Social Anxiety and Alcohol Consumption:

The Role of Social Context

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Abstract

Research has identified social anxiety as a risk factor for the development of alcohol use disorder. However, studies have produced equivocal findings regarding the relationship between social anxiety and drinking behaviors in authentic drinking environments. This study examined how social-contextual features of real-world drinking contexts might influence the relationship between social anxiety and alcohol consumption in everyday settings. At an initial laboratory visit, heavy social drinkers (N=48) completed the Liebowitz Social Anxiety Scale. Participants were then outfitted with a transdermal alcohol monitor individually-calibrated for each participant via laboratory alcohol-administration. Over the next seven days, participants wore this transdermal alcohol monitor and responded to random survey prompts (6x/day), during which they provided photographs of their surroundings. Participants then reported on their levels of social familiarity with individuals visible in photographs. Multilevel models indicated a significant interaction between social anxiety and social familiarity in predicting drinking, $b=-.004$, $p=.003$ Specifically, among participants higher in social anxiety, drinking increased as social familiarity decreased $b=-.152$, $p<.001$, whereas among those lower in social anxiety, this relationship was non-significant, $b=.007$, $p=.867$. Considered alongside prior research, findings suggest that the presence of strangers within a given environment may play a role in the drinking behavior of socially anxious individuals.

Introduction

A large body of research has provided support for social anxiety's role in motivating drinking. Social anxiety has been identified as a risk factor for the development of alcohol use disorder in both cases of social anxiety disorder (Buckner et al., 2008) and subclinical presentations (Crum & Pratt, 2001). Furthermore, individuals with comorbid alcohol use and social anxiety disorders report drinking specifically to alleviate tension in social settings at higher rates than those with alcohol use disorder alone (Cooper et al., 2014). Experimental manipulations have also indicated that consuming alcohol, when compared to placebo and control beverages, leads to reductions in stress among socially anxious participants within social stress paradigms (Abrams et al., 2001; Stevens et al., 2017). Consequently, results of both clinical and experimental research suggest it is important to examine the relationship between social anxiety and drinking behaviors in order to better understand how and why these cooccur and may eventually lead to alcohol use disorder.

From a motivational perspective, several prominent theories within the addiction literature provide potential reasons for socially anxious individuals' decisions to engage in drinking behaviors. For example, the social-attributional model suggests that alcohol reduces fears of social stressors and improves the quality of interpersonal interactions (Fairbairn & Sayette, 2014), social rewards that may be particularly valuable to those who find social situations distressing. More broadly, affective models provide support for alcohol's role in alleviating negative mood (Bresin & Mekawi, 2021; Cooper et al., 1995), thus potentially rendering drinking appealing for individuals with heightened social anxiety who may be expected to experience negative mood in social environments. Similarly, social drinking has been found to increase experiences of positive mood (Fairbairn et al., 2018), thus providing

another affective pathway through which social anxiety may increase drinking as individuals

seek amplification of positive moods in social contexts. Furthermore, research investigating

situational alcohol consumption among socially anxious individuals has found support for

conformity motives, with individuals endorsing drinking in order to fit in with peers who were

also drinking (Terlecki & Buckner, 2015). Consequently, when evaluating the extant literature

and theory surrounding social anxiety and drinking motives, the value of understanding the role

these variables play in shaping problematic drinking behaviors is clear.

      Despite plausible affective mechanisms supporting links between social anxiety and

drinking, along with established correlations between clinical-level presentations, studies have

produced varying findings regarding associations between social anxiety and alcohol

consumption (for review, see Morris et al., 2005). Some studies find those *lower* in social

anxiety tend to drink more when seeking relief (Tran et al., 1997), while others have found only

mixed support for this idea (Booth & Hasking, 2009), and still others have reported positive

relationships between high social anxiety, drinking quantity, and negative alcohol-related

consequences (Ham et al., 2016). One aspect of alcohol consumption that may help clarify these

equivocal results is the social contexts in which drinking commonly occurs. Historically, studies

of social anxiety and alcohol consumption have not simulated the characteristics of authentic

social settings in their methods or assessments. Studies that seek to induce social anxiety in a

laboratory setting (e.g., Abrams et al., 2001; Stevens et al., 2014; Stevens et al., 2017) often do

so by instructing participants to complete tasks that fail to mirror experiences drinkers might

encounter in more natural settings (e.g., giving a self-disclosing speech to a panel of judges).

Survey-based studies (e.g., Booth & Hasking, 2009; Ham et al., 2016; Tran et al., 1997) carry a

similar limitation, as while their measures often target general social anxiety in everyday

environments, they are frequently retrospective in approach, meaning that they do not capture

socially anxious individuals' behaviors within their daily lives. Finally, although several

experience-sampling studies (e.g., Battista et al., 2015; Goodman et al., 2018) have examined

associations between social anxiety and alcohol, such designs have relied on self-reports of

alcohol consumption and have often focused on participant-level factors as opposed to

interactions between these participant-factors and socio-contextual variables.

Recently, technology has emerged to aid in capturing participants' real-world experiences

and drinking behaviors, thus permitting a fuller integration of contextual factors in the study of

real-world drinking. One such technological advancement takes the form of transdermal alcohol

sensors, devices which are mounted on a participant's body and continuously monitor their

drinking by tracking the amount of alcohol diffusing through the skin (Barnett et al., 2014). Use

of objective transdermal sensors might address a variety of concerns surrounding self-reports of

drinking, including concerns regarding potential cognitive demands (e.g. need to convert

quantity of alcohol consumed to standardized drinking measures) and measurement reactivity

(e.g. drawing attention to drinking behaviors) during ambulatory assessment periods. Notably,

these concerns may be amplified for socially anxious participants who may already find social

environments to be cognitively resource-intensive (Clark & Wells, 1995). Furthermore, to aid in

capturing participants' social environments, transdermal sensors can be combined with

experience-sampling measures in which participants use their personal devices to provide

photographs of their surroundings as they go about their daily lives (Christensen et al., 2003;

Fairbairn et al., 2018; Goodman et al., 2018). Such a design allows researchers a direct view into

participants' drinking contexts while simultaneously diminishing cognitive demands associated

with reporting on social factors and relationships in-vivo via questionnaires.

The present study leverages novel ambulatory technology to explore interactions between person and place in predicting drinking, aiming to elucidate the relationship between social anxiety and alcohol consumption through a consideration of context. Participants completed measures of social anxiety during an initial baseline laboratory visit, then engaged in one week of ambulatory assessment during which they wore a transdermal alcohol sensor and completed experience-sampling measures of social context involving direct image-capture techniques. Consistent with tension-reduction theory (MacAndrew, 1982) and research suggesting that people are motivated to drink to relieve distress (Cooper et al., 2014) and to achieve social rewards (Fairbairn & Sayette, 2014), we predicted a significant interaction between social anxiety and contextual social familiarity in predicting drinking. Specifically, we predicted that participants higher in social anxiety would drink at greater levels in unfamiliar social contexts relative to familiar social contexts, motivated either by a desire to relieve distress or facilitate smoother social interaction. In contrast, we expected the effect of unfamiliar context on drinking would be attenuated among those low in social anxiety.

Methods

Participants

Participants included 48 social drinkers between the ages of 21 and 28 (*M*=22.6). Participants were recruited through flyers posted throughout the community, online advertisements, and participant referrals. Within this sample, 56% of participants identified as White, 13% as Black, 17% as Asian, and 6% as Hispanic. Additionally, 50% of the sample identified as female. Individuals interested in the study completed an in-person screening interview and were excluded from participation if they were pregnant, had been diagnosed with an alcohol use disorder, reported a medical condition that prevented the consumption of alcohol,

or felt uncomfortable with study procedures. All participants were heavy or "at risk" drinkers as

defined by the National Institute on Alcohol Abuse and Alcoholism, with participants reporting

drinking an average of 2-3 times per week with 3.8 drinks per episode and binge drinking on an

average of 4.09 occasions within the past month at the time of screening. A detailed account of

study procedures is provided in Fairbairn et al. (2018).

Procedure

Eligible participants were invited to the laboratory for an initial orientation visit. After

providing a 0.00 breathalyzer reading (BrAC), participants completed survey items assessing

their mood, personality, and drinking behaviors, including levels of social anxiety (see

Measures). Participants were next assigned a SCRAM-CAM transdermal ankle bracelet

(SCRAM©; Alcohol Monitoring Systems, Inc., Littleton, CO) to be worn for the duration of the

study. SCRAM was chosen as a well-validated and robust instrument for detecting alcohol

consumption in real-world contexts (Marques & McKnight, 2009; Sakai et al., 2006), having

demonstrated strong positive correlations with traditional breathalyzer measures (for full

discussion, see Fairbairn & Kang, 2019). Participants were then asked to download Metricwire

(Trafford, 2016) an app-based survey platform, on their smartphone or, if needed, on a

laboratory-owned iPod touch device. Over the course of the week-long study, participants were

required to complete six surveys each day administered at random times between the hours of

12:00 PM and 12:00 AM. Within these surveys, participants were asked to take a photograph of

their surroundings ("Take a picture of your environment right now. Take a picture of what you

see."), during which they were instructed to take a few steps back, zoom out with their camera,

and capture as much of the setting as possible. Participants were also asked to provide daily self-

reports of the number of drinks they had consumed during the previous day. Additionally,

participants were required to attend two additional laboratory visits as part of their study

participation—a mid-study "check-in" visit to ensure compliance with ambulatory procedures

(four days after study initiation), and an end of study "close-out" visit on which ambulatory

equipment was returned (final day of the study). Importantly, one of these two additional

sessions (order counterbalanced across participants) served as an alcohol-administration

calibration session for the transdermal alcohol bracelet.

At their first follow-up visit, participants were provided an update on their Metricwire

response rate. If this session was the alcohol-administration calibration session, they were served

an alcoholic beverage intended to achieve a peak BrAC of approximately .08%, mirroring a

binge episode outside the lab (0.82 g/kg alcohol dose for men, 0.74 g/kg for women; Sayette et

al., 2012). Participants were breathalyzed at approximately 30-minute intervals after beverage

administration to establish a reference point for their SCRAM data. Participants were monitored

in the lab until their BrAC fell below 0.03%, at which point they were dismissed.

On their final visit to the laboratory, participants completed a photo-report task to provide

information about the social environments they had engaged with during the study. In this task,

using a custom-designed software program, participants viewed all photographs they had taken

during the ambulatory portion of the study and reported on their relationships with the people in

those photographs (see Measures). Note that we opted to use this photo report task vs. self-

reports of social relationships taken in the moment via surveys because of concerns regarding

survey length and participant burden in environments with many individuals present, as well as

the accuracy of such detail-oriented responses in moments when participants were heavily

intoxicated. Once the photo-report task had been completed, participants were paid $160 for their

participation, as well as an additional $40 if they had completed at least 70% of the Metricwire

surveys they had received.

Measures

Liebowitz Social Anxiety Scale

The Liebowitz Social Anxiety Scale (LSAS) is a 24-item measure that assesses how individuals would react in response to hypothetical social situations (e.g. meeting a stranger) (Heimberg et al., 1999), producing an overall score as well as scores for social "fear" and "avoidance." In this study, all participants completed the LSAS once during the orientation visit. Note that, despite the non-clinical sample, participants still reported substantial variability in LSAS scores (*M*=35.54, *SD*=18.67, range=5-76; median=30.00 α=.94; see Supplementary Materials, Figure 1). Furthermore, LSAS scores for 26 of the 48 participants (54.17%) exceeded 30, which has been identified as a cutoff for non-generalized social anxiety disorder; 5 of these 26 participants (10.42% of the total sample) also met the cutoff of 60 for generalized social anxiety disorder (Mennin et al., 2002). Cronbach's alphas for the Avoidance and Fear subscales were α=.87 and α=.91, respectively.

Alcohol Consumption

Alcohol consumption was measured using data derived from transdermal alcohol sensors, which were worn by participants throughout the study. SCRAM reports were also validated with secondary measures of drinking behaviors, which included daily self-reports of the number of drinks consumed as well as evidence of drinking as coded from participant photographs (e.g., alcohol present or absent).

Following data collection, transdermal data were converted into estimated breath alcohol concentration (eBrAC) values using BrAC Estimator software (Luczak & Rosen, 2014). BrAC Estimator Software uses a first principles forward model for estimating BrAC from transdermal

data, and the parameters in this model were tuned to each individual SCRAM device and participant based on breathalyzer and transdermal readings collected at laboratory calibration sessions. Prior research indicates strong correspondence between eBrAC derived from this software and self-reports and breathalyzer measures of alcohol consumption (Luczak & Rosen, 2014).

Social Context and Familiarity

Social context was assessed according to the environmental pictures participants submitted during the ambulatory portion of the study and later rated in the laboratory using the photo-report task. In the context of the photo report task, participants indicated the approximate total time they had spent interacting with each person visible within the photograph. Eleven binned response options ranged from 0 hours in cases of strangers to 10,000+ hours for close friends or family members, and participants were provided with reference points to help them provide accurate estimates (see Supplementary Materials, Table 1 for response options and reference points). They also categorized their relationship with each person (choosing from "romantic partner," "family member," "close friend," "friend," "acquaintance," "coworker," "stranger," or "other"). Our primary index of familiarity in this study assessed the total time spent with the individuals present in this environment (see also Fairbairn et al., 2018), as a measure capable of assessing dimensions of both familiarity (e.g., environments involving many close friends) as well as novelty (e.g., stranger contexts).

Data Analysis Plan

All data and analytic code required to replicate the results of this study can be found here: https://osf.io/j2eby/?view_only=8b3a4624b46b4623a0d8b284affefc34. Multilevel models were employed to account for the clustering of repeated observations within individuals (Raudenbush

& Bryk, 2002). These models incorporated two levels of analysis—within person (Level 1) and

between person (Level 2). Given non-normally distributed outcomes, we utilized generalized

linear models assuming a Poisson distribution and accounting for overdispersion. We also

incorporated covariates consistent with Fairbairn et al. (2018) aimed at controlling for key person

and context-level factors including time of day and day of week at Level 1 and gender, age, and

typical drinking patterns at Level 2. In line with our prior analysis of drinking context (Fairbairn

et al., 2018), we opted to examine concurrent vs. lagged drinking patterns.[1] For all models, *ExpB*

is a risk ratio reflecting the relative percentage change (increase or decrease) in the dependent

variable per unit increase in the independent variable. In the context of this dataset comprising

1544 photographs (N=48 individuals; see Ambulatory Descriptives below), assuming a 2-tailed

test of significance with α= 05, the current dataset afforded 80% power to detect interactions

between social anxiety and contextual familiarity that are small in magnitude (r^2=.013; Faul et

al., 2007).

Results

Preliminary Analyses and Ambulatory Descriptives

Participants completed an average of 93.1% of ambulatory surveys, yielding a total of

1559 responses and 1544 environmental photographs (see Figure 1). See Supplementary

Materials for full discussion of ambulatory alcohol measures, though note that sixteen

observations produced eBrAC values above .3% and were excluded as outliers, leaving 1543

eBrAC values to be used in subsequent analyses pertaining to drinking outcomes. Regarding

measures of social context and familiarity, results indicated considerable variability in drinking

environment and levels of social familiarity (see Supplementary Materials). Results also

indicated no relationships between levels of social anxiety and various indices of social context

(see Supplementary Materials).

Primary Analyses of Social Anxiety and Contextual Familiarity

Results indicated a main effect for social familiarity on alcohol consumption, such that eBrAC decreased as familiarity increased, $b=-.096$, $ExpB=.908$, $t=-3.96$, $p<.001$ (Figure 2; see also Fairbairn et al., 2018). However, no significant main effect emerged for social anxiety on alcohol consumption, $b=.003$, $ExpB=1.003$, $t=.44$, $p=0.659$.

In testing our main hypothesis, results revealed a significant interaction between social anxiety and social familiarity in predicting eBrAC, $b=-.004$, $ExpB=.996$, $t=-2.99$, $p=.003$, (see Figure 3). To probe this interaction, we conducted analyses in which we re-centered participants' LSAS scores both one standard deviation above ("high" social anxiety) and one standard deviation below ("low" social anxiety) the mean. Among those lower in social anxiety, no significant relationship emerged between social familiarity and eBrAC, $b=.007$, $ExpB=1.007$, $t=.17$, $p=.867$. In contrast, among those higher in social anxiety, there was a 14% increase in eBrAC per unit decrease in social familiarity within the drinking context, $b=-.152$, $ExpB=.859$, $t=-4.92$, $p<.001$. To elucidate which elements of social anxiety were driving our effects, we subdivided LSAS total scores into primary indexes of "Fear" and "Avoidance." Results revealed a significant interaction between social anxiety and contextual familiarity for Fear, $b=-.009$, $ExpB=.991$, $t=-3.67$, $p<.001$, but the effect was smaller for Avoidance, $b=-.005$, $ExpB=.995$ $t=-1.62$, $p=.106$. Taken together, results suggest that participants higher in social anxiety (particularly social fear) consume greater quantities of alcohol in unfamiliar social contexts, whereas participants low in social anxiety exhibit no such setting-dependent drinking patterns.

Primary models presented above include *all* eBrAC values collected during ambulatory assessment, and thus capture participants during a mixture of sober and intoxicated moments.

Thus, it is unclear whether the above models capture contextual anxiety effects on the decision to consume any alcohol at all (i.e., to start drinking) vs. effects on the decision to consume more alcohol (i.e., to drink more when already in a drinking context). We therefore conducted two supplementary models: one logistic model predicting a binary index of drinking, and one generalized model predicting continuous eBrAC values specifically within drinking episodes. Results suggested the interaction between social anxiety and social familiarity emerged specifically in the continuous model predicting the quantity of alcohol consumed within drinking episodes, b=-.003, $ExpB$=.997, t=-2.32, p=.021, but not in the logistic model predicting drinking vs. not, b=-.001, $ExpB$=.999, t=-0.85, p=.396. Consequently, hypothesized interactions reported above appear to be driven primarily by variability in the quantity of alcohol consumed in drinking situations vs. variability in whether or not individuals decide to drink in the first place.

Discussion

The current study integrated survey-based experience-sampling methodology with transdermal alcohol sensor technology in an effort to examine relationships between participants' drinking behaviors and levels of social anxiety. In doing so, this study sought to explore the role of the social familiarity in shaping patterns of alcohol consumption, a factor that is often discounted in traditional alcohol research paradigms and that may be particularly relevant in the area of social anxiety. Consistent with our predictions, as well as theory regarding social drinking motivations (Cooper et al., 2014; Fairbairn & Sayette, 2014; MacAndrew, 1982), findings indicated that participants with higher levels of trait social anxiety consumed more alcohol in unfamiliar social environments relative to familiar social settings. In contrast, participants with lower levels of trait social anxiety did not demonstrate this pattern of context-dependent consumption. These results suggest that accounting for variations in drinking settings,

especially as these relate to social factors such as familiarity, may represent an important step in clarifying the relationship between social anxiety and drinking behaviors. Additionally, although the research literature has indicated strong links between alcohol use disorder and social anxiety, studies have been surprisingly mixed surrounding the question of whether socially anxious individuals consume alcohol in greater quantities (Booth & Hasking, 2009; Ham et al., 2016; Tran et al., 1997). Results of this study may offer a first step in resolving these inconsistencies by indicating that differences in environment may account for some of this variability.

Results of supplementary analyses further indicated that the interaction between trait social anxiety and familiarity emerged specifically in predicting quantity of alcohol consumed and not in predicting whether any alcohol consumption had taken place. One possible interpretation of this result is that, when participants felt the urge to drink, this urge was particularly strong, driven by the characteristics of the social environment in which they found themselves. Analyses subdividing social anxiety into sub-classes of fear and avoidance further indicated results were driven primarily by participants' fear of social situations and less so by avoidance, potentially suggesting that participants were not necessarily avoiding social environments, but rather that they may have experienced heightened distress-driven urges to drink within them. Future research targeting participant motivations for engaging in drinking would provide valuable clarity on this point.

Study results offer an expansion of the extant literature examining social anxiety and drinking behaviors by providing support for a trait-by-context interaction in shaping alcohol consumption. Prior research exploring state social anxiety via experience-sampling methodology has found support for the role of elevated social distress in predicting drinking behaviors (Battista et al., 2015; Goodman et al., 2018), a result that is broadly consistent with the present

findings as well as models of negative affect regulation (e.g. Bresin & Mekawi, 2021; Cooper et al., 1995). Such results, however, raise questions when compared against equivocal findings regarding trait-level assessments of social anxiety and alcohol consumption (Morris et al., 2005). The present results may represent a step towards resolving this inconsistency by suggesting that perhaps the *interaction* between trait social anxiety and familiarity across social environments is what drives alcohol use, a perspective that may, in turn, allow for the integration of seemingly contradictory patterns within studies to date.

Limitations of the present research should be considered. First, the number of social photographs depicting drinking in the current study was modest, although we note our aforementioned 80% power to detect small interactions between social anxiety and familiarity. Additionally, study results are derived only from trait-level assessments of social anxiety, as data regarding fluctuations in social anxiety across environments were not collected. Furthermore, our results are derived from a non-clinical sample with generally low levels of social anxiety. As such, future studies of clinical populations should endeavor to integrate assessments of social relationships to clarify the contexts in which problematic drinking occurs. We also note that our social context measure was imperfect, as not all individuals present in the setting were captured in participant photographs. While retrospective reconstructions of social environments would likely be difficult for participants, integrating opportunities to provide information on non-visible individuals may help address this limitation. Finally, we note that methods for translating transdermal alcohol data to BrAC values are still early in development, and situational factors (e.g. environmental alcohol) may influence transdermal device outputs. Future validation research in the area of transdermal sensors is needed.

Conclusion

      Results of this study suggest that a consideration of context is critical to understanding individual-level drinking patterns and vulnerability to alcohol use disorder. Alcohol consumption does not occur in a vacuum, but instead represents a product of individuals' motivations to drink and the broader environmental contexts in which they consume alcohol. Consequently, in seeking to develop effective strategies for protecting against the development of alcohol use disorder in socially anxious individuals, an approach that integrates a consideration of both person and environment is essential.

References

Abrams, K., Kushner, M., Medina, K. L., & Voight, A. (2001). The pharmacologic and expectancy effects of alcohol on social anxiety in individuals with social phobia. *Drug and Alcohol Dependence, 64*(2), 219-231.

Barnett, N. P., Meade, E. B., & Glynn, T. R. (2014). Predictors of detection of alcohol use episodes using a transdermal alcohol sensor. *Experimental and Clinical Psychopharmacology, 22*(1), 86-96.

Battista, S. R., Mackinnon, S. P., Sherry, S. B., Barrett, S. P., MacNevin, P. D., & Stewart, S. H. (2015). Does alcohol reduce social anxiety in daily life? A 22-day experience sampling study. *Journal of Social and Clinical Psychology, 34*(6), 508-528.

Booth, C., & Hasking, P. (2009). Social anxiety and alcohol consumption: The role of alcohol expectancies and reward sensitivity. *Addictive Behaviors, 34*(9), 730-736.

Bresin, K., & Mekawi, Y. (2021). The "why" of drinking matters: A meta-analysis of the association between drinking motives and drinking outcomes. *Alcoholism: Clinical and Experimental Research, 45*(1), 38-50.

Buckner, J. D., Schmidt, N. B., Lang, A. R., Small, J. W., Schlauch, R. C., & Lewinsohn, P. M. (2008). Specificity of social anxiety disorder as a risk factor for alcohol and cannabis dependence. *Journal of Psychiatric Research, 42*(3), 230-239.

Christensen, T. C., Barrett, L. F., Bliss-Moreau, E., Lebo, K., & Kaschub, C. (2003). A practical guide to experience-sampling procedures. *Journal of Happiness Studies, 4*(1), 53-78.

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. Heimberg, M. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York: Guilford Press.

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology, 69*(5), 990–1005.

Cooper, R., Hildebrandt, S., & Gerlach, A. L. (2014). Drinking motives in alcohol use disorder patients with and without social anxiety disorder. *Anxiety, Stress & Coping: An International Journal, 27*(1), 113-122.

Crum, R. M., & Pratt, L. A. (2001). Risk of heavy drinking and alcohol use disorders in social phobia: A prospective analysis. *The American Journal of Psychiatry, 158*(10), 1693-1700.

Fairbairn, C. E., Bresin, K., Kang, D., Rosen, I. G., Ariss, T., Luczak, S. E., Barnett, N.P., & Eckland, N. S. (2018). A multimodal investigation of contextual effects on alcohol's emotional rewards. *Journal of Abnormal Psychology, 127*(4), 359-373.

Fairbairn, C. E., & Kang, D. (2019). Temporal dynamics of transdermal alcohol concentration measured via new-generation wrist-worn biosensor. *Alcoholism: Clinical and Experimental Research, 43*(10), 2060-2069.

Fairbairn, C. E., Rosen, I. G., Luczak, S. E., & Venerable, W. J. (2019). Estimating the quantity and time course of alcohol consumption from transdermal alcohol sensor data: A combined laboratory-ambulatory study. *Alcohol, 81*, 111-116.

Fairbairn, C. E., & Sayette, M. A. (2014). A social-attributional analysis of alcohol response. *Psychological Bulletin, 140*(5), 1361-1382.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Goodman, F. R., Stiksma, M. C., & Kashdan, T. B. (2018). Social anxiety and the quality of

   everyday social interactions: The moderating influence of alcohol consumption. *Behavior*

   Therapy, 49(3), 373-387.

Ham, L. S., Bacon, A. K., Carrigan, M. H., Zamboanga, B. L., & Casner, H. G. (2016). Social

   anxiety and alcohol use: The role of alcohol expectancies about social outcomes.

   Addiction Research & Theory, 24(1), 9-16.

Heimberg, R. G., Horner, K. J., Juster, H. R., Safren, S. A., Brown, E. J., Schneier, F. R., &

   Liebowitz, M. R. (1999). Psychometric properties of the Liebowitz social anxiety scale.

   Psychological Medicine, 29(1), 199-212.

Luczak, S. E., & Rosen, I. G. (2014). Estimating BrAC from transdermal alcohol concentration

   data using the BrAC estimator software program. *Alcoholism, Clinical and Experimental*

   Research, *38*(8), 2243–2252.

MacAndrew, C. (1982). An examination of the relevance of the individual differences (A-trait)

   formulation of the tension-reduction theory to the etiology of alcohol abuse in young

   males. *Addictive Behaviors, 7*(1), 39-45.

Marques, P. R., & McKnight, A. S. (2009). Field and laboratory alcohol detection with 2 types of

   transdermal devices. *Alcoholism: Clinical and Experimental Research, 33*(4), 703-711.

Mennin, D. S., Fresco, D. M., Heimberg, R. G., Schneier, F. R., Davies, S. O., & Liebowitz, M.

   R. (2002). Screening for social anxiety disorder in the clinical setting: Using the

   Liebowitz Social Anxiety Scale. *Journal of Anxiety Disorders, 16*(6), 661-673.

Morris, E. P., Stewart, S. H., & Ham, L. S. (2005). The relationship between social anxiety

   disorder and alcohol use disorders: A critical review. *Clinical Psychology Review, 25*(6),

   734-760.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 2). Thousand Oaks, CA: Sage.

Sakai, J. T., Mikulich-Gilbertson, S., Long, R. J., & Crowley, T. J. (2006). Validity of transdermal alcohol monitoring: Fixed and self-regulated dosing. *Alcoholism: Clinical and Experimental Research, 30*(1), 26-33.

Sayette, M. A., Creswell, K. G., Dimoff, J. D., Fairbairn, C. E., Cohn, J. F., Heckman, B. W., Kirchner, T. R., Levine, J. M., & Moreland, R. L. (2012). Alcohol and group formation: A multimodal investigation of the effects of alcohol on emotion and social bonding. *Psychological Science, 23*(8), 869-878.

Stevens, S., Cludius, B., Bantin, T., Hermann, C., & Gerlach, A. L. (2014). Influence of alcohol on social anxiety: An investigation of attentional, physiological and behavioral effects. *Biological Psychology, 96*, 126-133.

Stevens, S., Cooper, R., Bantin, T., Hermann, C., & Gerlach, A. L. (2017). Feeling safe but appearing anxious: Differential effects of alcohol on anxiety and social performance in individuals with social anxiety disorder. *Behaviour Research and Therapy, 94,* 9-18.

Terlecki, M. A., & Buckner, J. D. (2015). Social anxiety and heavy situational drinking: Coping and conformity motives as multiple mediators. *Addictive Behaviors, 40*, 77-83.

Trafford, E. (2016). MetricWire (Version 2.2.10) [Mobile application software].

Tran, G. Q., Haaga, D. A. F., & Chambless, D. L. (1997). Expecting that alcohol use will reduce social anxiety moderates the relation between social anxiety and alcohol consumption. *Cognitive Therapy and Research, 21*(5), 535-553.
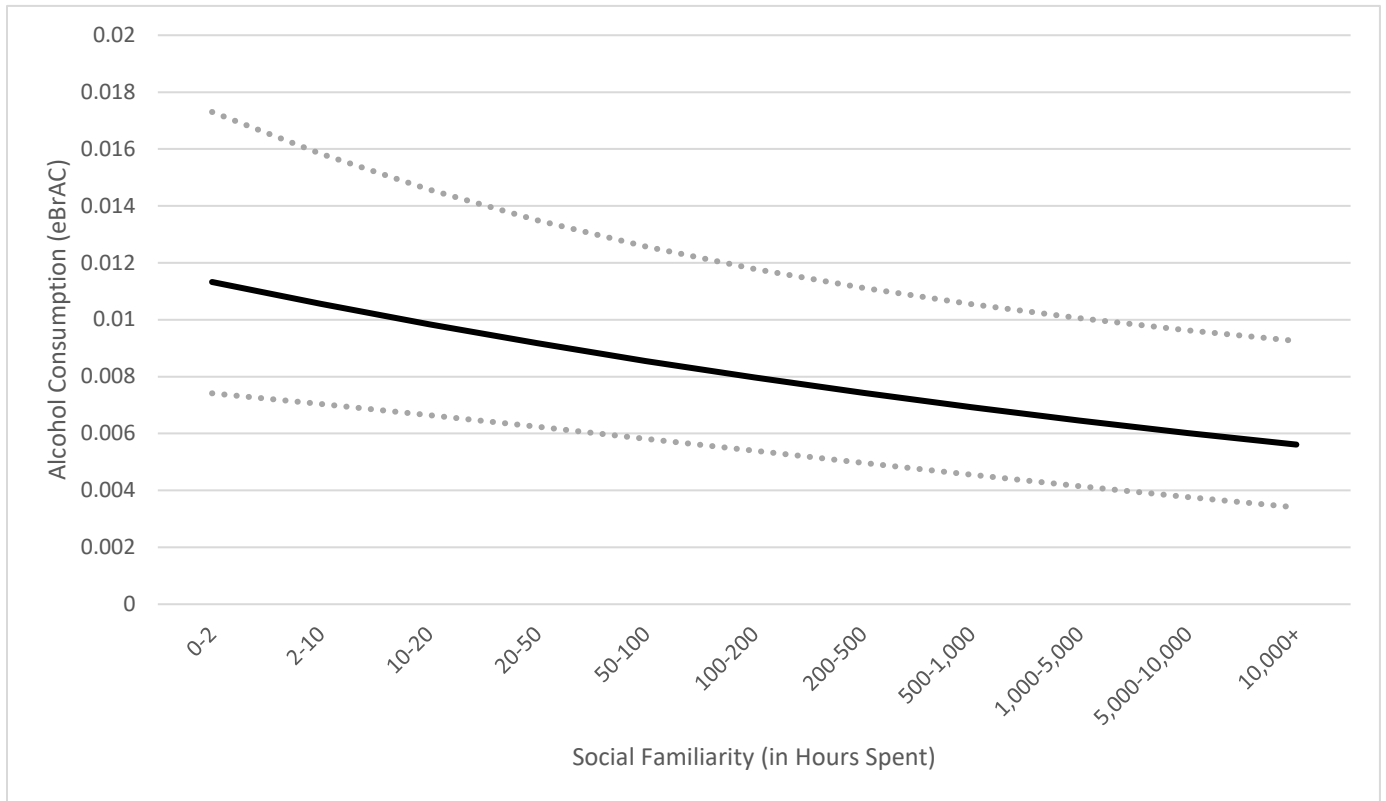
Figure 1

Examples of participant photographs, depicting individuals they were drinking with as well as any strangers that may have been present and the surrounding drinking context. Participants whose photographs are depicted provided consent for image dissemination via scientific publication.
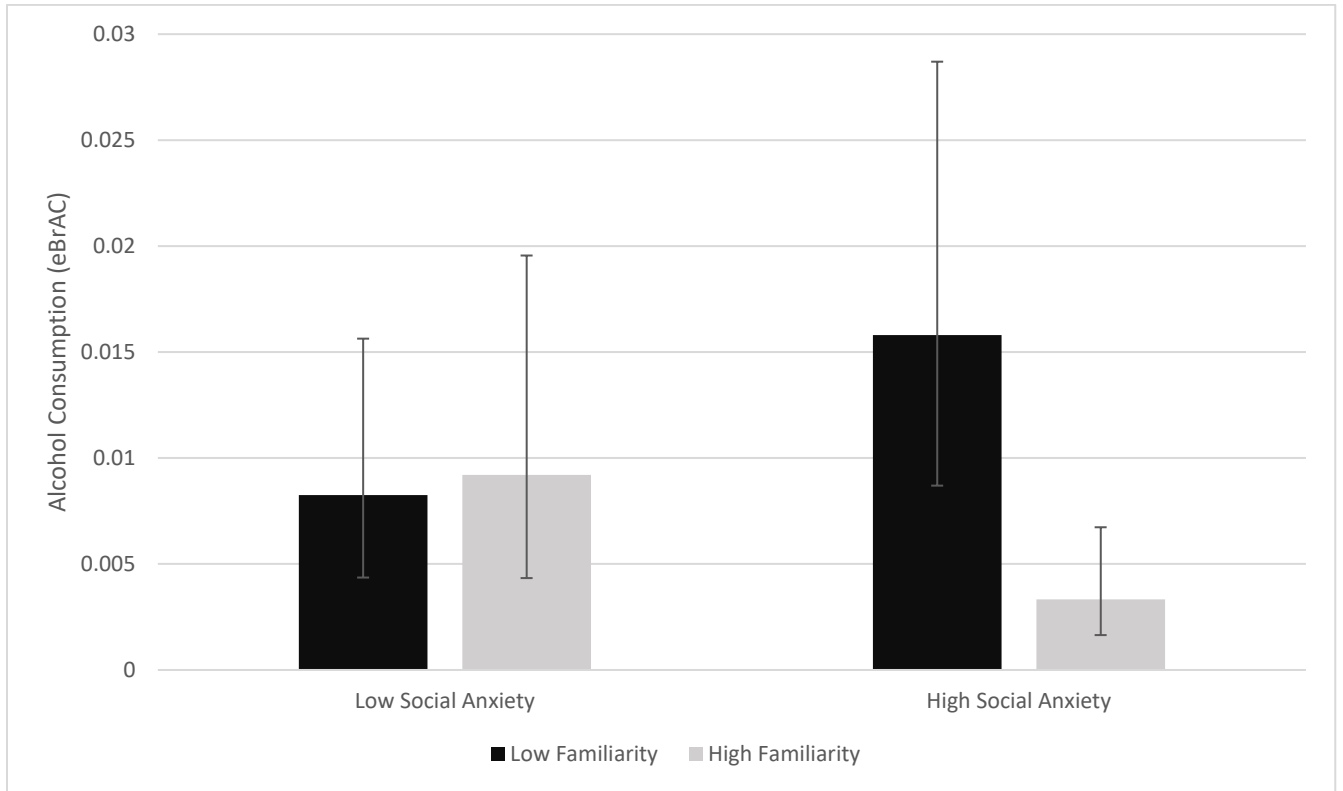
Figure 2

Graph depicting the relationship between eBrAC and social familiarity across all data points, as

well as 95% confidence interval

Figure 3

Graph depicting the relationship between eBrAC and social familiarity for both low and high

social anxiety across both low and high levels of social familiarity

"Low" and "high" social anxiety were defined as 1 *SD* below and 1 *SD* above the mean LSAS

score, respectively. For the purposes of this graph, "low" familiarity was defined as the lowest

response option (0-2 hours), while "high" familiarity was defined as the highest response option

(10,000+ hours).