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The role of excessive reassurance seeking: An eye tracking study of the indirect effect of social anxiety symptoms on attention bias

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ABSTRACT

High social anxiety is associated with increased attentional bias, and difficulties disengaging from relevant threat information, though social anxiety may also be associated with avoidance of threat. Few mechanisms of this relationship have been empirically evaluated, whereas theories and treatment manuals implicate avoidance and/or safety behaviors as significant agents of negative reinforcement for anxiety symptoms and search for threat. The current study sought to investigate one safety behavior, excessive reassurance seeking, as a mediator of the relationship between social anxiety and attention bias to disgust facial stimuli. Support was found for our hypotheses, such that social anxiety symptoms had an indirect effect on attention bias to disgust faces through increased reassurance seeking. These results suggest that reassurance seeking may result in disengagement of attention to threat stimuli. Specifically, social anxiety may result in a decreased threshold for negative social cues and therefore seek out reassurance feedback and avoid threatening stimuli. Future studies should test these directly and utilize a prospective design. The current study suggests that reassurance seeking may be involved in the attention bias process, providing additional data for current cognitive theories of social anxiety and additional support for reinforcement patterns of anxiety symptoms.

1. Introduction

Attentional biases are key to symptom maintenance and impairment across a variety of anxiety disorders as a result of loaded working memory and decreased top-down control (Eysenck and Derakshan, 2011; Eysenck et al., 2007; Hirsch and Mathews, 2012). Cognitive models suggest that a variety of biases are characteristic of social anxiety, particularly attention bias (Rapee and Heimberg, 1997; Hirsch and Clark, 2004; Hofmann, 2007). In fact, studies indicate that individuals high in social anxiety demonstrate early and automatic bias to threatening social information such as faces (Gilboa-Schechtman et al., 1999; Pishyar et al., 2004), often regardless of the facial expression (Cooney et al., 2006). However, in support of models of social anxiety which indicate threat is avoided, studies have also demonstrated that social anxiety may be associated with attentional avoidance (Chen et al., 2002; Mansell et al., 1999; Judah et al., 2013) and/or no bias. Additionally, social anxiety symptoms are linked to slowed first fixation to happy compared to angry facial expressions and fewer fixations to angry faces compared to happy and neutral (Staugaard and Rosenberg, 2011). These early effects are followed by shorter fixation duration to angry and disgust faces compared to happy faces. Together, these data suggest that the social anxiety-attention relationship is not entirely clear. To better understand these discrepancies, mechanisms related to the generation of attentional processes or which influence attention should be investigated, as some symptoms may facilitate bias or avoidance of threat. Furthermore, some of these processes may result in increased attention to particular types of facial expressions. The goal of the current study is to determine if one symptom associated with social anxiety, excessive reassurance seeking (ERS), may aid in explaining the relationship between social anxiety symptoms and biased attention to facial stimuli.

Though the research regarding positive and neutral facial expressions is somewhat mixed, the data more clearly link social anxiety symptoms to attention bias for threatening faces (Schofield et al., 2012; Amir et al., 2003; Buckner et al., 2010a,b). For example, using eye tracking data Schofield et al. (2012) found that social anxiety was associated with both attention to emotional (angry, fearful, happy, and neutral) faces and difficulties disengaging from angry faces. Alternatively, some have found that attentional biases in social anxiety are limited to negative as opposed to positive stimuli (Pishyar et al., 2004), and that those with social anxiety more easily detect angry faces among neutral distracters (Gilboa-Schechtman et al., 1999). A study using eye tracking methodology found social anxiety is associated with difficulties disengaging from threat, such as disgust, and not with eye

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movements toward happy facial expressions (Buckner et al., 2010b). In line with these findings, others have not found attentional biases for happy facial expressions among those with social anxiety (Bradley et al., 2000).

However, some studies indicate that certain conditions may affect attention bias for those with social anxiety symptoms. For instance, there is evidence that socially anxious individuals demonstrate an attention bias away from emotional faces under conditions of evaluation (Mansell et al., 1999), though others have demonstrated loading working memory results in difficulties disengaging from disgust faces (Judah et al., 2013). Another study similarly found that a general threat manipulation, as compared to threat of social exclusion was associated with attention bias to negative faces among those with social anxiety (Buckner et al., 2010a), and some data indicates that attentional bias may vary as a function of social anxiety level and stimulus threat value (Bradley et al., 2000). These and other data, suggest that some other variable(s) may affect the relationship between social anxiety and attention bias for threatening information. However, these previous studies have focused on moderators of attention bias, as opposed to investigating underlying processes which may facilitate attentional biases for those with social anxiety symptoms. We were interested in examining a variable that may result in attentional biases towards threatening stimuli for individuals with social anxiety symptoms.

One such variable may be safety behaviors, those aimed at escape from immediate or future threat, or those behaviors performed to reduce anxiety symptoms or other distress. Individuals with high versus low social anxiety symptoms more frequently use a greater variety of safety behaviors, in a greater variety of contexts (McManus et al., 2008), and this overreliance continuously reinforces anxiety symptoms (Salkovskis et al., 1996), though they are perceived by individuals with social phobia to be helpful (Clark and Wells, 1995). In addition, performing safety behaviors may result in decreased attention control (Rapee and Heimberg, 1997; Sloan and Telch, 2002) likely resulting in increased stimulus driven attention to and difficulties disengaging from threat (Hirsch and Mathews, 2012). These behaviors may include speaking more, speaking less, or rehearsal of speech (McManus et al., 2008) as a function of self-focused attention. Some data suggests that individuals with social anxiety symptoms, compared to those with limited symptoms may engage in increased directed gaze on (Wieser et al., 2009), though generally these behaviors are avoidant in nature.

In particular, excessive reassurance seeking (ERS; i.e., requests of information aimed at confirming known information; Salkovskis, 1985) may be of importance in the relationship between social anxiety and attentional biases. ERS is associated with social anxiety along with other anxiety disorders (Cougle et al., 2012; Grant et al., 2014) and it is reinforced both by immediate reductions in anxiety and by subsequent increases in anxiety associated with urges to reduce distress (Lohr et al., 2007; Abramowitz et al., 2002). Specifically, social anxiety is linked to self-focused attention and may result in checking behaviors (e.g., ERS) as a means to obtain relief from anxiety symptoms. For example, a study investigating relationship dyads found ERS was negatively correlated with partner positive affect and partner's positive perceptions of an interaction (Heerey and Kring, 2007), and social anxiety was linked to increased reassurance seeking. Of note, ERS may be limited to interpersonal relationships (Davila and Beck, 2002), rather than ubiquitously used in social interactions, as models suggest that individuals with social anxiety may be more avoidant of seeking feedback in some social situations (Clark and Wells, 1995). Despite the link between social anxiety and reassurance seeking as a potential maintaining factor, no study has investigated the indirect effects of social anxiety on attentional biases through reassurance seeking.

Attention bias has not been widely studied as a consequence of excessive reassurance seeking and, in fact, to our knowledge only two studies have evaluated the attention bias and reassurance seeking relationship, and both have been within the context of health anxiety (Hadjistavropoulos et al., 1998; Owens et al., 2004). Again, this limited attention may be the consequence of social anxiety largely being associated with avoidance, though data suggests that social anxiety also is associated with relationship difficulties and dependency (Davila and Beck, 2002; Darcy et al., 2005). These studies found health anxiety is associated with attention bias to concerning health information, which leads to increased medical attention and symptom checking as a means of seeking reassurance (Hadjistavropoulis et al., 1998; Owens et al., 2004). Though data and theory suggest a high prevalence of ERS (among other safety behaviors) within anxiety disorders, it has not been largely studied, nor has it been investigated as a potential mechanism of attentional biases.

Given that mechanisms of attention bias in social anxiety have garnered little research and the proposed maintaining role of ERS, we investigated the relationships between social anxiety symptoms, ERS, and attention to emotional faces during a free viewing task. A valuable technology for assessing attentional biases, eye tracking, was utilized. Eye tracking within the free viewing paradigm is advantageous in that it allows for unprompted directed attention to stimuli ensuring greater external validity and fewer confounds than reaction time tasks (Armstrong and Olatunji, 2012). We hypothesized that social anxiety symptoms would be associated with increased ERS, which in turn would be associated with increased attention to threat-related facial expressions, specifically disgust and angry faces. We also predicted that social anxiety symptoms would directly be associated with increased attention bias to threatening facial expressions. We made no a priori hypotheses regarding non-threatening facial expressions (i.e. happy, sad, and neutral). Additional metrics that are typically measured in attentional bias (i.e. time to first fixation and mean fixation duration) paradigms also were evaluated in exploratory analyses. No a priori hypotheses were made regarding the indirect effects on these dependent variables. Investigating ERS as a potential contributor to attention bias will lend additional support to current theories of social anxiety and may provide further rationale for ERS and other safety behaviors as a point of intervention in anxiety disorders.

2. Methods

2.1. Participants

Participants included 79 undergraduates who were primarily female (57.5%) and Caucasian (66.3%). Ethnicity of our sample otherwise was 10% Asian/Asian American, 9.5% Multiple Ethnicity, 3.8% Native American/American Indian, and 3.5% African American. 7.5% of individuals chose to not respond to this question. Age ranged between 18 and 41 (M = 19.79, SD = 3.32).

2.2. Materials

2.2.1. Questionnaires

Demographics: Participants were administered a brief demographics questionnaire regarding background information, including age, sex, and ethnicity.

Social interaction anxiety scale and social phobia scale – short forms (SIAS-6; SPS-6; Peters et al., 2012): The SIAS-6 and SPS-6 are each 6-item measures of fears of evaluation related to social interactions and performance situations most commonly associated with Social Anxiety Disorder, and are derived from the original 20-item SIAS (Mattick and Clark, 1998). Higher scores indicate increased likelihood for social anxiety. Scores over 7 on the SIAS-6 indicate probable clinical diagnosis and scores over 2 on the SPS-6 indicate elevated levels of social anxiety. Internal consistency for the SIAS-6 in the current study was good (α = 0.83), as was the case for the SPS-6 (α = 0.87).

Depressive interpersonal relationships inventory – reassurance seeking subscale (DIRI-RS; Joiner et al., 1992; Joiner et al., 1992): The DIRI is a 24-item questionnaire aimed at assessing maladaptive interpersonal

styles that are commonly associated with depression, in particular reassurance seeking. The reassurance seeking subscale assesses response styles aimed at evaluating how individuals *really* feel about a person. For example, items include "Do you find yourself often asking the people you feel close to how they *truly* feel about you?" and "Do the people you feel close to sometimes get 'fed up' with you for seeking reassurance from them about whether they *really* care about you?" There are four items (items 20–23) which assess ERS; these were used in the current study, and they demonstrated excellent internal consistency (α = 0.92).

Patient health questionnaire – 9-Item (PHQ-9; Kroenke et al., 2001): The PHQ-9 is a 9-item measure aimed at assessing depressive symptoms and their severity. Scores are summed and increased scores indicate higher depressive symptoms. Because depressive symptoms are associated with increased attentional biases to negative information, as well as ERS, this item was included as a covariate in each analysis. This was added as a post-hoc analysis recommended by reviewers and results are presented in footnotes. Internal consistency of the PHQ-9 in the current study was excellent (α = 0.91).

2.2.2. Eye tracking

Eye tracking task: Participants completed a free viewing eye tracking task consisting of 10 trials, each which displayed 5 emotional faces (i.e., angry, disgusted, happy, neutral, and sad) depicted by the same male or female actor per trial (see Fig. 1 for an example trial). Each trial lasted 30-seconds each for a total of approximately 5 min. This is consistent with prior work which utilizes eye tracking to evaluate attention to emotional facial expressions (Beevers et al., 2011; Kraines et al., 2017, 2018). In total, 60 images were selected from the Karolinska Directed Emotional Faces (KDEF) database (Lundqvist et al., 1998). Each emotional face was counterbalanced in its placement per trial (e.g., the disgusted face appeared in the center only twice, once in a male trial and once in a female trial). Participants were instructed to freely view the trials, as if they were viewing a photo album. In between trials, participants fixated on a white cross in the middle of a black screen. The experimenter advanced to the next trial only when the participant fixated on the white cross. Each participant sat 60–70 cm from the viewing screen. Each of the 5 faces per trial measured 9.19 cm (approximately 8.1° visual angle) × 7.11 cm (approximately 6.2° visual angle). The five faces per trial were evenly distributed on the display screen.

We examined the internal consistency of total fixation duration for each of the stimulus types in our eye tracking task. Happy faces had excellent internal consistency (α = 0.91) and disgust faces had acceptable consistency (α = 0.75). Sad and angry faces had questionable consistency (αs = 0.66 and 0.61, respectively). Neutral faces had unacceptable internal consistency (α = 0.49).

Eye tracking system: This study employed a Tobii T60 eye tracker and Tobii Studio software. The screen measures 17″ diagonally and is 1280 × 1024 pixels. This monitor detects the position of the pupils and corneal reflection of both eyes simultaneously (binocular tracking). Gaze location was sampled every 16.7 ms (60 Hz). A small rectangle cropped to each emotional face in a trial was identified via Tobii Studio software as an area of interest (AOI). As a result, a small portion of the AOI contained non-facial stimuli, which consisted of a plain background.

Eye tracking outcome: Based upon previous literature, this study utilized total fixation duration as an index of maintenance of attention over an entire trial (Armstrong and Olatunji, 2012). Total fixation duration measures the amount of sustained attention to a particular AOI across the entire task. A fixation is defined as the individual glances that occur within a particular AOI. Total fixation duration is calculated by summing the amount of time an individual fixates within an AOI across the entire task, and is a commonly used eye tracking metric for overall attentional allocation over time (Kellough et al., 2008).

In addition, we have included analyses which utilize the time to first fixation for each stimulus and the mean fixation duration, other commonly used metrics in eye tracking studies (Kellough et al., 2008). Time to first fixation indicates the amount of time that passes prior to the first fixation for each stimulus time, and the mean fixation duration (glance duration) is averaged from total fixation duration for each stimulus type over the total number of fixations for that stimulus type. Longer glance durations are indicative of difficulties disengaging or shifting attention from particular stimuli (Kellough et al., 2008). Again, we have made no a priori hypotheses regarding these metrics. However, previous research has assessed time to first fixation as an indicator of vigilance (faster time to first fixation) or avoidance (slower time to first fixation) to a stimulus (Staugaard and Rosenberg, 2011).

Fig. 1. An example trial used in the eye tracking tasks. Top Left = happy, Top Right = sad, Center = angry, Bottom Left = disgust, Bottom Right = neutral.

Table 1
Means, and standard deviations for each facial expression type and their correlations to study measures.

		SIAS-6	SPS-6	DIRI-RS	M	SD
Total fixation duration	Disgust	0.01	−0.03	−0.22*	13.65	13.65
	Sad	−0.01	0.002	−0.13	45.31	12.46
	Angry	0.02	−0.08	−0.11	41.98	11.41
	Neutral	0.09	0.08	0.28*	59.40	15.70
	Happy	−0.13	−0.07	−0.01	75.22	34.72
Time to first fixation	Disgust	−0.07	−0.04	0.11	2.04	3.68
	Sad	0.01	−0.09	−0.10	1.89	2.48
	Angry	−0.08	0.08	−0.17	1.97	1.96
	Neutral	−0.04	−0.04	−0.02	1.91	3.61
	Happy	−0.07	−0.03	0.16	1.65	1.79
Mean fixation	Disgust	0.01	−0.03	0.13	0.46	0.11
	Sad	−0.07	−0.13	0.04	0.45	0.10
	Angry	0.04	−0.04	0.19	0.47	0.11
	Neutral	0.01	0.000	0.24*	0.49	0.11
	Happy	−0.03	0.002	0.24*	0.52	0.17

Note: Significant correlations are denoted as * ($p < 0.05$).

2.3. Procedure

As part of a broader study, undergraduates from a large Southwestern university were recruited using an online participant recruitment website to complete the in-lab study. They were provided informed consent via the IRB approved consent form and then were asked to complete the questionnaires. Participants next completed the free viewing eye tracking task. After these procedures, along with other tasks relevant to a larger study which is still in data collection, participants were debriefed and given course credit for their participation.

2.4. Data analytic plan

Our data were evaluated to assure they do not violate assumptions of regression based analyses, including homoscedasticity, multivariate normality, and maintaining low multicollinearity. Descriptive statistics and correlations between SIAS-6, SPS-6, DIRI-RS, and each outcome variable (total fixation duration, time to first fixation, mean fixation) for each face type (disgust, sad, happy, angry, and neutral) were evaluated and are presented in Table 1. The indirect effect of social anxiety symptoms on each eye tracking outcome variable for each facial expression through excessive reassurance seeking were evaluated using PROCESS macro for SPSS, which utilizes bias-corrected bootstrapping techniques and linear regression (Hayes, 2017). In addition, PHQ-9 was entered as a covariate in each analysis as recommended by reviewers to control for the potential confounding effects of depressive symptomology. Similarities and any notable differences in results when controlling for depressive symptoms are presented in footnotes or in text. Confidence intervals are produced for mediation through several iterations of sampling and replacing cases from the data; these data were resampled 5000 times. Confidence intervals that do not contain zero are considered significant.

3. Results

3.1. Hypothesized indirect effects

3.1.1. Total fixation duration – disgust facial expressions

The indirect effect of SIAS-6 on fixation duration to disgust facial expressions via DIRI-RS was significant (*95% CI* [−0.3273, −0.0117]), and the direct effect of SIAS-6 on fixation duration to disgust facial expressions was not significant (*95% CI* [−0.5122, 1.1009]). Social anxiety symptom increases were significantly associated with increased DIRI-RS (*95% CI* [0.5135, 1.0332]), and increased DIRI-RS was associated with decreased attention to disgust faces (*95% CI* [−1.2218, −0.0542]). The results for this model are presented in Table 2 and

Table 2
Overall indirect effects on total fixation duration for the hypothesized and exploratory models.

Model *IV*	*DV*	*Coefficient estimate*	*SE*	95% Confidence interval *Lower*	*Upper*
SIAS-6	Disgust	−0.16	0.08	−0.3273	−0.0117
	Angry	−0.08	0.08	−0.2490	0.0751
	Sad	−0.09	0.08	−0.2488	0.0561
	Neutral	0.18	0.06	0.0600	0.3165
	Happy	0.05	0.07	−0.0606	0.2014
SPS−6	Disgust	−0.13	0.07	−0.2774	0.0102
	Angry	−0.03	0.08	−0.1709	0.1362
	Sad	−0.08	0.07	−0.2309	0.0515
	Neutral	0.15	0.06	0.0447	0.2802
	Happy	0.01	0.06	−0.0908	0.1325

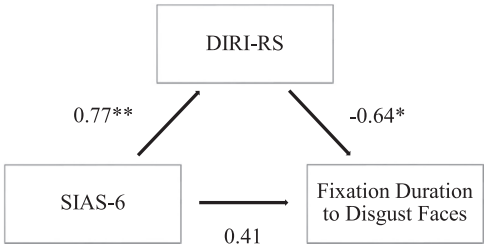

Fig. 2. Hypothesized model diagram and path summary for the indirect effect of SIAS-6 on attention to disgust facial expressions.
Note: Path coefficients denoted with ** indicate significance at $p < 0.001$ and those denoted with * indicate significance at $p < 0.05$. Coefficients are in unstandardized form.

Fig. 2 displays a visual representation of the model.

The indirect effect of SPS-6 on fixation to disgust faces through DIRI-RS also was evaluated and this effect was not significant (*95% CI* [−0.2774, 0.0102]). The direct effect of SPS-6 on fixation to disgust was not significant (*95% CI* [−0.6090, 0.7983]). Increased social phobia symptoms were associated with increased DIRI-RS (*95% CI* [0.3940, 0.8693]), but increased DIRI-RS was not significantly associated with decreased attention to disgust faces (*95% CI* [−1.1274, 0.0232]).[1] Results are presented in Table 2 and Fig. 3 displays a visual representation of the model.

3.1.2. Total fixation duration – angry facial expressions

The indirect effect of SIAS-6 on fixation to angry facial expressions via DIRI-RS (results in Table 2), was not significant (*95% CI* [−0.2490, 0.0751]). The direct effect of SIAS-6 on fixation duration to disgust faces also was not significant (*95% CI* [−0.6708, 0.7051]). The indirect effects of SPS-6 on attention to angry facial expressions through DIRI-RS were evaluated (results in Table 2), and were not significant (*95% CI* [−0.1709, 0.1362]), nor was the direct effect of SPS-6 on angry facial expressions (*95% CI* [−0.8869, 0.2981]). Each of these results held when including PHQ-9 as a covariate.

3.2. Exploratory indirect effects on total fixation duration

3.2.1. Sad facial expressions

The indirect effect of SIAS-6 on total fixation to sad facial expressions via DIRI-RS was not significant, (*95% CI* [−0.2488, 0.0561]), and the direct effect was not significant, (*95% CI* [−0.7027, 0.7765]). This also was the case for SPS-6, such that there was no indirect effect on

[1] When covarying PHQ-9, the indirect effect of SIAS-6 was significant, though DIRI-RS was not associated with decreased attention to disgust facial expressions (path b coefficient estimate = -0.60; *95% CI* [-1.2744, 0.0714]). Results for the indirect effect of SPS-6 were the same.

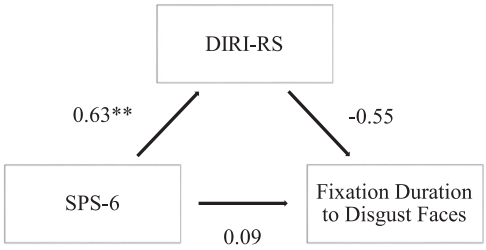

Fig. 3. Hypothesized model diagram and path summary for the indirect effect of SPS-6 on attention to disgust facial expressions
Note: Path coefficients denoted with ** indicate significance at $p < 0.001$. Coefficients are in unstandardized form.

attention to sad facial expressions through DIRI-RS, (*95% CI* [−0.2309, 0.0515]), and the direct effect was not significant, (*95% CI* [−0.6517, 0.6283]).[2] Results of each of these analyses are presented in Table 2.

3.2.2. Neutral facial expressions

The indirect effect of SIAS-6 on attention to neutral facial expressions through DIRI-RS was evaluated, and the indirect effect was significant, (*95% CI* [0.0600, 0.3165]), but the direct effect was not, (*95% CI* [−1.6788, 0.1545]). This also was the case for SPS-6. The indirect effect was significant, (*95% CI* [0.0447, 0.2802]), and the direct effect was not, (*95% CI* [−1.3480, 0.2435]). When including PHQ-9 as a covariate, the indirect effects were no longer significant. Results of these analyses are displayed in Table 2 and the path coefficients for these significant models are displayed in Table 5.

3.2.3. Happy facial expressions

The indirect effect of SIAS-6 on attention to happy facial expressions via DIRI-RS was lastly evaluated. The indirect effect was not significant, (*95% CI* [−0.0606, 0.2014]), nor was the direct effect, (*95% CI* [−3.2141, 0.8529]). This also was the case for SPS-6, as the indirect effect was not significant, (*95% CI* [−0.0908, 0.1325]), nor was the direct effect, (*95% CI* [−1.9902, 1.555]), and these results held when including PHQ-9 as a covariate. Again, results are in Table 2.

3.3. Exploratory indirect effects on time to first fixation

The indirect effect of SIAS-6 and SPS-6 on time to first fixation for each face type through DIRI-RS also was evaluated. Results showed that there were no indirect or direct effects for each face type (see Table 3), aside from happy faces. There was an indirect effect of SIAS-6 on time to first fixation on happy facial expressions through DIRI-RS, (*95% CI* [0.0295, 0.3263]). The direct effect was not significant, (*95% CI* [−0.1887, 0.0538]). Results for SPS-6 were similar, such that there was a significant indirect effect of SPS-6 on time to first fixation for happy facial expressions, (*95% CI* [0.0196, 0.2827]), and no direct effect, (*95% CI* [−0.1470, 0.0248]). These results were similar when including PHQ-9 as a covariate. The estimated path coefficients for the significant models are displayed in Table 5.

3.4. Exploratory indirect effects on mean fixation duration

Finally, the indirect of SIAS-6 and SPS-6 on mean fixation duration via DIRI-RS was evaluated for each stimulus type (see Table 4). Results revealed that there was no direct effect or indirect effect of either SIAS-6 or SPS-6 on mean fixation to disgust, angry, or sad facial expressions.[3]

Table 3
Overall indirect effects on time to first fixation.

Model *IV*	*DV*	*Coefficient estimate*	*SE*	95% Confidence interval *Lower*	*Upper*
SIAS-6	Disgust	0.13	0.08	−0.0246	0.2807
	Angry	−0.09	0.08	−0.2403	0.0815
	Sad	−0.09	0.08	−0.2272	0.0993
	Neutral	0.002	0.09	−0.0858	0.2304
	Happy	0.16	0.08	0.0295	0.3263
SPS−6	Disgust	0.10	0.08	−0.0443	0.2573
	Angry	−0.09	0.08	−0.2218	0.0839
	Sad	−0.11	0.09	−0.2845	0.0735
	Neutral	−0.01	0.08	−0.0972	0.2092
	Happy	0.13	0.07	0.0238	0.2816

Table 4
Overall indirect effects on mean fixation duration.

Model *IV*	*DV*	*Coefficient estimate*	*SE*	95% Confidence interval *Lower*	*Upper*
SIAS-6	Disgust	0.10	0.10	−0.0840	0.3027
	Angry	0.13	0.10	−0.0390	0.3381
	Sad	0.06	0.07	−0.0813	0.2124
	Neutral	0.19	0.07	0.0578	0.3448
	Happy	0.21	0.09	0.0562	0.4095
SPS-6	Disgust	0.10	0.09	−0.0627	0.3141
	Angry	0.14	0.09	−0.0237	0.3428
	Sad	0.05	0.08	−0.0816	0.2225
	Neutral	0.15	0.07	0.0379	0.3108
	Happy	0.16	0.08	0.0141	0.3419

Indirect effects are presented in Table 4.

There was no direct effect of SIAS-6 on mean fixation for neutral facial expressions, (*95% CI* [−0.0112, 0.0014]), but there was a significant indirect effect, (*95% CI* [0.5978, 0.3448]). There were similar results for SPS-6, such that there was no direct effect, (*95% CI* [−0.0090, 0.0019]), but there was a significant indirect effect on neutral facial expressions, (*95% CI* [0.0379, 0.3108]). For happy facial expressions, there was a direct effect, (*95% CI* [−0.0188, −0.0002]) and an indirect effect of SIAS-6 on mean fixation duration, (*95% CI* [0.0562, 0.4095]). For SPS-6, there was no direct effect, (*95% CI* [−0.0143, 0.0045]) but there was a significant indirect effect on mean fixation to happy facial expressions, (*95% CI* [0.0141, 0.3419]). Path *a* and path *b* coefficient estimates are displayed in Table 5 for each of these significant effects.

4. Discussion

Safety behaviors, such as excessive reassurance seeking, may influence attentional biases, such that engaging in reassurance seeking may be a form of avoidance and reinforcement for fear of threat. As previously suggested, our results should be cautiously interpreted, as theory and some data indicate social anxiety is associated with avoidance of feedback (Meleshko and Alden, 1993), though some data have found social anxiety is associated with increased reassurance seeking (Heerey and Kring, 2007; Davila and Beck, 2002). Heerey and Kring explain that these discrepancies may be a function of whether socially anxious participants are expected to direct conversation in a laboratory compared to interactions in naturalistic settings. The results from the current study are in partial support of our hypotheses. Our results show

[2] When including PHQ-9 as a covariate, there was a significant indirect effect of each SIAS-6 (path b coefficient estimate = -0.59; *95% CI* [-0.2564, -0.0066]) and SPS-6 on total fixation duration to sad facial expressions (path b coefficient estimate = -0.56; *95% CI* [-0.2032, -0.0018]).

[3] When including PHQ-9 as a covariate results were largely similar. There was no direct or indirect effect of SIAS-6 or SPS-6 on mean fixation to disgust or sad faces, though there was an indirect effect of each on angry facial expressions. For SIAS-6, the path b coefficient estimate was 0.11 (*95% CI* [0.0123, 0.2524]) and for SPS-6 it was 0.08 (*95% CI* [0.0116, 0.2318]). Results for neutral and happy facial expressions were similar when PHQ-9 was included as a covariate.

Table 5
Path b coefficients for un-hypothesized significant models.

Model		*b Coefficient estimate*	*SE*	95% Confidence interval	
IV	*DV*			*Lower*	*Upper*
SIAS-6	Neutral – TF	0.81	0.33	0.1448	1.4717
	Happy – TFF	0.08	0.04	0.0032	0.1476
	Neutral – MF	0.01	0.002	0.0012	0.0104
	Happy – MF	0.01	0.003	0.0029	0.0164
SPS-6	Neutral – TF	0.72	0.33	0.0714	1.3726
	Happy – TFF	0.07	0.04	0.0000	0.1404
	Neutral – MF	0.01	0.002	0.0007	0.0096
	Happy – MF	0.01	0.02	0.0013	0.0147

Note. TF – Total Fixation, TFF – Time to First Fixation, MF – Mean Fixation. For each SIAS-6 path a coefficient = 0.77, *95% CI* [0.5135, 1.0332] and each SPS-6 path a coefficient = 0.63, *95% CI* [0.3940, 0.8693].

that there was an indirect effect of social interaction anxiety symptoms and social phobia symptoms on attention bias to sad and disgust facial expressions through ERS, though our confidence intervals were close to zero. These effects were significant even when controlling for depression symptoms, though some results differed. Moreover, social interaction anxiety symptoms and social phobia symptoms were both associated with increased ERS, though ERS was not significantly associated with attention to either sad or disgust facial expressions. When depression symptoms were included as a covariate, there was an indirect effect on fixation to sad facial expressions.

Though many of our indirect effects coefficients indicated that there was a negative relationship on total fixation to sad and disgust, it is not clear that this effect is the result of ERS, per se, as this path was not significant. ERS could be linked to some pattern of avoidance. Our results are somewhat in agreement with theories that point to avoidance of threat as a consequence of anxiety (Hofmann, 2007), but are not necessarily in line with those which propose that social anxiety is characterized by attention bias to threat (Rapee and Heimberg, 1997; Hirsch and Clark, 2004; Vassilopoulos, 2005) as our direct effects were not significant. Most importantly, these results point to an increased need to investigate mechanistic variables of attention bias to or away from threat.

In addition, our results suggest that ERS may be linked to slow orienting to happy facial expressions. Increased social anxiety symptoms had an indirect effect on time to first fixation for happy facial expressions, via ERS, and these results were not replicated with any other facial expressions. Our results suggest that social anxiety may indirectly lead to slowed orienting of attention to mood incongruent information, though it is indirectly linked to shorter sustained durations of attention to negative facial expressions and average longer fixations on less threatening facial expressions. Others have found somewhat similar results. For instance, Staugaard and Rosenberg (2011) found slowed orienting to happy faces paired with faster orienting to both disgust and angry faces, indicating vigilance. Our data did not demonstrate this pattern, however. Weiser and colleagues also found that social anxiety was associated with more frequent orienting to happy facial expressions followed by longer fixations on happy female expressions, as well (Wieser et al., 2009), and similarly we found social anxiety symptoms were associated with difficulties disengaging from happy facial expressions. In addition, our data indicated that social anxiety symptoms were indirectly associated with difficulties disengaging from angry and neutral faces.

Importantly, our study shows that symptoms of social interaction anxiety and social phobia symptoms are significantly related to increased excessive reassurance seeking as predicted, which is consistent with prior research (Heerey and Kring, 2007; Joiner et al., 1999; Cougle et al., 2012). Aside from these studies however, ERS is inferred as a relevant target behavior in treatments (Helbig-Lang and Petermann, 2010); limited data have tested its role as a mechanism in symptom development and maintenance. Individuals may show an increased preponderance to seek out alleviating information, which at an acute level may have temporary anxiolytic effects, but also could continuously reinforce anxiety symptoms (Wells et al., 1995). Whereas our study cannot provide specific evidence for this phenomenon, we found that individuals high in social anxiety symptoms seek reassurance from others, and their symptoms have an indirect effect on attentional processes. Our data indicate this indirectly results in a decreased threshold for threat, and slowed early attention to safety/mood incongruent faces, but longer mean durations on those faces. Again our ERS-attention bias paths were not significant, but were in the negative direction for threat. This suggests that ERS may reinforce avoidance of attention to threat cues or indicators of negative feedback.

We also did not find evidence for indirect effects related to angry facial expressions, which suggests there may be other factors which influence in response styles to different types of negative facial expressions. However, when depression symptoms were included as a covariate there was a significant indirect effect on angry facial expressions. Other data have found that individuals with social anxiety compared to healthy controls demonstrate an attention bias to angry faces (Gilboa-Schechtman et al., 1999; Mogg et al., 2004). Alternatively, another study suggests that disgust facial expressions are rated as more negative compared to angry among those with social anxiety (Amir et al., 2010). This may account for the current discrepancy in findings if angry faces were perceived as less threatening in the current study.

Frequent engagement in safety behaviors is prevalent and impairing in social anxiety (McManus et al., 2008) and it consumes cognitive resources, which may reduce top-down attentional control (Rapee and Heimberg, 1997; Sloan and Telch, 2002). As a result, individuals who engage in these behaviors may demonstrate attentional difficulties related to threat perception or with negative thinking styles (Plasencia et al., 2011). In fact, a study found that among a high socially anxious sample loaded working memory was associated with attention bias to disgust facial expressions, whereas no load was associated with avoidance (Judah et al., 2013). These results indicate that cognitive factors which decrease attentional resources may result in biases. For those who already experience reduced cognitive capacity due to the load of anxiety (Eysenck et al., 2007; 2011) this could exacerbate attentional difficulties. Our data suggest that social anxiety concerns lead to increased engagement in reassurance seeking. Other safety behaviors associated with social anxiety may load working memory or affect attentional control. In fact, a recent study demonstrated that high versus low attentional control was associated with increased avoidance of threat stimuli and the most severe PTSD symptoms over the course of six months (Bardeen and Daniel, 2017).

In contrast, our data were cross-sectional, and previous data have indicated that attentional biases predict behavior, such that attention bias to safety predicts safety behaviors (Xu et al., 2014). For example, studies found that directed attention to threat and decreased safety seeking behaviors result in decreased social anxiety symptoms (Wells and Papageorgiou, 1998; Kim, 2005). One also might conclude the inverse may be true, such that ERS or other safety behaviors may lead to increased social anxiety symptom severity. Therefore, the effect of attentional biases on safety seeking behaviors should also be evaluated, as well as the effects of those behaviors on social anxiety symptoms. In line with this assumption, our data are not entirely suitable to truly test mediation, as it was a cross-sectional design and a temporal relationship between our variables could not fully be established. The direction of the relationship in fact may be reversed, such that attentional biases may lead to ERS and subsequently lead to increased social anxiety symptoms; future studies should investigate this research question prospectively.

Limitations to this study include the use of a non-clinical, college sample that was primarily of Caucasian ethnicity, so these findings may not generalize. The confidence intervals in our results also were close to including zero. Thus, increased statistical power and evaluation of

alternate mechanisms may improve the confidence in these effects and their specificity. For example, examination of other relevant avoidance or safety seeking behaviors is of necessity. Negative thinking styles typically associated with anxiety, including co-rumination, worry, and anticipatory processing may impact attentional biases or the likelihood to engage in avoidance. Future studies may consider evaluating negative thinking styles in the relationship between social anxiety and attention bias. Also, this study did not utilize a clinical sample, though we might expect such a sample would strengthen our effects. Furthermore, anxiety literature on the whole has established that there are attentional biases to threat (for a review see: Cisler and Koster, 2010), so evaluating these effects in a population of individuals with anxiety or generalized anxiety may be beneficial. Though our task design did not permit evaluation of variations in attention over the course of a trial (e.g. evaluating in 500 ms increments; Schofield et al., 2012), future studies may investigate these effects and lend a more nuanced perspective to this research question. Finally, there is much variability across attention bias paradigms (e.g. stimulus duration) and eye tracking parameters, and it should be noted that these differences may contribute to poor reliability (McNally, 2018). Studies should nonetheless continue to cautiously evaluate early, late, and sustained attention to threat information. Our results should be evaluated with these limitations in mind. In line with this concern, the data regarding sad and angry facial expressions should be considered in light of the lower reliability metrics for our attention bias task.

The current study is one of the first to evaluate the indirect effects of social anxiety on sustained attention to threat related information via one safety behavior, ERS. Furthermore, this study is strengthened by its use of state-of-the-art methodology to examine attention bias. While anecdotal evidence and treatments point to reassurance seeking as pertinent in social and other anxiety disorders, very few studies have investigated these behaviors. As our data suggest, social interaction anxiety and social phobia symptoms are associated with reassurance seeking behaviors, though they were not directly linked to attentional biases. ERS may be used as a means to alleviate socially related concerns and their effects on cognition and attention should continue to be evaluated. Attentional biases or avoidance in social anxiety may be the result increased search for threat and/or the result of low tolerance for threat related information. Further attention should be paid to differences in attentional control, as those with increased capacity paired with social anxiety symptoms may be at greater risk to engage in unhelpful behaviors or disengage from threat. Those with social anxiety may have a lower threshold for threat and engage in ERS as a coping mechanism. Our findings further emphasize the importance of targeting said behaviors in treatment, because they could facilitate reinforcement of anxiety symptoms.

Human rights

All procedures performed in this study were in accordance with the ethical standards of the institution and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all participants included in this study.

Declarations of interest

None.

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