



Always Saying the Wrong Thing: Negative Beliefs About Losing Control Cause Symptoms of Social Anxiety

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Abstract

Background Individuals with social anxiety disorder (SAD) often report a fear that they will lose control of their emotions or report intense, unpleasant thoughts or images of uncontrollably humiliating themselves in social situations. These fears and associated beliefs that one is likely to lose control may underlie the anxiety and/or cognitive biases (e.g., self-focused attention and negative post-event processing) experienced during and following social situations. The present experiment examined whether manipulating beliefs about losing control would cause changes in symptoms of SAD.

Methods One hundred and twenty-six undergraduate psychology students were given false feedback that they were either at high or low risk of losing control, and then completed a social interaction task with an actor. Participants rated their anxiety before and during the interaction and completed a post-event processing questionnaire 24-hours later.

Results Participants in the high beliefs about losing control (HLC) condition reported significantly greater subjective anxiety than those in the low beliefs about losing control (LLC) condition leading up to the social interaction task, and significantly more negative post-event processing.

Conclusion Results suggest beliefs about losing control may play a causal role in the development and maintenance of SAD. These beliefs may represent a novel domain to be targeted in CBT.

Keywords Social Anxiety · SAD · Experiment · Losing control · Beliefs · Cognition

Introduction

Social anxiety disorder (SAD) is characterized by significant fear and anxiety across social situations or in contexts where being scrutinized is possible (American Psychiatric Association, 2013). Cognitive theories propose excessively negative appraisals of one's performance in social situations are a key factor underlying the etiology and maintenance of SAD (Clark & Wells, 1995; Rapee & Heimberg, 1997). Identifying and examining cognitive phenomena which appear exaggerated among individuals with SAD is critical to the ongoing development and refinement of clinical interventions (Ouimet et al., 2021; Zvolensky et al., 2001). One common concern among individuals with SAD which has not been studied extensively is the belief that they may

lose control over their behaviour, emotions or physiological reactions, and that this failure will lead to judgment and humiliation. This study aims to replicate and extend previous work examining the causative role of these negative beliefs about losing control in the development and maintenance of symptoms of social anxiety in an analogue sample.

Maladaptive beliefs are core to cognitive models of SAD (Clark & Wells, 1995; Rapee & Heimberg, 1997). These cognitive distortions are thought to cluster into different domains such as negative self-perception, high social cost, low perceived emotional control and perceived poor social skills (Hofmann, 2007). During feared social interactions, individuals with SAD selectively attend to internal cues of anxiety and performance (i.e., heightened self-focused attention) which increase and maintain their anxiety over time (Mor & Winquist, 2002; Mulkens et al., 1999; Spurr & Stopa, 2002; Wild et al., 2008). This selective attention for internal cues of negative performance can lead to failures to attend to their conversation partner in social interactions or other deficits in social performance (Alden & Wallace, 1995; Moscovitch & Hofmann, 2007; Rowa et

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al., 2015; Stopa & Clark, 1993). Despite observed social skills deficits, individuals with SAD regularly overestimate the severity of their social incompetence and underestimate their performance (Ashbaugh et al., 2005; Johns & Peters, 2012; Thompson & Rapee, 2002; Voncken & Bögels, 2008). Once they leave a social situation, they selectively attend to, engage with and recall events and behaviours which reinforce these beliefs and maintain their anxiety (Brozovich & Heimberg, 2008; Rachman et al., 2000). This negative rumination, termed post-event processing, is considered a hallmark symptom of SAD and has been shown to maintain negative beliefs about oneself, negative memory biases and predict anticipatory anxiety in subsequent social interactions (Brozovich & Heimberg, 2008; Rachman et al., 2000). Understanding how maladaptive beliefs about losing control impact symptoms of SAD such as anticipatory anxiety, self-focused attention and negative post-event processing is critical in establishing their role in causing and maintaining SAD.

Individuals who endorse negative beliefs about control express excessive concerns about the likelihood, meaning, consequences and severity of failure to control their behaviour, emotions and/or physiological responses (Clark & Purdon, 1993; Moulding & Kyrios, 2006; Radomsky & Gagné, 2020). This overestimation of the likelihood and catastrophic consequences of losing control have been identified across cognitive theories of many disorders, including panic (Clark, 1986; Cloitre et al., 1992), obsessive-compulsive disorder (Clark, 2004; Radomsky & Gagné, 2019; Reuven-Magril et al., 2008; Sanavio, 1988), and eating disorders (Fairburn et al., 1986, 2003). In SAD, concerns about losing control over one's emotions have been proposed as a core maintaining factor for anticipatory anxiety leading up to social situations (Hofmann, 2007). However, individuals with social anxiety describe concerns about controlling a host of behaviours and physiological reactions beyond simply their emotions. For example, Hackmann et al., (1998) found that people with SAD report intense intrusive imagery of themselves failing to control their behaviour or reactions, such as dropping a tray of food or trembling uncontrollably in feared social situations.

Few studies have looked at the specific role of beliefs about losing control in SAD (De Castella et al., 2014; Gagné et al., 2020; Hofmann, 2005; Kelly-Turner & Radomsky, 2020; Spokas et al., 2009). Compared to healthy controls, individuals with social anxiety have reported less personal control over social situations and ascribe more control to other people in those situations (Cloitre et al., 1992). These low beliefs about personal control in social situations have been linked to more severe symptoms of social anxiety and worse outcomes following treatment for SAD (Leung & Heimberg, 1996; Rapee, 1997). Clearly, beliefs related

to control are important to the experience of fear and anxiety among individuals with SAD. However, the perceived controllability of feared situations, while likely related to beliefs about *losing* control, does not capture the fear that one might not be able to control their own behaviours, emotions or physiology nor does it address perceived consequences of this perceived poor control.

The fear of losing control over emotions in SAD has received more research attention than other domains of control (i.e., behaviour, physiological responses). For example, Spokas et al., (2009) found that relative to individuals low in social anxiety, individuals high in social anxiety held more negative beliefs about the consequences of losing control over their emotions, place greater importance on maintaining control and attempt to do so through suppression of their emotions. In turn, poor perceived control over negative emotions predicted higher perceived stress and trait anxiety and lower self-esteem among individuals with SAD after accounting for symptom severity (De Castella et al., 2014) and has been shown to underlie the perceived danger of social situations (Hofmann, 2005). Together, these studies highlight importance of negative beliefs about losing control over emotions in SAD. However, individuals with SAD have reported fears of uncontrollable behaviours and/or physiological reactions in frightening social situations (Hackmann et al., 1998).

To our knowledge, only two experiments have examined the role of beliefs about *losing* control on social anxiety (Gagné et al., 2020; Kelly-Turner & Radomsky, 2020). Gagné et al., (2020) manipulated beliefs about losing control by providing bogus information about the risks and consequences of losing control over behaviour after consuming alcohol then had participants consume either alcohol, placebo or orange juice (control) before taking part in a social interaction task with an actor. Participants in the alcohol and placebo conditions reported significantly more anticipatory anxiety before the interaction and significantly more post-event processing 24-hours later than in controls. This suggests that beliefs about losing control over behaviours when control is inhibited (or believed to be inhibited) produce symptoms of social anxiety. However, this study focused on alcohol expectancies; while this provides important insight into the impact of negative beliefs about control, individuals with SAD also report feeling out of control of their behaviours and/or physiological reactions in the absence of alcohol.

Kelly-Turner & Radomsky (2020) attempted to assess the effect of negative beliefs about losing control on symptoms of social anxiety more broadly. Using false feedback, they manipulated beliefs about losing control over behaviour and physiological responses prior to a social interaction task. Undergraduate participants completed a bogus cognitive

task and received feedback that they were at either high or low risk of losing control. They then took part in a 3-minute, unstructured social interaction task with an actor trained to feign disinterest. Participants who believed they were at risk of losing control were more anxious before, but not during, the social interaction. They also reported less perceived control over their emotions, behaviours and physiological reactions during the task. These results provided preliminary support for the notion that negative beliefs about control are relevant in anticipatory anxiety and self-focused attention. However, this experiment did not consider how beliefs about losing control would impact post-event processing following a social interaction. Further, the disinterested behaviour of the actor, which was intended to generate anxiety, involved explicitly shifting their affect a few seconds into the interaction from interested to disinterested, regardless of the content of the conversation. This behaviour as described by Kelly-Turner & Radomsky (2020) is an atypical (or unexpected) response for the situation and the authors noted it may have been perceived as rude or artificial, leading to an uncomfortable social interaction unrelated to the manipulation of beliefs about losing control. This may have introduced more confusion and irritation among participants rather than anxiety. A more naturalistic social interaction task would be better suited to assess the impact of beliefs about losing control on anxiety.

The present study is a replication and extension of Kelly-Turner & Radomsky (2020) with more naturalistic behaviour and to assess post-event processing. An analogue sample completed a bogus cognitive task and then received false feedback that they were either at high or low risk of losing control. Experimental manipulation of beliefs related to psychopathology in analogue samples can provide valuable insight into how these phenomena may function among clinical populations (e.g., Abramowitz et al., 2014; Gagné et al., 2018). This research was conducted in the context of the COVID-19 pandemic; therefore, all data collection and interactions were conducted online. Though we did not have any hypotheses related to the format, it did allow us to test the effects of beliefs about losing control in a new (online) social context.

Hypotheses

Manipulation Check. Participants led to believe they were at high risk of losing control (HLC condition) would report a greater belief that they would lose control over their actions than would participants led to believe they were at low risk of losing control (LLC condition).

1. (a) Participants in the HLC condition would report greater anticipatory anxiety leading up to the social interaction task than those in the LLC condition.
 - (b) Participants in the HLC condition would report greater anxiety during the social interaction task than those in the LLC condition.
2. (a) Participants in the HLC condition would report worse performance after the social interaction task relative to those in the LLC condition.
 - (b) Participants would rate their performance as significantly worse than actor ratings of performance.
3. Participants in the HLC condition would report greater concerns about losing control over their behaviour, emotions and physiology (e.g., visible blush response) in the social interaction task than those in the LLC condition.
4. Participants in the HLC condition would report greater perceived losses of control over their behaviour, emotions and physiological reactions than those in the LLC condition.
5. Participants in the HLC condition would report more post-event processing than those in the LLC condition.

Method

Participants

Participants ($N = 147$) were undergraduate students recruited from Concordia University's Psychology Department Participant Pool. Participants received either course credit for their participation or an entry into a cash draw for \$250. Twenty-one participants were excluded for having previously met and interacted with the actor, for interruptions in their home during the experiment (e.g., family member entering the room during the tasks), for failing to complete the follow-up questionnaire within 24-hours of receiving the link or for reporting they found the study completely non-credible (i.e., rating of zero on a credibility check, see below). The demographic characteristics of the sample is described in Table 1. The final sample consisted predominantly of women (84.1%). The mean age of participants was 24.7 ($SD = 6.8$) years. There were no significant differences in age ($t(124) = 1.08, p = 0.28$) or gender ($\chi^2(1, 126) = 2.96, p = 0.09$) between conditions.

Table 1 Demographics by condition

| Demographics | LLC | HLC |
|---|---------------|---------------|
| Age [<i>M</i> (<i>SD</i>)] | 25.4 (7.5) | 24.0 (6.0) |
| Gender (% women) | 78.8 | 90.0 |
| Ethnicity (%) | | |
| Caucasian | 62.1 | 60.0 |
| Asian | 15.1 | 10.0 |
| Latinx | 7.6 | 6.7 |
| Middle Eastern | 6.1 | 10.0 |
| African/Caribbean | 1.5 | 8.3 |
| Other | 7.6 | 5.0 |
| Marital Status (%) | | |
| Single | 80.3 | 85.0 |
| Married/Common Law | 16.7 | 13.3 |
| Divorced/Separated | 3.0 | 1.7 |
| Education (%) | | |
| Secondary school | 19.7 | 10.0 |
| College degree | 30.3 | 41.7 |
| Undergraduate degree | 45.5 | 45.0 |
| Graduate degree | 4.5 | 3.3 |
| General Psychopathology [<i>M</i> (<i>SD</i>)] | | |
| DASS-21 | 27.52 (18.55) | 30.77 (20.27) |
| SPIN | 21.35 (13.35) | 21.62 (12.63) |
| BALCI | 21.76 (14.98) | 25.41 (16.10) |

Note. HLC=high beliefs about losing control. LLC=low beliefs about losing control

Measures

Demographics. Participants were asked to report basic demographic information (i.e., age, gender, ethnicity, education level).

Manipulation check (Kelly-Turner & Radomsky 2020). This single-item measure presented immediately following the manipulation asked participants to rate how likely they believe it was that they would behave or react in a way that they could not control when meeting the actor (0 to 100 scale; 0 = “not at likely all”; 100 = “extremely likely”). To mask the purpose of this question, it was included in an ‘experiment feedback’ questionnaire which purported to evaluate the clarity and quality of the feedback they received following the bogus cognitive task.

Credibility check (Kelly-Turner & Radomsky 2020). To assess the believability of the deception; participants were asked to rate the degree to which they believed the feedback they received was accurate measure of their self-control on a 0 to 100 scale (0 = “I did not believe at all”; 100 = “I completely believed”).

Ratings of anxiety. Ratings of anxiety were collected at three time points throughout the study: at baseline, just before the social interaction task and immediately following the social interaction task. Prior to the task, participants were asked to rate their anticipatory anxiety. Following the task, they were asked to rate how anxious they felt while

interacting with the actor. To mask the purpose of these measures, participants were asked to rate other positively and negatively valenced mood items (e.g., excited, bored).

Ratings about performance during social interaction. The participant and actor rated the participant’s performance during the social interaction using an adapted version of Stopa and Clark’s (1993) measure of social performance. The measure was adapted to assess concordance between self- and observer-reported performance in the social interaction. Items consist of 16 positive (e.g., confident, relaxed) and 6 negative (e.g., nervous, uncomfortable) attributes (hands-shaking was removed in the current study as the actor could not see participants’ hands over video conference). Ratings were provided on a 0 to 8 scale (“not at all characteristic” to “extremely characteristic”). Internal consistency was excellent for actor ratings ($\alpha=0.96$) and participant ratings of performance ($\alpha=0.95$).

Ratings of concern over losing control (Kelly-Turner & Radomsky 2020). Participants were asked to rate the degree to which they felt concerned that they would lose control over their behaviour, emotions and physical reactions (e.g., sweating, heart rate) during the social interaction from 0 (“Not at all concerned”) to 100 (“Very concerned”).

Ratings of perceived loss of control (Kelly-Turner & Radomsky 2020). Participants were asked to rate the degree to which they felt they lost control over their behaviour, emotions and physical reactions during the social interaction on a series of visual analogue scales with anchors at 0 (“I did not lose control at all”) and 100 (“I completely lost control”).

Social Phobia Inventory (SPIN; Connor et al., 2000). This 17-item measure assesses fear of social situations and has been shown to have strong psychometric properties. It has good internal consistency in clinical (α 's=0.87–0.94) and non-clinical samples (α 's=0.82–0.90; Connor et al., 2000). In the present study it showed excellent internal consistency ($\alpha=0.92$).

Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond 1995). The DASS-21 is a 21-item self-report measure assessing negative emotional states. The DASS-21 showed excellent internal consistency in the present study ($\alpha=0.91$; Antony et al., 1998; Lovibond & Lovibond, 1995).

Beliefs about Losing Control Inventory (BALCI; Radomsky & Gagné 2019). The BALCI is a 21-item transdiagnostic measure which assesses the degree to which people hold beliefs about losing control of their thoughts, behaviours, emotions and physiological responses. It has been shown to have good convergent and divergent validity (Radomsky & Gagné, 2019). In the present study, it was found to have excellent internal consistency ($\alpha=0.94$).

Post Event Processing Questionnaire – Revised (PEPQ-R; McEvoy & Kingsep 2006; adapted from Rachman et al., 2000) The PEPQ-R is a 14-item measure assessing the degree to which participants ruminated about their performance in the social interaction task. The PEPQ-R was administered 24h following the completion of the initial study. The PEPQ-R showed good internal consistency in the present study ($\alpha=0.87$).

Procedure

This study was conducted fully online in one live session and one follow-up questionnaire over two days for each participant via video conference. On day one, participants were given the false purpose that this study was assessing self-control and impression management. They were told they would be asked to complete a cognitive task and a “getting to know you” social interaction wherein their conversation partner would be judging their social performance. This study used the same false purpose and experimental manipulation as in Kelly-Turner & Radomsky (2020). All questionnaires were completed via online survey software (i.e., Checkbox) in their browser.

Participants first completed demographics, the DASS-21, the SPIN and provided their baseline rating of anxiety. Next, participants were asked to complete the bogus cognitive self-control task requiring them to read aloud from two texts, alternating between them after every word. They were told that people tend to be poor judges of their own self-control and that this task was an objective measure of control over verbal behaviour. They were instructed to complete this task as quickly and accurately as possible. The experimenter appeared to be keeping track of errors and timing their efforts. The task is sufficiently difficult to produce errors in all participants (see Kelly-Turner & Radomsky (2020) for a detailed description of the task and feedback). Participants were then randomly assigned to either the LLC or the HLC condition. The experimenter only knew which condition participants would be in just prior to giving the feedback. Briefly, false feedback was given that participants had performed *better* than average, indicating *good* control over verbal behaviour and physiological stress responses and they were primed to think of a time they had maintained control over their emotions and subsequent behaviour (i.e., “Think about times you’ve been nervous either presenting to a group or meeting someone new, you may have noticed you thought something and decided not to say it or you’ve avoided saying the wrong thing.” LLC condition) or *worse* than average performance, indicating *poor* control over verbal behaviour over verbal behaviour and physiological stress responses (i.e., “Think about times you’ve been nervous either presenting to a group or meeting

someone new, you may have noticed you thought something and then blurted it out by accident or accidentally said the wrong thing, or wanted to say something but only realised afterwards that you forgot to say it.” HLC condition). Participants then completed the manipulation check and rated anticipatory anxiety.

Next, participants completed a three-minute social interaction over Zoom with a female undergraduate research assistant actor who was unaware of the participants’ feedback condition. Participants were told to “get to know the other person, as if you were meeting for the first time for coffee or at a social event.” Sessions were video recorded to enhance the anxiogenic nature of the task itself.

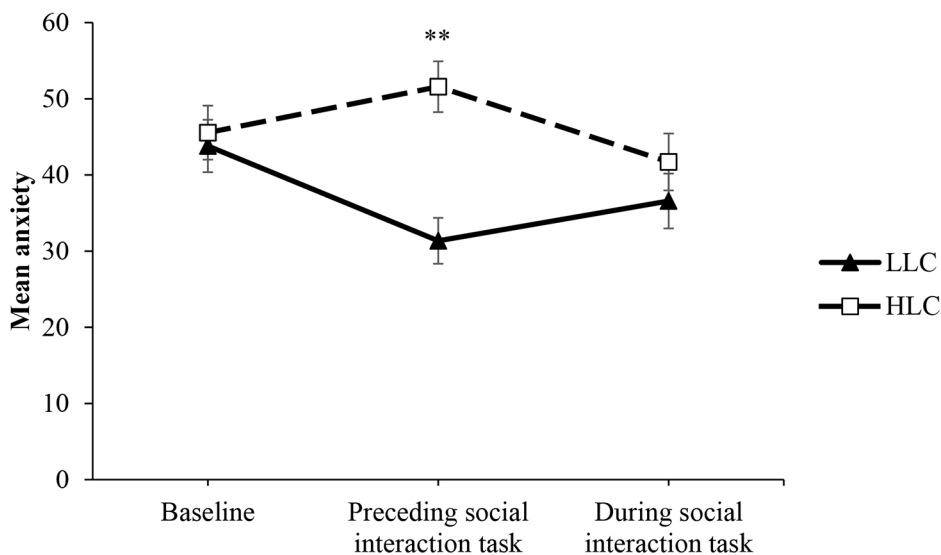
After three minutes, the experimenter re-entered the video session, and the actor disconnected to complete their ratings. Participants then completed a final rating of anxiety, and the remaining questionnaires. Finally, participants completed the credibility check.

After 24-hours, participants received a link to complete the PEPQ-R; participants were asked to complete this within the following 24-hour period. Upon completing the PEPQ-R participants were fully debriefed regarding the true purpose of the study and asked to provide informed consent now that they were fully aware of the true study purpose and of the nature of the deception employed; this was in addition to the initial consent provided at the outset of the study.

Actor Behaviour

The research assistant actor was trained to be neutral, limiting both positive and negative feedback and minimizing their non-verbal feedback (e.g., avoiding nodding). She was trained to provide a natural conversational style to maximize external validity and believability of the interaction. She allowed participants to lead the conversation and did not break silences lasting less than 5s. Longer silences were broken by asking a question from a pre-set list (e.g., “What do you do for fun?”). This training was carried out over two one-hour sessions followed by five pilot cases with volunteers from the research lab. After each pilot case, the actor received feedback on her performance and her perceived warmth to verify that the interaction felt natural, and the actor came off as neither too warm nor too cold. This approach was used to maximize the external validity of the interaction rather than a rote script which may have artificially raised the awkwardness of the interaction.

Fig. 1 Mean ratings of anxiety by condition. HLC=high beliefs about losing control. LLC=low beliefs about losing control. ** $p < 0.01$



Results

Data Screening

Prior to analyses, all outcome variables were assessed for outliers, non-normality and heteroscedasticity. Several univariate outliers were observed on ratings of control variables (i.e., behaviour, emotions, physical reactions) for LLC condition, such that outliers positively skewed the mean. Upon inspection, there was no evidence that these outliers represented invalid data given transformation or removal of outliers can distort the dataset, they were retained untransformed (Osborne & Overbay, 2004). Based on absolute skewness less than three and absolute kurtosis less than ten, there was no evidence of non-normality in any outcome variables (Kline, 2020). Further, variance was acceptably homoscedastic for all outcome variables (variance ratio between conditions < 2 ; Kline, 2009). All data points were within acceptable limits of normality and homoscedasticity.

General Psychopathology

To assess whether the conditions differed on general psychopathology, independent samples t -tests were conducted on SPIN, BALCI and DASS-21 scores. As expected from random assignment, conditions did not differ on measures of social anxiety, as measured by the SPIN ($t(124)=0.12$, $p=0.91$), pre-existing beliefs about losing control, as measured by the BALCI ($t(124)=1.32$, $p=0.19$), nor on a general measure of depressive and anxious symptoms, as indicated by the DASS-21 ($t(124)=0.94$, $p=0.35$).

Manipulation Check

To assess whether the manipulation was successful, an independent samples t -test was conducted on the manipulation check question. As expected, following the ‘self-control’ task, individuals in the HLC condition ($M=51.78$, $SD=25.89$) reported significantly greater beliefs that they may lose control over their emotions, behaviour or physiological reactions than those in the LLC condition ($M=21.20$, $SD=21.63$; $t(124)=7.22$, $p < 0.001$, $d=1.28$).

Credibility Check

An independent samples t -test confirmed there were no differences between the conditions on the credibility of the manipulation ($t(124)=0.30$, $p=0.77$). Overall, mean credibility was moderately high for the believability of the feedback ($M=64.53$, $SD=26.17$).

Self-reported Anxiety

To assess anxiety in anticipation of and during the social interaction task, a series of independent samples t -tests were conducted (see Fig. 1; see Table 2 for means and standard deviations). At baseline, the LLC and HLC groups did not differ significantly in anxiety ($t(124)=0.35$, $p=0.73$). As predicted in hypothesis 1a, after receiving feedback about their risk of losing control, but just before the social interaction task, individuals in the HLC condition reported significantly more subjective anxiety than those in the LLC condition ($t(124)=4.51$, $p < 0.001$, $d=0.80$). However, contrary to hypothesis 1b, following the social interaction task, ratings of anxiety did not differ between conditions ($t(124)=0.99$, $p=0.33$, $d=0.18$).

Table 2 Means and standard deviations of subjective ratings of anxiety, post-event processing and control measures

| | LLC | | HLC | | <i>t</i> | <i>d</i> |
|--|----------|-----------|----------|-----------|----------|----------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | |
| Anxiety | | | | | | |
| Baseline | 43.80 | 28.00 | 45.55 | 27.48 | 0.35 | 0.06 |
| Preceding social interaction task | 31.35 | 24.48 | 51.58 | 25.85 | 4.51** | 0.80 |
| During social interaction task | 36.58 | 29.24 | 41.70 | 28.93 | 0.99 | 0.17 |
| PEPQ-R ratings (24-hours post task) | 24.85 | 12.48 | 41.64 | 18.79 | 5.21** | 1.05 |
| Ratings of concern over losing control | | | | | | |
| Behaviour | 24.85 | 24.43 | 36.18 | 29.19 | 2.37* | 0.42 |
| Emotions | 11.83 | 19.08 | 21.17 | 25.83 | 2.32* | 0.41 |
| Physiological responses | 22.35 | 26.08 | 33.47 | 28.22 | 2.30* | 0.41 |
| Ratings of loss of control | | | | | | |
| Behaviour | 14.11 | 18.95 | 22.00 | 20.24 | 2.26* | 0.40 |
| Emotions | 11.61 | 20.38 | 17.23 | 20.76 | 1.53 | 0.27 |
| Physiological responses | 20.17 | 24.55 | 32.72 | 27.86 | 2.69* | 0.48 |

Note. HLC = high beliefs about losing control. LLC = low beliefs about losing control. PEPQ = Post Event Processing Questionnaire – Revised. For PEPQ-R, $N=98$ (49 per condition) due to participants failing to complete the follow-up questionnaire. * $p < 0.05$ ** $p < 0.01$

Table 3 Ratings of social performance during social interaction task by rating source

| | LLC | | HLC | | <i>t</i> | <i>d</i> |
|---------------------|----------|-----------|----------|-----------|----------|----------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | |
| Actor ratings | 136.77 | 24.60 | 136.48 | 23.99 | 0.07 | 0.01 |
| Self-report ratings | 117.74 | 26.43 | 104.15 | 29.81 | 2.71** | 0.48 |

Note. HLC = high beliefs about losing control. LLC = low beliefs about losing control. * $p < 0.05$ ** $p < 0.01$.

Ratings of Performance

To assess differences in perceived and observed social performance, a 2×2 (rating source \times condition) repeated measures ANOVA was conducted on mean performance ratings. As predicted in hypothesis 2b, a significant main effect of rating source was found such that observed performance ratings were significantly more positive than self-reported performance ($F(1, 124) = 100.67, p < 0.001, \text{partial } \eta^2 = 0.45$). Contrary to hypothesis 2a, there was no main effect of condition on performance. Though individuals in the HLC condition were rated as having worse performance in the social interaction task regardless of rating source, This effect was not significant ($F(1, 124) = 3.13, p = 0.08, \text{partial } \eta^2 = 0.025$). There was a significant rating source \times condition interaction ($F(1, 124) = 6.75, p = 0.01, \text{partial } \eta^2 = 0.052$). Follow-up analysis revealed that the simple effect of condition was significant for self-reported ratings of performance such that participants in the HLC condition reported significantly worse performance than those in the LLC condition ($t(124) = 2.71, p = 0.008, d = 0.48$). There were no differences in actor rated performance ($t(124) = 0.67, p = 0.95, d = 0.01$; see Table 3 for the mean performance ratings).

Ratings of Concern Over Losing Control

To assess whether participants differed in their concerns about losing control over their behaviour, emotions and

physiology in the social interaction task, a one-way multivariate ANOVA (MANOVA) was conducted to check for an overall effect of condition on concerns about losing control. There was a trend towards individuals in the HLC condition reporting greater concerns about losing control overall than those in the LLC condition ($F(3, 122) = 2.34, p = 0.077, \text{partial } \eta^2 = 0.054$). Though these results were non-significant, a series of exploratory independent samples *t*-tests was conducted on participants' concerns about losing control over behaviour, emotions and physiological reactions during the social interaction task (see Fig. 2). These results revealed moderate effect sizes such that individuals in the HLC condition reported greater concerns about losing control over their behaviour ($t(124) = 2.37, p = 0.019, d = 0.42$), their emotions ($t(124) = 2.32, p = 0.022, d = 0.41$) and their physiological reactions ($t(126) = 2.30, p = 0.023, d = 0.41$), suggesting changes in beliefs about losing control may have increased these concerns in the HLC condition. However, given the non-significant omnibus test, these results should be interpreted with caution.

Ratings of Control

A one-way MANOVA was conducted to assess whether participants differed in the degree to which they perceived they lost control. The overall effect of condition was significant such that individuals in the HLC condition reported greater perceived losses of control in general than LLC condition

Fig. 2 Mean ratings of the amount of concern about losing control over different domains during the social interaction task by condition. HLC=high beliefs about losing control. LLC=low beliefs about losing control. * $p < 0.05$

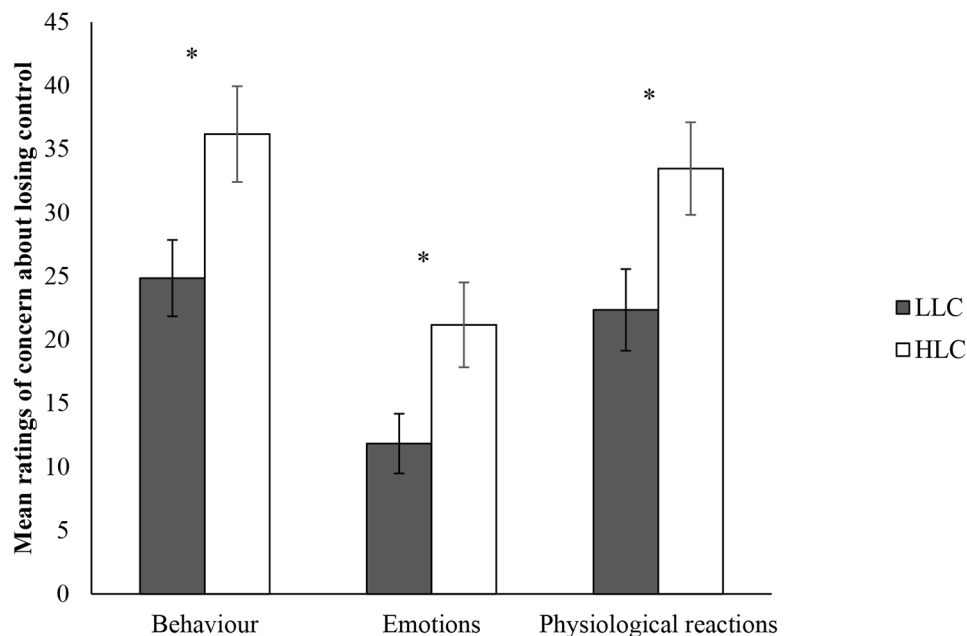
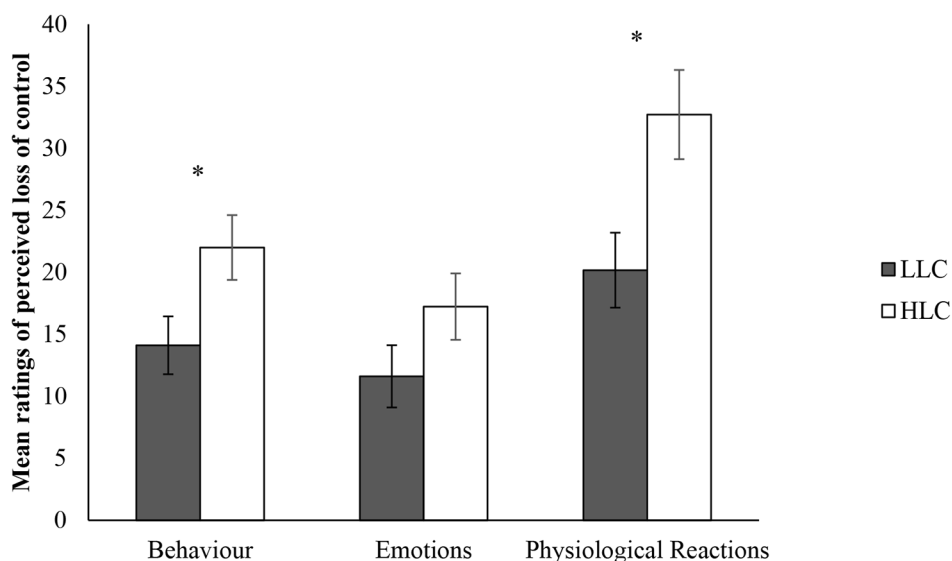


Fig. 3 Mean ratings of perceived loss of control over different domains during the social interaction task by condition. HLC=high loss of control. LLC=low loss of control. * $p < 0.05$



participants ($F(3, 122) = 2.92, p = 0.037, \text{partial } \eta^2 = 0.067$). A series of follow-up independent samples t -tests were conducted on participants' perceived losses of control over their behaviour, emotions and physiological reactions during the social interaction task (see Fig. 3). Individuals in the HLC condition reported significantly greater perceived losses of control over their behaviour ($t(124) = 2.26, p = 0.026, d = 0.40$) and their physiological reactions ($t(124) = 2.69, p = 0.008, d = 0.48$) compared to those in the LLC condition. However, pairwise comparisons revealed no significant difference between conditions on perceived losses of control over their emotions ($t(124) = 1.53, p = 0.13, d = 0.27$).

Post-event Processing

To assess the degree of post-event processing following the social interaction task, an independent samples t -tests was conducted (see Table 2). Not all participants completed the post-event processing questionnaire and any participants who did not complete the questionnaire within 24h of receiving the follow-up link were excluded from this analysis. As such only 98 participants were included in this analysis. As predicted in hypothesis 5, individuals in the HLC condition ($M = 41.64, SD = 18.79$) reported significantly more post-event processing 24h following the social interaction task

than did those in the LLC condition ($M=24.85$, $SD=12.48$; $t(96)=5.21$, $p<0.001$, $d=1.05$).

Discussion

As predicted, the results of this experiment show that holding negative beliefs about losing control led to increased social anxiety. When led to believe they were at high (versus low) risk of losing control, participants experienced more anticipatory anxiety, greater perceived losses of control, rated their performance as worse despite no differences in actor-rated performance and engaged in more post-event processing the following day. These results are consistent with cognitive models of SAD (Clark & Wells, 1995; Rapee & Heimberg, 1997) and previous research on negative beliefs about losing control in SAD (Gagné et al., 2020; Kelly-Turner & Radomsky, 2020). Together these results provide compelling evidence that beliefs about losing control are relevant in the aetiology and maintenance of symptoms of SAD.

Kelly-Turner & Radomsky (2020) found that individuals in the HLC and LLC conditions did not differ in level of anxiety during the social interaction task, with anxiety levels of the LLC condition rising the same level as the HLC condition. The authors attributed this to the anxiogenic nature of the actor's behaviour, suggesting it may have overpowered the effect of the manipulation. The present study addressed this by using a naturalistic interaction with a neutral to warm actor, which has been shown to be sufficient to induce anxiety both in person and online (Huneke et al., 2021; Mellings & Alden, 2000; Shalom et al., 2015). Still, we observed no differences in anxiety during the task, with anxiety falling in the HLC condition in the present study despite a more naturalistic interaction. Given that both studies found that anxiety appeared to align with actor behaviour (i.e., a warmer, natural actor produced less anxiety than a colder, disinterested actor regardless of condition), we suspect that degree of anxiety experienced in the interaction itself was more influenced by the behaviour of their partner than by participants' self-perceived internal states. There is some evidence in the attention literature to support this, with low-socially anxious individuals being less sensitive to internal cues even after primes to shift their attention internally relative to highly socially anxious samples (Mellings & Alden, 2000; Papageorgiou & Wells, 2002). However, since participants did not provide feedback on the actor's behaviour in the present study, it is difficult to say how much they were attending to their partner's social cues versus their internal states. It would be interesting to examine the effect of this type of false feedback on perceptions of the partner among both socially anxious and healthy controls both in terms of

degree of anxiety and perception of the partner as friendly/unfriendly. Despite this, the manipulation appears to have impacted other cognitive processes relevant to SAD.

Perhaps the most novel finding in the present study was that negative post-event processing was significantly higher in the HLC condition than the LLC condition despite conditions reporting similar anxiety levels during the social interaction itself. This suggests that although participants in both conditions experienced little anxiety while talking with the actor and reported similar levels of performance, the way those in the HLC encoded and processed the interaction led to increased post-event processing. The mean level of post-event processing in the HLC condition is consistent with scores observed in highly socially anxious samples (Fehm et al., 2008; Perera et al., 2016; Rachman et al., 2000) While post-event processing is not unique to SAD (Perera et al., 2016), this does suggest that we produced symptoms like those we would expect among individuals high in social anxiety. Given the similar PEPQ-R scores and the well-established link between SAD and post-event processing (Brozovich & Heimberg, 2008; Rachman et al., 2000), this result provides compelling evidence that negative beliefs about losing control are relevant to the etiology and maintenance of social anxiety.

There are at least two possible explanations for this relationship. Previous research has shown that ambiguous social situations, such as conversations with an unknown social partner, are more difficult than structured interactions for individuals high in social anxiety (Voncken & Bögels, 2008). It seems likely that inducing negative beliefs about losing control created a more ambiguous social situation wherein participants could interpret normal or neutral behaviours, such as stumbling over words or interrupting their conversation partner, as losses of control. That ambiguity would then provide fertile soil for selective attention for perceived (or imagined) failures to maintain control and negative memory biases, which we would then expect to further increase anticipatory anxiety for future interactions.

Alternatively, believing they were partially out of control may have presented a source of uncertainty about how they acted or recalled their behaviour. Intolerance of uncertainty is experienced in clinical and non-clinical populations and has been linked to negative post-event processing in SAD (McEvoy et al., 2010; McEvoy & Mahoney, 2013) and memory distrust has been linked with a desire to mentally check (Alcolado & Radomsky, 2011). Manipulating beliefs about losing control may have made participants distrust their own ability to maintain control. This may have driven them to mentally check and review their behaviour following the social interaction which has been linked to both negative post-event processing and less certainty in recall, ultimately undermining their confidence in their memory of

their behaviour (Radomsky et al., 2006; van den Hout & Kindt, 2004). The present study did not measure memory confidence or perceived ambiguity of the situation, so how beliefs about losing control lead to post-event processing remains a question for future studies.

Our results are consistent with research on self-focused attention in SAD. When individuals are led to believe they are experiencing increases in arousal they underestimate their social performance, experience greater anxiety and overestimate their *observable* arousal irrespective of differential changes in arousal (Mulken et al., 1999; Wild et al., 2008). Though our study did not measure self-focused attention directly, greater concerns about losing control over behaviour and physiological arousal and significantly greater subjective losses of control in the HLC condition despite no observable performance differences suggest greater self-focused attention and a bias for overestimating the visibility of their losses of control relative to the LLC condition. Therefore, believing one is at risk of losing control may lead to some of the increases in self-focused attention observed in social anxiety disorder.

The present study has implications for cognitive theories of SAD. Cognitive theories propose those with SAD assume they will fail to control their anxiety and experience abject humiliation as a consequence (i.e., concern about losing control over their emotions, Clark & Wells 1995; Hofmann, 2007). Despite the non-significant MANOVA for overall concerns about losing control, the moderate effect sizes in the *post hoc* tests of individual domains suggest that the fear of losing control in SAD is not limited to concerns about controlling anxiety. The manipulation made no mention of emotional control, focusing instead on ‘failures’ to control behaviour (e.g., blurting something out) and physiology (e.g., trembling, sweating) when nervous meeting someone new. Despite this, individuals in the HLC condition reported greater concerns about losing control over their behaviour, emotions, and physiological reactions respectively during the social interaction task. This suggests negative beliefs about losing control over emotions proposed by cognitive theories of SAD may extend to concerns over losses of control of behaviour and physiological reactions. This is consistent with self-presentation theories of social anxiety which emphasize one’s perceived inability to make a positive impression as a core factor in the experience of anxiety (e.g., Schlenker & Leary 1982).

The significant interaction between rating source and condition such that performance deficits were only identified by self-report suggests that manipulating beliefs about losing control may have undermined participants’ self-perceived ability to control their physiological responses and behaviour, which may have led to doubts in their self-perceived social competence relative to what would be seen as

typical or normal. This is consistent with research on social interaction tasks among socially anxious individuals, who even in the presence of observed performance deficits, still underestimate their social competence when led to believe they will not measure up to the average level of performance (Moscovitch & Hofmann, 2007). However, it is hard to know whether these concerns were prospective, or retrospective given we only assessed perceived performance following the interaction. Further, we cannot comment about the persistence of this perceived skill deficit. It would be interesting in a future study which manipulates beliefs about losing control to measure participants’ anticipated performance prior to the social interaction task and again 24-hours later to better assess the relationship between perceived social competence, social anxiety and post-event processing in greater detail.

Despite these interesting findings, the present study had some important limitations to be highlighted. First, though participants in the HLC condition reported greater concern about losing control over their emotions, physiology, and behaviours, they only perceived losses of control over their behaviour and physiology. This may be because the false feedback described what a behavioural and physiological loss would look like (i.e., blurting something out, sweating, blushing), but did not provide a specific example of an emotional loss of control. The present study was not designed to assess these nuances between domains of control (e.g., emotions, behaviour, physiology) as it aimed to support their importance in SAD more generally. A future study which either manipulates different domains individually or operationalizes loss of emotional control to participants in a way that is both visible and distinct from behaviour/physiology would be ideal, perhaps by describing becoming anxious and being unable to calm down, and might better elucidate the nuances of these different domains.

Further, it did not include a neutral condition, making it difficult to state whether positive feedback about control reduced symptoms of social anxiety or negative feedback increased them. However, fears of losing control are commonly held, even among the non-clinical population (Chrisler, 2008; Friedrichsen & Milberg, 2006), so even assuming the differences observed are due to a reduction in beliefs about losing control, it supports their relevance in the experience of social anxiety. If reducing negative beliefs about losing control reduces anxiety and post-event processing, it would imply that targeting these beliefs in treatment could reduce in anticipatory anxiety in future social interactions. Still, a future study including a neutral condition would more clearly delineate the direction of effect of the manipulation.

Another limitation is that the manipulation focuses primarily on the likelihood of losing control. This study

manipulated likelihood, but not perceived consequences of losing control (e.g., do something horrible, never get control back). A future study which emphasizes perceived consequences of losing control could provide a more nuanced understanding of how these beliefs cause and maintain anxiety.

Finally, although experimental work with analogue samples provides valuable insight into the cognitive mechanisms which underlie symptoms observed in disorders such as SAD (e.g., Abramowitz et al., 2014; Gagné et al., 2018), they are not a replacement for work with clinical samples. Further, given that beliefs about losing control and post-event processing are thought to be relevant in anxiety-related disorders more transdiagnostically (e.g., Perera et al., 2016), an important future direction for this research would be to examine the specificity of these beliefs in social anxiety, perhaps by comparing nature of these beliefs and their impact on symptoms across anxiety related disorders.

Despite these limitations, the present study provides insight into the role of this novel belief domain in SAD. Understanding how maladaptive beliefs impact symptoms of anxiety disorders can help inform targets for treatment and is essential in improving existing interventions. Existing treatments for SAD encourage attentional retraining to teach people with SAD to focus on external cues over their internal states. Attentional retraining could be extended to include shifting attention between internal cues of loss of control and others' reactions to test the frequency or visibility of imagined losses of control. Conversely, if we assume that the LLC condition increased perceived control, then interventions which increase perceived control such as fostering confidence in social skills or grounding exercises may be indicated to increase mastery in highly distressing social situations. In either case, investigating how these beliefs function among individuals with SAD is an important next step to developing interventions which target beliefs about losing control in social anxiety disorder.

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