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# The Impact of Mindfulness Training on Post-Event Processing in Social Anxiety: A Multi-Method Investigation

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# **THE IMPACT OF MINDFULNESS TRAINING ON POST- EVENT PROCESSING IN SOCIAL ANXIETY: A MULTI- METHOD INVESTIGATION**

A Thesis

Submitted to the Graduate Faculty of  
the Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
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Master of Arts

in

The Department of Psychology

by

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## Abstract

Post-event processing (PEP) is theorized to maintain pathological social anxiety. However, little is known about the impact of interventions that may interfere with this maintenance factor. The current study examined the impact of mindfulness training on PEP and state anxiety among socially anxious individuals. Participants were 81 persons (74.07% female, 61.72% non-Hispanic White,  $M_{\text{age}} = 21.83$ ) with clinically elevated social anxiety who attended one appointment in the laboratory during which they were randomized to receive a brief mindfulness-based training ( $n = 41$ ) or no training (i.e., thinking as usual control group;  $n = 40$ ). After the training period, participants underwent a 3-minute social anxiety induction task. They were instructed to apply their thinking strategy (i.e., mindfulness or thinking as usual) following the induction task and to complete questionnaires regarding their PEP and state anxiety. Next, participants were asked to complete two weeks of daily online surveys that included a PEP induction task, instructions to use their thinking strategy following the PEP induction, and measures of state PEP and state anxiety. Individuals in the mindfulness condition reported significantly less state anxiety post-training compared to the control condition. However, conditions did not differ on state anxiety or state PEP after the social anxiety induction task or during the two-week follow-up period. Time spent practicing the strategy did not moderate these relationships. Importantly, the mindfulness condition was associated with decreased state PEP over the two-week follow-up period between days 1-5 to 10-14 compared to the control condition, but not for state anxiety. In sum, mindfulness-based strategies reduced state anxiety after training and state PEP (but not state anxiety) during strategy use over a two-week period among individuals with clinically elevated social anxiety.

## **Introduction**

Social anxiety disorder (SAD) is one of the most common psychiatric disorders, with an estimated lifetime prevalence rate of 12% (Kessler et al., 2005). SAD is a chronic disorder, typically with an onset during childhood or adolescence (Chavira & Stein, 2005; Kessler et al., 2005). Individuals with clinically elevated social anxiety experience fear and avoidance in social situations due to possible scrutiny of others, resulting in distress and dysfunction (American Psychiatric Association, 2013). Impairments experienced by those with clinically elevated social anxiety include difficulties in academic pursuits, lower occupational functioning, greater health-related issues and subsequent financial burden, reduced likelihood of forming platonic and romantic relationships, and reduced overall life satisfaction (Bruch & Cheek, 1995; Fehm, Beesdo, Jacobi, & Fiedler, 2008; Katzelnick et al., 2001; Schneier et al., 1994; Stein et al., 2005). Despite the extensive suffering associated with those with clinically elevated social anxiety, only half seek treatment, usually after having experienced symptoms for 10 or more years (Gross et al., 2005; Schneier, 2006; Stein & Stein, 2008; Wang et al., 2005). Thus, it is important to identify brief interventions to help individuals with clinically elevated social anxiety learn to manage their social anxiety symptoms and improve their quality of life.

### **Post-event Processing**

One promising target for such interventions is post-event processing (PEP). PEP is defined as engaging in detailed and repetitive self-focused review of one's performance in social situations (Brozovich & Heimberg, 2008; Kocovski, Endler, Rector, & Flett, 2005). PEP is theorized to maintain pathological social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). In support of these models, persons who endorse greater social anxiety are more likely to experience PEP than those who report lower social anxiety (Abbott & Rapee, 2004; Brozovich &

Heimberg, 2013; Kocovski & Rector, 2007; Rachman, Grüter-Andrew, & Shafran, 2000). All individuals engage in self-focused thought on a day-to-day basis, which can be useful to help evaluate one's behavior and to attain one's goals. However, people with elevated levels of social anxiety have recall biases toward negative information related to their social performance (Edwards, Rapee, & Franklin, 2003). Further, socially anxious individuals tend to repeatedly review their negative thoughts regarding prior social situations (Kocovski et al., 2005). Individuals with higher levels of social anxiety also describe their memories of negative social events as more intrusive and disruptive to their concentration than those with lower levels of social anxiety (Brozovich & Heimberg, 2008).

According to Rapee and Heimberg's (1997) model, socially anxious persons view others as being inherently critical of people in social situations. Therefore, socially anxious individuals hold themselves to high and unattainable standards of how to act in social situations, often resulting in their performance not meeting these expectations. PEP can alter socially anxious individuals' memories of events to fit with their negative self-focused thoughts, helping form negative impressions of one's self and fueling their anticipatory anxiety (Brozovich & Heimberg, 2013; Kocovski et al., 2005). This detailed self-focused scrutiny can lead to increased frequency and intensity of self-focused thoughts over time and further reinforce negative beliefs about one's ability in social situations (Abbott & Rapee, 2004; Brozovich & Heimberg, 2008). Thus, PEP can lead to re-experiencing the anxious symptoms of the social situation (Mor & Winquist, 2002). Taken together, findings suggest that PEP may contribute to the maintenance of social anxiety symptoms.

The gold standard for treatment of clinically elevated social anxiety is cognitive behavioral therapy (CBT), which includes exposure-based techniques (e.g., Heimberg,

Brozovich, & Rapee, 2014; Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012; Leichsenring et al., 2013; Mayo-Wilson et al., 2014). During treatment, individuals are exposed to their feared stimuli, social situations, and learn that these situations tend to not be inherently dangerous. The anxious symptoms associated with their feared stimuli reduce through habituation and extinction learning and through obtaining disconfirming information (information that is counter to maladaptive beliefs regarding their feared stimuli; e.g., Abramowitz, 2013). Importantly, PEP decreases during the course of CBT, despite CBT not specifically targeting PEP (Abbott & Rapee, 2004; McEvoy, Mahoney, Perini, & Kingsep, 2009; Price & Anderson, 2011). However, socially anxious persons with greater levels of PEP improve at a decreased rate than those with lower levels of PEP (Price & Anderson, 2011). PEP may attenuate treatment outcomes by sustaining increased anxiety during self-focused review, when extinction learning of the feared stimuli is supposed to occur (Price & Anderson, 2011; Rowe & Craske, 1998; Tsao & Craske, 2000). Given that PEP appears to interfere with CBT outcomes, it is important to enhance PEP intervention efforts. Mindfulness techniques may be one way to target PEP by teaching individuals to focus on the present rather than review their past social performance.

### **Mindfulness Interventions**

Mindfulness refers to the state of giving one's attention to the present moment in time, while simultaneously maintaining an open and accepting mind and avoiding moral judgements (Bishop et al., 2004; Singer & Dobson, 2007). Results from numerous treatment studies suggest that the implementation of mindfulness strategies can help to reduce social anxiety symptomology (Goldin & Gross, 2010; Goldin, Ramel, & Gross, 2009; Kocovski, Fleming, & Rector, 2009). Some mindfulness-based therapies include: mindfulness-based stress reduction (MBSR), which consists of formal and informal meditation practice (Kabat-Zinn & Hanh, 2009);

mindfulness-based cognitive therapy (MBCT), which combines mindfulness-based strategies with CBT (Segal, Williams, & Teasdale, 2002); and mindfulness and acceptance-based therapy, which integrates MBCT with acceptance-based strategies, such as accepting one's experiences instead of trying to control them (Kocovski et al., 2009). A mindfulness and acceptance-based group therapy (MAGT) for SAD significantly reduced both social anxiety symptoms and depressive rumination following 12 weeks of treatment (Kocovski et al., 2009). Moreover, a group MBSR intervention for SAD resulted in decreased social anxiety, state anxiety, depressive rumination, negative self-endorsement, and negative emotion experience, as well as increased self-esteem and positive self-endorsement (Goldin & Gross, 2010; Goldin et al., 2009). Further, results from a randomized control trial (RCT) indicated that MAGT did not significantly differ from group CBT in reducing social anxiety symptom severity among individuals with SAD (Kocovski, Fleming, Hawley, Huta, & Antony, 2013). Further, results from another RCT indicated no significant difference between MBSR and group CBT in social anxiety symptom reduction post-treatment or maintenance of social anxiety symptom reduction at the one-year follow-up (Goldin et al., 2016).

Mindfulness may alleviate social anxiety by encouraging present-focused attention rather than past-focused review (which is characteristic of PEP). There are only two known studies that tested the utility of mindfulness to decrease PEP and associated symptoms among individuals with clinically elevated social anxiety. In the first (Cassin & Rector, 2011), participants with SAD underwent a brief, single session training on one of three strategies: mindfulness (i.e., mindful breathing exercise), distraction (i.e., turn their attention away from their negative affect and think about a pleasant or neutral task), or control (i.e., continue to think about the social situation in the way that they normally would). After the training period, PEP was induced by



asking participants to recall their most recent social situation in which they felt awkward, embarrassed, or uncomfortable, and to focus on the details of that situation for five minutes. Following the PEP induction task, participants were asked to practice their thinking strategy for five minutes (i.e., post-event period). Individuals in the mindfulness group reported a significant decrease in their distress during the post-event period, whereas those in the distraction and control groups did not. The reduction in distress was greater in the mindfulness condition than the control (but not distraction) condition. These findings suggest that a single use of a brief mindfulness strategy may not be any more effective than distraction in reducing one's distress, which is consistent with the anxiety literature (e.g., Abramowitz, 2013) that cognitive avoidance (e.g., distraction) provides individuals with short-term relief. However, mindfulness may be a more adaptive strategy to utilize for longer-term symptom change through exposure to one's distressing PEP thoughts rather than maintenance of one's symptoms through avoidance. However, this study neglected to examine whether mindfulness reduced PEP.

The second study examined the effects of a single 40 minute session of mindful breathing or cognitive restructuring compared to 15 minute control condition (in which participants were told that it is sometimes helpful to continue to think about their own performance on past events) to manage PEP among participants with SAD (Shikatani, Antony, Kuo, & Cassin, 2014). Prior to their training, participants engaged in an impromptu speech to elicit PEP. Participants in both intervention conditions reported significant reductions in PEP, distress, and state negative affect compared to the control group, suggesting that mindfulness and cognitive restructuring are promising strategies to promote a short-term decrease in PEP. However, the mindfulness and cognitive restructuring group did not significantly differ from the control group on PEP, distress, or negative affect during the one-day follow-up period. Together, findings from the two studies

(Cassin & Rector, 2011; Shikatani et al., 2014) suggest that a brief mindfulness strategy may be sufficient in reducing PEP and distress associated with PEP directly after mindfulness training. However, the application of a mindfulness strategy to manage PEP following a social anxiety-inducing task has yet to be examined. Further, it is unknown whether encouraging participants to continue to use mindfulness techniques following PEP inductions will result in reductions in PEP and associated distress over time.

### **The Current Study**

The current study aimed to further understand the impact of mindfulness on PEP and associated negative affect among individuals with elevated social anxiety. First, the current study sought to replicate prior work (Cassin & Rector, 2011; Shikatani et al., 2014) by examining the acute impact of mindfulness on state PEP and state anxiety. The current study aimed to extend prior work by including a social anxiety induction task to elicit PEP after a social anxiety-provoking situation to test the intervention's efficacy on state PEP and state anxiety. We hypothesized that participants in the mindfulness condition, compared to the control group, would report less state PEP and state anxiety post-strategy use during an in-lab visit. Second, the current study aimed to further extend prior work (Cassin & Rector, 2011; Shikatani et al., 2014) by examining whether continued strategy use (i.e., mindfulness or thinking as usual) to manage PEP for the two weeks following baseline would impact state PEP and state anxiety. We hypothesized that the mindfulness condition would be associated with less average state PEP and average state anxiety compared to the control condition over the two-week follow-up period. Next, we tested the hypothesis that continued skill use during the two-week follow-up period would moderate the relationship of condition with state PEP and state anxiety. Specifically, we hypothesized that the number of minutes participants utilized their skill throughout the two

weeks would moderate the relationship between condition and follow-up PEP and state anxiety, such that participants in the mindfulness condition who utilized the mindfulness skill more would report lower state PEP and state anxiety compared to the control condition.

The study also had a secondary aim to further elucidate the impact of mindfulness on state PEP and state anxiety. Specifically, the study attempted to extend prior work (Cassin & Rector, 2011; Shikatani et al., 2014) by examining whether condition would be related to longer-term changes in state PEP and state anxiety during the two-week daily survey portion. We hypothesized that the mindfulness condition would report continued decreases in state PEP and state anxiety throughout the two-week daily survey portion (i.e., from days 1-5 to 6-9 and days 6-9 to 10-14) compared to the control condition.

## Method

### Participants

Participants were individuals who endorsed clinically elevated social anxiety per the Social Interaction Anxiety Scale- Straightforward version (SIAS-S; Mattick & Clarke, 1998), evidenced by a total score of 28 or higher on the 17 straightforward worded items (Rodebaugh et al., 2011). Participants were recruited from Louisiana State University's department of psychology's online survey sign-up system and via advertisements throughout the Baton Rouge community (e.g., flyers, Craigslist postings). We attempted to recruit individuals with clinically elevated social anxiety (e.g., flyers title: "Do social situations make you feel nervous or uneasy?") and advertised that the study included teaching of strategies to manage fear and anxiety. Community recruited participants were compensated \$25 for completing the in-person study visit and \$20 for completing the daily online portion of the study, which is consistent with previous daily survey studies examining social anxiety over a multiple week period (e.g., Mackinnon, Battista, Sherry, & Stewart, 2014). Louisiana State University psychology students were given the choice to participate for monetary compensation or research credit in their psychology class. To increase retention rates on the daily surveys, a bonus of \$5 was given to all participants who completed all the daily surveys each week for a total of \$10, as in prior work (McMahon & Naragon-Gainey, 2018). Thus, participants could earn up to \$55 for completing the entire study.

See Figure 1 for a CONSORT flow diagram. Of the 357 individuals who completed the online screening questionnaire between February 2019 and September 2019, 122 were ineligible due to being: under 18 years of age ( $n = 2$ ), below the clinical cut-off on the SIAS-S ( $n = 75$ ), and unwilling to attend an in-lab appointment and comply with the 14-day protocol ( $n = 45$ ). Of

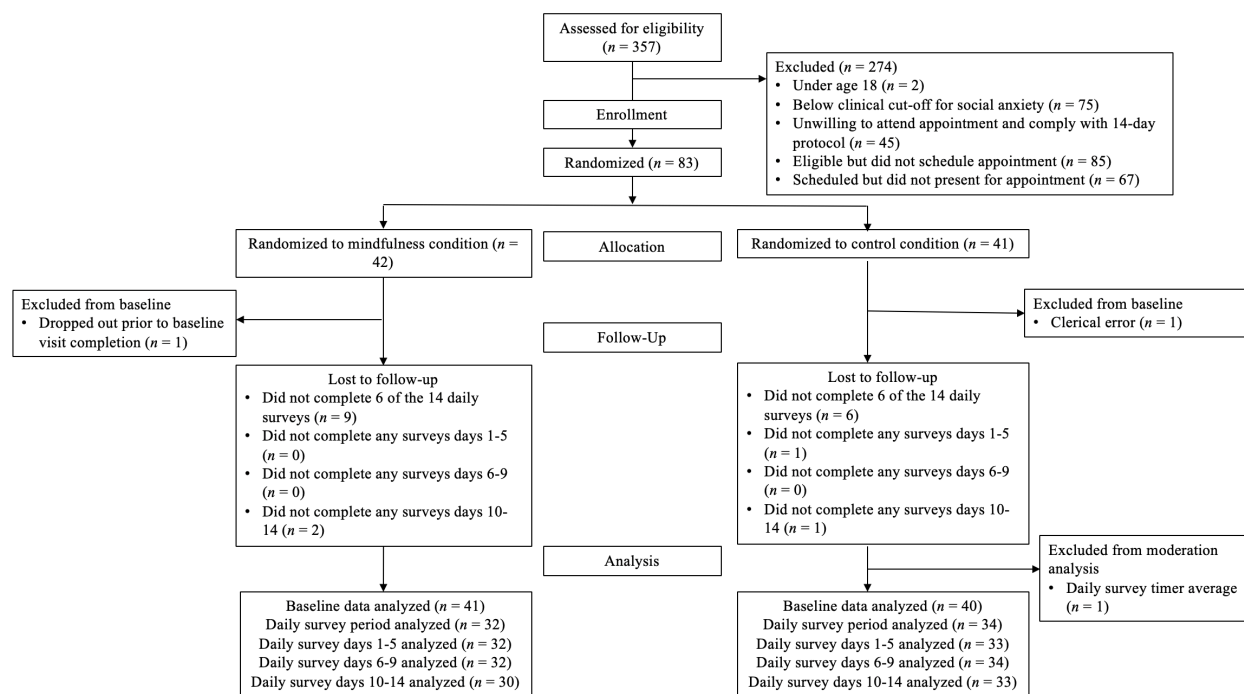


Figure 1. Participant flow chart following Consolidated Standards of Reporting Trials guidelines.

the 235 eligible individuals, 150 scheduled a baseline appointment. Of the 83 who presented for their baseline appointment and enrolled in the study, 82 completed the baseline visit (one participant dropped out after completing the baseline measures but prior to the social anxiety induction task; while the research assistant was introducing the participant to the confederate for the social anxiety induction task, the participant stated they no longer wanted to continue to participate in the study but did not provide a reason when inquired by the research assistant). One participant in the control condition did not receive the control condition instructions due to a technical difficulty and was excluded from analyses. The final baseline sample consisted of 81 participants (mindfulness  $n = 41$ , control  $n = 40$ ). The majority of the participants were recruited from the LSU undergraduate psychology research participant pool (48.3%) and flyers (44.3%). The final sample was primarily female and non-Hispanic/Latinx White (Table 1), aged 18-55 years old. The majority of the sample reported having education beyond high school, being a student, and being employed (Table 1).

During the follow-up portion, the majority of the sample (92.59%) completed at least one daily survey. However, of the 81 participants who completed baseline, 15 were excluded from analyses of follow-up data due to non-compliance of completing the daily surveys (information regarding compliance provided below). The final follow-up sample consisted of 66 participants (mindfulness  $n = 32$ , control  $n = 34$ ). Participants randomized to the mindfulness condition (78.05%) were not significantly more likely to complete follow-up than participants randomized to the control condition (85.00%),  $\chi^2(1, N = 81) = 0.65, p = .421, \phi = 0.09$ . Completers (74.24% female) did not significantly differ from non-completers in terms of gender (73.33% female),  $\chi^2(1, N = 81) = 1.58, p = .663, \phi = 0.14$ , age ( $M = 21.82, SD = 6.60$  vs.  $M = 21.87, SD = 5.87$ ),  $F(1, 80) = 0.001, p = .979, d = 0.01$ , or race/ethnicity (60.61% vs. 66.67% non-Hispanic White),  $\chi^2$

Table 1. Demographic and Baseline Characteristics of Sample by Condition.

	Total ( <i>N</i> = 81)	Mindfulness ( <i>n</i> = 41)	Control ( <i>n</i> = 40)	F or $\chi^2$	<i>p</i>	<i>d</i> or Cramer's V
Age	21.83 (6.44)	23.22 (8.48)	20.4 (2.66)	4.03	0.051	0.04
Gender (% female)	74.07	70.73	77.50	3.06	0.383	0.19
Race/Ethnicity						
White/Non-Hispanic)	61.72	58.54	65.00	0.42	0.657	0.07
White/Hispanic (%)	2.47	2.44	2.50			
African-American (%)	8.64	12.20	5.00			
American Indian (%)	1.23	0.00	2.50			
Asian (%)	11.11	12.20	10.00			
Multiracial (%)	8.64	12.20	5.00			
Other (%)	6.17	2.44	10.00			
Employment status (%)	60.49	60.98	60.00	2.04	0.564	0.16
Family income	104,691.85 (125,839.13)	92,560.98 (79,324.03)	117,126.00 (160,362.49)	0.78	0.383	0.19
Student status (% student)	95.01	90.24	100.00	4.11	0.043	0.23
Level of education (% > high school)	76.54	80.49	72.50	8.48	0.132	0.32
Marital status (% single)	86.42	80.49	92.24	4.02	0.547	0.22
Treatment status (% in treatment)	28.40	26.83	30.00	0.10	0.752	0.04
SIAS-S <sup>a</sup>	45.28 (9.17)	44.15 (9.40)	46.45 (8.9)	1.28	0.261	0.25
PEP	45.04 (7.48)	45.59 (6.61)	44.47 (8.32)	0.44	0.508	0.15
Trait Mindfulness	126.30 (15.97)	125.44 (16.48)	127.17 (15.60)	0.24	0.628	0.11
State Anxiety	46.70 (18.49)	45.98 (18.13)	47.45 (19.05)	0.13	0.722	0.08
Number of daily surveys completed <sup>b</sup>	9.84 (4.55)	9.29 (4.81)	10.40 (4.25)	1.21	0.276	0.24

*Note.* SIAS-S = Social Interaction Anxiety Scale Straightforward version (Mattick & Clarke, 1998); PEP = Post-event processing; <sup>a</sup> administered at screening; <sup>b</sup> calculated for the follow-up period.

(1,  $N = 81$ ) = 0.19,  $p = .663$ ,  $\phi = 0.048$ . Completers also did not differ from non-completers on baseline trait PEP ( $M = 44.86$ ,  $SD = 7.20$  vs.  $M = 45.80$ ,  $SD = 8.87$ ),  $F(1, 80) = 0.19$ ,  $p = .664$ ,  $d = 0.12$ , state anxiety, ( $M = 46.32$ ,  $SD = 18.15$  vs.  $M = 48.40$ ,  $SD = 20.48$ ),  $F(1, 80) = 0.15$ ,  $p = .696$ ,  $d = 0.11$ , or trait mindfulness ( $M = 125.17$ ,  $SD = 16.96$  vs.  $M = 131.27$ ,  $SD = 9.48$ ),  $F(1, 80) = 1.80$ ,  $p = .184$ ,  $d = 0.46$ . Further, student participants did not differ from community participants on baseline trait PEP ( $M = 44.68$ ,  $SD = 7.37$  vs.  $M = 52.00$ ,  $SD = 7.07$ ),  $F(1, 80) = 3.77$ ,  $p = .056$ ,  $d = 1.01$ , state anxiety, ( $M = 46.01$ ,  $SD = 18.52$  vs.  $M = 60.00$ ,  $SD = 13.44$ ),  $F(1, 80) = 2.21$ ,  $p = .141$ ,  $d = 0.86$ , or trait mindfulness ( $M = 125.64$ ,  $SD = 16.05$  vs.  $M = 139.00$ ,  $SD = 7.26$ ),  $F(1, 80) = 2.72$ ,  $p = .103$ ,  $d = 1.07$ .

Of the 66 participants included in the final follow-up sample, four participants were excluded from the secondary analyses for not providing any daily surveys during one of the three time intervals (i.e., days 1-5, 6-9, 10-14). The final sample for our secondary analyses consisted of 62 participants (mindfulness  $n = 30$ , control  $n = 32$ ).

## Measures

**Trait Social Anxiety.** Participants completed the SIAS-S (Mattick & Clarke, 1998). Although the SIAS is a 20-item measure, the 17 straightforward worded items were used given that the total score of these items appear to be more valid indicators of social anxiety than the total score including the reverse scored items in both undergraduate and clinical samples (for review, see Rodebaugh et al., 2011). Items assessed social anxiety from 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*). The SIAS-S has evidenced excellent internal consistency in prior work (Rodebaugh, Woods, & Heimberg, 2007) and in the current sample ( $\alpha = .86$ ).



**Willingness.** Willingness to attend and comply with the 14-day protocol was assessed by asking the following yes or no question: “Are you willing and able to attend an in-lab study visit and complete a brief survey every day for the next two weeks?”

**The Post-event Processing Inventory (PEPI; Blackie & Kocovski, 2017).** The PEPI was administered to assess post-event processing. The PEPI contains trait (PEPI-T) and state (PEPI-S) forms with each form consists of 12 items. Items on the PEPI are rated on a five-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores representing higher trait or state PEP. Both forms of the PEPI evidenced good psychometric properties, including convergent, discriminant, divergent, incremental, and predictive validity, and the PEPI-T has shown good test-retest reliability (Blackie & Kocovski, 2017). The PEPI-T was administered at baseline and the PEPI-S at post-task assessment and daily during the two-week follow-up period. The trait form read, “Please rate each statement with regard to how you *generally* think following social situations.” The post-task assessment state form read, “Please rate each statement with regard to how much you are thinking about today’s social interaction right now,” whereas the daily state form read, “Please rate each statement with regard to how much you are thinking about the recent social situations right now.” The PEPI-T evidenced good internal consistency reliability in the current sample ( $\alpha = .89$ ) and the PEPI-S demonstrated excellent internal consistency reliability in the current sample ( $\alpha = .91$  and  $\alpha = .96$  for post-task and follow-up respectively).

**State Anxiety.** The anxiety version of the SUDS (Wolpe, 1958) was administered to assess state anxiety during the baseline assessment, post-training assessment, throughout the social anxiety induction task, post-task assessment, and daily during the two-week follow-up period. The one-item scale utilized a 0 (*totally relaxed, on the verge of sleep*) to 100 (*highest*

*anxiety that you have ever felt*) scale, with higher numbers indicating higher levels of state anxiety. Participants rated their state anxiety in the current moment by selecting the corresponding point on the scale. The SUDS has evidenced good convergent and discriminant validity (Kaplan, Smith, & Coons, 1995; Kim, Bae, & Chon Park, 2008).

**Level of Engagement.** Level of engagement in the thinking strategy (i.e., mindfulness or control) was assessed by asking the following instruction, “Please estimate the number of minutes you spent following the last audio-recorded instructions.”

## **Procedures**

First, participants were screened via Qualtrics, an online data collection website, for the following eligibility criteria: being 18 years of age or older, having clinically elevated social anxiety per the SIAS-S (Mattick & Clarke, 1998), and being willing to complete a two-week study protocol. Eligible participants were invited to attend one appointment in the laboratory. See Figure 2 for the baseline visit schedule.

During their baseline appointment, participants first provided written informed consent to participate in the study. All self-report measures were completed on Qualtrics. Participants completed the baseline assessment measures. Next, participants were randomly assigned to either the mindfulness training or no training (i.e., thinking as usual control group). Urn randomization (i.e., systematically biased in favor of balancing; Stout, Wirtz, Carbonari, & Del Boca, 1994) was used to randomize participants to ensure equal distribution of relevant variables (i.e., age, gender [1=female, 2=all other gender identities], race and ethnicity, recruitment source, social anxiety severity, trait PEP, trait mindfulness, currently receiving treatment for anxiety) between

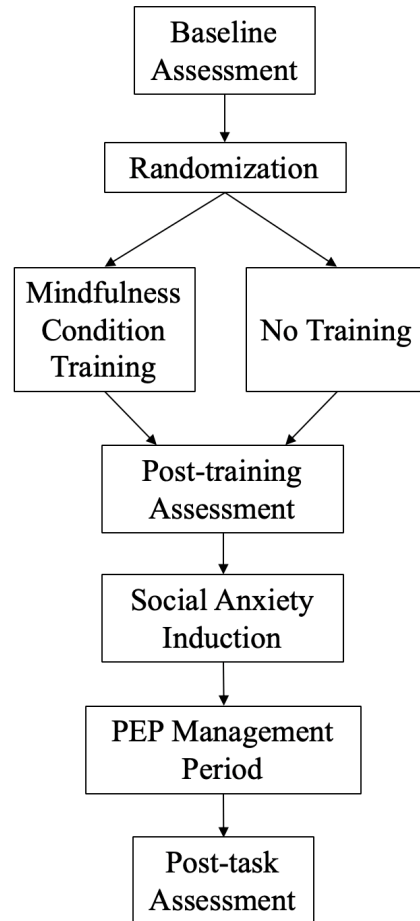


Figure 2. Laboratory visit schedule.

conditions. After randomization, participants completed their mindfulness training, which was also administered via Qualtrics, or received no training. Participants then completed the post-training assessment rating of their SUDS to confirm that mindfulness was related to less state anxiety than control.

Next, participants completed a social anxiety induction task, during which they were asked to introduce themselves to a confederate and make small talk with them for 3 minutes, per prior social anxiety induction studies (e.g., Buckner, Ecker, & Vinci, 2013). Participants were instructed to make a favorable impression on the confederate. The confederate was instructed to listen attentively but to not talk in response to the participant. Participants were also instructed that the interaction would be video recorded in order to further heighten anxiety. Participants rated their SUDS pre- (anticipatory phase; after participants were told about the task), mid-, and post-social anxiety induction. Next, participants completed a PEP management period during which they were instructed, via recorded instructions, to use their thinking strategy (i.e., mindfulness or thinking as usual) for the five minutes after the induction, as in prior work (Cassin & Rector, 2011; Shikatani et al., 2014). Following the PEP management period, participants completed post-task assessment of their state PEP and state anxiety (SUDS).

For the next 14 days, participants were emailed a Qualtrics link to be accessed daily each evening. A daily online method was chosen to reduce memory biases introduced by the elapsed time between experiences and one's reporting of the experiences (Bolger, Davis, & Rafaeli, 2003). Participants received the survey at 6:00pm each evening, and received three reminders (i.e., 7:00pm, 8:00pm, and 9:00pm) to complete the survey before the end of each day if the survey remained outstanding. The final reminder of each day (i.e., 9:00pm) reminded the participants of the monetary incentive given if they complete all their daily surveys.

The link included a PEP induction task during which participants were asked to think of a recent social situation and describe that situation in as much detail as possible, including details about negative aspects of their performance or others' negative reactions to their performance, using the script from Cassin and Rector's (2011) PEP induction. Following the PEP induction, participants were instructed to complete their mindfulness skill or thinking as usual using the same audio-recording as the in-lab visit. The number of minutes the participants listened to their audio-recording of their thinking strategy (i.e., mindfulness or thinking as usual) was recorded by Qualtrics (i.e., timer). However, because it is possible that participants would not attend to the recording while it was playing, participants were also asked to estimate the number of minutes they actively followed the audio-recorded instructions (i.e., level of engagement). Analyses were conducted using each of these variables as a moderator. Finally, participants were asked to complete questions assessing their state PEP and state anxiety.

**Confederate Training and Adherence.** As in prior work, confederates were undergraduate students who were trained to keep a neutral yet interested facial expression (Buckner, Zvolensky, Ecker, & Jeffries, 2016; De Boer, Schippers, & van der Staak, 1993). If a participant asked questions, the confederate responded, "Please stick to the instructions." If the participant was silent for more than five seconds, the confederate asked either, "Do you have any hobbies?" or "Is there anything you are specifically interested in?" A random selection of approximately 30% of task recordings were rated by a trained research assistant and a graduate student for adherence from 0 (*not at all neutral/interested*) to 7 (*very neutral/very interested*). Mean interest ( $M = 6.92$ ,  $SD = 0.28$ ) and neutrality were high ( $M = 5.71$ ,  $SD = 0.81$ ). Inter-rater reliability was good ( $\kappa = .91$ ) for the randomly selected sample of approximately 30% of recordings coded by both raters.

## **Intervention Conditions**

**Mindfulness condition:** Participants assigned to this condition underwent a task developed by Cassin and Rector (2011) given that the task resulted in reduced distress associated with PEP in their study. Specifically, participants were instructed to complete a mindful breathing exercise, using a script Cassin and Rector (2011) used, which they adapted from a prior brief mindfulness intervention study (Singer & Dobson, 2007). An audio-recording instructed participants to focus their attention on their current breathing, become aware of their current cognitive and physical states, accept their current thoughts and physical sensations, and switch their attention away from their current thoughts and physical sensations to their breathing. Once informed of the instructions, participants were instructed by the recording to practice the mindfulness task for five minutes. The recording reminded participants to acknowledge their current thoughts and refocus on their breathing every minute of the five-minute recording followed by silence.

**Control condition:** Participants in this condition did not receive training but completed a thinking as usual control task following the social anxiety and PEP induction tasks, which was developed by Cassin and Rector (2011), given that the task resulted in continued distress associated with PEP in their study. Specifically, they were instructed, through an audio-recording, to think about the social interaction how they normally would for the next five minutes. The recording reminded participants to think about the social interaction how they normally would every minute of the five-minute recording followed by silence.

## **Data analytic strategy**

First, to ensure that conditions did not differ on relevant variables, one-way analysis of variances (ANOVAs) were conducted for continuous variables and chi-square analyses for

categorical variables. Next, there were two manipulation checks. The first assessed whether training impacted SUDS using a 2 (condition: mindfulness vs. control) x 2 (time: baseline assessment vs. post-training assessment) mixed-model ANOVA. The second assessed whether the social anxiety induction impacted SUDS using a 2 (condition: mindfulness vs. control) x 5 (time: baseline assessment, post-training assessment, pre-, mid-, and post-social anxiety induction) mixed-model ANOVA.

To test the first hypothesis that condition would be related to less state PEP and state anxiety, two 2 (condition: mindfulness vs. control) x 2 (time: baseline assessment, post-task assessment) mixed-model ANOVAs were conducted with condition as the between-subject factor and time as the within-subject factor. Separate analyses were conducted for each dependent variable (i.e., state PEP, state anxiety). To test the second hypothesis that condition would be related to a significantly less follow-up state PEP and state anxiety, two 2 (condition: mindfulness vs. control) x 2 (time: baseline vs follow-up) mixed-model ANOVAs were conducted with condition as the between-subject factor and time as the within-subject factor. Follow-up dependent variables were calculated using the average of the 14 days. In the event of missing data, follow-up variables were calculated by determining the average number of days completed. Separate analyses were conducted for each dependent variable.

To test our hypotheses that the number of minutes participants use their coping strategy throughout the two-week follow-up period (i.e., timer and level of engagement) would moderate the relationship between condition and each continuous outcome (i.e., state PEP, state anxiety), a series of hierarchical linear regression models were conducted. Separate models were tested for each criterion variable for each measure of minutes. Predictor variables were: Step 1: baseline score for each outcome variable, Step 2: main effects of condition and number of minutes

participants utilized the coping strategy, and Step 3: the condition X number of minutes participants utilized the coping strategy. Both subjective and objective measure of minutes participants utilized their coping strategy were centered (Holmbeck, 2002).

Lastly, for the secondary analyses that condition would be related to a significant gradual lessening of state PEP and state anxiety during the 14-day follow-up period, two 2 (condition: mindfulness vs. control) x 3 (time: days 1-5, 6-9, 10-14) mixed-model ANOVAs were conducted with condition as the between-subject factor and time as the within-subject factor. Follow-up dependent variables were calculated using the average of each outcome variable for days in each time interval. Separate analyses were conducted for each dependent variable. Significant interactions were probed by examining interaction contrasts to test differences in the slopes between conditions.

Compliance with daily survey protocol was assessed by determining total number of daily surveys completed during the two-week follow-up period per participant. In line with prior work, participants were excluded from analyses concerning the daily survey period for providing less than six days of data (Farmer & Kashdan, 2012).

**A Priori Power Analysis and Sample Size.** Previous studies investigating the effects of mindfulness on social anxiety have found medium to large effects (for review see Shikatani et al., 2014). Thus, G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007) was used to estimate the sample size needed to detect a medium effect ( $f^2 = 0.25$ ) with power of 0.80 and an alpha level of .05 for a linear multiple regression analysis for our hypothesis that requires the largest sample using three predictor variables (e.g., condition, minutes, and condition x minutes interaction). According to G\*Power (Faul et al., 2007), 42 participants should provide sufficient power to test all hypotheses. Taking into account an 10% attrition rate from completing daily surveys for 14



days (Farmer & Kashdan, 2012), we needed to recruit at least 48 participants (24 per condition). Thus, our baseline ( $N = 81$ ) and daily survey ( $n = 66$ ) sample sizes should be sufficient to test study hypotheses.

## Results

### Sample Descriptives

We inspected the data for outliers (scores greater than 3.29 standard deviations above the mean; Tabachnick & Fidell, 2013), skew, and kurtosis. We observed an outlier for the following variables: daily survey timer ( $n = 1$ ). We removed outliers for each of these measures prior to conducting study analyses utilizing the measure. Table 2 presents means, standard deviations, skew, and kurtosis values for independent variables and dependent variables.

Table 2. Means, Standard Deviations, Skew, and Kurtosis of Study Variables.

	<i>M</i>	<i>SD</i>	Skew	Kurtosis
Baseline State Anxiety	46.70	18.49	0.24	-0.13
Baseline PEP	45.04	7.45	-0.36	-0.48
Baseline Post-task State Anxiety	51.40	23.30	-0.25	-0.95
Baseline Post-task PEP	46.10	7.45	-0.20	-0.01
Daily Survey Timer	59.12	33.03	0.74	0.14
Daily Survey Level of Engagement	58.58	33.33	0.76	0.16
Daily Survey State Anxiety	31.49	16.70	0.25	-0.66
Daily Survey PEP	41.36	9.07	-0.18	-0.17
Daily Survey days 1-5 State Anxiety	31.68	19.33	-0.34	-1.03
Daily Survey days 1-5 PEP	42.84	8.69	0.32	-0.43
Daily Survey days 6-9 State Anxiety	30.95	19.07	0.50	0.36
Daily Survey days 6-9 PEP	40.76	10.56	-0.37	-0.30
Daily Survey days 10-14 State Anxiety	30.50	17.32	0.72	0.14
Daily Survey days 10-14 PEP	40.65	10.64	0.23	0.41

Note. PEP = Post-event processing.

anxiety at baseline, or number of completed daily surveys (Table 1). Participants in the mindfulness condition were significantly older than those in the control condition. Further, there were significantly more current students in the control condition than in the mindfulness

condition. Thus, these variables were included as covariates in proceeding analyses. All baseline variables were significantly positively associated with one another (Table 3).

Table 3. Correlations among Baseline Variables.

	1	2	3	4
State Anxiety				
PEP	.39**			
Trait Mindfulness	.29**	.34**		
SIAS-S <sup>a</sup>	.33**	.47**	.30**	

*Note.* SIAS-S = Social Interaction Anxiety Scale Straightforward version (Mattick & Clarke, 1998); PEP = Post-event processing; <sup>a</sup> administered at screening; \*\*  $p < .01$ .

During the follow-up period, self-reported level of engagement was significantly positively correlated with state anxiety,  $r(66) = .26, p = .032$ , but not state PEP,  $r(66) = .09, p = .495$ . During the follow-up period, timer was not significantly correlated with state anxiety,  $r(66) = -.10, p = .425$ , or state PEP,  $r(66) = -.04, p = .759$ . Participants in the mindfulness condition reported a greater number of minutes using their coping strategy (i.e., self-reported level of engagement) during the follow-up period compared to the control condition,  $F(1, 64) = 9.83, p = .003, d = .08$ . Conditions did not differ on number of minutes the participants listened to the audio-recording of their thinking strategy recorded by Qualtrics (i.e., timer),  $F(1, 64) = 0.07, p = .795, d = .06$ . Participants exhibited a range of 165.84-9.52 minutes spent listening to the audio-recording of their thinking strategy (i.e., timer) total over the daily survey portion. Additionally, participants reported listening to the audio-recording of their thinking strategy between 149.93-7.00 minutes (i.e., level of engagement) total over the daily survey portion.

### Manipulation Checks

The 2 (condition: mindfulness vs. control) x 2 (time: baseline assessment vs. post-training assessment) interaction significantly predicted state anxiety following mindfulness training,  $F(1, 77) = 7.49, p = .008, \text{partial } \omega^2 = .08$ . There was no main effect of time,  $F(1, 77) = 2.03, p =$

.159, *partial*  $\omega^2 = .01$ , and no main effect of condition,  $F(1, 77) = 3.17, p = .079$ , *partial*  $\omega^2 = .03$ , although participants in the mindfulness condition reported significantly less anxiety after the training compared to the control condition  $F(1,77) = 5.99, p = .017, \omega^2 = .06$ . The interaction contrast was significant,  $F(1, 77) = 7.94, p = .006$ , *partial*  $\omega^2 = .08$ , suggesting that the mindfulness condition ( $M = 45.98, SD = 18.13$  to  $M = 39.29, SD = 21.00$ ) decreased at a greater rate relative to the control condition ( $M = 47.45, SD = 19.05$  to  $M = 46.63, SD = 21.08$ ; Figure 3).

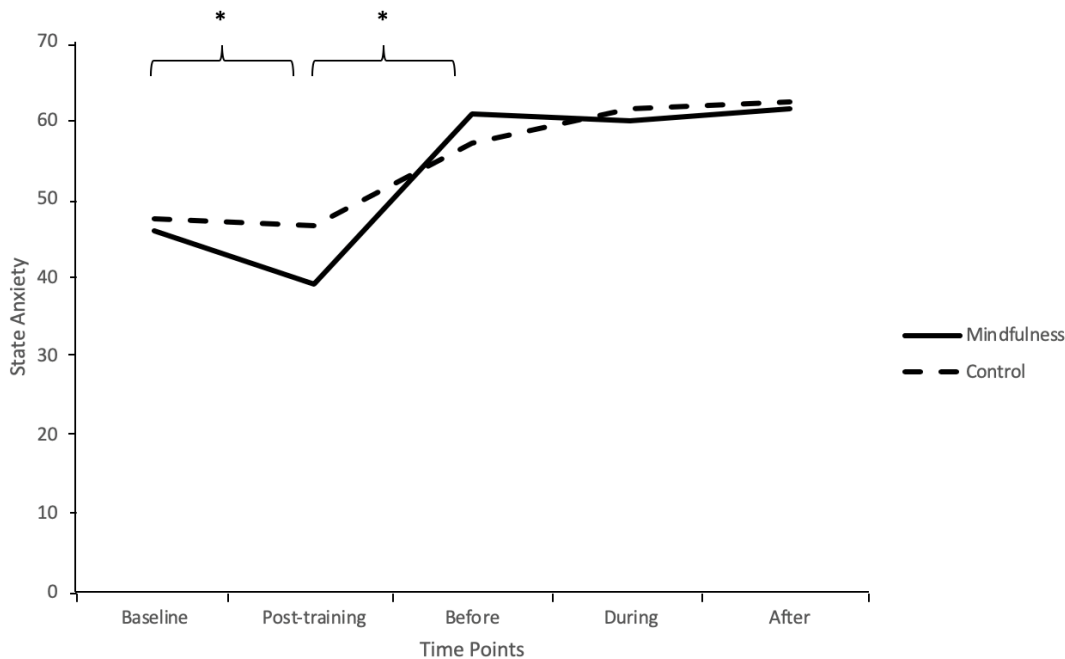


Figure 3. The interaction of time and condition in the prediction of state anxiety in response to mindfulness training and the social anxiety induction.

*Note.* Mindfulness condition was associated with a significant lessening of state anxiety from baseline to post-training compared to the control condition; Mindfulness condition was associated with a significant increase in state anxiety from post-training to pre-induction compared to the control condition; \*  $p < .05$ .

The 2 (condition: mindfulness vs. control) x 5 (time: baseline assessment, post-training assessment, pre-, mid-, and post-social anxiety induction) interaction was not significantly predictive of state anxiety following the social anxiety induction,  $F(4, 154.08) = 2.95, p = .055$ ,

$partial \omega^2 = .04$ . There was no main effect of time ( $F(4, 154.08) = 0.45, p = .641, partial \omega^2 = .00$ ), and no main effect of condition ( $F(1, 77) = 0.74, p = .392, partial \omega^2 = .00$ ). Conditions did not differ before ( $F(1, 77) = 0.11, p = .746, partial \omega^2 = .00$ ), during ( $F(1, 77) = 0.03, p = .864, partial \omega^2 = .00$ ), or after ( $F(1, 77) = 0.45, p = .504, partial \omega^2 = .00$ ) the social induction task (Figure 3). The increase in state anxiety were significantly greater in the mindfulness condition relative to the control condition from post-training to pre-anxiety induction,  $F(1, 77) = 8.06, p = .006, partial \omega^2 = .08$ ; however given that conditions did not differ on pre-anxiety induction state anxiety, this increase may reflect wearing off of the decrease in state anxiety experienced by those in the mindfulness condition following mindfulness training. The increase in state anxiety were not significantly different by condition from baseline assessment to pre-anxiety induction,  $F(1, 77) = 1.34, p = .251, partial \omega^2 = .01$  from baseline assessment to mid-anxiety induction,  $F(1, 77) = 0.39, p = .532, partial \omega^2 = .00$ , from baseline assessment to post-anxiety induction,  $F(1, 77) = .001, p = .981, partial \omega^2 = .00$ , from pre-induction to mid-induction,  $F(1, 77) = 1.59, p = .211, partial \omega^2 = .01$ , or from mid-induction to post-induction,  $F(1, 77) = 1.88, p = .175, partial \omega^2 = .01$ . In other words, the anxiety induction did not significantly increase anxiety at any of these timepoints by condition.

### **Impact of Condition on Post-task State Anxiety and State PEP**

Contrary to hypothesis, participants in the mindfulness condition ( $M = 48.39, SD = 21.90$ ) did not report less state anxiety post-task (following the social anxiety induction and PEP management period) compared to participants in the control condition ( $M = 54.47, SD = 24.55$ ),  $F(1, 77) = 0.68, p = .411, d = 0.26$ . Also contrary to hypothesis, participants in the mindfulness condition ( $M = 46.17, SD = 7.22$ ) did not report less state PEP post-task compared to participants in the control condition ( $M = 46.03, SD = 7.77$ ),  $F(1, 77) = 0.14, p = .707, d = 0.02$ .

### **Impact of Condition on Follow-up State Anxiety and State PEP**

Contrary to hypothesis, participants in the mindfulness condition ( $M = 27.85$ ,  $SD = 14.85$ ) did not report less mean state anxiety compared to participants in the control condition ( $M = 34.91$ ,  $SD = 17.81$ ) after the PEP induction tasks during the two-week follow-up period,  $F(1, 62) = 0.62$ ,  $p = .433$ ,  $d = 0.43$ . Also contrary to prediction, participants in the mindfulness condition ( $M = 39.26$ ,  $SD = 8.53$ ) did report less mean state PEP compared to participants in the control condition ( $M = 43.34$ ,  $SD = 9.25$ ) after the PEP induction tasks during the two-week follow-up period,  $F(1, 62) = 3.59$ ,  $p = .063$ ,  $d = 0.46$ .

### **Moderating Role of Time Spent Using Coping Strategy on State Anxiety and State PEP**

Contrary to prediction, time spent listening to instructions (as assessed by Qualtrics timer) did not moderate the relationship between condition and mean state anxiety after the PEP induction tasks during the two-week follow-up period (Table 4). Also contrary to prediction, Qualtrics timer, minutes of time spent listening to instructions, did not moderate the relationship between condition and average state PEP after the PEP induction tasks during the two-week follow-up period (Table 5). Notably, condition remained significantly associated with follow-up state PEP after accounting for the variance attributable to baseline PEP and timer (Table 5). Contrary to prediction, self-reported level of engagement did not moderate the relationship between condition and average state anxiety after the PEP induction tasks during the two-week follow-up period (Table 6). Also contrary to prediction, self-reported level of engagement did not moderate the relationship between condition and average state PEP after the PEP induction tasks during the two-week follow-up period (Table 7). Notably, condition remained significantly associated with follow-up state PEP after accounting for the variance attributable to baseline PEP and self-reported level of engagement (Table 7).

Table 4. Hierarchical Linear Regression of the Interaction of Condition x Objective Time (Minutes) Spent Listening to Instructions (per Qualtrics Timer) on Follow-up State Anxiety.

	$\Delta R^2$	$\Delta F$	$B$	$t$	$p$	$sr^2$
Step 1	0.00	0.12			0.892	
Age			0.03	0.07	0.945	0.00
Current Student			6.24	0.43	0.669	0.00
Step 2	0.29	25.19			< 0.001	
Baseline State Anxiety			0.50	5.02	< 0.001	0.29
Step 3	0.05	2.13			0.128	
Timer			0.05	1.07	0.290	0.01
Condition			-6.22	-1.75	0.085	0.04
Step 4	0.00	0.36			0.551	
Condition x Timer			-0.06	0.60	0.551	0.00

*Note.*  $B$  = unstandardized coefficient;  $sr^2$  = squared part (i.e., semipartial) correlations; Condition = Mindfulness (1) vs. Control (0).

Table 5. Hierarchical Linear Regression of the Interaction of Condition x Objective Time (Minutes) Spent Listening to Instructions (per Qualtrics Timer) on Follow-up State PEP.

	$\Delta R^2$	$\Delta F$	$B$	$t$	$p$	$sr^2$
Step 1	0.01	0.26			0.771	
Age			0.11	0.53	0.599	0.004
Current Student			5.61	0.71	0.483	0.007
Step 2	0.15	10.92			0.002	
Baseline PEP			0.51	3.31	0.002	0.15
Step 3	0.06	2.41			0.099	
Timer			0.008	0.26	0.795	0.00
Condition			-4.58	-2.18	0.033	0.06
Step 4	0.00	0.20			0.657	
Condition x Timer			-0.03	-0.45	0.657	0.00

*Note.*  $B$  = unstandardized coefficient;  $sr^2$  = squared part (i.e., semipartial) correlations; PEP= Post-event processing; Condition = Mindfulness (1) vs. Control (0).

Table 6. Hierarchical Linear Regression of the Condition x Self-Reported Level of Engagement Interaction on Follow-up State Anxiety.

	$\Delta R^2$	$\Delta F$	$B$	$t$	$p$	$sr^2$
Step 1	0.00	0.093			0.911	
Age			0.03	.08	0.941	0.00
Current Student			5.81	.39	0.696	0.00
Step 2	0.29	24.91			< .001	
Baseline State Anxiety			0.51	4.99	< .001	0.29
Step 3	0.05	2.40			0.099	
Level of engagement			0.09	1.62	0.111	0.02
Condition			-7.15	-1.90	0.062	0.03
Step 4	0.00	0.29			0.591	
Condition x Level of engagement			-0.06	-0.54	0.591	0.00

Note.  $B$  = unstandardized coefficient;  $sr^2$  = squared part (i.e., semipartial) correlations; Condition = Mindfulness (1) vs. Control (0).

Table 7. Hierarchical Linear Regression of the Condition x Self-Reported Level of Engagement Interaction on Follow-up State PEP.

	$\Delta R^2$	$\Delta F$	$B$	$t$	$p$	$sr^2$
Step 1	0.01	0.24			0.786	
Age			0.11	0.53	0.599	0.004
Current Student			5.41	0.67	0.503	0.007
Step 2	0.17	12.72			.001	
Baseline PEP			0.54	3.57	0.001	0.17
Step 3	0.05	2.05			0.138	
Level of engagement			0.00	0.09	0.931	0.00
Condition			-4.30	-1.96	0.051	0.05
Step 4	0.02	1.31			0.258	
Condition x Level of engagement			0.04	0.90	0.258	0.02

Note.  $B$  = unstandardized coefficient;  $sr^2$  = squared part (i.e., semipartial) correlations; PEP= Post-event processing; Condition = Mindfulness (1) vs. Control (0).



### Gradual Impact of Condition on State Anxiety and State PEP over Follow-up Period

We tested whether participants reported gradual reduction in state anxiety or state PEP using two 2 (condition: mindfulness vs. control) x 3 (time: days 1-5, 6-9, 10-14) mixed-model ANOVAs (one for each dependent variable). Contrary to hypothesis, the overall model for state anxiety was not significant,  $F(1.78, 103.24) = 0.30, p = .715, \text{partial } \omega^2 = 0.00$ . However, the overall model for state PEP was significant,  $F(2, 116) = 3.52, p = .033, \text{partial } \omega^2 = 0.04$  (Figure 4). Compared to those in the control condition, participants in the mindfulness condition did not report a greater decrease in state PEP from days 1-5 and 6-9,  $F(1, 58) = 3.75, p = .058, \text{partial } \omega^2 = 0.04$ , or from days 6-9 and 10-14,  $F(1, 58) = 0.49, p = .486, \text{partial } \omega^2 = 0.00$ . However, compared to the control condition, those in the mindfulness condition reported significantly greater decrease in state PEP from days 1-5 to 10-14,  $F(1, 58) = 5.14, p = .027, \text{partial } \omega^2 = 0.06$ .

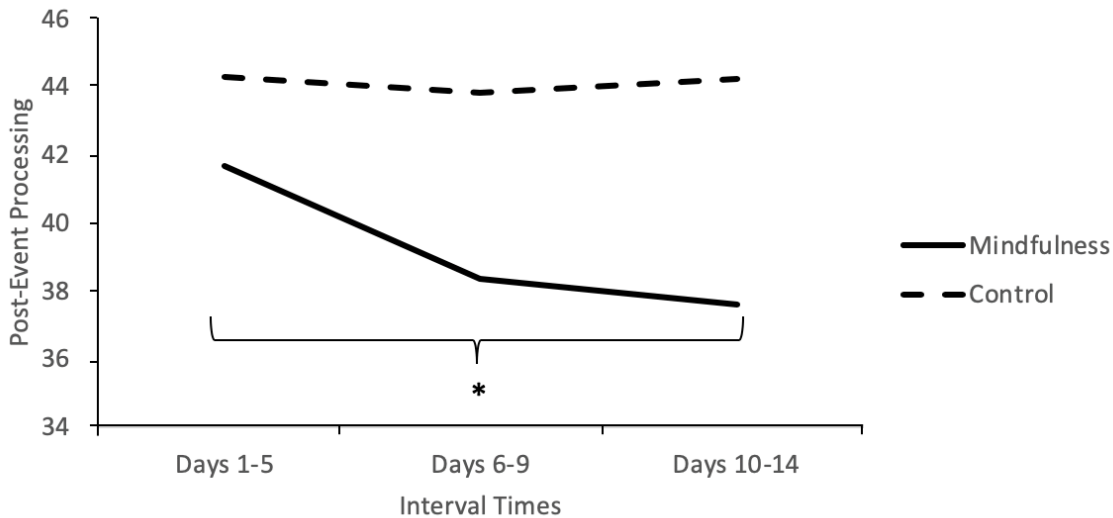


Figure 4. Significant the condition x time interaction in predicting post-event processing following post-event professing induction during the two-week follow-up period.

*Note.* Individuals in the mindfulness condition reported a significant decrease in state PEP from days 1-5 to 10-14 compared to individuals in the control condition; \*  $p < .05$ .

## Discussion

The current study tested whether a brief mindfulness intervention (compared to a thinking as usual control condition) reduced state anxiety and state PEP. The current study replicated the finding that mindfulness training results in less state anxiety compared to a control condition, consistent with the growing literature supporting the acute impact of mindfulness on PEP and anxiety (Cassin & Rector, 2011; Shikatani et al., 2014). The current study extended understanding of the impact of mindfulness in several ways. First, we tested whether mindfulness would be related to less state anxiety after a social anxiety induction task. The mindfulness condition was not associated with less state anxiety before, during, or after the task compared to the control condition. In fact, baseline state anxiety did not differ from pre-induction, suggesting that the induction may not have been successful in eliciting anxiety. On the other hand, results may indicate that one session of mindfulness may not be sufficient to reduce state anxiety in response to a social stressor.

Second, this is the first known study to test the longer-term impact of mindfulness on state PEP and associated anxiety. Participants in the mindfulness condition ( $M = 39.26$ ,  $SD = 8.53$ ) did not report significantly less state PEP compared to participants in the control condition ( $M = 43.34$ ,  $SD = 9.25$ ) after the PEP induction task during the two-week follow-up period. However, mindfulness was robustly related to less PEP after accounting for variance attributable to baseline PEP and an objective and subjective measure of time spent listening to the thinking (mindfulness vs thinking as usual) instructions. Importantly, individuals in the mindfulness condition reported lessening of state PEP gradually over the 14-day follow-up period such that individuals in the mindfulness condition reported a significant decrease in state PEP from days 1-5 to 10-14 compared to participants in the control condition. Notably, our findings are in contrast

to prior work finding that one mindfulness training session immediately reduced PEP after single use (Shikatani et al., 2014). One possible explanation is that Shikatani et al. assessed PEP following mindfulness training, whereas we assessed PEP following laboratory-induced state social anxiety and mindfulness strategy use. Thus, PEP may decrease after mindfulness training but not in response to a social situation. Taken together, these findings suggest that continued practice of the skill over time may be important for improvement in state PEP.

It is also noteworthy that mindfulness was not related to less state anxiety following PEP induction during the two-week follow-up period. Self-reported number of minutes participants used their thinking strategy and objective number of minutes the participants listened to the audio-recording of their thinking strategy did not moderate the relationship between condition and follow-up state anxiety and state PEP. Thus, the current study findings suggest that this brief mindfulness intervention did not impact state anxiety in response to social anxiety-provoking stimuli (i.e., social anxiety or PEP induction tasks), even with continued practice. This is consistent with the only other brief mindfulness intervention study with a follow-up period that found the mindfulness condition did not differ on distress after one day compared to the control condition (Shikatani et al., 2014). However, a group MBSR intervention (i.e., 8 weekly sessions) for individuals with social anxiety disorder resulted in decreased state anxiety (Goldin & Gross, 2010; Goldin et al., 2009). Additionally, an online-based mindfulness treatment study (e.g., daily practice for 8 weeks) evinced large decreases in anxiety from pre- to post-treatment compared to a control group and sustained such change at a 6 month follow up (Boettcher et al., 2014). Therefore, it is possible that with a longer period of time practiced, mindfulness practice may be useful for managing state anxiety among individuals with clinically elevated social anxiety.

Study findings should be considered in light of the study's limitations. First, the majority of the sample were non-Hispanic/Latinx White female college students. Although women are more likely to exhibit clinically elevated social anxiety (Xu et al., 2012), future work may benefit from testing whether results replicate in more diverse samples. Second, we chose a relatively short follow-up period (i.e., 14 days) and future work is necessary to test whether continued use of a brief mindfulness intervention is more useful in reducing state PEP and/or state anxiety over longer follow-up periods. Third, for the daily PEP induction task asked participants to think of a recent social situation to induce PEP per prior work (Cassin & Rector, 2011). Future work is needed to examine whether using the mindfulness intervention during real life PEP situations would also reduce state PEP. Fourth, future work is needed to understand whether incorporating this brief mindfulness task with standard CBT for SAD would be beneficial.

Despite these limitations, the current study provides novel information about the utility of mindfulness to manage PEP among those with clinically elevated social anxiety. Specifically, mindfulness may decrease state PEP following increases in state PEP. However, it may not impact state anxiety in response to anxiety-provoking situations. Thus, an important next step will be to test whether this intervention would aid CBT outcomes, given that individuals with greater levels of PEP improve at a decreased rate than those with lower levels of PEP (Price & Anderson, 2011). Such research could have important implications for prevention and intervention efforts among individuals with clinically elevated social anxiety.

## Appendix. IRB Approval

### ACTION ON PROTOCOL APPROVAL REQUEST



Institutional Review Board  
Dr. Dennis Landin, Chair  
130 David Boyd Hall  
Baton Rouge, LA 70803  
P: 225.578.8692  
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[irb@lsu.edu](mailto:irb@lsu.edu)  
[lsu.edu/research](http://lsu.edu/research)

**TO:** Julia Buckner  
Psychology

**FROM:** Dennis Landin  
Chair, Institutional Review Board

**DATE:** January 30, 2019

**RE:** IRB# 4173

**TITLE:** The Impact of Mindfulness Training on Post-Event Processing in Social Anxiety: A Multi-Method Investigation

**New Protocol/Modification/Continuation:** New Protocol

**Review type:** Full ☐ Expedited ☒ **Review date:** 12/20/2018

**Risk Factor:** Minimal ☒ Uncertain ☐ Greater Than Minimal ☐

**Approved** ☒ **Disapproved** ☐

**Approval Date:** 1/30/2019 **Approval Expiration Date:** 1/29/2020

**Re-review frequency:** (annual unless otherwise stated)

**Number of subjects approved:** 100

**LSU Proposal Number** (if applicable):

**By:** Dennis Landin, Chairman 

### PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –

#### Continuing approval is **CONDITIONAL** on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects\*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. **SPECIAL NOTE: When emailing more than one recipient, make sure you use bcc.**

*\*All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at <http://www.lsu.edu/irb>*

## References

- Abbott, M. J., & Rapee, R. M. (2004). Post-event rumination and negative self-appraisal in social phobia before and after treatment. *Journal of Abnormal Psychology, 113*(1), 136. doi:10.1037/0021-843x.113.1.136
- Abramowitz, J. S. (2013). The practice of exposure therapy: Relevance of cognitive-behavioral theory and extinction theory. *Behavior Therapy, 44*(4), 548-558. doi:10.1016/j.beth.2013.03.003
- Association, A. P. (2013). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5®)*: American Psychiatric Publications.
- Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., . . . Velting, D. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230-241. doi:10.1093/clipsy.bph077
- Blackie, R. A., & Kocovski, N. L. (2017). Development and validation of the trait and state versions of the Post-Event Processing Inventory. *Anxiety, Stress, & Coping, 30*(2), 202-218. doi:10.1080/10615806.2016.1230668
- Boettcher, J., Åström, V., Pålsson, D., Schenström, O., Andersson, G., & Carlbring, P. (2014). Internet-based mindfulness treatment for anxiety disorders: A randomized controlled trial. *Behavior Therapy, 45*(2), 241-253. doi:10.1016/j.beth.2013.11.003
- Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology, 54*(1), 579-616. doi:10.1146/annurev.psych.54.101601.145030
- Brozovich, F. A., & Heimberg, R. G. (2008). An analysis of post-event processing in social anxiety disorder. *Clinical Psychology Review, 28*(6), 891-903. doi:10.1016/j.cpr.2008.01.002
- Brozovich, F. A., & Heimberg, R. G. (2013). Mental imagery and post-event processing in anticipation of a speech performance among socially anxious individuals. *Behavior Therapy, 44*(4), 701-716. doi:10.1016/j.beth.2013.07.001
- Bruch, M. A., & Cheek, J. M. (1995). Developmental factors in childhood and adolescent shyness. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 163-178). New York, NY: Guilford Press.
- Buckner, J. D., Ecker, A. H., & Vinci, C. (2013). Cannabis use vulnerability among socially anxious users: Cannabis craving during a social interaction. *Psychology of Addictive Behaviors, 27*(1), 236. doi:10.1037/a0029763
- Buckner, J. D., Zvolensky, M. J., Ecker, A. H., & Jeffries, E. R. (2016). Cannabis craving in response to laboratory-induced social stress among racially diverse cannabis users: The impact of social anxiety disorder. *Journal of Psychopharmacology, 30*(4), 363-369. doi:10.1177/0269881116629115

- Cassin, S. E., & Rector, N. A. (2011). Mindfulness and the attenuation of post-event processing in social phobia: An experimental investigation. *Cognitive Behaviour Therapy*, 40(4), 267-278. doi:10.1080/16506073.2011.614275
- Chavira, D. A., & Stein, M. B. (2005). Childhood social anxiety disorder: From understanding to treatment. *Child and Adolescent Psychiatric Clinics*, 14(4), 797-818. doi:10.1016/j.chc.2005.05.003
- Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York, NY: Guilford Press.
- De Boer, M. C., Schippers, G. M., & van der Staak, C. P. F. (1993). Alcohol and social anxiety in women and men: Pharmacological and expectancy effects. *Addictive Behaviors*, 18(2), 117-126. doi:10.1016/0306-4603(93)90041-7
- Edwards, S. L., Rapee, R. M., & Franklin, J. (2003). Postevent rumination and recall bias for a social performance event in high and low socially anxious individuals. *Cognitive Therapy and Research*, 27(6), 603-617. doi:10.1023/A:1026395526858
- Farmer, A. S., & Kashdan, T. B. (2012). Social anxiety and emotion regulation in daily life: Spillover effects on positive and negative social events. *Cognitive Behaviour Therapy*, 41(2), 152-162. doi:10.1080/16506073.2012.666561
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G\* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175-191.
- Fehm, L., Beesdo, K., Jacobi, F., & Fiedler, A. (2008). Social anxiety disorder above and below the diagnostic threshold: Prevalence, comorbidity and impairment in the general population. *Social Psychiatry and Psychiatric Epidemiology*, 43(4), 257-265. doi:10.1007/s00127-007-0299-4
- Goldin, P. R., & Gross, J. J. (2010). Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. *Emotion*, 10(1), 83. doi:10.1037/a0018441
- Goldin, P. R., Morrison, A., Jazaieri, H., Brozovich, F., Heimberg, R. G., & Gross, J. J. (2016). Group CBT versus MBSR for social anxiety disorder: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 84(5), 427. doi:10.1037/ccp0000092
- Goldin, P. R., Ramel, W., & Gross, J. (2009). Mindfulness meditation training and self-referential processing in social anxiety disorder: Behavioral and neural effects. *Journal of Cognitive Psychotherapy*, 23(3), 242. doi:10.1891/0889-8391.23.3.242
- Gross, R., Olfson, M., Gameraoff, M. J., Shea, S., Feder, A., Lantigua, R., . . . Weissman, M. M. (2005). Social anxiety disorder in primary care. *General Hospital Psychiatry*, 27(3), 161-168. doi:10.1016/j.genhosppsych.2005.01.006

- Heimberg, R. G., Brozovich, F. A., & Rapee, R. M. (2014). A cognitive-behavioral model of social anxiety disorder. In S. G. Hofmann & P. M. DiBartolo (Eds.), *Social Anxiety* (pp. 705-728): Elsevier.
- Hofmann, S. G., Asnaani, A., Vonk, I. J. J., Sawyer, A. T., & Fang, A. (2012). The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research*, 36(5), 427-440. doi:10.1007/s10608-012-9476-1
- Holmbeck, G. N. (2002). Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology*, 27(1), 87-96. doi:10.1093/jpepsy/27.1.87
- Kabat-Zinn, J., & Hanh, T. N. (2009). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Delacourt.
- Kaplan, D. M., Smith, T., & Coons, J. (1995). A validity study of the subjective unit of discomfort (SUD) score. *Measurement and Evaluation in Counseling and Development*.
- Katzelnick, D. J., Kobak, K. A., DeLeire, T., Henk, H. J., Greist, J. H., Davidson, J. R. T., . . . Helstad, C. P. (2001). Impact of generalized social anxiety disorder in managed care. *American Journal of Psychiatry*, 158(12), 1999-2007. doi:10.1176/appi.ajp.158.12.1999
- Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, 62(6), 593-602. doi:10.1001/archpsyc.62.6.593
- Kim, D., Bae, H., & Chon Park, Y. (2008). Validity of the subjective units of disturbance scale in EMDR. *Journal of EMDR Practice and Research*, 2(1), 57-62. doi:10.1891/1933-3196.2.1.57
- Kocovski, N. L., Endler, N. S., Rector, N. A., & Flett, G. L. (2005). Ruminative coping and post-event processing in social anxiety. *Behaviour Research and Therapy*, 43(8), 971-984. doi:10.1016/j.brat.2004.06.015
- Kocovski, N. L., Fleming, J. E., Hawley, L. L., Huta, V., & Antony, M. M. (2013). Mindfulness and acceptance-based group therapy versus traditional cognitive behavioral group therapy for social anxiety disorder: A randomized controlled trial. *Behaviour Research and Therapy*, 51(12), 889-898. doi:10.1016/j.brat.2013.10.007
- Kocovski, N. L., Fleming, J. E., & Rector, N. A. (2009). Mindfulness and acceptance-based group therapy for social anxiety disorder: An open trial. *Cognitive and Behavioral Practice*, 16(3), 276-289. doi:10.1016/j.cbpra.2008.12.004
- Kocovski, N. L., & Rector, N. A. (2007). Predictors of post-event rumination related to social anxiety. *Cognitive Behaviour Therapy*, 36(2), 112-122. doi:10.1080/16506070701232090
- Leichsenring, F., Salzer, S., Beutel, M. E., Herpertz, S., Hiller, W., Hoyer, J., . . . Poehlmann, K. (2013). Psychodynamic therapy and cognitive-behavioral therapy in social anxiety



- disorder: A multicenter randomized controlled trial. *American Journal of Psychiatry*, 170(7), 759-767. doi:10.1176/appi.ajp.2013.12081125
- Mackinnon, S. P., Battista, S. R., Sherry, S. B., & Stewart, S. H. (2014). Perfectionistic self-presentation predicts social anxiety using daily diary methods. *Personality and Individual Differences*, 56, 143-148. doi:10.1016/j.paid.2013.08.038
- Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy*, 36(4), 455-470. doi:10.1016/S0005-7967(97)10031-6
- Mayo-Wilson, E., Dias, S., Mavranzouli, I., Kew, K., Clark, D. M., Ades, A. E., & Pilling, S. (2014). Psychological and pharmacological interventions for social anxiety disorder in adults: A systematic review and network meta-analysis. *The Lancet Psychiatry*, 1(5), 368-376. doi:10.1016/s2215-0366(14)70329-3
- McEvoy, P. M., Mahoney, A., Perini, S. J., & Kingsep, P. (2009). Changes in post-event processing and metacognitions during cognitive behavioral group therapy for social phobia. *Journal of Anxiety Disorders*, 23(5), 617-623. doi:10.1016/j.janxdis.2009.01.011
- McMahon, T. P., & Naragon-Gainey, K. (2018). The moderating effect of maladaptive emotion regulation strategies on reappraisal: A daily diary study. *Cognitive Therapy and Research*, 1-13. doi:10.1007/s10608-018-9913-x
- Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, 128(4), 638. doi:10.1037//0033-2909.128.4.638
- Price, M., & Anderson, P. L. (2011). The impact of cognitive behavioral therapy on post event processing among those with social anxiety disorder. *Behaviour Research and Therapy*, 49(2), 132-137. doi:10.1016/j.brat.2010.11.006
- Rachman, S., Grüter-Andrew, J., & Shafran, R. (2000). Post-event processing in social anxiety. *Behaviour Research and Therapy*, 38(6), 611-617. doi:10.1016/s0005-7967(99)00089-3
- Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy*, 35(8), 741-756. doi:10.1016/S0005-7967(97)00022-3
- Rodebaugh, T. L., Heimberg, R. G., Brown, P. J., Fernandez, K. C., Blanco, C., Schneier, F. R., & Liebowitz, M. R. (2011). More reasons to be straightforward: Findings and norms for two scales relevant to social anxiety. *Journal of Anxiety Disorders*, 25(5), 623-630. doi:10.1016/j.janxdis.2011.02.002
- Rodebaugh, T. L., Woods, C. M., & Heimberg, R. G. (2007). The reverse of social anxiety is not always the opposite: The reverse-scored items of the Social Interaction Anxiety Scale do not belong. *Behavior Therapy*, 38(2), 192-206. doi:10.1016/j.beth.2006.08.001
- Rowe, M. K., & Craske, M. G. (1998). Effects of an expanding-spaced vs massed exposure schedule on fear reduction and return of fear. *Behaviour Research and Therapy*, 36(7-8), 701-717. doi:10.1016/s0005-7967(97)10016-x

- Schneier, F. R. (2006). Social anxiety disorder. *New England Journal of Medicine*, 355(10), 1029-1036. doi:10.1056/NEJMcp060145
- Schneier, F. R., Heckelman, L. R., Garfinkel, R., Campeas, R., Fallon, B. A., Gitow, A., . . . Liebowitz, M. R. (1994). Functional impairment in social phobia. *The Journal of Clinical Psychiatry*.
- Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression*: Guilford Publications.
- Shikatani, B., Antony, M. M., Kuo, J. R., & Cassin, S. E. (2014). The impact of cognitive restructuring and mindfulness strategies on postevent processing and affect in social anxiety disorder. *Journal of Anxiety Disorders*, 28(6), 570-579. doi:10.1016/j.janxdis.2014.05.012
- Singer, A. R., & Dobson, K. S. (2007). An experimental investigation of the cognitive vulnerability to depression. *Behaviour Research and Therapy*, 45(3), 563-575. doi:10.1016/j.brat.2006.05.007
- Stein, M. B., Roy-Byrne, P. P., Craske, M. G., Bystritsky, A., Sullivan, G., Pyne, J. M., . . . Sherbourne, C. D. (2005). Functional impact and health utility of anxiety disorders in primary care outpatients. *Medical Care*, 43(12), 1164-1170. doi:10.2307/3768201
- Stein, M. B., & Stein, D. J. (2008). Social anxiety disorder. *The Lancet*, 371(9618), 1115-1125. doi:10.1016/S0140-6736(08)60488-2
- Stout, R. L., Wirtz, P. W., Carbonari, J. P., & Del Boca, F. K. (1994). Ensuring balanced distribution of prognostic factors in treatment outcome research. *Journal of Studies on Alcohol*, (12), 70-75. doi:10.15288/jsas.1994.s12.70
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6 ed.): Pearson Education, Inc.
- Tsao, J. C. I., & Craske, M. G. (2000). Timing of treatment and return of fear: Effects of massed, uniform-, and expanding-spaced exposure schedules. *Behavior therapy*, 31(3), 479-497. doi:10.1016/s0005-7894(00)80026-x
- Wang, P. S., Lane, M., Olfson, M., Pincus, H. A., Wells, K. B., & Kessler, R. C. (2005). Twelve-month use of mental health services in the United States: Results from the National Comorbidity Survey Replication. *Archives of General Psychiatry*, 62(6), 629-640. doi:10.1001/archpsyc.62.6.629
- Wolpe, J. (1958). *Psychotherapy by reciprocal inhibition*. Stanford, CA: Stanford University Press.
- Xu, Y., Schneier, F., Heimberg, R. G., Prins, A. L., Liebowitz, M. R., Wang, S., & Blanco, C. (2012). Gender differences in social anxiety disorder: Results from the national epidemiologic sample on alcohol and related conditions. *Journal of Anxiety Disorders*, 26(1), 12-19. doi:10.1016/j.janxdis.2011.08.006

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