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ORIGINAL ARTICLE

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Sociability Alcohol Expectancies Shape Predictions of Drinking Behavior and Anxiety in a Novel Affective Forecasting Task

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ABSTRACT

Background: Existing work proposes that people with higher social anxiety symptoms and sociability alcohol expectancies believe alcohol can lower their anxiety. However, studies have primarily analyzed retrospective reports, not anticipatory motives. Since predictions of future emotion (i.e., affective forecasts) strongly influence behavior, it is critical to understand how people predict alcohol will influence their anxiety. Additionally, intolerance of uncertainty (IU) is related to the use of alcohol as a coping tool, but there is a dearth of work testing whether IU influences alcohol-related forecasts. ***Objectives***: Utilizing a novel affective forecasting task, we tested the prediction that social anxiety symptoms, sociability alcohol expectancies, and IU would relate to predictions about alcohol use. In an initial study and preregistered replication, participants imagined themselves in stressful social scenarios and forecasted how anxious they would feel when drinking and when sober. In the replication, participants also forecasted whether they would drink in the imagined scenarios. ***Results***: Contrary to hypotheses, social anxiety symptoms and IU did not significantly predict higher forecasted anxiety across studies, nor did they predict forecasted drinking. Exploratory analyses showed that participants with higher sociability alcohol expectancies forecasted being more likely to drink, and forecasted feeling less anxious when drinking (versus being sober). Even after statistically controlling for social anxiety, the effect of sociability expectancies remained significant in predicting forecasted anxiety and forecasted drinking. ***Conclusions***: Clinicians could consider specifically targeting sociability expectancies for alcohol use difficulties, and future research should continue utilizing affective forecasting paradigms to test links between social anxiety, alcohol expectancies, and alcohol-use problems.

KEYWORDS
Affective forecasting; social anxiety; sociability alcohol expectancies; intolerance of uncertainty

Introduction

Excessive alcohol use, a grave public health issue, cost the US $249 billion in 2010 and causes over 140,000 annual deaths (CDC, 2022, Sacks et al., 2015). People with Social Anxiety Disorder (SAD) are at particular risk for developing alcohol or other substance use problems. A cross-national epidemiological study estimated that 26.7% of people with a lifetime history of SAD have a comorbid diagnoses of either alcohol use disorder or another substance use disorder (Stein et al., 2017), representing a much higher prevalence rate than global prevalence estimates for substance use disorders alone, which range from 2.2–8.4% (Castaldelli-Maia & Bhugra, 2022; Rehm & Shield, 2019). Epidemiological studies indicate that 20.9% of individuals with SAD abuse alcohol and 27.3% are dependent upon it, compared to the 17.8% prevalence rate of alcohol abuse and 12.5% prevalence rate of alcohol dependence in the general population (Schneier et al., 2010). Additionally, data from a 2009 national United States survey indicate that an existing diagnosis of SAD is linked with greater risk for alcohol abuse and dependence in adolescents (Conway et al., 2016). The cumulative literature on alcohol use in social anxiety indicates that while social anxiety symptoms do not necessarily predict a greater frequency or amount of alcohol use, they do connote greater risk for experiencing alcohol-related problems, such as aggression, driving under the influence, or alcohol poisoning (Morris et al., 2005; Schry & White, 2013). Given these high rates of comorbidity and the detrimental consequences of alcohol use disorders, it is important for research to probe cognitive and emotional processes that shape socially anxious individuals' decisions and perceptions surrounding alcohol use.

Researchers have proposed that socially anxious individuals use alcohol to attempt to combat future negative affect in social settings (Schry & White, 2013) and to enhance their ability to socialize (Buckner et al., 2013). The belief that alcohol can prevent negative affect and make someone more sociable, whether accurate or not, is thought to reinforce alcohol use problems in people with social anxiety (Buckner et al., 2013). Implicit in this literature is the idea that people with social anxiety engage in *affective forecasts* surrounding how alcohol will make them feel. Affective forecasting refers to the cognitive process wherein individuals predict how they will feel in the future. While affective forecasting has

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been implied in the drinking motives literature, past studies have been largely cross-sectional and retrospective, and have therefore not explicitly tested how individuals make *predictions* regarding the emotional impacts of alcohol. Given predicted emotion may exert a stronger influence on judgment and behavior than actual emotion (DeWall et al., 2015), it is vital to test not only people's retrospective understanding of why they drink in social settings, but also their predictions of how drinking can be used to cope with potential future negative emotions. Critically, people are often inaccurate in their forecasts of future emotions (Wilson & Gilbert, 2003), and this inaccuracy is exacerbated in social anxiety. People with higher social anxiety appear to overestimate how much negative affect they will feel in the future (Arditte Hall et al., 2018, 2020; Dev et al., 2023) and fail to update inaccurate affective forecasts even after receiving disconfirming affective information (Glenn et al., 2019). This begs the question of whether imprecise affective forecasts influence drinking behaviors in socially anxious individuals.

Existing work lends support to the concept that affective forecasts could play a role in the link between social anxiety and alcohol use. Morris et al. (2005) identify that an individual's fear about social interactions appears to invoke more alcohol use than their fear of nonsocial performance situations, implying that people's predictions about the anxiolytic effects of alcohol may drive their alcohol use in social settings. Stevens et al. (2017) found that for participants with SAD, receiving real alcohol *or* placebo alcohol lessened their anxiety about doing a speech task. Taken together, these results indicate that people with SAD form strong predictions about how alcohol will impact their future anxiety, such that they report less anxiety even when they only consumed a placebo drink. While participants with higher social anxiety symptoms may retrospectively report that their motives for drinking included enhanced sociability or emotional coping (i.e., Schry & White, 2013), understanding their underlying decision-making processes requires testing whether they would *forecast* the same effects. Furthermore, testing people's actual forecasts of whether they would drink in a social situation could help shed light on whether predictions about emotions drive alcohol use problems in socially anxious individuals. Finally, although sociability alcohol expectancies have been implied as a contributing factor in the link between social anxiety symptoms and alcohol use (Buckner et al., 2013), research has not explicitly tested how sociability alcohol expectancies influence affective forecasts surrounding alcohol use. This represents a major gap in the literature, especially as findings indicate that people who drink specifically to be more sociable are particularly vulnerable to alcohol use problems (Buckner et al., 2019; Buckner & Matthews, 2012). This line of work has important clinical implications. Treating a patient who inaccurately believes drinking will improve their sociability may require a different intervention than treating someone who correctly predicts that alcohol will make them feel better in social situations. Understanding whether social anxiety symptoms and sociability expectations are linked to affective forecasts regarding drinking is a critical first step in making these important treatment delineations.

Affective forecasts in general, and those made by individuals with social anxiety in relation to alcohol specifically, may also be influenced by a range of environmental and individual difference factors. One such variable is the level of uncertainty in the situation and an individual's ability to tolerate uncertainty. Evidence suggests that people's ability to cope with uncertainty influences their drinking behaviors. People higher in intolerance of uncertainty, a construct representing individual's affective, cognitive, and behavioral responses to uncertainty (Carleton, 2016; Dugas et al., 2004), tend to react negatively to uncertainty and employ various coping behaviors to reduce uncertainty and resultant distress (Bredemeier & Berenbaum, 2008; Rosen & Knäuper, 2009). Paralleling those with social anxiety, people high in intolerance of uncertainty use substances to cope with negative affect, including in social situations (Oglesby et al., 2015; Shapiro et al., 2020). Experimental work indicates that alcohol has a greater dampening effect on responses to uncertain stressors than to certain stressors (Bradford et al., 2013, 2017, 2022; Bradford, Dev, and DeFalco, 2023), implying that people high in intolerance of uncertainty may be especially likely to drink to cope in uncertain social situations. Importantly, intolerance of uncertainty, a risk factor for a range of psychopathology (e.g., Boswell et al., 2013), has been repeatedly demonstrated to predict social anxiety symptoms (Boelen & Reijntjes, 2009; Carleton et al., 2010) even when controlling for relevant constructs such as fear of negative evaluation (Whiting et al., 2014). To our knowledge, no existing studies have examined how intolerance of uncertainty may shape affective forecasts surrounding alcohol use. If found to influence predictions of drinking behavior and related affective forecasts, intolerance of uncertainty could become a proximal treatment target for co-occurring social anxiety symptoms and alcohol use problems.

We conducted an online study (Study 1) and a preregistered replication and extension (Study 2) with young adult participants. In both the initial study and replication, we tested the association between alcohol-related forecasts, social anxiety, and intolerance of uncertainty by using an innovate affective forecasting task. This task asked participants to imagine themselves in various stressful social scenarios. We manipulated the certainty of the social stressor by presenting each scenario twice, once with a relatively uncertain outcome and once with a relatively certain outcome. Participants provided two affective forecasts: one imagining their anxiety if they were sober and another imagining their anxiety if they were drunk. In the preregistered replication, we also examined forecasted drinking by asking individuals to predict whether they would drink in each scenario, representing a key improvement upon past work. Our first aim was to test the hypothesis that there would be an interaction between certainty condition and imagined intoxication with social anxiety and with intolerance of uncertainty. We predicted that individuals with higher social anxiety would endorse higher rates of forecasted anxiety, but that forecasted anxiety would be attenuated when they were imagining themselves to be drunk. Similarly, we predicted that those with higher intolerance of uncertainty would predict higher anxiety when imagining

themselves sober as compared to when imagining themselves drunk. Our second aim was to test the hypothesis that individuals with higher levels of social anxiety and higher levels of intolerance of uncertainty would predict they were more likely to drink, with this relationship being stronger in the uncertain condition compared to the certain condition. Finally, though not preregistered, we used Study 1 and Study 2 as exploratory and confirmatory data sets (Yarkoni and Westfall, 2017) to respectively develop and test a novel hypothesis that sociability expectancies shape forecasted anxiety and forecasted drinking. While some research on social anxiety and alcohol use excludes participants who do not drink, we note that we did not constrain our sample based on participants' alcohol use (i.e. whether they currently drink or not). This is due to our use of an affective forecasting paradigm in which participants make predictions about hypothetical scenarios. Participants who do not currently drink can draw upon their past experience to make predictions about their emotions and behavior if they were to drink again. Additionally, even participants who have never tried alcohol are likely to have knowledge about its effects, and can utilize this knowledge to make predictions.

Method

Transparency and openness

We report how we determined our sample size, data exclusions, manipulations, and measures. We conducted an initial online study (Study 1) and a preregistered replication and extension study (Study 2). For both studies, all survey materials, data, and analysis code are available at https://osf.io/pskg7/. Study 2 was preregistered following data collection but prior to any analyses being conducted and the preregistration can be found at https://osf.io/5gv6w . Data were analyzed using R statistical software.

Participants

Both Study 1 ($N = 224$) and Study 2 ($N = 256$) utilized a young adult sample recruited from a large Southeastern university. Participants had to be above age 18 to participate in this study. As participants in both studies were recruited through a university subject pool, we aimed to collect as many participants as possible, but were inherently limited by the number of subjects who chose to sign up for our study. Participants who participated in Study 1 were not eligible to participate in Study 2. In return for participation, participants received research familiarization credits. All participants were 18 or older and procedures were approved by the university Institutional Review Board.

Study 1

A total of 273 participants were recruited. After excluding 44 participants for exiting the survey before completion and 5 participants for careless responding[1], the final sample size used for analysis was 224 (63% female, 1% gender nonbinary, M_{age} = 19.3, SD_{age} = 2.5). Participants reported their ethnicity as follows: 67.4% White, 13.4% Black, 11.6% Asian, 0.04% Native American, 5.4% mixed race, and 1.8% did not identify with any of the previous categories. 26.4% of participants identified as Hispanic or Latino/a.

Study 2

Initially, 298 participants were recruited. Of these, 32 were excluded for exiting the survey before completion, and 10 were excluded for careless responding. The final sample size used for analysis was 256 (52% female, 0.04% gender nonbinary, M_{age} = 19.7, SD_{age} = 1.8). Participants reported their ethnicity as follows: 66.7% White, 12.9% Black, 12.5% Asian, 0.04% Native American, 4.7% mixed race, and 2.7% did not identify with any of the previous categories. 24.6% of participants identified as Hispanic or Latino/a.

Procedure

For both studies, the survey was administered via Qualtrics. Participants first provided informed consent. They then read survey instructions and completed the comprehension check, followed by completing demographic measures. They then completed the key experimental task, an anxiety forecasting task. Finally, participants answered multiple self-report questionnaires, administered in randomized order.

Anxiety forecasting task

In both Study 1 and Study 2, we presented hypothetical social scenarios and tested how imagined intoxication (drunk vs. sober) influenced forecasted anxiety. Participants read five separate hypothetical scenarios that were potentially socially-stressful and could involve drinking alcohol. The scenarios reflected situations commonly assessed in well-validated measures of social anxiety and related constructs. For example, items probing worry around talking with strangers are included in the brief Fear of Negative Evaluation scale (Duke et al., 2006), Liebowitz Social Anxiety Scale (LSAS; Heimberg et al., 1999), Subtle Avoidance Frequency Examination (SAFE; Cuming et al., 2009), and Social Interaction Anxiety Scale (SIAS; Mattick et al., 1998). Likewise, items measuring fears around going to a party are included in the LSAS and SIAS, and items assessing fear of sweating are included in the SAFE and Anxiety Sensitivity Index-3 (Taylor et al., 2007). Additionally, some scenarios addressed situations in which alcohol might be used to facilitate sociability, a concept frequently assessed in alcohol expectancy measures (e.g., Alcohol Expectancy Questionnaire, Brown et al., 1987; Comprehensive Effects of Alcohol measure, Fromme et al., 1993).

Each scenario was presented twice: once with a relatively uncertain outcome regarding the social stressor and once with a relatively certain outcome. See the OSF repository linked above for all scenarios used, but a demonstrative example is included below (bolded sentence highlights uncertain vs certain component of scenario).

Scenario 1, uncertain condition

You are at a small gathering at the house of one of your friends. You are talking with a group of people, some people you know and some people you just met, about a sensitive subject. You notice that while you talk, you have started to blush and sweat. **You look around but you can't tell if anyone has noticed your sweat.**

Scenario 1, certain condition

You are at a small gathering at the house of one of your friends. You are talking with a group of people, some people you know and some people you just met, about a sensitive subject. You notice that while you talk, you have started to blush and sweat. **You see that most of the people are occasionally glancing at the sweat stains on your shirt near your armpits, and you realize that they have noticed you are sweating.**

Scenarios were presented in a randomized order. The presentation of scenarios was counterbalanced such that a specific scenario was not repeated until at least three other unique scenarios had been shown.

After reading each scenario, participants provided two separate affective forecast ratings on a sliding scale from 0 (not at all anxious) to 100 (extremely anxious). Participants first provided a sober-forecast of how anxious they would feel imagining they had not consumed any alcohol (i.e., "How anxious would you feel in this scenario having not drank any alcohol?"). This was followed by a drunk-forecast imagining how anxious they would feel if they had had a few drinks (i.e., "How anxious would you feel in this scenario after having had a few drinks?").

In Study 2, we also examined forecasted drinking. After reading each scenario, participants forecast whether they would be likely to drink in the scenario (i.e., drinking forecasts). Specifically, they are asked "If there was alcohol available to you in this scenario, would you be likely to drink?" (slider scale from 0 = No, I would not be likely to drink to 100 = Yes, I would drink).

At the conclusion of the forecasting task in both studies, participants reported how realistic the scenarios were to their broad past experiences (1 = 'Not realistic at all', 2 = 'Slightly unrealistic', 3 = 'Slightly realistic', to 4 = 'Very realistic').

Self-report measures

Participants completed the following self-report measures.

Drinking Behaviors Questionnaire (DBQ), selected items

The DBQ is a 10-item measure assessing alcohol use. We administered two items from the DBQ. The first item assesses drinking frequency ("On the average, how often do you consume alcoholic beverages of any kind?") and is rated on a ten-point scale ranging from 1 = "Once a month or less" to 10 = "21 or more times a week" (Cahalan et al., 1969). The second item assessed drinking amount ("On the average, how many "drinks" do you have each "time" or on each occasion when you do consume alcoholic beverages?") and is rated on a ten-point scale ranging from 1 = "Less than one whole drink" to 10 = "More than 12 drinks". We asked participants to consider their current alcohol use when answering these questions.

Intolerance of uncertainty (IUS)

The IUS-12 (Carleton et al., 2007) comprises twelve self-report items and is a short version of the original 27-item IUS (Freeston et al., 1994). It assesses emotional, cognitive and behavioral reactions to ambiguity, uncertainty, and attempts to control or plan for future events. The IUS-12 shows good internal consistency, test-retest reliability, and good discriminant validity between clinical and non-clinical samples (Khawaja & Yu, 2010). The IUS-12 shows similarly good construct validity, internal consistency, and reliability in clinical samples with GAD, and it is also responsive to treatment for anxiety disorders (Wilson et al., 2020). Seven items assess Prospective Anxiety, defined as a desire for predictability (e.g., "Unforeseen events upset me greatly"), and five items assess Inhibitory Anxiety, defined as difficulty acting in the face of uncertainty (e.g., "When I am uncertain I can't function very well"). Participants responded on a five-point Likert scale (1 = Not at all characteristic of me to 5 = Entirely characteristic of me). Summed total scores can range from 12—60 and higher scores indicate higher intolerance of uncertainty.

Social Interaction Anxiety Scale (SIAS)

To assess social anxiety symptoms, we utilized the 20-item SIAS (Mattick and Clarke 1998). The SIAS measures fear in social interactions (e.g., "I find myself worrying that I won't know what to say in social situations"). Scores on the SIAS demonstrate adequate internal consistency, high test-retest reliability, and moderate to high correlations with measures of associated constructs. The SIAS is also able to distinguish those with social anxiety from those with other anxiety disorders (Mattick et al., 1998; Peters, 2000; Ries et al., 1998) and is responsive to symptom improvement (Ledley et al., 2009). SIAS items were rated on a 5-point Likert scale (0 = Not at all characteristic of me to 4 = Extremely characteristic of me). Summed total scores can range from 0 to 80, with higher scores demonstrating higher levels of fear in social situations.

Comprehensive effects of alcohol (CEOA). The 38-item CEOA (Fromme et al. 1993) measures people's expectancies about the outcomes of drinking alcohol. It assesses seven domains: Sociability, Tension Reduction, Liquid Courage, Sexuality, Cognitive and Behavioral Impairment, Risks and Aggression, and Self-Perception. The CEOA shows adequate internal consistency, stability, and construct validity (Fromme et al., 1993), and support for the CEOA's construct validity has replicated (Ham et al., 2005). For this project, we focus on

the eight-item Sociability domain, which concerns people's expectations about whether they will be more friendly and sociable when drinking (e.g., "When I drink alcohol, I expect that it would be easier to talk to people"). Items were rated on a 4-point Likert scale (1 = Disagree and 4 = Agree). Summed total scores for the Sociability items range from 8 to 32, with higher scores reflecting a stronger expectation of sociability when drinking.

Preregistered analyses

We preregistered Study 2 analyses based on preliminary results of Study 1. Specifically, we planned to analyze forecasted anxiety using General Linear Models (GLMs) with repeated measures for scenario certainty and imagined intoxication. To test the hypothesis that people higher in social anxiety would endorse higher rates of forecasted anxiety, but that forecasted anxiety would be attenuated when they were imagining themselves to be drunk, we assessed for an interaction between imagined intoxication and social anxiety symptoms (measured by the SIAS) in a GLM analyzing forecasted anxiety. To test the hypothesis that individuals with higher levels of social anxiety would predict they were more likely to drink and that this relationship would be stronger in the uncertain condition compared to the certain condition, we conducted a logistic GLM and assessed for an interaction between social anxiety symptoms and scenario certainty in predicting forecasted drinking. We had similar hypotheses for the effect of intolerance of uncertainty on forecasted anxiety and forecasted drinking. To test for effects of intolerance of uncertainty (measured by the IUS), identical models were run, simply replacing social anxiety symptoms (SIAS) with intolerance of uncertainty scores (IUS). All models included an additive between-subjects regressor for perceived scenario realism (mean centered) to control for effects of individual differences regarding scenario realism.

Table 1. Descriptive statistics for key variables.

	Measure	*M*	*SD*	Min	Max	Skew	Kurtosis	α
Study one	DBQ frequency	1.11	1.20	0.25	5.50	1.50	1.42	N/A
	DBQ amount	3.01	2.50	0.50	13.00	1.60	3.35	N/A
	CEOA sociability	26.08	5.5	8	32	−1.24	1.12	0.92
	IUS	28.43	9.83	12	60	0.57	−0.17	0.91
	SIAS	27.71	14.77	4	67	0.7	−0.1	0.93
Study two	DBQ frequency	1.23	1.71	0.25	21	6.47	67.92	N/A
	DBQ amount	3.27	2.42	0.5	13	1.07	1.24	N/A
	CEOA sociability	25.6	5.37	8	32	−1.32	2.03	0.91
	IUS	29.77	9.75	12	57	0.36	−0.36	0.91
	SIAS	30.25	15.16	4	64	0.19	−0.97	0.94

Note. CEOA sociability: comprehensive effects of alcohol, sociability expectancies subscale; IUS: Intolerance of Uncertainty Scale; SIAS: Social Interaction Anxiety Scale; *M*: mean; *SD*: standard deviation; α: Cronbach's alpha.

Results without exclusions

Some research shows that careless responding may be associated with alcohol use and related problems (Jones et al., 2023). We sought to confirm that our results would replicate when including participants who we had originally excluded for careless responding. These exclusions comprised 5 participants in study 1 and 10 participants in study 2. We repeated all main analyses when including these participants. Overall, the pattern of results did not qualitatively differ in this full sample, with the exception of one effect, which is footnoted below.

Results

Analyses were conducted in R. Self-report variables showed adequate range and good reliability, and approximated normalcy. The only exception to this was the DBQ frequency variable, which was skewed due to a large outlier (Table 1).

As shown in Table 1, across both studies, participants reported drinking around once per week and consuming around three drinks per drinking occasion. The number of participants reporting drinking at least two to three times per month was 58.48% in study 1 and 64.06% in study 2. See Table 2 for a full distribution of participant alcohol use frequency and amount within our samples.

Affective forecasting task

Task validity and reliability

Given the affective forecasting task was developed for the purpose of these studies, we sought to probe its validity and reliability within this sample. Overall, mean ratings of scenario realism indicated that participants found the scenarios

Table 2. Frequencies for Drinking Behaviors Questionnaire (DBQ).

Drinking frequency			Drinking amount		
	Study 1 (%)	Study 2 (%)		Study 1 (%)	Study 2 (%)
Once a month or less	41.52	35.94	Less than 1 drink	23.21	17.97
2-3 times/month	20.09	21.09	One drink	5.36	8.59
Once/week	10.27	14.45	Two drinks	15.63	14.45
Twice/week	13.84	13.67	Three drinks	22.32	19.14
3–4 Times/week	12.95	12.50	Four drinks	12.95	14.45
5–6 Times/week	1.34	1.17	Five drinks	8.48	9.38
7–8 Times/week	0	0	Six drinks	4.46	6.25
9–13 Times/week	0	0	7–9 drinks	3.12	7.03
14–20 Times/week	0	0	10–12 drinks	2.23	1.56
21+ Times/week	0	0.39	More than 12 drinks	1.34	0.39

Note. For frequency, participants were asked "On the average, how often do you currently consume alcoholic beverages of any kind?" For amount, participants were specifically asked "On the average, how many drinks do you current have each time or on each occasion when you consume alcohol beverages?"

reasonably realistic (study 1: $M = 2.78$, $SD = 0.84$, Median = 3; study 2: $M = 2.88$, $SD = 0.64$, Median = 3). As noted above, all reported models controlled for scenario realism. Table 3 reports descriptive statistics for forecasted anxiety. To confirm that the scenarios elicited anxiety, we tested an intercept-only model with average forecasted anxiety (collapsed across all scenarios and conditions) as the outcome variable. This allowed us to examine whether average forecasted anxiety was significantly higher than 0. Forecasted anxiety was significantly higher than 0 in study 1 ($b = 45.01$, 95% CI [43.75, 46.27], $t(223) = 70.11$, $p < 0.001$) and study 2 ($b = 30.8$, 95% CI [29.63, 31.98], $t(255) = 51.30$, $p < 0.001$).

Finally, we tested the Spearman Brown corrected split-half reliability of participants' forecasted anxiety ratings across the even-numbered and odd-numbered scenarios. For this analysis, we collapsed across the imagined intoxication and certainty conditions. The split-half reliability was good for both studies (Study 1: 0.92, Study 2: 0.94)

Forecasted anxiety across imagined intoxication and certainty conditions

In line with hypotheses, forecasted anxiety was significantly lower when participants imagined themselves to be drunk (study 1: $b = -17.91$, 95% CI [−19.48, −16.33], $t(223) = -22.41$, $p < 0.001$; study 2:$b = -5.38$, 95% CI [-6.52, −4.25], $t(255) = -9.32$, $p < 0.001$). We did not specify hypotheses for the effect of certainty on forecasted anxiety. However, across both studies, forecasted anxiety was lower in the uncertain condition than in the certain condition (study 1: $b = -2.65$, 95% CI [−3.97, −1.33], $t(223) = -3.94$, $p < 0.001$, study 2: $b = -2.45$, 95% CI [−3.69, −1.20], $t(255) = -3.87$, $p < 0.001$). See Table 3.

In both studies, there was a significant interaction between scenario certainty (certain vs. uncertain) and imagined intoxication condition (sober vs. drunk) in predicting forecasted anxiety. However, the direction of the effect varied across studies. In study 1, in line with hypotheses, the effect of imagined intoxication was larger in the uncertain condition than in the uncertain condition ($b = -1.73$, 95% CI [−2.66, −0.81], $t(222) = -3.70$, $p = <0.001$). Contrary to hypotheses, in study 2, the effect of imagined intoxication was larger in the certain than in the uncertain condition (study 2: $b = 0.77$, 95% CI [0.14, 1.40], $t(254) = 2.39$, $p = 0.018$). See Figure 1.

Main analyses

Social anxiety analyses

Forecasted anxiety. We conducted a GLM with social anxiety symptoms, imagined intoxication, and their interaction as predictors of forecasted anxiety. As stated

Table 3. Descriptive statistics for forecasted anxiety.

	Certain condition *M (SD)*		Uncertain condition *M (SD)*		Total *M (SD)*	
	Study 1	Study 2	Study 1	Study 2	Study 1	Study 2
Imagining drinking	37.81 (18.65)	29.14 (19.15)	34.29 (19.00)	27.08 (19.72)	36.05 (18.88)	28.11 (19.45)
Imagining sober	54.85 (14.92)	34.91 (18.31)	53.07 (14.85)	32.08 (18.86)	53.96 (14.90)	33.49 (18.62)
Total	46.33 (18.90)	32.03 (18.93)	43.68 (19.45)	29.58 (19.44)	45.01 (19.22)	30.8 (19.22)

Note. M: mean; *SD*: standard deviation.

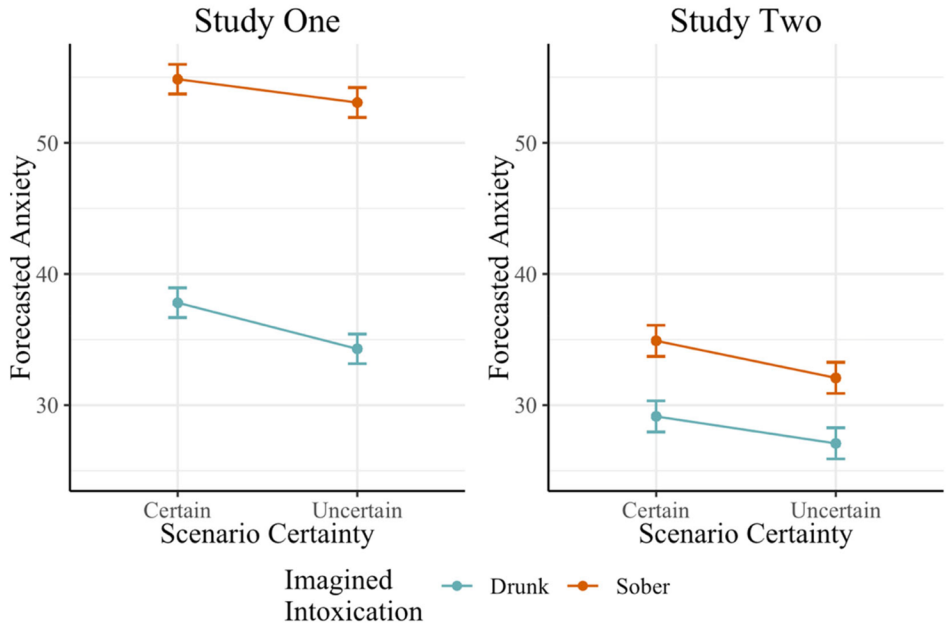

Figure 1. Interaction of scenario certainty and imagined intoxication on forecasted anxiety.

above, all models controlled for perceived scenario realism (mean centered).

This analysis collapsed across scenario certainty conditions. For study 1, the overall model explained 2.4% of the variance in forecasted anxiety and did not obtain significance, $F(2, 221)=2.71$, $p=0.069$. In study 1, there was a significant interaction effect between social anxiety symptoms and imagined intoxication, such that the effect of imagined intoxication on forecasted anxiety was attenuated in those reporting higher social anxiety symptoms ($b=0.07$, 95% CI [0.01, 0.14], $t(222)=2.33$, $p=0.022$). This was in line with our hypotheses that people with higher social anxiety symptoms would generally forecast higher anxiety, but that they would forecast slightly lower anxiety when imagining themselves drunk. For study 2, the overall model explained less than 1% of the variance in forecasted anxiety and did not obtain significance, $F(2, 252)=0.31$, $p=0.74$. Contrary to hypotheses, the interaction between social anxiety symptoms and imagined intoxication did not obtain significance in study 2 ($b=0.01$, 95% CI [−0.03, 0.06], $t(254)=0.63$, $p=0.527$). See Figure 2.

Forecasted drinking. We hypothesized an interaction such that higher levels of social anxiety would correspond to higher forecasted drinking, and that this relationship would be stronger in the uncertain condition compared to the certain condition. To test this within study 2 (as only study 2 included the forecasted drinking outcome variable), we conducted a hierarchical linear model that regressed forecasted drinking on social anxiety symptoms, scenario certainty, and their interaction. This model accounted for random effects at the participant level and at the scenario level, given that participants made forecasts about drinking across five unique scenarios. Predictor variables were centered. The model including predictors did not fit significantly better than the random intercept only model (χ^2 (3)=7.41, $p=0.06$). Marginal R^2, calculated for this model as described in Johnson (2014), was 1.8%. Contrary to hypotheses, the interaction between social anxiety symptoms and scenario certainty was not a significant predictor of forecasted drinking ($b=-0.01$, 95% CI [−0.02, 0.01], $z(255)=-0.96$, $p=0.339$). After dropping this non-significant interaction from the model to test main effects, neither scenario certainty ($b=0.06$, 95% CI [−0.15, 0.27], $z(255)=0.60$, $p=0.550$) nor social anxiety symptoms ($b=0.02$, 95% CI [−0.001, 0.04], $z(255)=1.88$, $p=0.061$) significantly predicted forecasted drinking.[2]

Sociability alcohol expectancy analyses

Forecasted anxiety. We conducted follow-up exploratory analyses to further probe the relationship between social anxiety symptoms, and forecasted anxiety. Specifically, in a hierarchical linear model, we regressed forecasted anxiety on social anxiety symptoms, sociability-related alcohol expectancies, and the interaction between social anxiety symptoms and sociability alcohol expectancies. We included a term to account for participant-level random effects given that participants made anxiety forecasts for multiple scenarios, one for each possible 2 × 2 combination of scenario certainty (certain vs. uncertain) and imagined intoxication.

For both studies, the model including the aforementioned predictors fit significantly better than the intercept-only model with just participant-level random effects (study 1: χ^2 (4)=49.01, $p<0.001$; study 2: χ^2 (4)=82.25, $p<0.001$). Marginal R^2 was 11.80% in study 1 and 23.5% in study 2. In both studies, all predictors were significant, including the interaction terms. See Table 4 for full model results.

As noted above, social anxiety symptoms and sociability expectancies significantly interacted in predicting forecasted anxiety. We probed this interaction by testing simple slopes in study

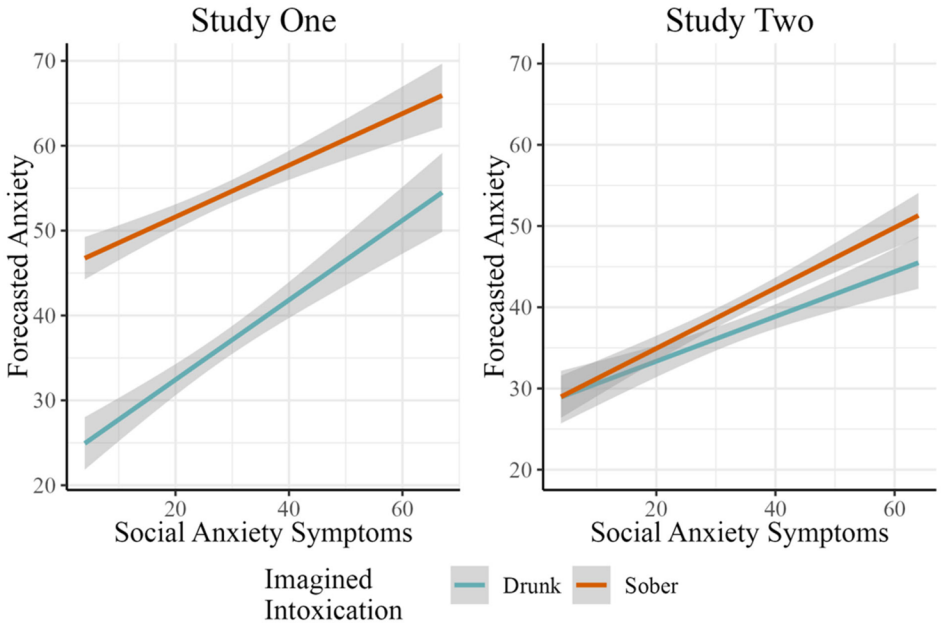

Figure 2. Interaction of imagined intoxication and social anxiety on forecasted anxiety.

Table 4. Sociability alcohol expectancies and social anxiety symptoms on forecasted anxiety.

	Variable	B [95% CI]	SE B	*t*	*p*
Study 1	(Constant)	6.70	8.66	0.77	0.440
	Scenario realism (centered)	0.67 [−1.50, 2.84]	1.12	0.60	0.546
	Sociability expectancies	1.07 [0.43, 1.70]	0.33	3.26	**0.001**
	Social anxiety symptoms	0.95 [0.42, 1.49]	0.27	3.49	**<0.001**
	Sociability expectancies × social anxiety symptoms	−0.02 [−0.04, −0.002]	0.01	−2.14	**0.033**
Study 2	(Constant)	−4.11	9.03	−0.46	0.649
	Scenario realism (centered)	3.00 [−0.67, 5.37]	1.53	1.96	0.051
	Sociability expectancies	0.69 [0.04, 1.46]	0.35	1.99	**0.047**
	Social anxiety symptoms	1.27 [0.76, 2.04]	0.32	4.04	**<0.001**
	Sociability expectancies × social anxiety symptoms	−0.03 [−0.06, −0.01]	0.01	−2.30	**0.023**

Significant p-values (<.05) have been bolded for ease of interpretation.

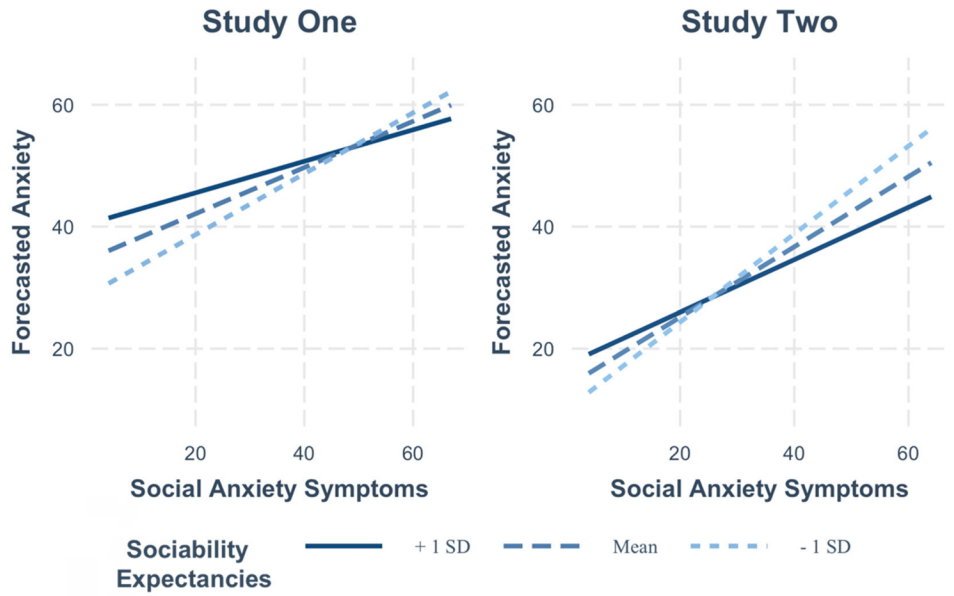

Figure 3. Interaction of social anxiety symptoms and sociability expectancies on forecasted anxiety.

1 and confirming this analysis in study 2. In study 1, social anxiety symptoms were a significant predictor of forecasted anxiety at low levels of sociability expectancies (−1 SD; B=0.50, 95% CI [0.34, 0.66], t(218) = 6.07, p<0.001), average levels of sociability expectancies (B=0.38, 95% CI [0.26, 0.50], t(218) = 6.17, p<0.001), and high levels of sociability expectancies (+1 SD; B=0.26, 95% CI [0.09, 0.42], t(218) = 3.07, p<0.001). Likewise, in study 2, social anxiety symptoms were a significant predictor of forecasted anxiety at low (−1 SD; B=0.75, 95% CI [0.56, 0.93] t(249)=7.91, p<0.001), average, (B=0.58, 95% CI [0.45, 0.72], t(249)=9.02, p<0.001), and high levels of sociability expectancies (+1 SD; B=0.41, 95% CI [0.24, 0.59], t(249)=4.71, p<0.001).

For every one-point increase in sociability expectations [i.e., for those higher on this measure], the influence social anxiety had on increasing forecasted anxiety was attenuated by roughly 0.02 − 0.03 points (Table 4). In other words, the higher the sociability expectations held, the less effect individuals' social anxiety symptoms had on their forecasted anxiety. See Figure 3 for a visual representation of the interaction between social anxiety symptoms and sociability alcohol expectancies in predicting forecasted anxiety.

Forecasted drinking. We conducted an exploratory hierarchical linear model testing the interaction of social anxiety symptoms and sociability alcohol expectancies on forecasted drinking. This model accounted for random effects at the participant level and at the scenario level, given that participants made forecasts about drinking across five unique scenarios. Predictor variables were centered. The model including predictors fit significantly better than the random intercept only model (χ^2 (4) = 43.64, p<0.001). Marginal R^2 was 10.6%. In this model, the interaction between social anxiety symptoms and sociability alcohol expectancies was not a significant predictor of forecasted drinking (b=0.00, 95% CI [−0.003, 0.003], z(249) = 0.09, p=0.931). After dropping the interaction term to test main effects, the main effect of sociability alcohol expectancies was significant, such that higher sociability alcohol expectancies predicted higher rates of forecasted drinking (vs. forecasting staying sober) (b=0.16, 95% CI [0.11, 0.22], z (254) = 5.56, p<0.001). The main effect of social anxiety symptoms was not a significant predictor of forecasted drinking (b=0.01, 95% CI [−0.01, 0.03], z (254) = 1.34, p=0.181).

Intolerance of uncertainty analyses

Forecasted anxiety. We hypothesized an interaction such that intolerance of uncertainty would correspond with higher forecasted anxiety but that this effect would be weaker in

the drunk imagined intoxication condition compared to the sober condition. We regressed forecasted anxiety on intolerance of uncertainty, imagined intoxication, and their interaction. This model collapsed across scenario certainty condition. In study 1, this model explained less than 1% of the variance in forecasted anxiety and did not obtain significance, $F = 1.03$ (2, 221), $p = 0.36$. Likewise in study 2, this model explained less than 1% of the variance in forecasted anxiety and did not obtain significance, $F = 0.21$ (2, 251), $p = 0.807$. Intolerance of uncertainty did not significantly interact with imagined intoxication in predicting forecasted anxiety in study 1 ($b = 0.07$, 95% CI [−0.03, 0.16], $t(221) = 1.43$, $p = 0.153$) or study 2 ($b = -0.02$, 95% CI [−0.08, 0.05], $t(251) = -0.43$, $p = 0.668$).

Forecasted drinking. We regressed forecasted drinking on intolerance of uncertainty, scenario certainty, and their interaction. This model accounted for random effects at the participant level and at the scenario level, and the intolerance of uncertainty variable was centered. The model including predictors did not fit significantly better than the random intercept only model (χ^2 (4)=5.00, $p = 0.287$). Marginal R^2 was 1.2%. Contrary to hypotheses, the interaction between intolerance of uncertainty and scenario certainty was not a significant predictor of forecasted drinking ($b = 0.003$, 95% CI [−0.02, 0.02], $z(254)=0.30$ $p = 0.765$). After dropping this non-significant interaction from the model, the main effects of scenario certainty ($b = 0.06$, 95% CI [−0.15, 0.27], $z(254)=0.60$, $p = 0.552$) and intolerance of uncertainty ($b = 0.01$, 95% CI [−0.02, 0.04], $z(254)=0.95$, $p = 0.342$) did not achieve significance in predicting forecasted drinking. This was contrary to hypotheses that people higher in intolerance of uncertainty would be more likely to forecast that they would drink.

Discussion

Across two studies that included separate racially and ethnically diverse undergraduate samples, we tested relationships between social anxiety symptoms, sociability alcohol expectancies, and intolerance of uncertainty on individuals' predictions of how they would feel and behave in social situations involving alcohol. Participants completed a novel affective forecasting task in which they predicted whether they would drink in hypothetical social scenarios, and how anxious they would feel when drinking and when sober. Results indicated that social anxiety symptoms corresponded with higher forecasted anxiety, but that neither social anxiety symptoms nor intolerance of uncertainty robustly and reliably predicted forecasted drinking. However, sociability alcohol expectancies influenced both forecasted anxiety and forecasted drinking behavior.

In line with our hypotheses, participants in both studies forecasted that they would be less anxious when drinking than when sober. This aligns with past work indicating that people generally believe drinking will dampen the anxiety they feel in socially stressful situations (Bradford et al., 2023; Carrigan & Randall, 2003). Additionally, we found that forecasted anxiety was lower for uncertain scenarios than for certain scenarios. In our hypothetical scenarios, participants imagined being certain of a stressful social outcome (e.g., being sure others noticed you sweating during a conversation about a personal subject), or being uncertain if a stressful social outcome occurred (e.g., not being sure if others noticed you sweating). Given that individuals typically find social uncertainty aversive and are motivated to reduce it (FeldmanHall & Shenhav, 2019), we might have expected to see the opposite pattern of results, wherein uncertain situations evoked more anxiety than certain ones. One potential explanation for our finding is that people prefer to be uncertain about negative social outcomes because it leaves open the possibility that they will not face the consequences of that outcome. Indeed, researchers have found that uncertainty surrounding aversive outcomes can be preferable to certain bad news (Ganguly & Tasoff, 2017). A related possibility is that it is harder for people to make strong affective forecasts for uncertain scenarios, due to the inherent ambiguity of these situations. Difficulty making forecasts in the face of ambiguity might have driven down forecasted anxiety for uncertain scenarios. Future work should further probe how uncertainty in social settings shapes people's emotions.

We did not find evidence of an interaction between intolerance of uncertainty and imagined intoxication in predicting anxiety forecasts. Additionally, our results did not support that intolerance of uncertainty influences people's predictions of whether they would drink in a stressful social situation. These results are somewhat opposed to past work indicating that individuals high in intolerance of uncertainty endorse drinking to cope with social situations (Oglesby et al., 2015; Shapiro et al., 2020). If people high in intolerance of uncertainty *do* drink to cope in social settings, our results may suggest that expectations of lower anxiety are not the main driver of drinking. Future work could investigate forecasts surrounding emotions other than anxiety (e.g. sadness). Additionally, it is possible that the lack of a significant relationship between intolerance of uncertainty and drinking behavior in our results is due to inaccurate forecasting. When faced with real-life socially threatening situations, individuals higher in intolerance of uncertainty might end up drinking more, even if they do not forecast that they would do so in the context of an online study. In fact, the inability to predict one's motivation to drink when encountering socially stressful situations may warrant exploration as a clinically relevant risk factor for individuals high in intolerance of uncertainty. Future studies should investigate for a mismatch between predicted and actual drinking behavior, and this line of work may benefit from utilizing experimental paradigms that invoke more extreme social threat than our imagined scenarios.

Similar to our results for intolerance of uncertainty, the interaction between imagined intoxication and social anxiety symptoms on forecasted anxiety was not robust across both studies. To further probe this, we conducted exploratory analysis in Study 1 to examine the influence of sociability alcohol expectancies (i.e., people's expectations that alcohol will make them more sociable), which we then tested in Study 2 for confirmation. In the absence of preregistration of this hypothesis, this approach using exploratory and confirmatory

datasets takes lessons from machine learning to allow increased confidence in our findings (Yarkoni and Westfall, 2017). Both social anxiety symptoms and their interaction with sociability alcohol expectancies produced strong effects on forecasted anxiety. Although people with higher social anxiety symptoms predicted greater forecasted anxiety in general, those who also endorsed high sociability alcohol expectancies forecast less anxiety than those with lower sociability alcohol expectancies. This indicates that people's beliefs about alcohol making them more sociable may be a key element in influencing socially anxious individuals' judgments of whether alcohol can be used to cope with social anxiety. Further supporting this, in a model testing the effect of social anxiety symptoms, sociability-related alcohol expectancies, and their interaction on forecasted drinking, those with higher sociability expectancies were more likely to forecast that they would drink. Taken as a whole, our results replicate and expand on previous retrospective work demonstrating links between sociability alcohol expectancies and drinking behavior (Buckner et al., 2013, 2019; Buckner & Heimberg, 2010; Terlecki & Buckner, 2015). We show that not only do sociability alcohol expectancies shape appraisals of future anxiety, but also that sociability alcohol expectancies alone may shape an individual's predictions of whether they would drink in a socially stressful situation.

We believe that expanding past work on social anxiety, sociability expectancies, and alcohol use to an affective forecasting framework represents an important iteration of work in this area. Still, our results must be interpreted in light of a few important limitations. First, we sampled undergraduate students, inherently limiting the generalizability of our work. However, our results do align with past research conducted in non-student populations (Thomas et al., 2003). Alcohol use in college-aged individuals represents a serious public health issue, underscoring the importance of testing predictors of drinking behaviors in young adults. Problematic alcohol use can begin at an early age, with an estimated 40% of US college students engaging in binge drinking behavior. Furthermore, drinking in college-age adults has been linked to greater use of cigarettes, more drunk driving, and more engagement in risky sexual encounters (Windle, 2003). Additionally, our sample's racial make-up is in line with population estimates from the 2020 United States Census (US Census Bureau, 2021). Roughly 25% of our participants identified as Hispanic or Latin, which exceeds the 2020 Census estimate for the US population (18.7%). Regardless, future work should still seek to replicate our results in more generalizable community samples and should also test these findings amongst clinical samples. Regarding study methodology, we note that our work is cross-sectional and relies primarily on our novel affective forecasting task. Future work validating similar affective forecasting tasks is sorely needed. To understand the extent to which forecasts map on to and influence actual lived outcomes, future studies could also employ longitudinal designs that compare forecasted anxiety and drinking to actual experienced emotion and drinking behavior. Finally, our use of the DBQ to collect data on current alcohol use presents an additional limitation. First, the lowest DBQ response option for drinking frequency is "once per month or less", making it impossible for us to disentangle participants who currently drink very rarely from participants who do not drink at all. This also means we do not have data on lifetime usage (i.e., whether participants have ever consumed alcohol or simply currently do not). Future work should replicate our results using a sample that excludes participants who have never consumed alcohol, and furthermore, future research should test if our results are robust in a sample of participants who endorse current alcohol use.

Social anxiety symptoms and alcohol use problems represent major public health burdens (Nardi, 2003; Sacks et al., 2015), and their comorbidity gives rise to various dangerous outcomes, including aggression, driving under the influence, and alcohol poisoning (Morris et al., 2005; Schry & White, 2013). Accordingly, we believe our results have several important implications. When treating individuals with social anxiety, it may be pertinent for clinicians to explore beliefs that alcohol can be used as an effective, long-term tool to increase sociability and manage anxiety in social settings. Given that sociability-related alcohol expectancies but not social anxiety symptoms significantly influenced individuals' predictions of whether they would actually drink, clinicians should be specifically attuned to whether individuals possess sociability-related alcohol expectancies. Above and beyond social anxiety symptoms, these expectancies may reinforce the problematic use of alcohol and could be uniquely targeted in treatment. Future cognitive and behavioral therapy research should continue to utilize affective forecasting paradigms to better understand the relationship between social anxiety, alcohol expectancies, and alcohol-use problems.

Notes

1. Careless responding was defined as failing more than two of three catch items as well as a comprehension check. Catch items were distributed throughout the self-report measures and required participants to select a specific answer choice (e.g., "Please click 'slightly agree' for this item"). The comprehension check was administered after participants read survey instructions and consisted of a multiple-choice question about the survey instructions.
2. In the full sample without exclusions for careless responding, the effect of social anxiety symptoms narrowly obtained significance in predicting forecasted drinking ($b = 0.02$, 95% CI [0.001, 0.04], $z(265) = 1.90$, $p = .04$).

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Data availability statement

For both studies, all survey materials, data, and analysis code are available at https://osf.io/pskg7. Study 2 was preregistered following data collection but prior to any analyses being conducted and can be found at https://osf.io/ucxzs.

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