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ORIGINAL ARTICLE

Manipulating Alcohol Expectancies in Social Anxiety: A Focus on Beliefs About Losing Control

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Abstract

Background Social anxiety is associated with increased *and* decreased alcohol use. Alcohol expectancies may help explain these inconsistencies. For example, a fear of losing control in front of others could motivate avoidance of alcohol. Similarly, cognitive models propose that individuals with elevated social anxiety believe they are at risk of behaving inappropriately and embarrassing themselves, indicating that beliefs about losing control over one's behaviour may be involved in social anxiety. This experiment aimed to manipulate negative alcohol expectancies about losing control to assess their impact on symptoms and processes associated with social anxiety.

Methods Ninety-three undergraduate participants (i.e., non-clinical sample) were randomly assigned to an alcohol, placebo, or control condition and were 'informed' that alcohol makes people lose control over their actions/speech. They then completed a 'getting to know you' task.

Results Participants in the placebo and alcohol (versus control) conditions experienced greater anxiety before and during the task and engaged in more post-event processing 24 h later. However, the physiological effects of alcohol influenced results: participants in the alcohol (versus placebo) condition experienced lower anticipatory anxiety, perceived themselves as making a better first impression, and demonstrated a lower reliance on safety behaviour.

Conclusions Although this experiment used a non-clinical sample, beliefs about losing control may be important to consider when conceptualizing social anxiety and treating associated symptoms from a cognitive-behavioural framework.

Keywords Social anxiety · Alcohol · Beliefs · Losing control · Post-event processing · Safety behaviour

Introduction

Social anxiety disorder (SAD) is characterized by elevated fear of situations in which being scrutinized or evaluated by others is possible (American Psychiatric Association [APA] 2013). Individuals with SAD fear behaving in a way or showing signs of anxiety that might lead to embarrassment, humiliation, and/or rejection (APA 2013). According to epidemiological surveys, the lifetime prevalence rate of SAD is 13% (Kessler et al. 2012). SAD is also associated with the development of other problems, including substance use (e.g., Schneier et al. 2010) and mood disorders (e.g., Koyuncu et al. 2014), and with substantial impairment in social and occupational domains (e.g., Aderka et al. 2012). Nonetheless, experiences associated with SAD fall on a continuum. Research on subclinical social anxiety has shown that 50% to 61% of individuals report being socially anxious in at least one situation (Hofmann and Roth 1996; Stein et al. 1994). As such, examining social anxiety in various samples, including non-clinical ones (e.g., university students), is important to better understand the spectrum of social anxiety and human behaviour (e.g., Purdon et al. 2001).

According to early cognitive models (e.g., Clark and Wells 1995; Leary 2001; Rapee and Heimberg 1997), individuals who experience social anxiety perceive social situations as threatening. Specifically, they believe they are at risk of behaving in an unacceptable manner and overestimate the cost of such behaviour (e.g., loss of status/worth and rejection). Unconditional beliefs about oneself (e.g., "I'm odd"), high standards for social performance (e.g., "I must appear smart all the time"), and assumptions about social evaluation (e.g., "If others see I'm odd, they'll reject me") are proposed to underlie these perceptions of threat. Importantly,

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cognitive-behavioural processes appear to play a role in the maintenance of symptoms, as they prevent disconfirmation of such beliefs and assumptions. For example, prior to a social situation, individuals with elevated social anxiety often engage in anticipatory processing (i.e., thinking about what might happen and focusing on negative images of oneself and/or past social failures), which is accompanied by anticipatory anxiety and, sometimes, avoidance of the situation altogether. During a social situation, it is not uncommon for those with social anxiety to rely on safety behaviour to prevent negative consequences from happening and/or alleviate their anxiety (e.g., speaking less, avoiding eye contact, holding nearby objects tightly to avoid shaking). After a social situation, engaging in post-event processing—or reviewing a social interaction with a focus on perceived negative aspects of the interaction—reinforces irrational beliefs/assumptions and transforms the event into another social failure for the individual (e.g., Clark and Wells 1995).

Alternative (but complementary) models of social anxiety suggest that perceived anxiety control, or the extent to which one believes they have control over their anxiety response, plays a key role in the aetiology and maintenance of symptoms (Hofmann 2005; Hofmann and Barlow 2002; Rapee et al. 1996). In other words, individuals with social anxiety avoid social situations in part because they fear *losing* control over their emotional response (i.e., "emotional bursts", Hofmann 2005, p. 887). This idea has been captured in items of self-report measures of SAD (e.g., "I worry I'll lose control in front of other people"; Mattick and Clarke 1998) and psychometric findings have provided evidence for these alternative models. For instance, the relationship between estimated social cost and anxiety in a given social situation has been shown to be mediated by perceived anxiety control (Hofmann 2005).

These models are in line with earlier research showing that beliefs about control over one's emotions are central cognitions across anxiety disorders (e.g., Glass and Singer 1970). However, beliefs about control cover a range of psychological functions beyond emotions. For instance, a fear of losing control over one's bodily sensations has been documented in panic disorder (e.g., Hedley et al. 2001). Also, individuals with obsessive–compulsive disorder (OCD) report a fear of losing control over their thoughts and, as a result, over their behaviour (e.g., Clark 2004; Gagné and Radomsky 2017, 2020). Again, cognitive models emphasize that individuals with social anxiety *believe* they are at risk of behaving in an unacceptable fashion and of embarrassing themselves (e.g., Clark and Wells 1995), indicating that negative beliefs about losing control over one's *behaviour* may be involved in the maintenance of experiences associated with social anxiety.

Research investigating the complex relationship between social anxiety and alcohol use also appears to support the importance of negative beliefs about losing control over one's behaviour. Interestingly, social anxiety is associated with *both* increased risk for alcohol use disorder (e.g., Himle and Hill 1991; Regier et al. 1990) and lower levels of alcohol use (e.g., Bruch et al. 1992; Rohsenow 1983; Tran et al. 1997). Other research has found no association between these two variables (e.g., Buckner et al. 2006). It has been proposed that alcohol expectancies—one's *beliefs* about the consequences of drinking—may explain these inconsistent findings (e.g., Brown et al. 1980; Goldman et al. 1987). On the one hand, individuals with positive alcohol expectancies may believe that drinking will allow them to alleviate their anxiety—the basic idea behind tension reduction theory (Conger 1951, 1956; Greeley and Oei 1999). On the other hand, those with negative alcohol expectancies may believe that drinking will lead to behavioural impairment and embarrassment in front of others (e.g., Eggleston et al. 2004; Fromme et al. 1993). As such, this fear of behaving in an unacceptable fashion and/or of embarrassing oneself may underlie avoidance of alcohol for some individuals with social anxiety (e.g., Eggleston et al. 2004). In support of this hypothesis, research has shown that, among individuals with lower levels of positive alcohol expectancies, those with higher social anxiety symptoms were significantly less likely to use alcohol (Tran et al. 1997). Also, it has been demonstrated that alcohol expectancies operate as a suppressor variable, such that adding this variable in regression models reveals a significant, negative relationship between shyness and alcohol use (e.g., Bruch et al. 1992).

The goal of the current experiment was to manipulate negative alcohol expectancies pertaining to losing control over one's behaviour (i.e., the belief that alcohol puts you at risk of losing control over your behaviour and that this can lead to embarrassment) as a way to assess their impact on symptoms and processes associated with social anxiety. As such, in this experiment, participants were randomly assigned to drinking vodka with orange juice (i.e., alcohol condition), alcohol-free vodka with orange juice (i.e., placebo condition), or orange juice only (i.e., control condition). Participants were then exposed to a prime targeting these negative alcohol expectancies and were asked to interact with a stranger (i.e., a research assistant during a 'getting to know you' task). The placebo condition was included to observe the unique contribution of these negative beliefs about losing control (without intoxication).

The rationale underlying our predictions was that negative beliefs about losing control over one's behaviour would be the primary ingredient driving the development of experiences related to social anxiety. Accordingly, it was hypothesized that participants in the alcohol and placebo conditions would provide similar (i.e., not significantly different) ratings of anticipatory anxiety, anxiety during the 'getting to know you' task, perceived social competence (i.e., perception of

the first impression they made), and post-event processing. It was also predicted that ratings of anticipatory anxiety, anxiety during the 'getting to know you' task, and post-event processing would be significantly lower in the control (versus alcohol and placebo) condition. However, it was hypothesized that ratings of subjective first impression would be significantly higher in the control (versus alcohol and placebo) condition. Length of time spent speaking during the 'getting to know you' task was included as an exploratory measure of safety behaviour and was thus also compared across conditions. Previous experimental work by Battista et al. (2012) has shown that, for socially anxious individuals, drinking alcohol (versus orange juice) reduces the tendency to rely on safety behaviour (e.g., increased speaking time), and so including this variable appeared informative. Battista and colleagues conceptualized reduced speaking time as a form of avoidance or safety behaviour as participants might be 'holding back' when providing shorter answers.

Method

Participants

Participants were 93 undergraduate students recruited from Concordia University. There were 31 participants in each condition. The sample size was consistent with results from a priori power analyses conducted with G*Power 3.1 (Faul et al. 2009), in which parameters were entered as follow: $f=0.33$; $\alpha=0.05$; $1-\beta=0.80$; groups = 3. Participants either received $10 per hour or course credits for participating. To be eligible, they had to meet the following criteria: (1) 18 years of age or older; (2) fluent in English; (3) must have consumed at least one alcoholic drink in the past month; (3) no history of or current problem with alcohol use; (4) not pregnant, trying to get pregnant, or breastfeeding; (5) not taking medications for which alcohol consumption is contraindicated; (6) no current medical conditions that would make alcohol consumption problematic; (7) not advised by any health professionals not to consume alcohol; and 8) no history of head injuries. Participants' mean age was 22.16 ($SD=2.90$; range 18–32) years. Also, 70.97% of the sample was female ($n=66$) and 55.91% of the sample was Caucasian ($n=52$). There were no significant differences in terms of age, $F(2, 90)=2.20$, $p=0.12$, sex, $\chi^2(2)=0.31$, $p=0.86$, ethnicity, $\chi^2(12)=10.52$, $p=0.57$, or educational attainment, $\chi^2(8)=6.85$, $p=0.55$, between the three conditions.

Measures

Demographics

Participants provided general demographic information (e.g., age, sex, ethnicity, and educational attainment).

Manipulation checks

Two manipulation checks were included in this experiment.

Sensation Scale To assess participants' perceptions of their physiological experience/intoxication level, they completed the Sensation Scale (Maisto et al. 1980). Participants were asked to rate the extent to which they experienced 31 physical sensations associated with alcohol consumption (e.g., drowsy, nauseous, warm), on a scale from 0 ("not at all") to 10 ("a great deal"). Because our formulas targeted a breath alcohol concentration (BrAC) of approximately 0.08 gm%, it was expected that participants in the alcohol (versus placebo and control) condition would score significantly higher on this measure (e.g., Martin et al. 1990). Still, it was expected that participants in the placebo condition, relative to those in the control condition, would also score significantly higher on this measure (e.g., Abbey et al. 2005).

Beliefs About Losing Control To assess the extent to which participants believed they could lose control over their behaviour after drinking their assigned beverages, they were asked the following question: "On a scale from 0 ("not at all") to 100 ("extremely"), to what extent do you believe you could lose control over what you do and/or say because of the drinks you just had?" (adapted from Gagné and Radomsky 2017). It was expected that participants in the alcohol and placebo conditions would provide similar (i.e., not significantly different) ratings on this item, and that their ratings would be significantly higher than those in the control condition.

Credibility Checks

Two credibility checks were included in this experiment.

Alcohol To assess the extent to which participants believed they had actually consumed alcohol, they were asked the following question at the end of the protocol: "On a scale from 0 ("did not believe it at all") to 100 ("believed it completely"), to what extent did you believe that you were drinking alcohol?". Based on previous work (see Testa et al. 2006 for a review), it was expected that participants in the alcohol (versus placebo and control) condition would score significantly higher on this question; it was also expected that participants in the placebo condition, relative to the control condition, would score significantly higher on this question.

Purpose of the Study To assess the extent to which participants believed the false purpose of the study (i.e., investigating the relationship between alcohol and first impressions), they were asked the following question at the end: "On a scale from 0 ("did not believe it at all")

to 100 ("believed it completely"), to what extent did you believe that the study examined alcohol and first impressions?". No significant differences were expected between the three conditions.

Anticipatory Anxiety

To assess the extent to which participants felt anxious about meeting the research assistant (i.e., anticipatory anxiety), they were asked the following question after drinking their assigned beverages and prior to the 'getting to know you' task: "On a scale from 0 ("neutral/not anxious at all") to 100 ("the worst anxiety you can imagine"), to what extent are you anxious about meeting the research assistant?" (adapted from Wolpe 1958).

Anxiety During the 'Getting to Know You' Task

To assess the extent to which participants felt anxious during the 'getting to know you' task, they were asked the following question immediately after completing the task: "On a scale from 0 ("neutral/not anxious at all") to 100 ("the worst anxiety you can imagine"), how anxious did you feel during the social interaction?" (adapted from Wolpe 1958).

Subjective First Impression

To assess participants' perception of their social competence, they were asked to provide a subjective rating of the first impression they made during the 'getting to know you' task. Immediately after completing the task, they were asked the following question: "On a scale from 0 ("worst impression") to 100 ("best impression"), how good a first impression do you think you made?".

Post-Event Processing Questionnaire—Revised (PEPQ-R)

The PEPQ-R (McEvoy and Kingsep 2006; adapted from Rachman et al. 2000) is a 14-item self-report measure. It was used to assess the extent to which participants engaged in post-event processing 24 h following the laboratory session. A link to the questionnaire was sent to them via email. Instructions were modified to ensure participants had the 'getting to know you' task with the research assistant in mind when completing the questionnaire. The first item focuses on how much anxiety participants experienced, and the other thirteen items are directly related to the extent to which they engaged in post-event processing (0 = "not at all"; 100 = "extremely"). The 14-item version has been shown to have good internal consistency ($\alpha = 0.87$; McEvoy and Kingsep 2006), which was the case in the current sample as well ($\alpha = 0.85$).

Table 1 Means and standard deviations of breath alcohol concentration (gm%) for participants in the alcohol condition

Timepoint	*M*	*SD*
Baseline	0.00	0.00
End of absorption period	0.07	0.01
Before GTKY task	0.08	0.02
After GTKY task	0.08	0.02
Peak concentration	0.09	0.02

For participants in the alcohol condition, breath alcohol concentration was measured at baseline, at the end of the 20-min absorption period, and then after every 10-min window (i.e., one measure took place before the 'getting to know you' task and one after the task) until peak concentration was determined. For participants in the placebo condition, breath alcohol concentration (i.e., 0.00 gm%) was also measured at the same timepoints to make the procedure believable. For participants in the control condition, breath alcohol concentration was only measured at baseline (i.e., 0.00 gm%). *M* = mean. *SD* = standard deviation. GTKY task = 'getting to know you' task. $n = 31$

Speaking Time

Participants' speaking time during the 'getting to know you' task was measured (in seconds) and was used as an index of safety behaviour, with shorter speaking times indicating a higher reliance on safety behaviour (see Battista et al. 2012). Because the research assistant was trained to follow a script and always provide the same responses, the full length of the 'getting to know you' task was used as the dependent variable (such that only variations in participants' responses/speaking time would influence the total length of the interaction).

Materials

Breathalyzer

An Alco-Sensor IV breathalyzer device (Intoximeters, Inc. 1997) was used throughout the protocol to assess participants' BrAC. Please see Table 1 for means and standard deviations of BrAC for those in the alcohol condition throughout the protocol.

Procedure

Those interested in participating in this study signed up to complete a screening questionnaire through Concordia University's participant pool. The questionnaire assessed the abovementioned eligibility criteria (including demographic information); potential participants received course credits

for completing this part. If eligible, potential participants were contacted via email and were provided with key information about the laboratory session. If interested, a session was scheduled. Participants were instructed not to drink alcohol, smoke cannabis, or take medications for twelve hours prior to the session, not to eat and drink anything (other than water) for three hours prior to the session, and not to drive a car or ride a bike to campus.

Upon arriving to the laboratory, participants entered a waiting room and were asked to verify their responses on the screening questionnaire. All participants denied any changes since completing the questionnaire. The other eligibility criteria (e.g., not driving) were also verified. Participants were told that the study focuses on how alcohol influences people's first impressions of others but especially others' first impression of them (i.e., incomplete/false purpose of the study). They were provided with information about the protocol (e.g., "you will be randomly assigned to the alcohol or orange juice condition") but no information about the placebo condition was provided. They then read and signed the consent form.

To begin, participants' baseline BrAC was assessed to ensure a reading of 0.00 gm% (which was the case for all participants). Then, their weight was measured using a digital scale. Afterwards, they were asked to move to a laboratory room (i.e., the 'bar') designed to look like a contemporary bar as a way to enhance ecological validity.

Participants sat on a stool at the bar and the experimenter remained behind the bar (i.e., typical position of a bartender). Participants were then randomly assigned to one of the three conditions using an online randomizer and were informed of the results—although those in the placebo condition were told that they had been randomly assigned to the alcohol condition. The experimenter prepared the drinks according to their condition and participants were able to observe the process. Drinks were prepared based on a formula commonly used in studies involving alcohol (e.g., MacDonald et al. 2000). This formula is designed so that participants in the alcohol condition reach a BrAC of approximately 0.08 gm%. In the alcohol condition, participants received a mix of vodka and orange juice (women: 2.28 ml 50% USP units of alcohol per kilogram of body weight, mixed 1:4 parts vodka/orange juice; men: 2.73 ml 50% USP units of alcohol per kilogram of body weight, mixed 1:4 parts vodka/orange juice). In the placebo condition, participants received a mix of alcohol-free vodka and orange juice (same total volume of liquid as in the alcohol condition based on sex and weight but 60% of the volume was alcohol-free vodka and 40% of the volume was orange juice). Of note, the alcohol-free vodka was presented in an identical bottle as the alcoholic vodka. In the control condition, participants received orange juice (same total volume of liquid as in the alcohol condition based on sex and weight but 100% of the volume was orange juice). The total volume was equally distributed into three glasses (i.e., three drinks to consume). Participants were given five minutes to consume each drink. The experimenter left the 'bar' while participants were drinking but came back every five minutes to give them the next drink.

This step was followed by a 20-min absorption period. The experimenter told participants that he would take advantage of that waiting time to provide them with information about the negative consequences of consuming alcohol (i.e., prime). Participants were 'informed' that alcohol lowers inhibitory capacities and that it can make people lose control over what they do and what they say around others. They were also told that this explains why people often do or say embarrassing things under the influence of alcohol. Those in the control condition were told that they were protected from these negative consequences given that they had only received orange juice. Then, participants were given information about the upcoming 'getting to know you' task. They were told that they would soon get to know a research assistant who is completely sober and who has experience in meeting new people for this study. Participants were also told that they would be videorecorded and that they would evaluate each other's performance after the interaction. For the rest of the absorption period, participants remained by themselves in the 'bar' and were asked to read a 'brochure' about the negative consequences of drinking (i.e., prime). This bogus document was created to reiterate similar information as mentioned above (i.e., alcohol can make people lose control over their behaviour). Bogus references and logos of health agencies and of the university were included on the document.

After the absorption period, the experimenter came back and asked all participants to rinse their mouth for ten seconds and to repeat this procedure three times. Then, for participants in the alcohol and placebo conditions, their BrAC was measured. They were not informed of their BrAC at any point. Afterwards, participants moved to a computer room to answer the two manipulation check questions and to provide a rating of their anticipatory anxiety. The form included a number of filler questions to hide the true purpose of the study (e.g., "On a scale from 0 ("not tasty at all") to 100 ("extremely tasty"), how tasty were the drinks you just had?"). They then moved back to the 'bar' and sat on the same stool.

The experimenter provided participants with instructions regarding the upcoming 'getting to know you' task. They were given a document with 15 questions and were told that the research assistant had been 'randomly assigned' to ask questions with an odd number, such that participants would ask questions with an even number. In reality, the research assistant was always assigned questions with odd numbers to ensure she followed the script. Then, for participants in the

alcohol and placebo conditions, their BrAC was measured (i.e., ten minutes since the last measure). The videorecorder was turned on and the experimenter left the 'bar'.

For the 'getting to know you' task, the research assistant sat close to the participant (i.e., there was always one empty stool between them). The research assistant asked the first question and participants answered back. Then, participants asked the second question and the research assistant answered back according to the script (so forth and so on until they reached the fifteenth question). The document included questions about past experiences, the future, and hypothetical scenarios (e.g., "What would constitute a perfect day for you?"). The 'getting to know you' task was timed to measure participants' speaking time. The same female research assistant interacted with all participants. She was trained to remain neutral by not displaying any positive or negative emotional reactions following participants' responses. After the task, the experimenter came back in the 'bar' and provided participants and the research assistant with 'evaluation sheets'. Participants were asked to provide a rating of their anxiety level during the social interaction and a rating of their subjective first impression. The form included a number of filler questions to hide the true purpose of the study (e.g., "On a scale from 0 ["worst impression"] to 100 ["best impression"], how good a first impression did the research assistant make?"). The research assistant left the 'bar' after 'completing' her form. Then, for participants in the alcohol and placebo conditions, their BrAC was measured (i.e., ten minutes since the last measure).

Participants moved to the waiting room for the detoxification period. All participants waited for at least 1.5 h to ensure consistency across conditions. During this time, no phones or computers were allowed to control for social interactions. Participants were provided with snacks and coffee/tea/water and were allowed to read and/or rest. For participants in the alcohol condition, their BrAC was monitored to determine peak concentration and when they would be able to leave the laboratory (i.e., at or below 0.04 gm%). For participants in the placebo condition, their BrAC was 'monitored' in the same manner to mimic this procedure. After 1.5 h, all participants moved to the computer room to answer the two credibility check questions. They then came back to the waiting room for the partial debriefing: they were provided with all information pertaining to the study (including the existence of a placebo condition) but no information regarding post-event processing was mentioned. They were told that they would receive a follow-up questionnaire by email in 24 h and were asked to complete it as soon as they received it. Participants were compensated and left the laboratory, although those in the alcohol condition typically had to wait for their BrAC to further decrease.

Twenty-four hours later, participants were sent a link to the PEPQ-R. After completing the questionnaire, a full debriefing document appeared and included contact information.

Statistical Plan

There were two univariate outliers on anxiety ratings during the 'getting to know you' task, one on PEPQ-R scores, and one on speaking time during the 'getting to know you' task. Each outlying score was replaced with the next highest score within 3.29 standard deviations of the mean (Tabachnick and Fidell 2007). There were no multivariate outliers and no missing data. For all dependent variables, skewness and kurtosis were found to be acceptable (Kline 2009).

For primary analyses, a one-way analysis of variance (ANOVA) was conducted to assess condition differences for each of the variables below (i.e., manipulation checks, credibility checks, and dependent variables). If significant ($p < 0.05$), the one-way ANOVA was followed by three independent samples *t*-tests to examine comparisons between the three conditions. Given the number of planned comparisons, a Bonferroni correction was applied ($\alpha = 0.05/3 \approx 0.02$).

Results

Manipulation Checks

Perception of Physiological Experience

There were significant differences between conditions on Sensation Scale scores, $F(2, 90) = 47.38$, $p < 0.001$, $\eta_p^2 = 0.51$. As expected, participants in the alcohol condition had significantly higher scores on the Sensation Scale, relative to those in the control condition, $t(34.30) = -9.21$, $p < 0.001$, $d = 2.34$. As predicted, participants in the alcohol condition also had significantly higher scores on the Sensation Scale, relative to those in the placebo condition, $t(52.49) = 5.60$, $p < 0.001$, $d = 1.42$. Finally, as hypothesized, participants in the placebo condition had significantly higher scores on the Sensation Scale, relative to those in the control condition, $t(39.34) = -3.86$, $p < 0.001$, $d = 0.98$. Please see Table 2 for means and standard deviations.

Beliefs About Losing Control

There were significant differences between conditions on ratings of beliefs about losing control over one's behaviour, $F(2, 90) = 27.93$, $p < 0.001$, $\eta_p^2 = 0.38$. As expected, participants in the alcohol condition had significantly higher scores on this manipulation check, relative to those in the control condition, $t(60) = -8.76$, $p < 0.001$, $d = 2.23$. As predicted, participants in the placebo condition also had significantly higher scores on this manipulation check, relative to those in

Table 2 Means and standard deviations of experimental variables by condition

Variable	Alcohol[a]		Placebo[a]		Control[a]		*F*	*p*	η_p^2
	M	*SD*	*M*	*SD*	*M*	*SD*			
Physiological experience	103.87	50.00	43.29	33.58	18.19	13.42	47.38	< 0.001	0.51
Beliefs about losing control	66.29	24.46	52.26	39.09	10.81	25.40	27.93	< 0.001	0.38
Credibility (alcohol)	94.16	15.21	57.68	38.03	.32	1.80	123.82	< 0.001	0.73
Credibility (purpose)	70.29	25.42	71.77	30.76	64.84	26.03	0.55	0.58	0.01
Anticipatory anxiety	30.55	27.29	48.23	25.74	14.87	20.81	14.07	< .001	0.24
Anxiety during GTKY task	41.61	29.75	48.55	31.52	25.16	19.04	5.99	0.004	0.12
Subjective first impression	63.23	16.91	50.19	22.73	63.64	14.82	5.32	0.01	0.11
Post-event processing	412.39	168.31	444.74	227.71	314.00	130.60	4.44	0.02	0.09
Speaking time	372.13	100.69	342.16	97.43	295.81	60.50	5.90	0.004	0.17

"Physiological experience" represents participants' scores on the Sensation Scale (Maisto et al. 1980). "Post-event Processing" represents participants' scores on the Post-Event Processing Questionnaire—Revised (McEvoy and Kingsep 2006; adapted from Rachman et al. 2000); they were asked to complete the measure 24 h after the end of the protocol. "Speaking time" represents the duration of the 'getting to know you task' (in seconds); because the research assistant was following a script, variations in speaking time across conditions is a reflection of the participants' speaking time. "Speaking time" was taken as an index of safety behaviour: shorter speaking times (i.e., talking less) is associated with a higher reliance on safety behaviour

[a]$n = 31$

the control condition, $t(51.50) = -4.95$, $p < 0.001$, $d = 1.26$. Finally, as hypothesized, there were no significant differences on this manipulation check between the alcohol and placebo conditions, $t(50.37) = 1.69$, $p = 0.10$, $d = 0.43$. Please see Table 2 for means and standard deviations.

Credibility Checks

Alcohol

There were significant differences between conditions on the credibility check assessing the extent to which participants believed they had consumed alcohol, $F(2, 90) = 123.82$, $p < 0.001$, $\eta_p^2 = 0.73$. As expected, participants in the alcohol condition had significantly higher scores on this credibility check, relative to those in the control condition, $t(30.84) = -34.12$, $p < 0.001$, $d = 8.66$. As predicted, participants in the alcohol condition also had significantly higher scores on this credibility check, relative to those in the placebo condition, $t(39.36) = 4.96$, $p < 0.001$, $d = 1.26$. Finally, as hypothesized, participants in the placebo condition had significantly higher scores on this credibility check, relative to those in the control condition, $t(30.13) = -8.39$, $p < 0.001$, $d = 2.13$. Please see Table 2 for means and standard deviations.

Purpose of the Study

As expected, there were no significant differences between conditions on the credibility check assessing the believability of the false purpose of the study, $F(2, 90) = 0.55$, $p = 0.58$, $\eta_p^2 = 0.01$. Please see Table 2 for means and standard deviations.

Anticipatory Anxiety

There were significant differences between conditions on ratings of anticipatory anxiety, $F(2, 90) = 14.07$, $p < 0.001$, $\eta_p^2 = 0.24$. As expected, participants in the alcohol condition reported significantly greater anticipatory anxiety, relative to those in the control condition, $t(60) = -2.54$, $p = 0.01$, $d = 0.65$. Likewise, participants in the placebo condition reported significantly greater anticipatory anxiety, relative to those in the control condition, $t(30.13) = -5.60$, $p < 0.001$, $d = 1.43$. However, contrary to our hypothesis, participants in the placebo condition reported significantly greater anticipatory anxiety, relative to those in the alcohol condition, $t(60) = -2.62$, $p = 0.01$, $d = 0.67$. Please see Fig. 1 for a visual representation of these results and Table 2 for means and standard deviations.

Anxiety During the 'Getting to Know You' Task

There were significant differences between conditions on anxiety ratings during the 'getting to know you' task, $F(2, 90) = 5.99$, $p = 0.004$, $\eta_p^2 = 0.12$. As expected, participants in the alcohol condition reported significantly greater anxiety during the social interaction, relative to those in the control condition, $t(51.04) = -2.59$, $p = 0.01$, $d = 0.66$. Participants in the placebo condition also reported significantly greater anxiety during the interaction, relative to those in the control condition, $t(49.32) = -3.54$, $p = 0.001$, $d = 0.90$. Finally, as

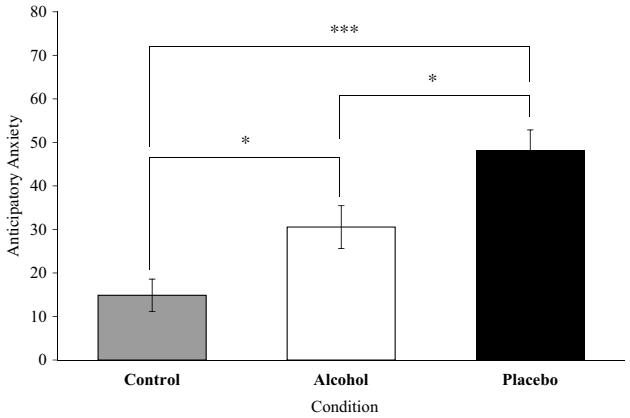

Fig. 1 Mean ratings of anticipatory anxiety prior to meeting the research assistant for the 'getting to know you' task by condition ($N = 93$). *$p < .02$, ***$p < .001$

hypothesized, there were no significant differences on anxiety ratings during the interaction between the alcohol and placebo conditions, $t(60) = -0.81$, $p = 0.38$, $d = 0.23$. Please see Table 2 for means and standard deviations.

Subjective First Impression

There were significant differences between conditions on ratings of subjective first impression, $F(2, 90) = 5.32$, $p = 0.01$, $\eta_p^2 = 0.11$. As expected, participants in the placebo condition reported making a significantly poorer first impression, relative to those in the control condition, $t(51.59) = -0.81$, $p = 0.01$, $d = 0.70$. However, contrary to our hypothesis, participants in the placebo condition also reported making a significantly poorer first impression, relative to those in the alcohol condition, $t(60) = 2.56$, $p = 0.01$, $d = 0.65$. Also, contrary to our hypothesis, there were no significant differences on subjective first impression between the alcohol and control conditions, $t(60) = 0.10$, $p = 0.92$, $d = 0.03$. Please see Table 2 for means and standard deviations.

Post-Event Processing

There were significant differences between conditions on PEPQ-R scores when measured 24 h after the laboratory session, $F(2, 90) = 4.44$, $p = 0.02$, $\eta_p^2 = 0.09$. As expected, participants in the alcohol condition reported engaging in significantly more post-event processing, relative to those in the control condition, $t(60) = -2.57$, $p = 0.01$, $d = 0.65$. Participants in the placebo condition also reported engaging in significantly more post-event processing, relative to those in the control condition, $t(47.81) = -2.77$, $p = 0.001$, $d = 0.70$. Finally, as hypothesized, there were no significant differences on PEPQ-R scores between the alcohol and placebo conditions, $t(60) = -0.64$, $p = 0.53$, $d = 0.16$. Please see Table 2 for means and standard deviations.

Speaking Time

As determined by a one-way ANOVA, there were significant differences between conditions on speaking time during the 'getting to know you' task, $F(2, 90) = 5.90$, $p = 0.004$, $\eta_p^2 = 0.17$. Participants in the alcohol condition spoke for a significantly longer time during the social interaction, relative to those in the placebo condition, $t(60) = 3.62$, $p = 0.001$, $d = 0.92$. Similarly, participants in the control condition spoke for a longer time (at trend level), relative to those in the placebo condition, $t(50.14) = 2.25$, $p = 0.03$, $d = 0.57$. There were no significant differences on speaking time between the alcohol and control conditions, $t(60) = -1.19$, $p = 0.24$, $d = 0.30$. Please see Table 2 for means and standard deviations.

Discussion

Some models of social anxiety propose that beliefs about losing control over one's anxiety response are a core aspect of its development and maintenance (e.g., Hofmann 2005). However, it appears that negative beliefs about the likelihood and consequences of losing control over one's *behaviour* (e.g., embarrassment) may be involved in experiences associated with social anxiety as well (e.g., Clark and Wells 1995). This is also in line with the proposal that some individuals with social anxiety avoid drinking alcohol as they believe it might lead to behavioural impairment and embarrassment (e.g., Eggleston et al. 2004). As such, the current experiment aimed to manipulate beliefs about losing control over one's behaviour by using three beverage assignments to examine their impact on symptoms and processes associated with social anxiety.

Results demonstrated that participants in the alcohol and placebo conditions did report significantly greater anxiety prior to the 'getting to know you' task, as compared to those in the control condition. But contrary to our hypothesis, those in the placebo condition experienced significantly greater anxiety relative to those in the alcohol condition. These results support the idea that negative beliefs about losing control over one's behaviour may play a role in the development of anticipatory anxiety—a phenomenon associated with social anxiety. Clark and Wells (1995) proposed that some individuals with social anxiety review what they think might happen prior to a social situation and that this anticipatory processing often includes negative self-images. Believing that one is likely to lose control and embarrass themselves may negatively bias these self-images and increase anticipatory anxiety. However, it appears that we

neglected the anxiolytic effects of alcohol when generating our hypotheses—as proposed by tension reduction theory (Conger 1951, 1956). Indeed, for those in the alcohol condition, the impact of beliefs about losing control on anticipatory anxiety was present but significantly alleviated compared to the placebo condition. An alternative explanation to tension reduction theory is offered by the appraisal-disruption model (Sayette 1993). It suggests that alcohol weakens connections between information in long-term memory and new information. In this way, intoxicated individuals are less likely to associate past social failures to the current situation, which in turn prevents the current situation from being appraised as highly threatening.

A similar (but slightly different) pattern of results emerged with perceived social competence and reliance on safety behaviour. On the one hand, participants in the alcohol condition reported making a first impression that was as good as those in the control condition. On the other hand, participants in the placebo condition perceived themselves as making a significantly poorer first impression compared to the two other conditions. Likewise, it appeared that participants in the placebo condition 'held back' and spent less time speaking during the 'getting to know you' task relative to the two other conditions (i.e., at significance level compared to the alcohol condition and at trend level compared to the control condition). This behavioural inhibition is commonly seen in individuals who experience social anxiety (e.g., Voncken and Bögels 2008). There were also no significant differences on speaking time between the alcohol and control conditions. In these cases, too, it could be that alcohol expectancies pertaining to losing control had a negative impact on perceived social competence and made participants rely on safety behaviour to a greater extent. Again, the anxiolytic effects of alcohol may have attenuated the effect of these negative expectancies on subjective first impression and safety behaviour. Still, Battista et al. (2012) found that administering alcohol (versus orange juice) to socially anxious individuals resulted in significantly *longer* speaking times. It would be interesting to examine whether it was the belief manipulation that prevented replication of this finding, such that participants in the alcohol condition might have been affected by some behavioural inhibition as well (i.e., it could be that the anxiolytic effects of alcohol did not *fully* attenuate the impact of beliefs about losing control, as with anticipatory anxiety). Of note, Battista and colleagues used a sample of socially anxious individuals whereas the current study relied on an undergraduate (non-clinical) sample—this may explain the difference in findings.

In their cognitive model, Clark and Wells (1995) discuss the possibility of experiencing anxiety-induced performance deficits. Therefore, participants in the placebo condition may have been accurate in rating their subjective first impression as poorer: they experienced greater anticipatory anxiety and ended up speaking for a shorter amount of time. Still, it is unclear whether such performance deficits could be observed in undergraduate and community (versus clinical) samples. Interestingly though, participants in the alcohol and placebo conditions reported being as anxious *during* the 'getting to know you' task and as being more anxious than those in the control condition. Although this finding is consistent with our hypothesis, it goes against the current pattern of results showing how participants in the alcohol (versus placebo) condition may have 'benefited' from the anxiolytic effects of vodka. It may be that the 'getting to know you' task was too anxiety-provoking[1] (e.g., neutral conversational partner; videorecorded) and prevented us from observing the phenomenon as it would occur in naturalistic conversations. Similar effects have been noted in other experiments on social anxiety (e.g., Moscovitch and Hofmann 2007). Nonetheless, participants in the alcohol condition may have interpreted that anxiety differently than those in the placebo condition (e.g., less catastrophically), which perhaps resulted in less performance deficits (e.g., talking more) and greater perceived social competence (e.g., better subjective first impression). For instance, it has been proposed that participants who fully believe they have been administered alcohol can 'blame' their performance deficits on their intoxication level (e.g., Himle et al. 1999). Another explanation is offered by the self-awareness model of alcohol use (Hull 1981). It claims that alcohol interferes with the encoding of self-relevant information, which in turn decreases self-awareness and negative self-evaluation.

Finally, results demonstrated no significant differences on post-event processing 24 h following the laboratory session between the alcohol and placebo conditions. As expected, participants in both of these conditions engaged in significantly more post-event processing relative to those in the control condition. This finding matches the overall pattern of results supporting the impact of negative alcohol expectancies pertaining to losing control on phenomena associated with social anxiety. Here, participants in the alcohol condition were no longer intoxicated and perhaps had a similar experience to those in the placebo condition—hence the full impact of the belief manipulation on this cognitive process. The positive relationship between social anxiety and post-event processing following non-drinking events is well-documented (Brozovich and Heimberg 2008), but this association in the context of drinking events is more complex and appears to be moderated by variables like gender and drinking habits (e.g., Battista et al. 2014). Beliefs about

[1] In support of this suggestion, a paired samples *t*-test showed that participants in the control condition experienced a significant increase in anxiety when comparing their scores of anticipatory anxiety ($M = 14.87$, $SD = 20.81$) and anxiety during the 'getting to know you' task ($M = 25.16$, $SD = 19.04$), $t(30) = -3.37$, $p = 002$.

losing control over one's behaviour may be another variable to consider when examining the relationship between social anxiety and post-event processing following alcohol consumption.

However, the current experiment has limitations. First, this study was conducted using an undergraduate sample that was mostly female and symptoms of SAD were not assessed at baseline nor at any point during the protocol. Although symptoms associated with social anxiety fall on a continuum, more nuanced (and sometimes different) effects can be obtained with clinical samples and/or groups of participants with higher versus lower social anxiety scores (e.g., Battista et al. 2010). In this way, the current findings are limited and exclusively pertain to anxiety in the context of a social interaction as experienced by undergraduate students. Also, important gender differences have been observed across many experiments on social anxiety and alcohol use (e.g., Battista et al. 2010), hence the need for a more balanced sample. Second, the 'getting to know you' task lacked ecological validity and may have been quite anxiety-provoking. Thus, it is unclear whether participants in the alcohol condition would have been as anxious in the context of a more naturalistic conversation. Third, including other measures of anxiety *during* the 'getting to know you' task (e.g., heart rate) would have provided a more complex and possibly more accurate picture of participants' emotional state. In this study, a self-report assessment of their anxiety was completed immediately *after* the task, and retrospective assessments can be flawed. Fourth, the current design prevents us from knowing whether participants in the placebo condition did in fact make a poorer first impression. Researchers should consider collecting data from conversational partners and/or blind coders, given Clark and Wells' (1995) proposal that real performance deficits can be observed. Fifth, participants in the placebo (versus control) condition endorsed significantly more body sensations associated with alcohol intake. We cannot eliminate the possibility that this different physiological experience played a role in the results, beyond the belief manipulation. Still, this 'perceived intoxication' was expected and can enhance the believability of the manipulation (e.g., Abbey et al. 2005). Sixth, participants in the placebo condition were told that their drinks were a placebo at the end of the session (because of our university ethics board guidelines). This is an important limitation which may have impacted the extent to which participants engaged in post-event processing. For instance, knowing about the presence of a placebo may have led participants to ruminate about how naive they were to believe they actually drank alcohol (i.e., more post-event processing in this example). Seventh, all anxiety-related measures were single-item ratings, which prevented us from evaluating the reliability of such assessments. Nonetheless, state anxiety is often measured using the Subjective Units of Distress Scale (Wolpe 1958) in laboratory and clinical settings and provides quick and useful information about how individuals feel in the moment. Eighth, the idea that shorter speaking times represent a greater reliance on safety behaviour is based on the assumption that participants were holding themselves back to prevent feared consequences from happening (e.g., Battista et al. 2012). Participants' *motivation* for speaking more versus less should have been assessed and would have allowed us to draw firmer conclusions regarding safety behaviour.

Future researchers should consider investigating the impact of negative beliefs about losing control over one's behaviour on symptoms of social anxiety outside of the alcohol context (e.g., Kelly-Turner and Radomsky 2020). It would be relevant to know whether these beliefs play a role in the maintenance of social anxiety in general. If so, these beliefs could explain why individuals with social anxiety avoid a broad range of social situations, even when alcohol is not involved and behavioural impairment is rationally unlikely. Moreover, future work may want to assess the longitudinal effects of the current findings. It would be interesting to examine whether the several 'advantages' of drinking alcohol (e.g., lower anticipatory anxiety) motivated those in the alcohol condition to drink again prior to a following social interaction—which could then provide insight into the detrimental effects of drinking in social anxiety. Investigating whether individuals with elevated beliefs about losing control (using self-report measures; e.g., Radomsky and Gagné 2020) are more likely to avoid drinking alcohol would also be relevant. Further, evaluating the mechanisms through which alcohol alleviated the effects of the belief manipulation would be highly important (e.g., decreased anxiety versus self-awareness). Replicating the current experiment in a setting where it is ethically appropriate to hide the presence of a placebo condition (even after participants have left the laboratory) is warranted to adequately assess post-event processing with limited bias. Finally, investigating the current research questions with a number of different samples is a natural next step. These include, of course, a sample of individuals diagnosed with SAD. Conducting a similar experiment with a clinical sample would allow us to draw stronger conclusions and make more precise recommendations for theoretical models of and psychological treatments for SAD. It could be that beliefs about losing control interact with core beliefs that are typically seen in SAD (e.g., "I am socially incompetent") and lead to even higher anxiety during a social interaction. Using samples of participants with higher versus lower levels of social anxiety symptoms and/or of beliefs about losing control—by screening participants based on these variables prior to the laboratory session—is also relevant to examine how an everyday prime (e.g., consuming alcohol in this case) can interact with such pre-existing symptoms and/or beliefs and impact feelings of anxiety

in social situations. Similarly, the current participants (i.e., university students/young adults) may have come into the laboratory with beliefs about alcohol that were specific to their group (e.g., Thombs et al. 2005), hence the need for replication with other samples.

In terms of theoretical implications, results from the placebo condition provided support for the relevance of beliefs about the likelihood and consequence of losing control over one's behaviour in the development of symptoms and processes associated with social anxiety. These findings contrast with previous work showing how participants in a placebo condition typically experience *lower* anxiety during a social interaction compared to those in a control condition (i.e., the expectancy effect; e.g., Wilson and Abrams 1977), highlighting the pivotal role of the 'losing control' prime. Results from the alcohol condition painted a more complex picture and showed how other factors could possibly mitigate the effects of these beliefs (e.g., tension reduction). Cognitive models emphasize three primary belief domains in the maintenance of social anxiety: unconditional beliefs about the self, conditional beliefs about social evaluation, and high standards for social performance (e.g., Clark and Wells 1995). Other work also suggests that perceived anxiety control plays a critical role in social anxiety (e.g., Hofmann 2005). With additional evidence from experiments with clinical samples, it could be proposed eventually that *perceived anxiety and behavioural control* should be considered as an additional belief domain involved in experiences related to social anxiety.

In terms of clinical implications, experiments with clinical samples and intervention studies are necessary prior to making definitive recommendations. Still, some preliminary ideas can be generated based on the current findings. For instance, using behavioural experiments to target negative beliefs about losing control over one's behaviour may be a potential avenue in cognitive-behaviour therapy for social anxiety. Clients/patients could videotape themselves during a social interaction and compare the number of times they actually 'lost control' to their predicted number. Guided discovery can also be used to critically evaluate one's perceived consequences of losing control in front of others (e.g., embarrassment). Finally, providing clients/patients with psychoeducation about the detrimental effects of alcohol in the maintenance of social anxiety symptoms may be relevant. With the current study, we now have information that is perhaps more specific to those with elevated beliefs about losing control (e.g., alcohol will reduce anticipatory anxiety but will likely lead to post-event processing later on). Again, these suggestions would be best subjected to empirical testing (e.g., clinical trials).

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Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Compliance with Ethical Standards

Conflict of Interest Jean-Philippe Gagné, Adam S. Radomsky, and Roisin M. O'Connor have no conflict of interest.

Ethics Approval The study was approved by the University Human Research Ethics Committee of Concordia University (Ethics Approval Number: 30003402).

Informed Consent Informed consent was obtained from all individual participants included in the study. Consent to publish was obtained from all individual participants included in the study during the informed consent procedure.

Animal Rights This article does not contain any studies with animals performed by any of the authors.

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