

This used a two (intervention: CBM-I vs. control) x two (social anxiety group: high vs. low) between subjects design, whereby the independent variables were the CBM-I

training technique (CBM-I, control) and the level of anxiety (high, low), and the dependant

variables were the test of interpretation bias and the three State Trait Anxiety Index (STAI)

measures. Subjects were randomly allocated to either a control group or a CBM-I training

group and then placed in either the high or low anxiety group, through a median split,

depending on their scores on the Brief Fear of Negative Evaluation (BFNE) measure.

Materials

State-Trait Anxiety Index: State Version (STAI-S; Marteau & Bekker, 1992)

The first scale measuring anxiety was the State-Trait Anxiety Index (Spielberger,

1983). We used the shortened state anxiety scale version (STAI-S) developed by Marteau and

Bekker (1992), which evaluates an individual's current level of anxiety, gathering

information such as how they feel in the current moment, and measuring more subjective

feelings of nervousness, worry etc. This test contained six items and responses to this forced

Likert scale ranged from "not at all" to "very much so" (1-4). Example items include

questions such as "I feel calm" and "I am worried". Overall, internal consistency for the

STAI was high, ranging from 0.86 in students and 0.96 in military populations (Leary, 1983).

When compared to other strong anxiety measures, the STAI has been shown to have high

content validity, correlating from 0.73 to 0.85 on the Taylor Manifest Anxiety Scale (Amir et

al., 2009) and the Cattell and Scheier's Anxiety Scale Questionnaire (Cattell & Scheier, 1963)

respectively. Research has shown that Marteau and Bekkers' (1992) shortened version is the

most effective in regard to internal consistency reliability and validity when correlated with

the original STAI-S developed by Spielberger (Tluczek et al., 2009). The STAI-S scale at

time one was highly reliable (six items; $\alpha = .83$). The STAI-S scale at time two was highly

reliable (six items; $\alpha = .88$). Finally, the STAI-S scale at time three was also highly reliable

(six items; $\alpha = .77$).

Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983)

The second scale was the BFNE (Leary, 1983), which is a scale designed to measure an individual's fear of negative evaluation, a core aspect of social anxiety disorder. Items in this scale gathered information on a person's tolerance of perceived negative evaluation by including questions such as "I am frequently afraid of people noticing my shortcomings" or reverse coded items such as "Other people's opinions of me do not bother me". This test contained 12 questions and responses to this Likert scale ranged from "Not at all" to "Extremely" (1-5). This scale is considered to be a more stable measure of social anxiety. Overall, the BFNE has been shown to be an effective measure of social anxiety (Weeks et al., 2005). High levels of discriminant validity, concurrent validity and internal consistency were demonstrated (Duke et al., 2006; Weeks et al., 2005). The BFNE demonstrated high reliability in this study (12 items; $\alpha = .92$).

Distraction Material

The distraction material was presented in the form of the first two chapters from the popular novel "The Invisible Man", displayed on the computer screen. Participants had five minutes to read as far as they could through the passage of text. A distraction task was placed in between participants completing the STAI-S at time 1 and time 2 in order to space out the length of time in which participants had to complete the STAI-S and to allow the anxiety induction to take effect.

Anxiety Induction

In order to elicit an anxious state, participants were informed that they would be asked to perform a five-minute timed speech at the end of the study, on a topic provided prior to performance. The aim here was to present a benign anxiety induction to prevent other emotions related to the topic of the speech from confounding the desired result of the anxiety

induction itself. The anxiety induction itself was included to induce an anxious state for participants that was analogue to naturally experienced states of anxiety in everyday life, which would therefore allow this study to more reliably test the effectiveness of bias modification against naturally induced anxiety levels that would apply outside of a laboratory setting.

Cognitive Bias Modification: Interpretation (CBM-I; Mathews & Mackintosh, 2000)

The CBM-I technique was constructed based on that of a previously published study conducted by Mathews and Mackintosh (2000), that successfully designed and administered an effective CBM-I training technique that reduced participants' negative interpretation bias. However, crucially, we also implemented various "future direction" recommendations highlighted throughout the literature to manufacture a more holistic CBM-I training technique more suited to treating anxiety as a construct.

Commonly, CBM programmes designed to alter interpretative biases involve introducing contingencies between ambiguous stimuli and the valence of specific words that seemingly resolve the ambiguity of the event or information, and as such, lead the participant to think of the ambiguous information in either a positive or a negative way (Amir et al., 2010). Such a method has been shown to be effective in both socially anxious and non-anxious individuals (Grey & Mathews, 2000; Mathews, & Mackintosh, 2000; Beard & Amir, 2008; Murphy et al., 2007).

The CBM-I training technique used within this study was the ambiguous situation paradigm (Mathews & Mackintosh, 2000). The ambiguous situation paradigm presents participants with socially ambiguous situations, each described in a block of text, and asks the participant to place themselves in that situation. Crucially here, the social situations are left ambiguous up until the final word of the text, which resolves the ambiguity in either a

positive, negative, or neutral way. For example, an ambiguous situation used in our study would read "You are sitting in a seminar room listening intently when the teacher asks a question. Nobody answers the question and the teacher looks directly at you. You give an answer to the question. Your teacher and classmates thought that your answer was …". After this block of text, the participant was presented with a partially censored word fragment that solved the ambiguity of the scenario. In this instance, the word would have read "go-d", and the participant had to fill in the missing letter to identify the word. The key here is that participants were trained to positively interpret socially ambiguous situations. A comprehension question was then included to ensure that the participant fully internalised the positive interpretation provided. Such a comprehension question for the previous example read "Did you provide a good answer for the class?". CBM-I training consisted of 50 different social scenarios.

To ensure that this CBM-I technique achieved the desired improvements in interpretation bias, we also made the amendments discussed previously to the CBM-I technique derived from Mathews and Mackintosh (2000), in order to make it more unique and tailor it more towards reducing anxiety. The two primary amendments that we focused on were the meaning of anxiety related thoughts and making the valance of the ambiguous cues specific to anxiety. The first primary amendment manifested through encouragement to endorse words such as "normal" when describing anxious thoughts or behaviours, as opposed to "crazy" or "abnormal", which differed to the original CBM technique in which only high or low anxiety related stimuli were used, such as "boring/friendly". The second change involved using scenarios commonly associated with heightened anxiety, such as speech or interview situations, and placing the participants into the most stressful moment of the scenario in order to most effectively interpretation bias. This amendment differed to the original version in which many of the scenarios in Mathews and Mackintosh's version were

anticipatory in nature, often asking the subject how people might perceive them before they even enter the situations in question. For example, one item placed participants into a scenario whereby they are getting ready to attend their partner's company anniversary dinner, in which many people they have never met will be attending, and the participant is prompted to think how the people there might perceive them. The amended scenarios, however, aimed to submerge the participant into an anxiety inducing situation as if they were personally being judged directly due to their actions or behaviour in the moment. An example of this would be question one, in which the participant envisioned introducing themselves to a group, before filling out the respective word fragment on what the audience thought of them. In another example, participants were asked to imagine a scenario in which they were asked a question by a teacher in class, and were given a word fragment to describe what their teacher and fellow students thought of their answer.

In addition, we also reduced the number of scenarios that needed to be shown before training was complete to test whether the treatment was still effective when administered within a shorter time frame. This differed from the original in which 64 scenarios were shown compared to 50 in this procedure. A shorter overall treatment time would improve its potential to be utilised in treatment plans such as online or in apps.

Control Condition

In the control condition, the same CBM-I procedure was administered, with the only difference being that an equal number of positive and negative interpretation scenario resolutions were provided to ensure that no interpretation bias training would occur.

Interpretation Bias Outcome Assessment (Mathews & Mackintosh, 2000)

In order to assess the effectiveness of the CBM-I training technique, an interpretation bias test was administered. The interpretation bias outcome assessment used was the

recognition task, designed by Mathews and Mackintosh (2000), which included 10 new socially ambiguous scenarios presented in blocks of text. Once again, word fragments were presented at the end of these text blocks, however, they did not disambiguate the scenario. For example, a scenario titled "the evening class" was used, which read "You've just started going to an evening class. The instructor asks a question and no one in the group volunteers an answer, so he looks directly at you. You answer the question, aware of how your voice must sound to the …". The word fragment presented here was "oth--s", with the comprehension question reading "Have you been going to the evening class for a long time?". Once completed, the second part of the recognition task involved participants being once again presented with the title of the ambiguous scenario, but this time together with two sentences (a and b). Similarly to the sentences used in studies such as that of Matthews and Makcintosh (2000), Salemink et al. (2014), and Van Den Hout (2014), the two sentences in this study represented:

a)   A positive interpretation (E.G You answer the question and then realise what a good answer it is.)

b)   A negative interpretation (E.G You answer the question, aware of how unsteady your voice sounds.)

Participants were instructed to rate each individual sentence for its similarity in reference to the original scenario proposed on a four point forced Likert scale ranging from "very different in meaning" to "very similar in meaning (1-4). Participants were excluded from the analysis if they got over 20% of the interpretation bias assessment comprehension questions wrong (three participants excluded).

Research into the recognition task as a measure for interpretation bias has highlighted its robust resistance to temporarily induced mood states and its high validity (Salemink & van den Hout, 2010).

Procedure

Study one lasted for approximately 30 minutes. Before initiating the study, participants signed up to a timeslot via the research participation scheme. Upon arrival, participants were first presented with the information sheet containing details of the upcoming study and clarification of how data would be used and protected, before then being asked to complete the informed consent sheet, where they provided confirmation that they were willing to partake in this study. After this, participants filled out some demographic information, before completing the first STAI-S measure of anxiety, to obtain an initial measure of their current state of anxiety at the beginning of the study. Subsequently, participants were presented with the anxiety induction. Then, the distraction task was administered. Following this, participants completed another STAI-S measure to once again determine their current anxious state, this time to identify whether the anxiety induction had been successful. Once measured, participants were randomly allocated to either the CBM-I training or control group. Those in the CBM-I training group undertook positive interpretation bias training which lasted approximately 20 minutes. Those in the control group completed the control "training" condition that elicited no interpretation bias training of any kind, and also lasted approximately 20 minutes. Once the participant finished their respective group training method, they completed a final STAI-S measure of their current anxious state, before being presented with the interpretation bias assessment. This final test of interpretation bias was administered to determine whether there was a significant difference between interpretation bias scores recorded in the CBM-I training and control groups. After this, participants completed the BFNE test. Finally, participants were presented with the

debrief, which revealed the true intentions of the study and key information about the study. This included the participant being informed that they did not have to perform the speech, that their data was anonymous and that they could remove their data from the study at any time, and that they could ask any further questions if they desired. In addition, included in the debrief was an opportunity to watch an anxiety calming video that was provided in any circumstances where participants felt they desired immediate support.

Statistical Analysis

Based on previous research examining the effect of CBM-I procedures on reducing cognitive biases and anxiety (Cristea, Mogoașe, David & Cuijpers, 2015b; Hallion & Ruscio, 2011; Liu et al., 2017), an a priori power analysis was conducted using G*Power version 3 (Faul et al., 2007) to compute the sample size required to detect a small effect size of $R2 = 0.03$, with alpha set to .05, and power 0.80. Results showed that a total sample size of 256 would be required in order to detect a small effect size with 0.80 power for this study, with at least 128 participants required per group.

In order to examine the effects of intervention type and anxiety on the dependant variables, two separate two-way general linear model (GLM) analyses were conducted to assess the effectiveness of CBM-I training in high and low anxiety groups on levels of interpretation bias and STAI-S scores at time three. Interpretation bias scores were obtained by reversing appropriate items and then calculating the mean response value for each participant on the four point Likert scale presented in the interpretation bias assessment test, such that higher scores signified more positive interpretation bias. As described by Cohen (2013), effect sizes of 0.2 are considered small, effect sizes of 0.5 are considered moderate, and effect sizes of 0.8 are considered large.

The first two-way GLM analysis used a two (training: active vs. control) × two (anxiety: high vs. low) design and was conducted on interpretation bias. The first GLM analysis therefore compared the effect of the intervention type and level of anxiety on interpretation bias scores. The second two-way GLM analysis used a two (training: active vs. control) × two (anxiety: high vs. low) design and was conducted on STAI-S scores at time three. The second GLM analysis therefore compared the effect of the intervention type and level of anxiety on STAI-S three scores.

To identify any further indications that the CBM-I training was effective, the correlations between trait anxiety (BFNE scores) and state anxiety (STAI-S scores) at time three were calculated and compared between the control and the CBM-I condition. A significant positive correlation would indicate that no training had occurred, as participants higher in trait anxiety would also report being higher in state anxiety. However, a nonsignificant correlation may indicate that some form of training occurred, as both low and high trait anxiety participants would score similar values on STAI-S 3 measures, and a significant negative correlation would show that those higher in trait anxiety actually reported significantly lower STAI-S 3 scores than those lower in trait anxiety, and would therefore indicate that training may have occurred.

Results

Mean participant ratings were calculated for each of the intervention and anxiety conditions (see Tables 1.1 and 1.2 for the raw mean values). This allowed us to examine the initial differences between the conditions in relation to scores on both scales. Descriptive statistics were also calculated for STAI-S participant scores at times 1, 2, and 3 (see Table 1.3.) to provide a preliminary indication of the effectiveness of the anxiety induction and any successful reductions in anxiety that may have occurred. Finally, scatter plots were created to

more clearly outline the distribution of mean interpretation bias and STAI-S at time three

scores for both intervention type and anxiety groups (see figure 1.1 And 1.2).

Table 1.1

Descriptive statistics for levels of interpretation bias with intervention type and trait anxiety

Intervention type	Anxiety	Mean	Std. Deviation	N
CBM-I	Low	2.80	.000	2
	High	2.60	.438	7
	Total	2.64	.389	9
Control	Low	2.80	.337	5
	High	2.35	.516	5
	Total	2.58	.474	10
Total	Low	2.80	.275	7
	High	2.50	.467	12
	Total	2.61	.426	19

Table 1.2

Descriptive statistics for levels of state anxiety at time 3 with intervention type and trait

anxiety

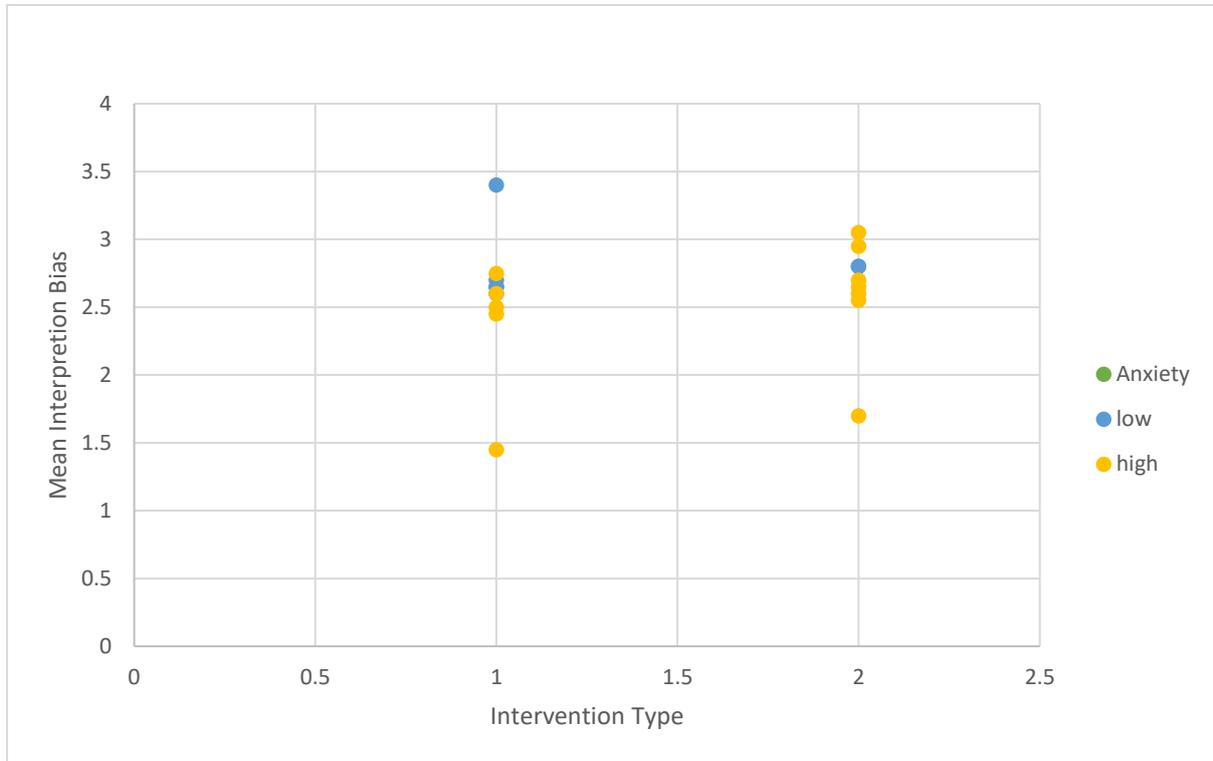| Intervention type	Anxiety	Mean	Std. Deviation	N
CBM-I	Low	1.42	.589	2
	High	1.98	.262	7
	Total	1.85	.395	9
Control	Low	1.67	.312	5
	High	2.10	.346	5
	Total	1.88	.385	10
Total	Low	1.60	.371	7
	High	2.03	.292	12
	Total	1.87	.379	19

Table 1.3

Descriptive statistics for levels of state anxiety at times 1, 2, and 3 with intervention type and

trait anxiety

	Intervention type	Anxiety	Mean	Std. Deviation	N
Mean STAI-S 1	CBM-I	Low	1.00	.000	2
		High	1.98	.401	7
		Total	1.76	.553	9
	Control	Low	1.57	.224	5
		High	1.90	.760	5
		Total	1.73	.557	10
	Total	Low	1.40	.331	7
		High	1.94	.547	12
		Total	1.75	.540	19
Mean STAI-S 2	CBM-I	Low	1.08	.118	2
		High	2.24	.693	7
		Total	1.98	.788	9
	Control	Low	1.57	.641	5
		High	2.13	.681	5
		Total	1.85	.691	10
	Total	Low	1.43	.576	7
		High	2.19	.658	12
		Total	1.91	.721	19
Mean STAI-S 3	CBM-I	Low	1.42	.589	2
		High	1.98	.262	7
		Total	1.85	.395	9
	Control	Low	1.67	.312	5
		High	2.10	.346	5
		Total	1.88	.385	10
	Total	Low	1.60	.371	7
		High	2.03	.292	12
		Total	1.87	.379	19

Figure 1.1

Mean interpretation bias scores across intervention type and anxiety conditions

Note. The distribution of mean interpretation bias scores are shown for both intervention type and anxiety conditions.

Figure 1.2

Mean STAI-S Scores Across Intervention Type and Anxiety Conditions
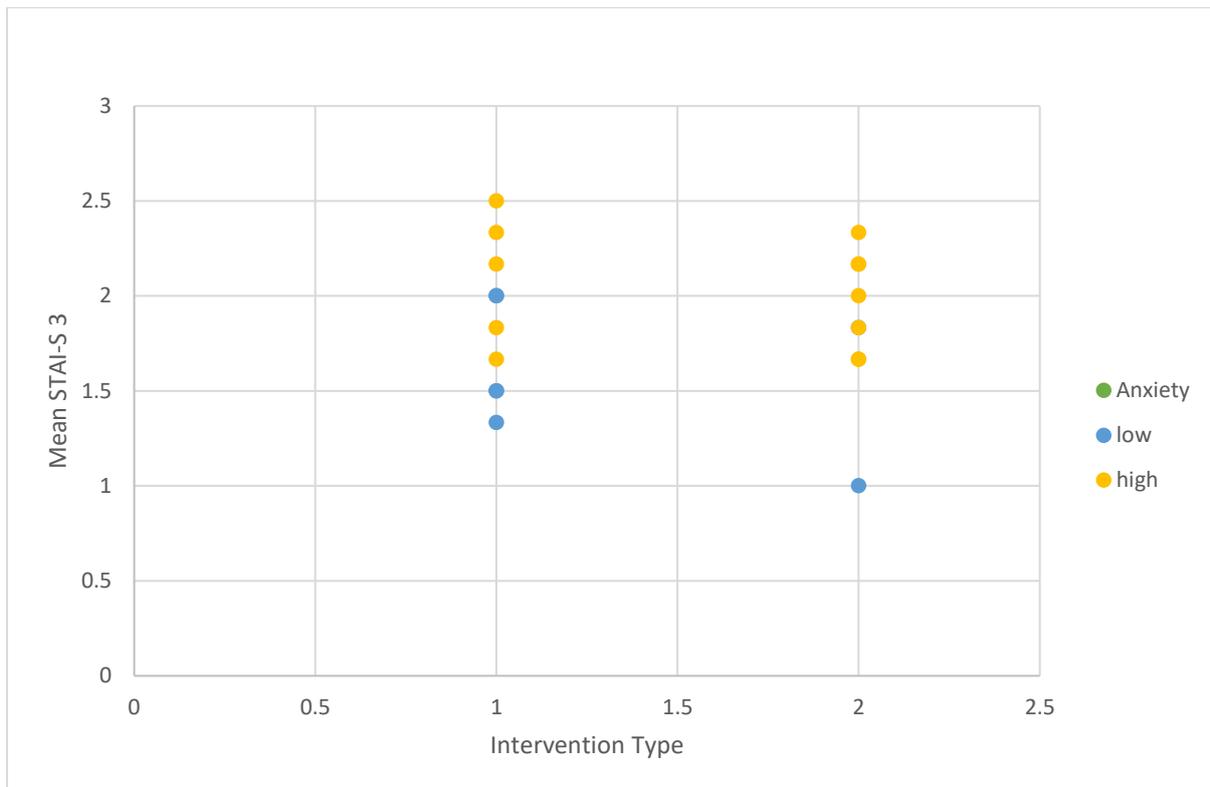
Note. The distribution of mean STAI-S 3 scores are shown for both intervention type and anxiety conditions.

Effect of CBM-I Training on Levels of Interpretation Bias

In the first two-way GLM analysis, the main effect of intervention type was not significant, $F(1, 15) = 0.337$, $p = .570$, $\eta^2_p = .022$. This revealed that the positive CBM-I training registered marginally more positive interpretation bias than the control on the interpretation bias test, however, the effect size was small and nonsignificant. The main effect of anxiety was not significant, $F(1, 15) = 2.276$, $p = .152$, $\eta^2_p = .132$. This revealed that the lower anxiety participants registered marginally more positive interpretation bias compared to higher anxiety participants on the interpretation bias test, however, although the effect size

was large, the main effect was nonsignificant. There was no interaction between intervention type and anxiety, $F(1, 15) = 0.337$, $p = .570$, $\eta^2_p = .022$.

Effect of CBM-I Training on Anxiety

In the second two-way GLM analysis, the main effect of intervention type was not significant, $F(1, 15) = 1.236$, $p = .284$, $\eta^2_p = .076$. This revealed that positive CBM-I training was marginally more effective in reducing anxiety reported by participants than the control, however, the effect was medium and nonsignificant. The main effect of anxiety was significant, $F(1, 15) = 8.717$, $p = .01$, $\eta^2_p = .368$. This demonstrated a trend in which high anxiety participants reported significantly higher levels of anxiety on the STAI-S three than low anxiety participants. The effect size for anxiety was also large. There was no interaction between intervention type and anxiety, $F(1, 15) = 0.141$, $p = .713$, $\eta^2_p = .009$.

Correlational Analysis

In the control condition there was a significant positive correlation between BFNE scores and STAI-S three scores, $r(10) = .715$, $p = .0.20$. This suggests that participants who scored higher in trait anxiety also scored higher in state anxiety at time three. In the positive CBM-I training condition, the correlation between BFNE and STAI-S three scores was also significant, $r(9) = .715$, $p = .031$. This once again suggests that those reporting higher trait anxiety on the BFNE also reported higher state anxiety on the STAI-S three.

Discussion

The findings of study one demonstrate that training participants via a positive CBM-I intervention did not significantly increase positive interpretation bias or reduce anxiety reported by participants, compared to a control condition. These results run counter to the hypotheses, and place in question the legitimacy of CBM-I as a tool for treating social anxiety in the future. However, there did emerge two points of interest regarding the direction

of data within the main effects that, although nonsignificant, may provide limited support for the study one hypotheses. The first was that participants in the CBM-I training condition reported marginally more positive interpretation bias compared to the control group. The second point of interest showed that participants in the positive CBM-I training condition reported marginally lower levels of anxiety compared to the control group. Thus, although there are indications that the treatment may have elicited some remnants of the desired effect, the overwhelming majority of evidence does not support the current study one hypotheses and suggests the intervention was not effective.

One key problem with study one was the small sample size, something that was caused by an abrupt halt to data collection experienced due to COVID-19 regulations. It has been shown that small sample sizes can fail to detect significant results (Zhang et al., 2019). Therefore, given the nature of study one and the uncertainty surrounding the results attained, study two was conducted to test not only whether any effects achieved in study one were transmissible to an online application of CBM-I, but also whether CBM-I or CBM-A could achieve significant reductions in their respective cognitive biases or anxiety via online administration given a larger sample size.

Method

Participants and Design

Seventy-five participants from the University of Kent (97.4%) and two from the Prolific website (2.6%), ranging from 18 to 56 years of age ($M = 20.79$, $SD = 6.22$), took part in study two. Fifty-seven participants were female (74%), whilst 20 participants were male (26%). Participant's reported trait anxiety, calculated via mean BFNE scores, was $M = 3.37$, $SD = 0.866$. Participation in this study was voluntary, with compensation for the participation of University of Kent students consisting of course credits that were required as part of their

Research Participation Scheme, and financial compensation (£3.25) for those that signed up via the Prolific website. All data was collected via the Qualtrics system.

This study consisted of a three (intervention: CBM-I vs. CBM-A vs. control) by two (social anxiety group: high vs. low) between subjects design, whereby the independent variables were training types (CBM-I, CBM-A and control) and social anxiety level (high or low) assessed by the BFNE. The dependant variables consisted of the tests of bias (attention and interpretation bias), and state measures of anxiety. Once again participants were placed into either high or low anxiety groups through a median split of BFNE scores.

Materials

State-Trait Anxiety Index: State Version (STAI-S; Marteau & Bekker, 1992)

This scale was the same as presented in study one. The STAI-S scale at time one was highly reliable (six items; $\alpha = .86$). The STAI-S scale at time two was highly reliable (six items; $\alpha = .84$). Finally, the STAI-S at time three was also highly reliable (six items; $\alpha = .79$).

Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983).

This scale was identical to the BFNE scale presented in study one. The BFNE demonstrated high reliability in this study (12 items; $\alpha = .93$).

Distraction Tasks

The first distraction material was presented in the form of the first two chapters from the popular novel "The Invisible Man", on screen, in which participants had five minutes to read as far as they could through the passage of text. This distraction task was included for the same purpose as study one.

The second distraction material was presented in the form of maths questions requiring participants to multiply numbers together and type the answer to each question in

the box provided. A distraction task was placed in between the bias training and the bias test in order to provide a break from long and intense bias training, reduce participant rehearsal of material, and reduce overall practice effects of the tasks at hand.

Anxiety Induction

In order to elicit an anxious state, participants were informed that they would be placed into a group chat and be asked to discuss a designated topic at the end of the study. Participants were instructed that they would be informed of the discussion topic just before they were placed into the group chat, to prevent other emotions related to the topic from confounding the desired result of the anxiety induction itself. The anxiety induction was included for the same purpose as in study one.

Cognitive Bias Modification: Attention (CBM-A; Boettcher et al., 2013)

This CBM-A technique focuses on positively training attention bias and is based on the dot probe paradigm, which is similar to the version reported in Boettcher et al. (2013), with the crucial difference being instead of using both faces and words we used eight social threat words (e.g., embarrassed, humiliated) and eight neutral words (e.g., cupboard, dishwasher) only as stimuli. We opted to present words exclusively as research has suggested that words may in fact be more effective in reducing anxiety than facial stimuli (Hakamata et al., 2010). In this exercise a social threat and a neutral cued word appeared on either the left or right side of the screen respectively. After 600ms the cue words disappeared, and the participants needed to detect a probe that appeared immediately in one of the two locations (left or right side of the screen). The probe remained present on the screen until the participant registered a response, which was recorded from the onset of the probe appearing to them pressing the key in response. Participants were instructed to respond as quickly as possible without sacrificing accuracy. In all 50 trials the probe appeared in the same location

as the neutral cue word. The concept here was that the cue replacing the neutral word positively trained the participant to direct attention away from the social threat word and towards more neutral words. The CBM-A training program was administered online.

Attention Bias Outcome Assessment

In order to assess the effectiveness of the CBM-A training technique, an attention bias test was administered. This test was similar to the CBM-A training, however, some of the words used in the assessment were different to reduce practice effects. The only other difference was that on 50% of the trials the probe appeared in the same location as the social threat word cue, and in the remaining 50% of trials the cue appeared in the same location as the neutral word cue. The key here was that socially anxious participants were expected to demonstrate significantly longer response times when the cue appeared in the location of the neutral word than when appearing in the same position as the social threat word compared to non-anxious controls, due to the difficulty in disengaging from threatening stimuli. Therefore, if the CBM-A training completed by participants successfully reduced the time taken to disengage with the social threat word and respond to validly and invalidly cued neutral words then the training was effective. The attention bias assessment consisted of 50 trials, all of which were presented online. Attention bias was calculated by subtracting the mean response to neutral cues from the mean response for threat cues. Higher scores indicated more negative attention bias towards threat cues. Inaccurate responses on trials were removed from the analysis, along with response times below 200ms and above 1000ms. Participants were excluded from the analysis if they had over 20% of trials removed (19 participants excluded).

Cognitive Bias Modification: Interpretation (CBM-I; Mathews & Mackintosh, 2000)

The CBM-I training technique used within this study was the same modified version of the ambiguous situation paradigm (Mathews & Mackintosh, 2000), which was validated in study one, with the only difference being it was administered online.

Interpretation Bias Outcome Assessment

The interpretation bias outcome assessment used was the same recognition task, designed by Mathews and Mackintosh (2000), used in study one, with the only difference being it was administered online. Participants were once again excluded from the analysis if over 20% of comprehension questions were wrong (seven participants excluded).

Control Condition

The control condition involved participants reading a passage of text about a fictional character called Sally, and subsequently answering questions about details contained within the short story of Sally's day. Crucially, here, the exercise did not evoke any kind of bias training, and participants did not complete any form of CBM-I or CBM-A training. Participants in the control condition did however complete both the interpretation and attention bias outcome assessments respectively.

Procedure

Study two lasted for approximately 30 minutes. Participants signed up to the study via the research participation scheme or Prolific, and completed the study online. Upon the initial signup participants read the information sheet, which contained information on the study and details of how their information would be stored, before then completing an informed consent sheet and confirming their willingness to participate in this study. After completing both forms participants then completed the first STAI-S, for a measure of their current state of anxiety at the beginning of the study. Subsequently, participants were exposed to the anxiety induction. Then participants completed the distraction task. Following this, the second STAI-

S measure was completed. Participants were then randomly allocated into either a CBM-I training condition, CBM-A training condition or control condition. Once the two training groups had completed the bias training, they completed the second distractor task, before those in the interpretation condition and the attention condition both carried out the interpretation bias or attention bias test, respectively. Those in the control condition did not have to undergo the distractor task, but instead then completed both the interpretation and attention tests. Finally, all participants were directed back to a final STAI-S measure, before being informed that the group chat was full, and that they would therefore not have to partake in the group chat, but would instead be asked to complete a final BFNE measure. Once the study was completed, participants were directed to the debrief to disclose the real intentions of the study. They were informed that they did not have to join a group chat, their data was stored anonymously, they could withdraw from the study at any time, and that they could ask any further questions as desired. Data was submitted online through Qualtrics, within a secure server. Once again, a link to an anxiety calming video was provided.

Statistical Analysis

Based on previous research examining the effect of CBM procedures on reducing cognitive biases and anxiety (Cristea et al., 2015b; Hallion & Ruscio, 2011; Liu et al., 2017), an a priori power analysis was conducted using G*Power version 3 (Faul et al., 2007) to compute the sample size required to detect a small effect size of $R2 = 0.03$, with alpha set to .05, and a power of 0.80. Results showed that a total sample size of 315 would be required to detect a small effect size with 0.80 power for this study, with at least 105 participants required per group.

In order to examine the effects of intervention type and anxiety on the dependant variables, three separate two-way general linear model (GLM) analyses were conducted to

assess the effectiveness of CBM-I and CBM-A training, in high and low anxiety groups, on levels of interpretation bias, attention bias and STAI-S scores at time three, respectively. Interpretation bias scores were obtained through the same method as study one. Attention bias scores were obtained by first calculating the mean reaction time for both threat and neutral cues, and then subtracting the mean threat reaction time from the mean neutral reaction time. A negative attention bias reflects an attention bias away from neutral cues and towards threat cues, whereby negative values indicate more negative attention bias, and positive values indicate more positive attention bias. Similarly to study one, effect sizes of 0.2 are considered small, effect sizes of 0.5 are considered moderate, and effect sizes of 0.8 are considered large (Cohen, 2013).

The first two-way GLM analysis used a two (training: CBM-I vs. control) × two (anxiety: high vs. low) design and was conducted on interpretation bias. The first GLM analysis therefore compared the effect of the two intervention types and level of anxiety on interpretation bias scores. The second two-way GLM analysis also used a two (training: CBM-A vs. control) × two (anxiety: high vs. low) design and was conducted on attention bias. The second GLM analysis compared the effect that the two intervention types and level of anxiety had on attention bias. The third two-way GLM analysis used a three (training: CBM-I vs. CBM-A vs. control) × two (anxiety: high vs. low) design and was conducted on STAI-S scores at time three. The third GLM analysis therefore compared the effect that the three intervention types and level of anxiety had on STAI-S scores after the implementation of each intervention.

To identify any further indications that the CBM-I training was effective, the correlations between trait anxiety (BFNE scores) and state anxiety (STAI-S scores) at time three were calculated and compared between the control, CBM-I, and CBM-A conditions.

Similarly to study one, a nonsignificant or significant negative correlation could indicate that some training had occurred.

Results

Mean participant ratings were calculated for each of the intervention and anxiety conditions (see Tables 2.1, 2.2 and 2.3., for the raw mean values). This allowed us to examine the initial differences between the conditions in relation to scores on both scales. Descriptive statistics were also calculated for STAI-S participant scores at times 1, 2, and 3 (see Table 2.4.) to provide a preliminary indication of the effectiveness of the anxiety induction and any successful reductions in anxiety that may have occurred.

Table 2.1

Descriptive statistics for levels of interpretation bias with intervention type and trait anxiety

Intervention type	Anxiety	Mean	Std. Deviation	N
CBM-I	Low	2.74	.337	15
	High	2.65	.376	18
	Total	2.69	.356	33
Control	Low	2.76	.287	10
	High	2.61	.323	9
	Total	2.69	.305	19
Total	Low	2.75	.311	25
	High	2.64	.354	27
	Total	2.69	.336	52

Table 2.2

Descriptive statistics for levels of attention bias with intervention type and trait anxiety

Intervention type	Anxiety	Mean	Std. Deviation	N
CBM-A	Low	.001	.025	14
	High	-.0002	.032	11
	Total	.0006	.028	25
Control	Low	-.0004	.016	10
	High	-.01	.036	9
	Total	-.005	.027	19
Total	Low	.0006	.021	24
	High	-.004	.033	20
	Total	-.002	.027	44

Table 2.3

Descriptive statistics for levels of state anxiety at time 3 with intervention type and trait

anxiety

Intervention type	Anxiety	Mean	Std. Deviation	N
CBM-I	Low	2.01	.631	15
	High	2.26	.637	18
	Total	2.15	.637	33
CBM-A	Low	2.04	.555	14
	High	2.02	.456	11
	Total	2.03	.504	25
Control	Low	1.87	.508	10
	High	2.15	.568	9
	Total	2.00	.541	19
Total	Low	1.98	.564	39
	High	2.16	.569	38
	Total	2.07	.570	77

Table 2.4

Descriptive statistics for levels of state anxiety at times 1, 2, and 3 with intervention type and

trait anxiety

	Intervention type	Anxiety	Mean	Std. Deviation	N
Mean STAI-S 1	CBM-I	Low	1.92	.796	15
		High	2.34	.670	18
		Total	2.15	.749	33
	CBM-A	Low	1.88	.421	14
		High	1.79	.597	11
		Total	1.84	.496	25
	Control	Low	2.08	.742	10
		High	2.22	.441	9
		Total	2.15	.606	19
	Total	Low	1.95	.657	39
		High	2.15	.635	38
		Total	2.05	.650	77
Mean STAI-S 2	CBM-I	Low	2.09	.687	15
		High	2.40	.717	18
		Total	2.26	.710	33
	CBM-A	Low	1.79	.431	14
		High	2.03	.433	11
		Total	1.89	.441	25
	Control	Low	2.15	.564	10
		High	2.04	.532	9
		Total	2.10	.537	19
	Total	Low	2.00	.582	39
		High	2.21	.618	38
		Total	2.10	.605	77
Mean STAI-S 3	CBM-I	Low	2.01	.631	15
		High	2.26	.637	18
		Total	2.15	.637	33
	CBM-A	Low	2.04	.555	14

	High	2.02	.456	11
	Total	2.03	.504	25
Control	Low	1.87	.508	10
	High	2.15	.568	9
	Total	2.00	.541	19
Total	Low	1.98	.564	39
	High	2.16	.569	38
	Total	2.07	.570	77

Effect of CBM-I Training on levels of Interpretation Bias

In the first two-way GLM analysis, the main effect of intervention type was not significant, $F(1, 48) = 0.007$, $p = .935$, $\eta^2_p = <.001$. The main effect of anxiety was not significant, $F(1, 48) = 1.511$, $p = .225$, $\eta2p = .031$. This revealed that high anxiety participants registered marginally more negative interpretation bias compared to low anxiety participants, however, the effect was small and nonsignificant. There was no interaction between intervention type and anxiety, $F(1, 48) = 0.081$, $p = .777$, $\eta2p = .002$.

Effect of CBM-A Training on Levels of Attention bias

In the second two-way GLM analysis, the main effect of intervention type was not significant, $F(1, 40) = 0.422$, $p = .520$, $\eta^2_p = .010$. This revealed that participants in the positive CBM-A condition showed marginally more negative attentional bias towards threat related items than those in the control intervention, however, the effect was small and nonsignificant. The main effect of anxiety was not significant, $F(1, 40) = 0.392$, $p = .535$, $\eta2p = .010$. This revealed that low anxiety participants exhibited marginally more negative attentional bias toward threat related items than compared to high anxiety participants, however, this effect was once again small and nonsignificant. There was no interaction between intervention type and level of anxiety, $F(1, 40) = 0.209$, $p =.650$, $\eta2p = .005$.

Effect of CBM Training on Anxiety

In the third two-way GLM analysis, the main effect of intervention type was not significant, $F(2, 71) = 0.396$, $p = .674$, $\eta^2_p = .011$. This revealed that participants who underwent the CBM-I intervention showed the highest levels of state anxiety, however, the effect was small and nonsignificant. The main effect of anxiety was not significant, $F(1, 71) = 1.581$, $p = .213$, $\eta2p = .022$. This revealed that low anxiety participants showed marginally lower levels of state anxiety than high anxiety participants, however, the effect was small and nonsignificant. There was no interaction between intervention type and level of anxiety, $F(2, 71) = 0.503$, $p = .607$, $\eta2p = .014$.

Correlational Analysis

In the control condition, the correlation between BFNE scores and STAI-S three scores was not significant, r(19) = .141, $p = .566$. In the positive CBM-I training condition, there was a significant positive correlation between BFNE and STAI-S three scores, r(33) = .365, $p = .037$. This correlation indicated that participants reporting high trait anxiety (high BFNE scores) also indicated high state anxiety (high STAI-S three scores). This suggests the CBM-I was not effective in reducing anxiety in participants. In the positive CBM-A training condition, the correlation between BFNE and STAI-S three scores was not significant, r(25) = .123, $p = .558$.

Discussion

The findings of study two revealed that training participants in a positive CBM-I or benign CBM-A intervention had no significant effect in reducing their respective bias or anxiety. In fact, in the CBM-A training condition, participants showed marginally more negative attention bias towards threat related items than the control. Similarly, participants in the CBM-I condition reported the highest levels of anxiety. Therefore, not only do the results

highlight how ineffective the treatments were, but furthermore, the marginal directions in data pose the question of whether the treatments may have had the inverse effect, whereby participants trained via CBM-A were subsequently more prone to threat related items, and CBM-I trained participants became more anxious.

However, one encouraging finding from study two revealed that there was no significant difference between the high versus low anxiety groups in reported levels of state anxiety at time three. This suggests that training in one of the two CBM conditions may have resulted in lower reported state anxiety from high trait anxiety participants. However, given the significant positive correlation between BFNE and STAI-S three scores in the CBM-I condition, there is little evidence to suggest that CBM-I was largely responsible for this nonsignificant result. These findings therefore provide very little evidence in support of our hypotheses and suggest that a single session CBM program may not be as effective a treatment for social anxiety as previously thought, although encouraging signs based on very limited evidence indicate that there may be potential.

General Discussion

The present study aimed to investigate the effectiveness of single session CBM-I and CBM-A interventions in successfully promoting more positive cognitive biases and reducing anxiety compared to a no training condition. Additionally, this study examined the translatability of CBM intervention effects when administered under virtual application. In two studies, we found that neither CBM-I nor CBM-A significantly increased positive cognitive biases or reduced anxiety, when compared to a control group. Furthermore, online delivered CBM produced no significant increases in cognitive biases or reductions in anxiety compared to a control group. These findings cast doubt upon our hypotheses, and instead question the legitimacy of CBM interventions as potential treatments for SAD. In addition,

these findings show that a single session of CBM may not be substantial enough to effectively treat SAD. There are two additional notes of interest. The first is reflected in the earlier findings of study one, which did provide some limited evidence in support of our hypotheses, whereby although nonsignificant, positive CBM-I training produced higher levels of positive interpretation bias and lower levels of anxiety compared to the control. However, it is also interesting to note that the online CBM-I condition in study two was unable to replicate the direction of data displayed in study one. This suggests that attempts to translate CBM training effects onto virtual devices may be too early, and that lab-based study is still the most effective method of administering CBM training.

The second note of interest was uncovered in study two, whereby there was no significant difference between the high and low anxiety groups and their reported state anxiety on the STAI-S three. This finding represents an encouraging indication that the CBM training may have had an effect in reducing state anxiety in high trait anxiety participants. However, it is also worth noting that, although nonsignificant, the high anxiety group reported marginally higher levels of state anxiety than the low anxiety group did.

One explanation for the limited directional evidence found in support of CBM-I, but not CBM-A, is echoed in research suggesting that CBM-I may be a more effective cognitive bias and anxiety treatment than CBM-A (Cristea et al., 2015; Liu et al., 2017; Jones & Sharpe, 2017). Indeed, a recent study comparing the efficacy of the two CBM procedures found that CBM-I reduced negative interpretation bias and social anxiety symptoms, in addition to an improved performance on a social stressor task. In contrast, the CBM-A intervention failed to modify attention bias or anxiety vulnerability (Yeung & Sharpe, 2019). Further evidence was provided by Jones and Sharpe (2017), who found in their meta-analysis that the estimated median effect size of CBM-I true efficacy was 0.65, compared to 0.61 for CBM-A. The advantage of CBM-I was also highlighted in a meta-analysis conducted by Liu

et al. (2017) who found that CBM-I was more effective in decreasing anxiety than CBM-A. One potential explanation for this may be reflected in a study by Mobini et al. (2014), who found that the CBM-I program used in training not only reduced negative interpretation bias, but also reduced attentional bias simultaneously. These findings support the notion proposed by Liu et al. (2017), that the cognitive mechanisms of interpretation and attentional biases may be far more interactive than first thought (Amir et al., 2010; White et al., 2011) and consequently, CBM-I can effectively alter both biases, resulting in the effects of both interventions manifesting in CBM-I only. In line with this theory, the interactive nature underlying CBM-I may explain the marginal positive effects found in support of CBM-I, but not CBM-A, in this study. In addition, the interactive nature of interpretation and attentional biases may also explain why we failed to identify significant differences between the two programs. One method of determining whether this interactive nature was a significant factor in this study could have been to test each CBM group on levels of both interpretation and attention bias.

However, regarding the current study, one should be cautious when interpreting these results, as CBM-A was not applied within a laboratory environment, unlike CBM-I in study one, where the limited evidence was found. Indeed, research has consistently highlighted the inability virtual applications of CBM have to transfer effects found in laboratory environments (Heeren et al., 2015; Jones & Sharpe, 2017; Zhang et al., 2019). Jones and Sharpe (2017) attempted to explain this lack of translatability by suggesting that due to the boring and repetitive nature of CBM tasks (Brosan et al., 2011), the more stringent laboratory environment leads to stricter adherence to instructions, and therefore produces a more sustained effort to pay attention to the screen and respond to each task more accurately. Similarly, Zhang et al. (2019) suggested that those undertaking online CBM are more likely to be distracted or disturbed by others during treatment. This was evidenced by De Voogd et

al. (2017), who found that many participants undertaking their designated online CBM programme either failed to adhere to the training timelines or condensed the training into one or two days. From the aforementioned research, it seems relatively clear that CBM is not as effectively executed when administered virtually compared to in the laboratory. Having said this, studies such as those conducted by Andrews et al. (2010) have shown that computerised CBT can effectively reduce anxiety symptoms, and as such, other treatments that alter cognitive mechanisms underlying social anxiety can successfully treat anxiety in participants virtually. Within the context of the current study, this issue of lab versus online application is raised due to a lack of transmissibility of the marginal positive effects found in study one CBM-I and the lack of such data emerging in study two. Therefore, it is difficult to determine that CBM-I outperformed CBM-A, as both were not compared in a controlled, laboratory environment, where research has shown CBM to be most effective. One further note of interest that challenges the notion of CBM-I outperforming CBM-A was found in study two. Given the significant positive correlation between BFNE and STAI-S three scores in the CBM-I condition, the nonsignificant difference between high versus low trait anxiety scores and STAI-S three scores found in study 2 may indicate that CBM-A had a marginally greater effect on reducing state anxiety in high trait anxiety participants than CBM-I did.

Although limited evidence in favour of our hypotheses did emerge, it is clear the overwhelming lack of significant effects produced by CBM training suggests that the interventions were not effective. The view that CBM should not be considered a viable potential treatment of social anxiety is one shared by various researchers within the CBM field, with Emmelkamp (2012) even going as far as to label CBM-A as the "emperor's new suit". Cristea et al. (2015) also echo this sentiment, as they found, when undertaking a meta-analysis on the effect of CBM on anxiety and depression, that the effects were small, showed high degrees of heterogeneity, and in most cases were non-significant. In addition, they found

that when excluding outliers, the effect sizes were significantly reduced, in some cases by almost as much as half. Cristea et al. also note that, of the four identified outliers, three of them had effect sizes almost ten times that of the pooled mean effect size. Furthermore, adjustment for publication bias rendered some outcomes non-significant, and reduced overall effect sizes considerably. These results place into question the legitimacy of CBM as an intervention capable of effectively treating social anxiety and suggest CBM may be not as effective as previously suggested. However, there are various methodological criticisms of this meta-analysis, such as the decision not to include bias change as a measure of CBM's efficacy. Considering research has indicated bias change is a required outcome for reliable changes in symptoms (Clarke et al., 2014) the decision not to include the measure seems strange as it may have resulted in a severe underestimation of effect size, due to studies unsuccessful in altering biases being included in the analysis. Another criticism suggested by Jones and Sharpe (2017) highlights the authors' decision to exclude outcomes related to stressor vulnerability due to heterogeneity between studies. This would have severely reduced the effect size specifically relating to CBM-A training research as effect sizes for stressor vulnerability were far greater than for symptom reduction. One further underestimation of CBM effectiveness was due to the meta-analysis including studies that did not focus on clinical symptoms or distress as primary outcomes (Jones & Sharpe, 2017). One such study was a CBM-A program administered by Sharpe et al. (2012) with the intentions of reducing biases towards pain. The inclusion of studies such as this no doubt also had a negative impact on the effect size of overall CBM efficacy.

Perhaps then, given the culmination of these decisions, it should be of no surprise that such low, and often times insignificant results were found by Cristea et al. (2015). In fact, Jones and Sharpe (2017) suggest that of all the meta-analyses, Cristea et al. had the most stringent criteria for study inclusion, and given they found an effect, albeit small, on reducing

anxiety, their dismissal of CBM may be in vain. This point was reinforced by Grafton et al. (2017), who reanalysed the results of the Cristea et al. (2015) meta-analysis using bias modification as the moderator. They found medium effect sizes where biases had been successfully modified, and no impact on emotional vulnerability when biases had not been successfully modified. This suggests that where CBM had been effectively implemented, changes in anxiety related symptoms were in fact effective. However, Cristea et al. (2017) reanalysed their previous meta-analysis from 2015, using anxiety as the outcome, and found smaller effect sizes than Grafton et al. though still significant, and also showed that changes in bias no longer predicted levels of anxiety. This therefore places into question once again the effectiveness of CBM in successfully reducing anxiety, even when taking into account bias change as a moderator.

One final note raised by Cristea et al. (2017), in response to Grafton's reanalysis, was that CBM cannot be evaluated based only on trials where the proposed mechanisms were successfully implemented, and biases were effectively changed. They suggest that this method of research completely contrasts that of accepted standards of evidence-based psychotherapies and "CBM cannot continue to eschew the rigorous scrutiny applied to other treatments" (Cristea et al., 2017, p. 1). This is perhaps another essential step to ensuring that the precise efficacy of CBM as a potential treatment for social anxiety is portrayed accurately throughout research in the field. If one were to apply this conceptual perspective to the current study, one may argue CBM was not effectively implemented, as no successful alteration of cognitive biases was achieved. However, given the CBM procedures utilised in this study were either adapted from or based on CBM programs used effectively by researchers in the past (Mathews & Mackintosh, 2000; Boettcher et al., 2013), one must question whether withdrawing results based on no effective cognitive bias change could be considered publication bias towards more positive CBM findings.

However, in spite of the criticisms regarding the methodology of the meta-analysis conducted by Cristea et al. (2015), they maintain that many of the studies that have shown positive effects of CBM are flawed, by suggesting CBM methodologies are often susceptible to demand characteristics. For example, from their meta-analysis they found that studies offering compensation found larger effect sizes than those that did not, with studies conducted in the lab also achieving higher effect sizes. In addition, the same meta-analysis found that effect sizes were "negatively linearly related to the number of sessions". This may dispel the popular notion proposed in many future direction sections that often suggest more sessions may be required to achieve a more effective and reliable set of results. However, contrary to this finding, Abend et al. (2019) found in a more recent analysis that incremental performance improved across sessions, suggesting more sessions may well translate to a greater effect, which may also explain the nonsignificant results found in the current study. Cristea et al. (2015) also suggest that a vulnerability to demand characteristics stems from participants being aware of the condition they are in and the direction of training it ensues, which may explain CBM's increased impact on biases. However, Macleod and Matthews (2012) argue not only that it is unlikely participants can accurately determine the desired responses on training and outcome measures, but also that participants consistently fail at correctly differentiating between the control and training conditions. Cristea et al. (2015) conclude that given the evidence provided, it is "not unlikely" that the influx of positive CBM findings have been influenced by certain elements of the experimenter effect (Rosenthal, 1976) or other artefacts unrelated to the experiment itself. Therefore, even if the aforementioned criticisms of the meta-analysis are upheld, there may be fundamental problems with the research providing evidence for CBM efficacy in the first place that raises questions over CBM's efficacy as a treatment for anxiety, regardless of limitations surrounding the meta-analysis.

The suggestion that demand characteristics influence CBM performance in lab-based studies may explain limited evidence found in study one but not two. In addition, the majority of participants in this study received RPS course credits as compensation, with only two participants receiving financial compensation. It may be that receiving credits for a compulsory module failed to elicit the same effect as financial compensation, perhaps due to the compulsory nature of the course requirements compared to monetary gain, and therefore, this may explain why this study failed to find significant effects when compared to studies using financial compensation for participation.

In light of the condemning analysis of CBM provided by Cristea et al. (2015), one must question how research conceived such a unanimous position of confidence in the potential of CBM in the first place. This may in fact be due to the phenomenon known as time lag bias, whereby studies revealing positive results are published first and therefore dominate the field, before more negative studies are published (Higgins et al., 2019; Ioannidis, 1998). Indeed, Cristea et al. (2015) found strong evidence of a "negative linear relationship between publication year and effect size across most outcome categories" (Cristea et al., 2015, p. 14) for CBM and even pointed out the irony in Schmidt et al.'s (2009) study being one of the three outliers they identified in their meta-analysis, ten times the size of the mean pooled effect size, as this paper is credited as being one of first articles to facilitate the burst of CBM-A practice and research.

Further evidence of a lack of empirical evidence for CBM was provided through the application of the Cochrane Collaboration's Risk of bias assessment tool in Cristea et al.'s meta-analysis. They highlighted that the overall quality of studies investigating CBM was substandard, with a significant number of the studies analysed satisfying no quality criteria, and two-thirds satisfying less than three. In fact, for three of the five risk of bias criteria used in the analysis, between 58% and 83% of studies either contained no important information to

assess or were unclear in analysis. In line with this, results for anxiety showed that the quality

of the studies was "negatively related to effect size", with effect sizes for anxiety decreasing

by 0.07 for every quality criterion that was satisfied (Cristea et al., 2015). In addition to time

lag bias and the quality of studies, another issue with replication studies precluding their

methodologies based on high effect sizes shown in earlier studies is that they are likely

powered to detect such large effect sizes and are therefore underpowered in and of

themselves. These factors, coupled with the glorification of CBM through the publication of

almost exclusively positive results in popular top-tier journals (Cristea et al., 2015), may

explain how CBM has been so highly lauded in publications, yet simultaneously so highly

criticised as being falsely labelled a "new clinical weapon" (MacLeod & Holmes, 2012) and

a promising future treatment for social anxiety. As such, it seems it may be too early to

suggest that CBM research has sufficient evidence to establish itself as a potential candidate

for future treatment of social anxiety, a notion reflected in the results of the current study.

However, although the majority of nonsignificant results found in this study did

support the notions proposed by Cristea et al. (2015; 2017), there was one particular result

that provided a slightly more encouraging outlook for CBM. That was the lack of a

significant difference between low and high trait anxiety participants on reported levels of

state anxiety after the intervention. This suggests that the CBM training programs may have

had a positive effect on reducing state anxiety in the high trait anxiety groups to levels of

those in the low trait anxiety group, who due to being low trait anxiety would have typically

reported lower state anxiety. This encouraging finding is in line with recently published

research that contradicts the findings of Cristea et al. (2015) and instead shows promising

results for the potential of CBM. One such meta-analysis was conducted by Liu et al. (2017),

who found small to medium effects of CBM on cognitive biases, and small effects on SAD

primary symptoms and reactivity to stressful situations after the intervention. Liu et al.

suggest that one explanation for the contrast in results to Cristea et al.'s. meta-analysis is that the two meta-analyses pooled data from different groups, with the Cristea et al. meta-analysis using 9 randomised control trials (RCTs), whereas the Liu et al. meta-analysis contained 24 RCTs. As such, the effect sizes presented by Liu et al. suggest that CBM does effectively reduce SAD symptoms.

However, although the nonsignificant difference between high versus low trait anxiety groups could be perceived as an encouraging finding, it may also reflect the fact that participants may not have believed the anxiety induction was real in the first place. As a result, participants in study one may have doubted the legitimacy of the proposed speech they were informed about, which would negate any desired increases in anxiety the study aimed to induce, and subsequently, reduce the levels of state anxiety participants would show in both groups. Furthermore, it may be that the online group chat proposed in study two was also not an effective anxiety induction, and similarly to study one, failed to induce the desired state of anxiety in participants. Indeed, research has shown that individuals with social anxiety perceive online communications as safer and less likely to lead to negative evaluation than face to face interactions (Lee & Stapinski, 2012). Therefore, even if participants believed the group chat was real, they may not have been as concerned about the prospect of a group chat compared to a face-to-face interaction, and as a result, the lack of a difference between trait anxiety groups in study two may have been due to the anxiety induction being ineffective.

One potential explanation for the small effect sizes of CBM on SAD symptoms may be related to the complex and diverse range of cognitive biases involved in the information processing of the disorder (Clark & McManus, 2002). The reason for lower effect sizes in CBM programs such as CBM-A or CBM-I may therefore be that they only target one cognitive bias (for example CBM-A only targeting attention bias), and therefore only implement a marginal effect on one of the many diverse cognitive mechanisms at play.

Indeed, studies have already shown that combining cognitive treatments, such as CBM and CBT, may enhance treatment effects on social anxiety (Rapee et al., 2013; Williams et al., 2013; Butler et al., 2015). This suggests that even if CBM effect sizes are low, there may be a potential avenue for the implementation of CBM treatments alongside CBT to successfully treat social anxiety. However, similarly to the meta-analysis conducted by Cristea et al. (2015), Liu et al. (2017) found that when assessing the quality of the analysed studies using the Cochrane Collaboration Risk of Bias Tool, the studies proved to be substandard, with as many as half satisfying fewer than three quality criteria. Therefore, even more recently published meta-analyses confirm that much of the research highlighting the positive effects of CBM is substandard at best.

Building upon the encouraging portrayal of CBM, Jones and Sharpe (2017) conducted a meta-analysis of the current meta-analyses on CBM programs targeting anxiety and depression and found that in all adult based meta-analyses included, bias was successfully changed, and anxiety symptoms were improved. In fact, from the current CBM research available, Jones and Sharpe concluded that there was good evidence of CBM efficacy in altering the targeted biases and improving anxiety and stress vulnerability. These results highlight the potential CBM may have in becoming a recognised treatment for social anxiety. However, although promising, one key cause for concern was highlighted by the fact that no analyses revealed a lasting effect of CBM on anxiety reduction. Therefore, although it seems clear CBM has the potential capability of both altering cognitive biases and reducing anxiety, the lack of long-term benefits casts doubt upon how efficacious CBM can really be, given that any effects it may have for patients are unlikely to last. Having said this, a more recent study by Pettit et al. (2020) utilised CBM-A on a sample of youths with CBT-resistant anxiety disorders and found not only that treatment significantly reduced anxiety, reporting medium to large effect sizes, but moreover, 50% of youths no longer met diagnostic criteria

for their respective primary anxiety diagnosis after the intervention. Interestingly, these effects were maintained after a 2-month follow up period. Thus, more recent evidence contradicts the notion that CBM programs are unable to achieve lasting effects, especially given the effects in question were applied to patients with CBT-resistant anxiety disorders, and therefore shows CBM has potential not only in the short-term relief of anxiety symptoms, but crucially, as a lasting treatment.

Given the decidedly mixed conclusions drawn by various researchers on CBM, it may be beneficial to seek an understanding of the neural effects CBM has on patients, in order to determine the extent to which CBM can impact the neurological underpinnings of anxiety. Wiers and Wiers (2017) conducted one of the earlier meta-analyses of neuroimaging and CBM studies, with findings indicating the clear potential CBM has in altering neural processes involved in the neuropathology of anxiety. From the included studies, they found that the fronto-amygdalar circuitry plays a key role in the efficacy of CBM in anxiety. Furthermore, Sakaki et al. (2020) found that activation of brain areas related to imagery of happy faces and actions and social reward perception, including the Somatomotor and somatosensory areas, occipital lobe, and the posterior cingulate gyrus, were greater during completion of the CBM-I program, compared to a control. From these findings, Sakaki et al. (2020) posit that social anxiety reduction via CBM-I was achieved due to the memories of positive interpretations being self-referentially retrieved and the imagery associated with the memories being altered to contain more social reward. Both of the aforementioned studies provide tangible evidence for the unique effects CBM has on specific brain areas associated with social anxiety, which further supports the notion that CBM can be used as an effective treatment for social anxiety, and is in line with a more encouraging outlook that may not be wholly reflected in our results. One explanation for the inability of this study to reflect such encouraging findings may be the limitations of the study.

There are several limitations to the current study. First, the quality of the sample was substandard, something that is reflected in the sample size for study one being notably small. This was instigated by the COVID-19 pandemic, which left the continuation of the laboratory study untenable, and meant the study had to be stopped short with only the current participants for data. Given that small sample sizes are known to impact the ability to detect reliable effect sizes and meaningful, statistically significant results (Beard et al., 2011; Zhang et al., 2019), this may be one explanation for nonsignificant results, particularly in study one. The issue of the small sample size was not wholly rectified in study two, as the ongoing COVID-19 pandemic resulted in the transfer of CBM from laboratory assessment to virtual application, something research has clearly shown is far less effective (Cristea et al., 2015; Jones & Sharpe, 2017; Liu et al., 2017). Moreover regarding the quality of the sample, for both studies, the exclusion rate was considerably high. This may be a reflection of methodological flaws such as a poor structure for comprehension questions in CBM-I and an unengaging procedural framework within CBM-A. One final point regarding the quality of the sample concerns the majority student population utilised within this study. Indeed, research has suggested that student samples are not consistently representative of the general population (Jones & Sonner, 2001; Shen et al., 2011; Gainsbury et al., 2014), with even different universities/Colleges reflecting different concentrations of attitudes and personality types (Corker et al., 2017). Therefore, due to the population used as data, this study may not have accurately tested a general, balanced population with CBM.

Second, there were issues with the CBM-A intervention itself, one of which may have been our decision to use words instead of faces as stimuli. Indeed, research has eluded to the possibility that facial stimuli are a more "sensitive index" of attention bias than are words (Pishyar et al., 2004). As such, our decision to use words may have limited the extent to which we were able to train and measure attentional bias. However, more recent research has

suggested the inverse, in which words may in fact be more effective in training and measuring attention bias (Miloff et al., 2015), although there are claims that words are less ecologically valid (Hakamata et al., 2010, Beard et al., 2012). In addition, Jones and Sharpe (2017) have shown that the orientation of the word pairs used as stimuli for training influences the effectiveness of CBM-A, with top-down orientation providing the most effective results. This therefore suggests that the decision to orient word pairs side by side in this study may have negatively impacted our CBM-A procedures' effectiveness.

Moreover, the high participant exclusion rate mentioned earlier suggests that participants likely found the CBM-A procedure boring and repetitive, something Jones and Sharpe (2017) suggests is detrimental to the effectiveness of CBM-A. They found that more distinct stimulus pairs generated larger effects of CBM-A compared to more repetitive stimulus pairs. Therefore, in order to engage the participants during training it may have been more beneficial and effective to include more distinct stimulus pairs. In line with this lack of engagement reasoning, Mogg and Bradley (2016) concluded that it may be beneficial for CBM-A to strengthen goal-directed inhibitory control rather than the processing of task irrelevant cues. This could involve, for example, training a subject's attention towards more positive faces in a crowd like environment, to simulate the experience of giving a speech, and therefore strengthen the goal of being more confident facing the crowd during a CBM-A training intervention, as opposed to simply processing task irrelevant threat cues. For our study, using word stimuli, it may have been more effective to use goal directed words such as "confident" or "success" as the positive word paired with the negative word, instead of benign words like "dishwasher" paired with negative words. The result of this may not only have been a more engaging procedure, but also one in which subjects internalised the goal directed aspect of CBM-A more. This effect may stem from the subject being more inclined to become more "confident", due to the goal driven nature of the exercise and striving toward

something, that would likely develop more positive attention bias, rather than simply directing attention away from negative cues and towards task irrelevant benign ones, which might only encourage a less intense "reduction" in negative attention bias.

Third, there were also issues with the CBM-I procedure. One such issue, that may have been responsible for the high exclusion rates, was the structure of the comprehension questions asked at the end of every attention bias test scenario. The aim of these comprehension questions was to ensure that participants had understood and fully internalised each scenario, which would allow us to exclude those that were not fully engaging with the task. However, one mistake may have been in not goal orientating every comprehension question so that they fully related to the task. For example, one comprehension question read "had you been attending the class for long", which can be considered a task irrelevant question only intended to judge a participant's attention to detail of the information contained in the scenario. Had we have rephrased the intent of the questions like the previous example to more anxiety related questions such as "was the whole class looking at you", we may have encouraged more engagement from participants and recorded a more accurate interpretation bias score with a lower exclusion rate.

The issue related to the structure of the comprehension questions may stem from a wider, more holistic issue regarding the creation of a "new" CBM-I procedure, adapted from other versions specifically for this study. Indeed, Cristea et al. (2015) suggest that the surge of researchers "constantly trying out" new variations of CBM procedures is actually detrimental to research, as this process hampers the development of well-conducted independent CBM studies. This lack of an established protocol for CBM has resulted in heterogenous procedures, measurements and methodologies being used, which has made the meta-analysis of CBM efficacy far more difficult and led to more mixed overall findings regarding significance and attenuated the pooled effect size (Liu et al., 2017). Thus, it may

have been more beneficial to adopt an already "established" CBM-I procedure, as opposed to adapting a new one for this study. One further implication of attempting to create a new version of CBM-I is that one runs the risk of failing to create a CBM procedure at all. This concept was elaborated on by Jones and Sharpe (2017), who suggested that an attempted "CBM" intervention that fails to successfully alter cognitive biases cannot ultimately be called CBM, as CBM is a process, rather than a procedure, and if the bias is not altered, CBM was not tested. Indeed, they found that two thirds of the meta-analyses they analysed found that greater bias change correlated with greater symptom improvement. The probability of encountering this premise was far greater considering we tried out a new intervention, something that research has suggested leads to more mixed findings (Cristea et al., 2015). Overall, this suggests that the current study may have been more effective had we tested a more "well-established" CBM-I procedure.

There are various improvements to the CBM field of research that can be implemented to gain a clearer and sounder picture of CBM efficacy in the treatment of social anxiety. First, future studies should attempt to clarify whether certain groups benefit more from CBM than others. For example, Liu et al. (2017) found through meta-regression results that benign CBM was more effective for women. One explanation for this potential phenomenon is reflected in the hypothesis proposed by (Stewart et al., 1997), which suggests gender differences in processing content, something that has been highlighted in studies that have found gender moderates the relationship between cognitive biases and anxiety (Keogh et al., 2004; Cannon & Weems, 2010; Zhao et al., 2014). Liu et al. go on to suggest that the utilisation of emotional faces, words or social scenarios by CBM may be more beneficial for female participants. Indeed, if through further study this gender moderation between cognitive biases and anxiety is confirmed to be the case, future research should focus on

developing the most effective adaptations of CBM treatment based on the treatment of men and women.

Another group variable that may dictate the efficacy of CBM treatment is age. Through their meta-analysis, Liu et al. (2017) found that younger participants consistently benefitted more from CBM than did older ones. In addition, Jones and Sharpe (2017) suggested that the relationship between age and CBM-A efficacy may be governed by an inverted U-shape, whereby adolescent and young adult participants benefit the most from CBM-A, although a meta-analysis conducted by Cristea et al. (2015) exclusively on child samples did find no significant effect of CBM-A on attention bias or anxiety. One explanation for the disadvantages older participants may have regarding CBM effectiveness is that cognitive reappraisal and executive function are highly sensitive to age-related declines (Mozolic et al., 2011; Opitz et al., 2012). Therefore, given that cognitive reappraisal has been shown to be a vital component in the regulation of emotions, it stands to reason that the decline of such a system due to age would negatively impact one's ability to thrive in programs that rely on affecting this process to evoke change. If such advantages of CBM are in fact moderated by age, future research could seek not only to target prime age groups to elicit the maximum effects, but also, adapt new CBM interventions for older or younger participants to negate the disadvantages caused by age.

Second, future research should aim to meet the standard of conceptualising CBM as a process, rather than a procedure (MacLeod & Grafton, 2016). Given that this study failed to register any significant effect of CBM on bias change or anxiety, it may be logical to conclude that CBM was not effective. However, as touched upon earlier, research has highlighted how bias change reliably leads to symptom reductions (Clarke et al., 2014; Grafton et al., 2017). Therefore, ensuring that the validation of a CBM program is dependent on whether or not it successfully altered the targeted bias may improve our ability to generate

more powerful paradigms for CBM. One additional way of achieving more powerful CBM paradigms may involve reducing the variation of CBM methodologies and procedures that are "tried out" (Cristea et al., 2015), and relying on more established, previously supported CBM programs that have successfully elicited bias changes and anxiety symptoms in the past. In doing so, the pooled efficacy and effect size of CBM may increase due to the more reliable success rate of future CBM studies, and more measured, gradual adjustments can be made to build upon a stronger foundation of CBM paradigms.

Third, as highlighted within this study, single session CBM procedures may not be effective enough to alter the mechanisms underlying cognitive biases. Therefore, future research should focus on testing multi-session CBM programs to have the best chance of successfully altering cognitive biases and developing a potential treatment for SAD. This notion is reflected in the findings of Abend et al.'s (2019) meta-analysis, which highlighted incremental performance improvements across sessions of CBM.

Fourth, given that much of CBM's advantage comes from its potential to be administered at low cost and without a therapist, future research should explore avenues of making online CBM more effective. Research has highlighted the fact that laboratory based CBM studies have found consistently higher efficacy and effect sizes compared to online CBM (Cristea et al., 2015, Jones & Sharpe, 2017; Liu et al., 2017). As such, it is important future research bridges this gap and develops a method of transferring more successful lab results onto online administration. Jones and Sharpe (2017) suggest that one reason that laboratory administration has been more successful is due to the stricter adherence to instructions and attention under testing conditions. Due to the boring and repetitive nature of CBM programs thus far in research (Brosan et al., 2011) virtual applications fail to elicit such engagement and attention to the screen and instructions. Therefore, future research should attempt to increase the engagement of CBM programs, in order to capture the participant's

sustained concentration and adherence to instructions more. One method of doing this may be to encourage active thinking in participants, perhaps through tasks such as making the participant imagine the scenarios and encouraging them to generate the meaning of given words or situations, something Jones and Sharpe (2017) found did lead to increased CBM efficacy.

Fifth, future studies should look to clarify the relationship between CBM-I and CBM-A, to determine not only whether one program is more efficacious than the other in direct comparison trials, but moreover, measure whether either CBM program alters both attention and interpretation bias simultaneously. The fact that CBM-I may be more effective than CBM-A in achieving bias change and anxiety reduction has been alluded to in various meta-analyses (Cristea et al., 2015; Jones & Sharpe, 2017; Liu et al., 2017), with one explanation being the interactive nature of interpretation and attention biases (Amir et al., 2010; White et al., 2011). If either CBM program did turn out to be more effective, perhaps through the ability to alter both biases, future research should look to utilise this fact and focus on developing the CBM program in question. In line with searching for the best method to exploit CBM effectiveness, it may also be beneficial for future research to explore the notion of combining CBM programs with CBT. Indeed, research has highlighted the increased effectiveness of CBM when combined with CBT procedures (Rapee et al., 2013; Williams et al., 2013; Butler et al., 2015). Therefore, although CBM alone may not reliably alter cognitive biases and reduce anxiety, as is the case in the current study, CBM combined with other successful interventions may show more potential.

Finally, taking into account the cultural context of participants may help improve CBM efficacy in the future. For example, a CBM program designed for more individualistic western cultures may contain scenarios or stimuli associated with self-accomplishment, success, and overall, a more independent self-construal of training. In contrast, a CBM

program designed for a more collectivist culture may include scenarios or stimuli associated with social harmony, reverence and overall a more inter-dependant self-construal (Hsu, 1981; Hofmann et al., 2010; Woody et al., 2015). Attempts to create a universally applicable CBM program may be in vain, and therefore future research looking to adapt versions of CBM to different cultural backgrounds may prove successful, something exemplified in Sun et al.'s (2019) adaption of CBM-I for Chinese undergraduates.

Results from the current study suggest that single session CBM is not an effective intervention for altering cognitive biases or reducing anxiety. Findings revealed no significant effect of CBM on either outcome variable. There was limited evidence detected in study one that indicated some effectiveness of CBM, whereby negative interpretation bias was lower in the CBM-I condition and anxiety was lower in the CBM-I condition, although the main effects were nonsignificant and small sample sizes rendered the outcome difficult to interpret. In addition, the non-significant difference between high and low trait anxiety participants on levels of state anxiety in study two also provided encouraging, albeit limited, evidence that CBM may have reduced state levels of anxiety in high trait anxiety participants. Overall, this study had some key limitations, and revealed no substantial effect of CBM on cognitive biases or anxiety. To improve CBM, future studies should look to identify where and in which groups CBM is most effectively administered and adapt such programs appropriately. In addition, future research should look to meet standards of conceptualising CBM as a process rather than a procedure and therefore look to successfully alter biases before considering effects on outcome variables. Furthermore, future research should look to test multi-session CBM and conduct direct comparisons between CBM-I and CBM-A in order to determine any potential advantage between the two and look to explore whether combining CBM programs with other cognitive treatments can improve overall effectiveness. Finally,

future studies should consider cultural differences in response to CBM, and look to develop

more appropriate CBM programs for different cultures.

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Appendix

School of Psychology
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Study Information Sheet

Title of Project:	How we deal with and respond to social situations	**Ethics Approval Number:**	
Investigator(s):	Luke George Bruton	**Researcher Email:**	Lgb26@kent.ac.uk

Aims of the Study:

This study aims to explore how individuals respond to a wide variety of social situations. You will first be asked to complete a series of questionnaires, before being presented with a number of social situations, which you will then be asked to respond to. You will then finally be asked to perform a speech at the end of the study. This will not be recorded but will be timed. We aim to collect information on how people respond to these social situations. Please be aware that, should you consent to participate in this study, you are free to withdraw yourself or your data at any time, either during or after the study has taken place. Doing so would remove any data provided and not affect the allocation of RPS credits. This study is being conducted part of my MSc-research project.

Eligibility Requirements:

You may enter this study if you are at least 18 years old and can read English.

What you will need to do and time commitment:

This study will take you approximately 30-minutes to complete.

Risks/Discomforts involved in participating:

There are no anticipated risks to your participation.

Confidentiality of your data

Any responses you provide will be treated confidentially. Any publication resulting from this work will report only aggregated findings or fully anonymised examples that will not identify you.

Any responses you provide will be completely anonymous—you will be asked to generate a participant code which will be kept with your responses in case of withdrawal of data. Only the research team will have access to the participant codes. The rest of your responses (anonymous) may be used by the research team, shared with other researchers, or made available in an online data repository.

Details of any payments/RPS credits (*must be approved by ethics committee)*

Remember that participation in this research study is completely voluntary. Even after you agree to participate and begin the study, you are still free to withdraw at any time and for any reason. Please note that once your data have been included in published analysis or data repositories, **it cannot be withdrawn**.

If you would like a copy of this information sheet to keep, please email the researcher. If you have any complaints or concerns about this research, you can direct these, in writing, to the Chair of the Psychology Research Ethics Committee by email at: psychethics@kent.ac.uk. Alternatively, you can contact us by post at: Ethics Committee Chair, School of Psychology, University of Kent, Canterbury, CT2 7NP.

School of Psychology
Keynes College
University of Kent
Canterbury, CT2 7NP

RESEARCH INFORMED CONSENT FORM

Title of Project:	How we deal with and respond to social situations.	**Ethics Approval Number:**	
Investigator(s):	Luke George Bruton	**Researcher Email:**	Lgb26@kent.ac.uk

Please read the following statements and, if you agree, initial the corresponding box to confirm agreement:

Initials

I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is <u>voluntary</u> and that I am free to withdraw at any time without giving any reason.

I understand that my data will be treated confidentially and any publication resulting from this work will report only data that does **not** identify me. My anonymised responses, however, may be shared with other researchers or made available in online data repositories.

I freely agree to participate in this study.

Signatures:

_____   _____   _____

Name of participant (block capitals)   Date   Signature

_____   _____   _____

Researcher (block capitals)   Date   Signature

If you would like a copy of this consent form to keep, please ask the researcher. If you have any complaints or concerns about this research, you can direct these, in writing, to the Chair of the Psychology Research Ethics Committee by email at: psychethics@kent.ac.uk.

Alternatively, you can contact us by post at: Ethics Committee Chair, School of Psychology, University of Kent, Canterbury, CT2 7NP.

Materials

Brief fear of evaluation test (BNFE)

Please read each of the following statements carefully and choose one response for each question that most applies to you.

I worry about what other people will think of me even when I know it doesn't make any difference.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I am frequently afraid of other people noticing my shortcomings.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I am afraid that others will not approve of me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I am afraid that people will find fault with me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

When I am talking to someone, I worry about what they may be thinking about me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I am usually worried about what kind of impression I make.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

Sometimes I think I am too concerned with what other people think of me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I often worry that I will say or do the wrong things.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I am unconcerned even if I know people are forming an unfavourable impression of me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

I rarely worry about what kind of impression I am making on someone.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

Other people's opinions of me do not bother me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

If I know someone is judging me, it has little effect on me.

1 Not at all

2 Somewhat

3 Moderately

4 Very much

5 Extremely

State trait anxiety index – State test (STAI-S):

Please read each of the following statements carefully and choose one response for each question that most applies to you.

I feel calm –

1 Not at all

2 Somewhat

3 Moderately

4 Very much

I feel tense –

1 Not at all

2 Somewhat

3 Moderately

4 Very much

I feel upset –

Not at all

Somewhat

Moderately

Very much

I am relaxed –

1 Not at all

2 Somewhat

3 Moderately

4 Very much

I feel content –

1 Not at all

2 Somewhat

3 Moderately

4 Very much

I am worried –

1 Not at all

2 Somewhat

3 Moderately

4 Very much

Cognitive bias modification – interpretation training

Question 1:

You are at a course that your company have sent you on. Your tutor asks each member of the group to stand up and introduce themselves. After your brief presentation, you guess that the others thought you sounded …

Co-fident/ sh-

Comprehension question:

Did you feel dissatisfied with your speech?

Yes/No

Question 2:

You asked a lot of questions during a lecture because you didn't understand the subject and tried to grasp it. The other students seemed to find it difficult too. They listened with … to all your questions.

In-ere-t/ irr-tat-on

Did the other students find you annoying?

Yes/No

Question 3:

As you are walking down a crowded street in Canterbury you spot your flatmate across the road. You call out but your flatmate does not answer. You think that this was because they were …

Di-tract-d/ Avoi-an-

Did your flatmate hear your call?

Yes/No

Question 4:

You are sitting in a seminar room listening intently when the teacher asks a question. Nobody answers the question and the teacher looks directly at you. You give an answer to the question. Your teacher and classmates thought that your answer was …

G-od/p-or

Did you provide a good answer to the class?

Yes/No

Question 5:

You are on the phone to an acquaintance. You are in the middle of describing how your day has been to them when the phone cuts off. You think that they must have lost …

Con-ectio-/ i-teres-

Did your friend hang up on you?

Yes/No

Question 6:

You are asked to give a presentation on a relevant topic in your module during one of your lectures. You carry out the presentation on your own, which lasts for 15 minutes. Once you finish you return to your seat. You feel that the presentation was a …

Gr-at/aw-ul

Did the presentation go well?

Yes/No

Question 7:

You see your friend sitting at a table with another group of people that you've never met before. Your friend calls you over and asks you to introduce yourself to everyone. You introduce yourself to them all. As they look back at you, you think that the others feel that you are …

Assu-ed/ ti-id

Did you make a good impression?

Yes/No

Question 8:

Your friend invites you to a house party, but you know you will likely not know many people there. You go because you promised your friend you would. When you and your friend arrive, they go straight to the toilet. You enter the living room, and as you do someone approaches and starts a conversation. You talk with them for a few minutes before they say they need to get a drink and leave for the kitchen. You think that they wanted to get …

Drin-s/ aw-y

Did the person enjoy the conversation?

Yes/No

Question 9:

You invited a few friends over to your place for dinner. They arrive and you have dinner. Before long they mention something has come up and they leave earlier than expected. You think that they left because they got …

Bor-d/ Cal-ed a-ay

Did your friends enjoy their time?

Yes/No

Question 10:

You catch someone looking over at you whilst you're working out in the gym. You think that the person looking over at you is … you.

J-d-ing/ adm-ri-g

Do you feel like the person felt positively about you?

Yes/No

Question 11:

You are giving a presentation when your voice goes shaky. The audience must think that you are …

Cr-zy/No-mal

Did the audience think that you did a good job?

Yes/No

Question 12:

You are about to give a speech when your hand starts shaking. As you approach the stage people look at you. You deliver the speech and feel your hands shaking throughout. You then leave the stage. During the speech, you think that the audience must have thought that you were …

Cra-y/ nor-al

Did people think that you acted strangely?

Yes/No

Question 13:

You sit next to someone on the train. After a few moments they turn to you and ask you to kindly move to another seat. You move to the other seat. You think the person asked you to move because they were …

S-ving the se-t for a frie-d/ un-omfor-abl-

Do you feel the other person was uncomfortable?

Yes/No

Question 14:

You are about to undertake an important interview. As you enter you feel nervous. During the interview you slightly fumble one of the questions and your face begins to go red. You finish your interview with a handshake and leave. You think that the interviewers thought that you were …

S-lly/ g-eat

Did you leave a good impression?

Yes/No

Question 15:

You are on a first date at a restaurant. You have just arrived and have been talking for a few minutes until the conversation goes silent for a short while. You think that your date thought that you were …

B-ring/ lo-ely

Did your date go well?

Yes/No

Question 16:

You've just started a new job and meet your new co-workers for the first time in the backroom. You introduce yourself and then leave for training. As you leave through the door you hear laughter. You think that they are laughing at …

A Jo-e/ Y-u

Were your new co-workers laughing at a joke?

Yes/No

Question 17:

You take a phone call for a preliminary interview for a vacant job position. During part of your phone call you stutter on a question and your voice begins to shake. You think that the interviewer thought that you were …

Wei-d/ no-mal

Did you make a good impression on the interviewer?

Yes/No

Question 18:

You are sitting in an important meeting in a room full of people. Suddenly the speaker asks an opened ended question and turns to you. Before long everyone else looks at you. You notice that you've started sweating slightly as you answer the question. You think that everyone thought you were …

St-ange/ norm-l

Did the others think that you were abnormal?

Yes/No

Question 19:

You are asked to see if a certain student is in their seminar class. You go to the class and see if you can find them. You knock on the seminar room and enter. The room is full of nearly 30 people, who all turn to look at you. You ask if the person is present, but they are not, so you leave. You think that the people in that room thought that you were being …

An-oyi-g/ h-lpf-l

Did the people in the class find you annoying?

Yes/No

Question 20:

You go online on your gaming console and see that your friend is online. You wait for an invite but after ten minutes you don't receive one. You think that this is because your friend didn't … that you were online.

Rea-ise/ ca-e

Did your friend know that you were online?

Yes/No

Question 21:

You decide to wear an extravagant outfit for a Halloween party you are invited to. The next day you see a picture of you in your costume posted online. You think that people were ... at your costume

La-ghin-/ im-ress-d

Did you have a good costume?

Yes/No

Question 22:

You've gone to a restaurant to meet a few of your friends for dinner. Your friends are running late, and you take a seat in the middle of the busy restaurant. You think that the other people in the restaurant think that you are ...

W-ird/ n-rmal

Did the other diners think that you were strange?

Yes/No

Question 23:

You are in a seminar workshop with your class conducting individual work from a worksheet. You see that there are not many students asking questions during the task. You find that you have put your hand up and ask a lot of questions. You think that the other students thought that you were...

S-upid/tho-oug-

Did you others in your class have a positive opinion of you?

Yes/No

Question 24

You're told that today in work you'll be under assessment for the day as part of annual performance checks. As you go about your day you see the assessor writing things down on the clipboard. You think that the assessor rated you ...

P-or-y/ h-gh-y

Did your assessment go well?

Question 25:

You start a conversation with the person next to you talking about the lecture content. After a sort while you stop talking and carry on with your work. You think that the person next to you thought that you were ...

Ann-yi-g/ co-fide-t

Did the person like you?

Yes/No

Question 26:

You are out on a first date at a restaurant. Your food comes and you notice your date looking to you as you eat and converse. You finish the food and leave the restaurant. You think that your date thought that you were …

M-ssy/ Ma-ner-d

Did your date think that you ate messily?

Yes/No

Question 27:

You are asked to step in and coach a local sports team to cover for the unwell manager for one weekend. You make some changes to the usual line-up and send your players out for the match. There is a crowd of locals who usually turn up to support the team. They think that you decisions were …

Stup-d/cal-ula-ed

Did the spectators like you stepping in?

Yes/No

Question 28:

You are at a large dinner with friends and family when the waitress takes your order. You fumble slightly when talking to her. The people you are with think that you are …

C-azy/no-mal.

Did the people at dinner with you think that your behaviour was abnormal?

Yes/No

Question 29:

You are out at a nightclub when you offer to buy someone a drink. You buy them one and talk to them for a few minutes. The person then apologies quickly and says that they need to run to the toilet for a second. You think that the person thought that you were …

Int-re-ting/dull

Did the person leave to get away from you?

Yes/No

Question 30:

You are in a new seminar class when the teachers asks you to split into groups for work. You form a group with three other people, who all sit around the table. You start to discuss the project where you give your input. You think that your groupmates thought that your input was …

Go-d/b-d

Did your groupmates like what you said?

Yes/No

Question 31:

You're asked to attend a conference on behalf of your company where you'll meet many new people from various backgrounds. As you enter the foyer you introduce yourself to a few people. As you go in for the handshake with one of them, they decline politely. You think that the person has a concern with…

Hygie-e/yo-

Was the person concerned by you as a person?

Yes/No

Question 32:

You decide to go swimming with your friend one afternoon. Once you arrive at the centre you get changed and head out to the swimming pool. As you walk to put your towels down at a seat you notice the pool is quite busy today. You lay the towels down and walk by the edge of the pool, ready to get in. You see some of the people in the pool looking around. You think that when they look at you, they are … towards you.

Ju-gemen-al/in-iffer-nt

Were the people interested in you?

Yes/No

Question 33:

You are out on a walk through town. The streets and roads are busy in rush-hour. As you are walking along the path a car drives past and beeps its horn abruptly. You think that the car was beeping at …

Y-u/ an-ther ca-

Was the car beeping its horn at you?

Yes/No

Question 34:

Your best friend is getting married and you're asked to do a speech for the happy couple. You soon realise that they have invited a lot of guests as you prepare to give the speech. You talk for a few minutes about the newlyweds, watching as all eyes are on you. Once you finish you sit down. You think that your speech was …

G-eat/aw-ul

Did the speech go well?

Yes/No

Question 35:

You are in a lecture when the lecturer asks a question a points to you. People turn to look at you and your face starts to go red. You answer the question and the lecturer continues. You think that everyone inside the lecture theatre thought that you were …

We-rd/in-elli-ent

Were the people in attendance impressed with you?

Yes/No

Question 36:

You and a friend have decided to go to a public lecture with a speaker on a topic you've been interested in for quite some time now. During the talk the speaker points to you and asks you to come up onto the stage. Once you get on stage the speaker asks you a few questions before demonstrating a point. You answer all the questions and sit back down. You think that the audience thought that you were ....

Gre-t/a-ful

Did the audience like you?

Yes/No

Question 37:

You are in a practical class after being told how to carry out the work in a previous lecture. You are unsure how to carry out a certain part of the practical assignment, so you raise your hand and ask some questions. Did the people in your class think that the questions you were asking were ...

Goo-/st-pid

Did the people in your class think that you asked good questions?

Yes/No

Question 38:

You are sitting at the front of a bus when a person turns and begins talking to you. The bus is full, and you know others can hear your conversation as you talk. You reach your bus stop and say goodbye, leaving the bus. You think that the people on the bus thought that you were very …

I-teres-ing/bo-ing

Did the conversation go well?

Yes/No

Question 39:

You are about to go into an interview for a job you've worked hard to secure. As you enter you greet the two interviewers. You feel very nervous as you go on with the interview and you think that the interviewers can see that. You think that they thought you were …

Cr-zy/nor-al

Did the interviewers find you abnormal?

Yes/No

Question 40:

You head up to your university on a day you know you will be presenting to the class. On your way you walk up with your friend. You tell them about how nervous you are feeling about the presentation. Your friend must think that you are acting …

Nor-al-y/w-ird-y

Did your friend find your behaviour strange?

Yes/No

Question 41:

You are asked to step in for an associate lecturer who has fallen ill and teach one of their classes as a big favour. The associate lecturer provides you with the presentation they were going to use themselves. You present the topic to the class. You think that they thought you did a … job.

G-eat/awf-l

Did you give the presentation well?

Yes/No

Question 42:

You have just secured a new job and are meeting your colleagues for the first time. As you enter the office you notice everyone looking towards you. As the day goes on you introduce

yourself to more and more people who work there. You think that your colleagues thought that you were …

Ni-e/d-ll

Did your new colleagues like you?

Yes/No

Question 43:

You are attending a new university in a new city for the first time. It's getting late and you're concerned you might be one of the last people to arrive at your dorm. You finally arrive at the halls, pack your stuff into your room, and enter the communal kitchen, where all your new flatmates are sitting and chatting. You introduce yourself to everyone. You think that your new flatmates really … you.

Li-ed/d-sli-ed

Did your first meeting with your flatmates go well?

Yes/No

Question 44:

You are asked to give a presentation as part of a university assignment. You are aware that the presentation will be graded, and you'll be giving it by yourself. You've worked hard on the presentation and have some very good points to show. During the presentation, you go blank and stand for a moment in silence, concerned that you have forgotten what you were about to say, and everybody is waiting for you. You go on to finish the presentation unsteadily. After the presentation, you think that the audience thought you were just …

In-ane/ne-vou-.

Did the audience think that you were crazy?

Yes/No

Question 45:

You manage to secure a weeks' worth of work experience with a company you aspire to one day work for. On your first day you meet a lot of the employees there. As you are being

shown around and introduced to everyone, they notice that you are shaking slightly. They thought that your behaviour was …

N-rmal/wei-d

Did the employees think your behaviour was strange?

Yes/No

Question 46:

You are in a seminar when you teacher asks students to read a passage each from a textbook. You listen intently to everyone who reads before you. Then you read out your passage, aware everyone else is listening. You think that the others thought that you read ...

W-ll/-oorly

Did the other people in the seminar enjoy your reading?

Yes/No

Question 47:

You are at a business convention sitting at a table full of people. You are discussing different things as a group, before someone makes a business idea suggestion. They then go around the table asking for people's opinion on it. Once it comes to your turn you tell them what you think of the idea. You think that they found your feedback ...

U-eful/u-e-ess

Were they happy with your feedback?

Yes/No

Question 48:

You are invited to a games night at your friend's house. You know your friend has invited a few other people that you've never met before. As you arrive you introduce yourself to everyone. You think that they thought you were a really ... person.

Lov-ly/bor-ng

Did you make a good first impression?

Yes/No

Question 49:

You have been attending the same university for three years now. The university has kindly asked you to host some campus tours, due to your wealth of knowledge about the campus. You host the tour and take the group of people around campus, answering questions and giving information. You think that the group thought that you were …

Gr-at/a-ful

Did the tours go well?

Yes/No

Question 50:

You are asked to do an interview for a local news report. The news team look very professional and capture the interview through their camera. You answer the questions posed to you. After the interview, you think that you looked very … during the interview.

Cl-ver/stu-id

Did the interview go well?

Yes/No

Interpretation bias assessment materials:

Question 1:

The evening class:

You've just started going to an evening class. The instructor asks a question and no one in the group volunteers an answer, so he looks directly at you. You answer the question, aware of how your voice must sound to the …

Ot-ers

Have you been going to the evening class for a long time?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You answer the question and then realise what a good answer it is.

b) You answer the question, aware of how unsteady your voice sounds.

Question 2:

The presentation:

You have been attending a course class for a while now and its time for you to do a presentation as part of the course. Your presentation is 10 minutes long and you start by introducing yourself. You finish the presentation, aware of everyone listening …

Cl-sel-

Were the others paying attention to you?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You give the presentation, aware of how well the audience thought you delivered it.

b) You give the presentation, aware of how shaky the audience thought your voice sounded.

Question 3:

The party:

Your friend invites you to a house party, but you know you will likely not know many people there. You go because you promised your friend you would. When you get there, you meet a group of people in the kitchen. You introduce yourself to everyone, having noticed that everyone had turned around to say …

Hel-o

Did the people in the kitchen notice you come in?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You introduce yourself and then realise how much they liked you.

b) You introduce yourself, aware of how nervous you looked to everyone.

Question 4:

The lecture:

You are in a lecture theatre listening to your teacher give a lecture on your course. You really enjoy the topic but You felt as though you had to ask a lot of questions during the lecture to try and understand the topic more clearly. As you ask the questions, you become aware of how your voice sounds to the …

O-hers

Did you enjoy the lecture?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You ask the questions and then realise how helpful the questions were to the other students.

b) You ask the questions, aware of how annoying you are to the other students.

Question 5:

The interview:

You are about to go into an important interview for a job you've worked very hard to secure. You've worked just as hard on preparing for the interview. As you enter the interview room two people are sitting on the other side of a table waiting for you. They greet you and you carry out the interview, aware of how much you want the …

j-b

Had you prepared for the interview?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You finish the interview, aware of how impressed the interviewers were of you.

b) You finish the interview, aware of how shaky your hands and voice was.

Question 6:

The conference:

You have been asked to attend a conference on behalf of your employer. You're asked to meet and talk with everyone there to discuss business. As you enter the venue you begin introducing yourself to everyone. As you do so, you realise how many people have already …

A-riv-d

Were you the first person to arrive?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You finish introducing yourself to everyone, aware of how much everybody enjoyed meeting you.

b) You finish introducing yourself to everyone, aware of how unconfident you looked.

Question 7:

The seminar class:

You are about to go into your first seminar class of the new term this year. You don't know any of the people in your class as you enter and take a seat. As the teacher is giving the class, they ask a question and point to you, looking for an answer. You give an answer, aware of how loudly the teacher had asked the …

q-est-on

Did you recognise any of the people in your class?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You answer the question, aware of how insightful the other students thought it was.

b) You answer the question, aware of how stupid the answer is.

Question 8:

The pitch:

You are looking for funding for a project of yours that you are very passionate about. You've been given the opportunity to present your ideas to important people with the power to provide the funding you need. You give the pitch, aware of how important this pitch was to …

Yo-rse-f

Were you passionate about your idea?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You give the pitch, aware of how confidently the audience thought you delivered it.

b) You give the pitch, aware of how unsure and nervous you looked.

Question 9:

The costume:

You go to a Halloween party with your friends and decide to dress up for the occasion. You arrive at the party and find out that most people there have made an effort and you enjoy the party. The next day you find out that a picture of you dressed up in the costume was uploaded to social media. Upon seeing the picture, you notice that the picture is so …

Cle-r

Was the picture of a good quality?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You see the picture, realising how great it must have looked for someone to post it online.

b) You see the picture, realising how bad it must have been for someone to post it online.

Question 10:

The new university:

You have recently been accepted onto your first-choice course at the university you wanted. It's your first day and you are moving into halls on campus. As you arrive it's quite late and you realise everyone has already arrived in your dorm. You pack away your things and introduce yourself to everyone that has gathered in the communal kitchen. You introduce yourself, aware of how everyone looks …

E-cit-d.

Were your new flatmates looking forward to the new term?

Yes/No

Please rate each of the following sentences for its similarity in meaning to the original scenario from 1 (very different in meaning) to 4 (very similar in meaning).

a) You introduce yourself and then realise how excited they all are to get to know you.

b) You introduce yourself and then wonder whether you embarrassed yourself.

Debrief: How people react to different social situations.

We would first like to make it clear that you **will not** need to undertake the 5-minute speech previously mentioned during the study. This was part of our "anxiety induction", where we attempted to present a stressor in order to produce a state of heightened anxiety. We did this so that the effects of the interpretation training could be more accurately identified.

This study was an investigation into a novel cognitive bias modification technique, focused on training positive interpretation bias, and its effectiveness in reducing social anxiety. Previous research has highlighted the importance of how we interpret ambiguous social situations in everyday life and has identified a relationship between negative interpretation bias and heightened anxiety. We wanted to see whether the positive interpretation training we used in this study would reduce anxiety when faced with a stressor.

In this experiment we informed participants that they would have to perform a timed speech at the end of the study in order to induce some anxiety so that we could clearly test the effects of the interpretation training. The anxiety questionnaire was used to define high and low socially anxious groups. We had participants complete the interpretation bias training or control condition by reading the ambiguous situations presented and completing the partially fragmented words to either positively or negatively resolve the situation. To test to see whether the training was successful, participants completed the interpretation bias test. This measured participant's interpretation bias, which involved participants rating the similarity of four different sentences to the ambiguous scenario presented. We then used a final anxiety questionnaire to achieve levels of anxiety in participants.

We anticipate that participants who completed the positive interpretation training would show a reduction in negative interpretation bias when assessed compared to those that did not undergo the positive interpretation bias training. If this is the case, this research could take a huge step in the development of a new, more accessible social anxiety treatment.

Should you feel that you need any further information on social anxiety disorder please visit the National Health Service's website at https://www.nhs.uk/oneyou/every-mind-matters/anxiety for an extensive review of anxiety and ways to cope with anxiety. If you feel you would like support whilst at university or simply have a question please email studentsupport@kent.ac.uk. Please contact the supervisor if you have any further questions regarding the study at the following email address: L.Kearney@kent.ac.uk.

Finally, we would like to once again thank you for your participation.

Study Two

School of Psychology
Keynes College
University of Kent
Canterbury, CT2 7NP

Study Information Sheet

Title of Project:	How we deal with and respond to certain cognitive tasks	Ethics Approval Number:	
Investigator(s):	Luke George Bruton	Researcher Email:	Lgb26@kent.ac.uk

Aims of the Study:

This study aims to explore how individuals respond to a variety of cognitive tasks. You will first be asked to complete a series of questionnaires, before being presented with a number of cognitive tasks, which you will then be asked to respond to. You will then finally be asked to discuss a designated topic in a group chat at the end of the study. We aim to collect information on how people respond to these cognitive tasks. Please be aware that, should you consent to participate in this study, you are free to withdraw yourself or your data at any time, either during or after the study has taken place. Doing so would remove any data provided. This study is being conducted part of my MSc-research project.

Eligibility Requirements:

You may enter this study if you are at least 18 years old and can read English.

What you will need to do and time commitment:

This study will take you approximately 30-minutes to complete.

Risks/Discomforts involved in participating:

There are no anticipated risks to your participation.

Confidentiality of your data

Any responses you provide will be treated confidentially. Any publication resulting from this work will report only aggregated findings or fully anonymised examples that will not identify you.

Any responses you provide will be completely anonymous—you will be asked to generate a participant code which will be kept with your responses in case of withdrawal of data. Only the research team will have access to the participant codes. The rest of your responses (anonymous) may be used by the research team, shared with other researchers, or made available in an online data repository.

Details of any payments/RPS credits (*must be approved by ethics committee)*

Remember that participation in this research study is completely voluntary. Even after you agree to participate and begin the study, you are still free to withdraw at any time and for any reason. Please note that once your data have been included in published analysis or data repositories, **it cannot be withdrawn**.

If you would like a copy of this information sheet to keep, please email the researcher. If you have any complaints or concerns about this research, you can direct these, in writing, to the Chair of the Psychology Research Ethics Committee by email at: psychethics@kent.ac.uk. Alternatively, you can contact us by post at: Ethics Committee Chair, School of Psychology, University of Kent, Canterbury, CT2 7NP.

School of Psychology
Keynes College
University of Kent
Canterbury, CT2 7NP

University of Kent

RESEARCH INFORMED CONSENT FORM

Title of Project:	How we deal with and respond to certain cognitive tasks	**Ethics Approval Number:**	
Investigator(s):	Luke George Bruton	**Researcher Email:**	Lgb26@kent.ac.uk

Please read the following statements and, if you agree, initial the corresponding box to confirm agreement:

Initials

I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is <u>voluntary</u> and that I am free to withdraw at any time without giving any reason.

I understand that my data will be treated confidentially and any publication resulting from this work will report only data that does **not** identify me. My anonymised responses, however, may be shared with other researchers or made available in online data repositories.

I freely agree to participate in this study.

Signatures:

_____   _____   _____

Name of participant (block capitals)   Date   Signature

_____   _____   _____

Researcher (block capitals)   Date   Signature

If you would like a copy of this consent form to keep, please ask the researcher. If you have any complaints or concerns about this research, you can direct these, in writing, to the Chair of the Psychology Research Ethics Committee by email at: psychethics@kent.ac.uk.

Alternatively, you can contact us by post at: Ethics Committee Chair, School of Psychology, University of Kent, Canterbury, CT2 7NP.

BFNE

As presented in study one.

STAI-S

As presented in study one.

Cognitive bias modification – interpretation training

As presented in study one.

Interpretation bias assessment

As presented in study one.

Cognitive bias modification – attention training materials

Left word	Right word
Nervous	Feather
Nervous	Candle
Branch	Humiliated
Collector	Anxious
Candle	Anxious
Anxious	Hardware
Embarrassed	Hardware
Stupid	Camera
Anxious	Feather
Camera	Judged
Judged	Journey
Branch	Judged
Camera	Nervous
Hardware	Humiliated
Boring	Candle
Camera	Boring
Collector	Embarrassed
Mistake	Feather
Stupid	Candle
Humiliated	Collector
Branch	Judged
Boring	Branch
Boring	Collector
Journey	Stupid
Journey	Embarrassed
Nervous	Feather
Camera	Boring
Anxious	Journey
Branch	Stupid
Feather	Boring
Nervous	Hardware
Embarrassed	Camera
Embarrassed	Feather
Mistake	Delivery
Stupid	Hardware
Delivery	Humiliated
Mistake	Candle
Nervous	Delivery
Candle	Nervous
Collector	Stupid
Collector	Judged
Delivery	Mistake

Humiliated	Journey
Delivery	Mistake
Branch	Mistake
Feather	Anxious
Humiliated	Hardware
Mistake	Journey
Delivery	Judged
Delivery	Embarrassed

Attention bias assessment materials

Left word	Right word
Newspaper	Speech
Shy	Parameter
Nervous	Ladder
Nervous	Clothes
Speech	Library
Nervous	Clothes
Nervous	Kitchen
Nervous	Clothes
Percentage	Speech
Wrong	Ladder
Embarrassed	Percentage
Kitchen	Speech
Anxious	Keyboard
Awkward	Newspaper
Library	Humiliated
Ladder	Embarrassed
Wrong	Percentage
Clothes	Shy
Embarrassed	Newspaper
Humiliated	Keyboard
Kitchen	Awkward
Ladder	Embarrassed
Anxious	Ladder
Kitchen	Anxious
Ladder	Speech
Library	Shy
Humiliated	Keyboard
Awkward	Library
Newspaper	Anxious
Embarrassed	Library
Percentage	Speech
Percentage	Awkward
Wrong	Clothes
Shy	Keyboard
Kitchen	Embarrassed
Newspaper	Wrong
Newspaper	Wrong
Parameter	Shy
Speech	Kitchen
Shy	Ladder
Parameter	Humiliated
Humiliated	Parameter
Keyboard	Awkward
Library	Anxious

Nervous	Newspaper
Percentage	Awkward
Keyboard	Wrong
Clothes	Humiliated
Parameter	Anxious
Awkward	Parameter

Control condition:

Please spend the next 5 minutes reading through the following text and be prepared to answer some questions after:

Sally was on home standby when she received a phone call from Scheduling, telling her that she would be needed to work on the EK418 from Dubai to Sydney.

She had two hours to get to the airport to report for her flight. Sally arrived at the airport at 07.15am with just 18 minutes to spare. She checked-in and made her way to Briefing Room 15 where she would meet the rest of her crew.

Henry was the purser on this 14-hour flight. He told Sally that she would be working in Economy, along with Charlotte, Mohammed, Craig and Kirsty. When Sally got to the plane she checked her equipment at Door 3L and reported her checks to Jackson.

She would be looking after 134 passengers on this flight and there were 19 special meals to get ready. Sally looked over the meal choices – A chicken casserole or vegetarian lasagne.

During the flight, Sally had to wait until the second break before she could go to the crew rest compartment and get some much-needed rest. Sally handed over to Charlotte who had been on the first break. She told her about a passenger in Seat 45K who wanted to buy some Duty-Free. The passenger wanted to buy a specific type of perfume but if this wasn't available, she would make do with a pink lip gloss that was on offer.

When Sally returned from her break, she had 30 minutes to help Mohammed get the second service ready in the third galley along. Unfortunately, Sally and her colleagues had to abandon the second meal service after heavy turbulence was experienced. The turbulence went on for 50 minutes but Sally did her best to calm her passengers.

Once they had landed in Sydney, the aircraft made its way Stand 34 – the taxi to the gate was quite short, only taking about 5 minutes. Sally was super eager to get to the hotel and they arrived at their city centre hotel about 1.5 hours after arrival. Sally could think of nothing better than to go straight to bed but first she had to Skype her family back home in Ireland.

Please answer the following questions in the time provided (3-5 minutes?)

Question 1

How long did Sally have to get to the airport when she was called by Scheduling?

1 hour --- 1 and a half hours --- 2 hours --- 2 and a half hours

Question 2

What Briefing Room did Sally have to go to after she checked in?

Briefing room 10 --- Briefing room 1 --- Briefing room 5 --- Briefing room 15

Question 3

How long was the flight going to take from Dubai to Syndey?

4 hours --- 10 hours --- 14 hours --- 24 hours

Question 4

When Sally went on her break, which crew member did she hand over to?

Charlette --- Kirsty --- Craig --- Jim

Question 5

What door on the aircraft was Sally responsible for checking the equipment at?

Door 3L --- Door 3C --- Door 7L --- Door 7C

Question 6

In which country did Sally's family live?

England --- Brazil --- Ireland --- Australia

Question 7

What did the passenger in seat 45K want to buy if the perfume she wanted was out of stock?

A pink lip gloss --- A red lip gloss --- A pink lipstick --- and red lipstick

Question 8

Which crew member did Sally help to get the second service set up?

Henry --- Craig --- Mohammad --- Jessica

Question 9

Which galley did Sally help to set the second meal service in?

The first --- The last --- The third --- The second

Question 10

At what stand did the aircraft at Sydney Airport?

Stand 3 --- Stand 334 --- Stand 34 --- Stand 44

Question 11

What was the vegetarian meal choice on board the flight to Sydney?

Pasta --- Lasagne --- Risotto --- salad

Question 12

How long did the turbulence last for?

5 minutes – 40 minutes --- 1 hour --- 50 minutes

Debrief: How we deal with and respond to certain cognitive tasks

We would first like to make it clear that you **will not** need to join a group chat as previously mentioned during the study. This was part of our "anxiety induction", where we attempted to present a stressor in order to produce a state of heightened anxiety. We did this so that the effects of the interpretation training could be more accurately identified.

This study was an investigation into two novel cognitive bias modification techniques, focused on training positive interpretation and attention biases, and their effectiveness in reducing social anxiety. Previous research has highlighted the importance of how we interpret and attend to ambiguous social situations in everyday life and has identified a relationship between both negative interpretation bias and negative attention bias and heightened anxiety. We wanted to see whether the positive training we used in this study would reduce anxiety when faced with a stressor.

In this experiment, participants were allocated into one of 3 separate groups; a cognitive bias modification task to train positive interpretation bias, a cognitive bias modification task to positively train attention bias, and a control group designed to provide no training of bias. This was done to compare the results of those that completed the training in positive interpretation bias and those that did not. We measured participant's interpretation and attention bias depending on their allocated group, which acted as our dependant variable. This was achieved using the interpretation bias assessment or the attention bias assessment, which participants completed at the end of the study. There were also two simple manipulations in this study. The first was the use of an anxiety induction, in which we informed participants that they would have to take part in an online group chat at the end of the study. The second was random allocation of participants into one of the 3 formerly mentioned groups.

We anticipate that participants who completed the positive interpretation training would show a reduction in negative interpretation bias and participants who completed the positive attention bias training would show a reduction in negative attention bias when assessed compared to those that did not undergo the positive bias training. In addition, both bias modification groups would show a reduction in levels of anxiety reported post training compared to their respective control. We also hypothesised that those in the positive interpretation training condition would show greater reductions in reported anxiety than participants who underwent the positive attention bias training. If this is the case, this research could take a huge step in the development of a new, more accessible social anxiety treatment.

Should you feel that you need any further information on social anxiety disorder please visit the National Health Service's website at https://www.nhs.uk/oneyou/every-mind-matters/anxiety for an extensive review of anxiety and ways to cope with anxiety. If you feel you would like support whilst at university or simply have a question please email

studentsupport@kent.ac.uk. Please contact the supervisor if you have any further questions regarding the study at the following email address: L.Kearney@kent.ac.uk.

Finally, we would like to once again thank you for your participation.

Ethics Application Study One

Title of the project:

How we deal with and respond to social situations.

Brief summary of the application (150-200 words). Please provide information on the study background (2-3 sentences), detail the study aims and hypothesis.

This study will investigate the effectiveness of training cognitive biases to reduce social anxiety. Specifically, we are conducting a study into a cognitive bias modification technique focused on training positive interpretation bias (CBM-I) and its efficacy in reducing social anxiety. Whilst effective treatments for social anxiety do already exist, research shows accessibility to such treatments is alarmingly low. This research will develop a more accessible treatment for social anxiety.

The aims of this study are to:

1. Establish a novel CBM-I training method.
2. Demonstrate a reduction in anxiety reported by participants in the CBM-I training condition, compared to the control, when faced with a stressor.
3. Demonstrate a reduction in cognitive biases reported by participants in the CBM-I training condition.

We hypothesise that positive CBM-I training will achieve a significant reduction in anxiety compared to participants who did not undertake such training.

Full description of the study methodology and procedures (suggested 350-500 words). Provide full description of the study method and procedures. Please be sure to include details of all the study conditions, full descriptions of stimulus materials and all response measures.

Participants will be aged 18 or over, from the University of Kent. This study will be a two group between subject's design, whereby the independent variable is the CBM-I training technique, and the dependant variable is the test of interpretation bias.

Anxiety will be measured using two different tests:

The first is the Brief Fear of Negative Evaluation (BFNE) test, which measures the more stable aspects of social anxiety. Responses will be provided on a Likert-type rating scale ranging from 1 (Not at all characteristic of myself) or 5 (extremely characteristic of me).

The state anxiety index (STAI-S) measures the current state of anxiety in an individual, focusing more primarily on aspects such as "how they feel in the current moment". Responses will be on a forced Likert scale ranging from 1 (almost never) to 4 (almost always).

The CBM-I technique focused on training interpretation bias is based on the ambiguous situation paradigm. This involves filling in partially fragmented words that resolve the ambiguity of social situations that often lead to elevated anxiety, especially with those more prone to social anxiety. The words will positively resolve the ambiguous scenario to train positive interpretation bias, and an interpretation test will follow each word.

The control condition will be based on the same ambiguous situation paradigm, but crucially, will not evoke any kind of interpretation bias training.

The effectiveness of the CBM-I training technique will be assessed using the recognition task. This includes a new set of socially ambiguous scenarios, however, the word fragment participants have to fill in does not disambiguate the scenario. Instead, participants are then required to read through four sentences that represent a positive interpretation, a negative interpretation, a positive foil sentence and a negative foil sentence. Participants will be asked to rate each sentence for its similarity to the original scenario they are linked with. This will achieve a measure of their interpretation bias post CBM-I training.

This study will last for approximately 30 minutes. Participants will sign up to the study via the research participation scheme and complete an informed consent sheet upon arrival. Then participants will complete both the BNFE, for a measure of social anxiety, and the STAI-S, for a measure of their current state of anxiety. Subsequently, participants will be informed that they would have to give a five-minute speech at the end of the study, which represented the anxiety induction. Then participants would have to listen to a short five-minute passage of the novel "The Hobbit". Following this, another STAI-S measure would be completed. Then participants will be randomly allocated into either a CBM-I training condition or a control condition. Those in the CBM-I training condition would then complete a set of ambiguous situation paradigms, whereby the word fragments they resolve would positively train their interpretation bias. Those in the control condition would do the same, only, the scenarios would be different, and the word fragments would elicit no kind of interpretation training. Both sets of participants would then complete a final STAI-S measure before carrying out the interpretation bias assessment. Once the study was completed, participants will be shown an anxiety calming video, before being debriefed on the real intentions of the study. They will be informed that they do not have to carry out the speech, their data is anonymous, they can withdraw from the study at any time, and they can ask any further questions as desired. Data will be submitted online through Qualtrics, within a secure server.

Information about the study given to participants (100 words recommended):

This study aims to explore how individuals respond to a wide variety of social situations. You will first be asked to complete a series of questionnaires, before being presented with various social situations, which you will then be asked to respond to. Please be aware that should you consent to participate in this study, you are free to withdraw at any time, even once you have finished the study and left. Doing so would remove any data provided and not affect the allocation of RPS credits. This study is being conducted as part of my MSc-research project.

Participants can take part if they are:

Over the age of 18 and can read English.

Participants cannot take part if they are:

Under the age of 18 and cannot read English.

Target sample size:

200 participants

Describe the means of obtaining prior informed consent:

Participants wishing to take part in this study will complete an informed consent sheet, after reading the information sheet, as they arrive to the study. They will not be allowed to participate without consenting to do so.

Please write a debrief in the box below:

We would first like to make it clear that you **will not** need to undertake the 5-minute speech previously mentioned during the study. This was part of our "anxiety induction", where we attempted to present a stressor in order to produce a state of heightened anxiety. We did this so that the effects of the interpretation training could be more accurately identified.

This study was an investigation into a novel cognitive bias modification technique, focused on training positive interpretation bias, and its effectiveness in reducing social anxiety. Previous research has highlighted the importance of how we interpret ambiguous social situations in everyday life and has identified a relationship between negative interpretation bias and heightened anxiety. We wanted to see whether the positive interpretation training we used in this study would reduce anxiety when faced with a stressor.

In this experiment we measured participant's interpretation bias, which acted as our dependant variable. This was achieved using the interpretation bias assessment, which participants completed at the end of the study, and involved rating the similarity of four different sentences to the ambiguous scenario presented. There were also two simple manipulations in this study. The first was the use of an anxiety induction, in which we informed participants that they would have to perform a 5-minute speech at the end of the study. The second was randomly splitting the groups into a control condition and a positive interpretation training condition. This was done to compare the results of those that completed the training in positive interpretation bias and those that did not.

We anticipate that participants who completed the positive interpretation training would show a reduction in negative interpretation bias when assessed compared to those that did not undergo the positive interpretation bias training. If this is the case, this research could take a huge step in the development of a new, more accessible social anxiety treatment.

Should you feel that you need any further information on social anxiety disorder please visit the National Health Service's website at https://www.nhs.uk/oneyou/every-mind-matters/anxiety for an extensive review of anxiety and ways to cope with anxiety. If you feel you would like support whilst at university or simply have a question please email studentsupport@kent.ac.uk. Please contact the supervisor if you have any further questions regarding the study at the following email address: L.Kearney@kent.ac.uk.

Finally, we would like to once again thank you for your participation

Ethics Application Study Two

Title of the project:

How we deal with and respond to social situations 2.

Brief summary of the application (150-200 words). Please provide information on the study background (2-3 sentences), detail the study aims and hypothesis.

This study will investigate the effectiveness of training cognitive biases to reduce social anxiety. Specifically, we are conducting a comparison of two cognitive bias modification techniques focused on training positive interpretation bias (CBM-I), training positive attention bias (CBM-A), and both treatment's effectiveness in reducing social anxiety. Whilst effective treatments for social anxiety do already exist, research shows accessibility to such treatments is alarmingly low. This research will develop a more accessible treatment for social anxiety.

The aims of this study are to:
1. Demonstrate a reduction in anxiety and interpretation based cognitive biases reported by participants in the CBM-I training condition, compared to the control, when faced with a stressor.
2. Demonstrate a reduction in anxiety and attentional cognitive biases reported by participants in the CBM-A training condition, compared to the control, when faced with a stressor.
3. Compare the efficacy of CBM-I and CBM-A in reducing reported social anxiety and negative cognitive biases

We hypothesise that:
1. Positive CBM-I and CBM-A training will achieve a significant reduction in anxiety and their respective cognitive biases compared to participants who did not undertake such training.
2. Positive CBM-I training will achieve greater reductions in anxiety than CBM-A.

Full description of the study methodology and procedures (suggested 350-500 words). Provide full description of the study method and procedures. Please be sure to include details of all the study conditions, full descriptions of stimulus materials and all response measures.

Participants will be aged 18 or over, and sourced from online sign ups. This study will be a 3 (intervention: CBM-I vs. CBM-A vs. control) x 2 (social anxiety group: high vs. low) group between subject's design, whereby the independent variables are training types (CBM-I, CBM-A and the control) and social anxiety level (high or low) assessed by the BFNE. The dependant variables are the tests of bias (attention and interpretation bias), and state measures of anxiety.

Anxiety will be measured using two different tests:
The first is the Brief Fear of Negative Evaluation (BFNE) test, which measures the more stable aspects of social anxiety. Responses will be provided on a Likert-type rating scale ranging from 1 (Not at all characteristic of myself) to 5 (extremely characteristic of me). This measurement will be taken in order to categorise participants into high and low anxiety groups.

The second is the state anxiety index (STAI-S), which measures the current state of anxiety in an individual, focusing more primarily on aspects such as "how they feel in the current moment". Responses will be on a Likert scale ranging from 1 (almost never) to 4 (almost always). This test will be used to measure participant's anxiety at specific points during the study.

The CBM-I technique that will focus on positively training interpretation bias is based on the ambiguous situation paradigm. This involves filling in partially fragmented words that resolve the ambiguity of social situations that often leads to elevated anxiety, especially with those more prone to social anxiety. The words will positively resolve the ambiguous scenario to train positive interpretation bias, and an interpretation test will follow each word.
The CBM-A technique that will focus on positively training attention bias is based on the dot probe paradigm, which is similar to the version reported in Boettcher et al. (2013), with the crucial difference being instead of using both faces and words we used eight social threat words (e.g., embarrassed, humiliated) and eight neutral words (e.g., cupboard, dishwasher) only as stimuli. We will be using exclusively words as research suggests words may in fact be more effective in reducing anxiety than facial stimuli (Hakamata et al., 2010). In this exercise a social threat and a neutral cued word will appear on either the left or right side of the screen respectively. After 600ms the cue words will disappear, and the participants will need to detect a probe that will appear immediately in one of the two locations (left or right side of the screen). The probe will remain present on the screen until the participant registers a response, which will be recorded from the onset of the probe appearing to them pressing the key in response. Participants will be instructed to respond as quickly as possible without sacrificing accuracy. In all trials the probe will appear in the same location as the neutral cue word. The concept here is that the cue replacing the neutral word will positively train the participant to direct attention away from the social threat word and towards more neutral words.

The control condition will involve participants reading a passage of text about a fictional character called Sally, and subsequently answering questions about details contained within the short story of Sally's day. Crucially, here, the exercise will not evoke any kind of bias training.

The effectiveness of the CBM-I training technique will be assessed using the interpretation bias test. This includes a new set of socially ambiguous scenarios, however, the word fragment participants have to fill in does not disambiguate the scenario. Instead, participants are then required to read through two sentences that represent a positive interpretation and a negative interpretation. Participants will be asked to rate each sentence for its similarity to the original scenario they are linked with. This will achieve a measure of their interpretation bias

post CBM-I training.

The effectiveness of the CBM-A training technique will be assessed using the attention bias test. This test will operate similarly to the attention training exercise, however, some of the words used in the assessment will be different. We will be using a modified version of the dot probe paradigm, which is similar to the version reported in Boettcher et al. (2013), with the crucial difference being instead of using both faces and words we used eight social threat words (e.g., embarrassed, humiliated) and eight neutral words (e.g., cupboard, dishwasher) only as stimuli. In this exercise a social threat and neutral word cue will appear on either the left or right side of the screen. After 600ms the cue word will disappear, and the participants will need to detect a probe that will appear immediately in one of the two locations (left or right). The probe will remain present on the screen until the participant registers a response, which will be recorded from the onset of the probe appearing to them pressing the key in response. On 50% of the trials the probe will appear in the same location as the social threat word cue, and in the remaining 50% of trials the cue will appear in the same location as the neutral word cue. The concept here is that socially anxious participants demonstrate significantly longer response times when the cue appears in the location of the neutral word than when appearing in the same position as the social threat word compared to non-anxious controls, due to the difficulty in disengaging from threatening stimuli. The hypothesis here is that the positive attention bias training completed by participants in the CBM-A group will reduce the time it takes those participants to disengage with the social threat word and respond to validly and invalidly social threat cued words.

This study will last for approximately 30 minutes. Participants will sign up to the study via advertisements on relevant social media. While the study will be advertised on social media, all data will be collected via the Qualtrics system, and no data will be gathered via Facebook, Twitter etc. Participants will firstly read the information sheet, before then completing an informed consent sheet, after which they will complete both the BNFE, for a measure of social anxiety, and the STAI-S, for a measure of their current state of anxiety. Subsequently, participants will be informed that they will have to join a group chat with several current members in order to discuss a designated topic, which represents the anxiety induction. Then participants would have to read a short five-minute passage from the novel "The Invisible Man", as a brief distraction task. Following this, another STAI-S measure will be completed. Then participants will be randomly allocated into either a CBM-I training condition, CBM-A training condition or the control condition. Once completed, each group will then carry out a distractor task, before those in the interpretation condition and the attention condition will both carry out the interpretation bias or attention bias test respectively. Note that those in the control condition will not have to carry out the interpretation or attention test. Finally, all participants will then be directed back to a final STAI-S measure, before being informed that the group chat is full, and that they will therefore not have to partake in the group chat, and will be asked instead to complete a final BFNE measure. Once the study is completed, participants will be directed to the debrief to disclose the real intentions of the study. They will be informed that they do not have to join a group chat, their data is anonymous, they can withdraw from the study at any time, and they can ask any further questions as desired. Data will be submitted online through Qualtrics, within a secure server.

Information about the study given to participants (100 words recommended):

This study aims to explore how individuals respond to a variety of cognitive tasks. You will first be asked to complete a series of questionnaires, before being presented with a number of cognitive tasks, which you will then be asked to respond to. You will then finally be asked to discuss a designated topic in a group chat at the end of the study. We aim to collect information on how people respond to these cognitive tasks. Please be aware that, should you consent to participate in this study, you are free to withdraw yourself or your data at any time, either during or after the study has taken place. Doing so would remove any data provided. This study is being conducted part of my MSc-research project.

Participants can take part if they are:

Over the age of 18 and can read English.

Participants cannot take part if they are:

Under the age of 18 and cannot read English.

Target sample size:

80 participants

Describe the means of obtaining prior informed consent:

Participants wishing to take part in this study will complete an online informed consent sheet, after reading the information sheet provided. They will not be allowed to participate without consenting to do so.

Please write a debrief in the box below:

We would first like to make it clear that you **will not** need to join a group chat as previously mentioned during the study. This was part of our "anxiety induction", where we attempted to present a stressor in order to produce a state of heightened anxiety. We did this so that the effects of the interpretation training could be more accurately identified.

This study was an investigation into two novel cognitive bias modification techniques, focused on training positive interpretation and attention biases, and their effectiveness in reducing social anxiety. Previous research has highlighted the importance of how we interpret and attend to ambiguous social situations in everyday life and has identified a relationship between both negative interpretation bias and negative attention bias and heightened anxiety. We wanted to see whether the positive training we used in this study would reduce anxiety when faced with a stressor.

In this experiment, participants were allocated into one of 3 separate groups; a cognitive bias modification task to train positive interpretation bias, a cognitive bias modification task to positively train attention bias, and a control group designed to provide no training of bias. This was done to compare the results of those that completed the training in positive interpretation bias and those that did not. We measured participant's interpretation and attention bias depending on their allocated group, which acted as our dependant variable. This was achieved using the interpretation bias assessment or the attention bias assessment, which participants completed at the end of the study. There were also two simple manipulations in this study. The first was the use of an anxiety induction, in which we informed participants that they would have to take part in an online group chat at the end of the study. The second was random allocation of participants into one of the 3 formerly mentioned groups.

We anticipate that participants who completed the positive interpretation training would show a reduction in negative interpretation bias and participants who completed the positive attention bias training would show a reduction in negative attention bias when assessed compared to those that did not undergo the positive bias training. In addition, both bias modification groups would show a reduction in levels of anxiety reported post training compared to their respective control. We also hypothesised that those in the positive interpretation training condition would show greater reductions in reported anxiety than participants who underwent the positive attention bias training. If this is the case, this research could take a huge step in the development of a new, more accessible social anxiety treatment.

Should you feel that you need any further information on social anxiety disorder please visit the National Health Service's website at https://www.nhs.uk/oneyou/every-mind-matters/anxiety for an extensive review of anxiety and ways to cope with anxiety. If you feel you would like support whilst at university or simply have a question please email studentsupport@kent.ac.uk. Please contact the supervisor if you have any further questions regarding the study at the following email address: L.Kearney@kent.ac.uk.

Finally, we would like to once again thank you for your participation.