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Do Sociability Expectancies Moderate Social Anxiety Predicting Alcohol Consumption Following a Social Stressor Speech Task

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by

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Dedication

This dissertation is dedicated to my dear friend Andrew, who was taken from this world too soon. You are missed friend.

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Abstract

Alcohol use disorder (AUD) and social anxiety disorder (SAD) are two of the most common and chronic psychiatric conditions in the United States. Research indicates individuals with SAD are more likely to meet lifetime criteria for AUD and experience greater AUD symptomatology and severity. Theories explaining this connection are limited, with most built upon tension reduction principles not specific to SAD; however, a recent biopsychosocial model focuses on factors specific to SAD, such as drinking to cope with states of high negative affectivity and arousal. Despite high rates of comorbidity, and more severe AUD presentation, the literature is mixed regarding social anxiety and alcohol consumption. Some have found positive, others negative, and many no association at all. One potential moderator that may help understand these inconsistent findings is alcohol expectancies. The current study recruited 52 undergraduate students to test the hypothesis that sociability expectancies would moderate the effect of social anxiety on ad-lib drinking following a social stressor; this hypothesis was not supported. Exploratory analyses found positive affect significantly moderated the effect of social anxiety on alcohol consumption. Consistent with the biopsychosocial model, among those with low positive affect social anxiety was positively associated with alcohol consumption; among those with high positive affect the association was negative, suggesting that positive anxiety may serve as a protective factor against alcohol consumption in socially anxious individuals. Further research is needed that includes individuals meeting diagnostic criteria for SAD, as well as experimental conditions with control groups, to clarify these results.

Chapter One:

Introduction

Social anxiety disorder (SAD) and alcohol use disorder (AUD) are two of the most common psychiatric disorders in the United States, affecting approximately 13% (Kessler et al., 2012) and 29% (Grant et al., 2015) of adults in their lifetime respectively. Large epidemiological surveys have found that these disorders are often comorbid; individuals with lifetime SAD are significantly more likely to report lifetime AUD than those without SAD (48.2% and 29.3% respectively; Grant et al., 2005), and those with co-occurring SAD and AUD report significantly more symptoms of AUD than those with AUD only (Schneier et al., 2010). As the development of SAD typically occurs prior to AUD, it is often thought that SAD contributes to the development of AUD (Schneier et al., 2010). Additionally, prospective studies found that those with subclinical (Crum & Pratt, 2001) and clinical (Buckner et al., 2008) symptoms of SAD were at elevated risk of developing AUD 13 and 14 years later, respectively.

In addition to large epidemiological studies, large treatment studies (e.g., Project MATCH; Project MATCH Research Group, 1997) have also found elevated rates of SAD among individuals seeking treatment for AUD, as well as increased symptoms and severity (i.e., higher scores on alcohol dependence measures) of AUD among those with both SAD and AUD (Thomas et al., 1999). Despite the increased symptoms and severity of AUD among those with SAD, the SAD and non-SAD groups did not differ on a number of different alcohol use variables, including age of onset of alcohol problems, quantity and frequency of drinking, and

proportion of days abstinent in the last 90 days (Thomas et al., 1999). Further, participants with SAD reported drinking to improve sociability and enhance functioning more than those without SAD. Many other studies of individuals in treatment for AUD have further demonstrated higher rates of SAD than found in the general population, as well as higher rates of comorbid psychiatric conditions among those with SAD and AUD as compared to those without SAD (e.g., Cooper et al., 2014; Terra et al., 2006; Yoshimi et al., 2016; see Oliveira, Bermudez, de Amorim Macedo, & Passos, 2018 for review). Despite high levels of problematic drinking among those with SAD, and a wealth of practical and theoretical research, our understanding of the mechanisms linking the two is still limited. The current study seeks to explore individual differences that may help explain this high level of comorbidity, including which individuals with SAD may be at higher risk of developing AUD.

Theoretical Models: Alcohol and Negative Affect

One of the most enduring sets of etiological theories underlying problematic alcohol use that have the potential to provide insight into the link between AUD and SAD are those focused broadly on alcohol's role in alleviating negative affect, including anxiety. For example, the tension-reduction theory (TRT), based on early work by Conger (1956), proposed that alcohol serves as an anxiolytic. Specifically, the TRT posits that people use alcohol because of its tension reduction effects, and that these effects help to reduce avoidance of situations that might normally elicit tension. The TRT may help to explain alcohol use among socially anxious individuals, as they are likely to use alcohol to reduce tension associated with social situations and therefore, when alcohol is used successfully to reduce tension, more likely to depend on alcohol to alleviate that tension in the future (Kushner et al., 1990). Further, consistent with the TRT, socially anxious individuals might use alcohol to reduce their avoidance of social situations

that would normally cause fear and anxiety (Morris et al., 2005). Later models expanded on the concepts brought forth in the TRT, with the self-medication hypothesis (Khantzian, 1985, 1997) positing that people are more likely to use a particular substance (e.g., alcohol for anxiety or cocaine for depression) if the pharmacological effects help to alleviate their distress or negative states caused by a psychiatric disorder. The stress response dampening model (Sher & Levenson, 1982) specified individual differences that influence the anxiolytic effects of alcohol, and thus how likely individuals are to drink alcohol for tension reduction purposes. Specifically, Sher and Levenson found that individuals with certain attributes, such as low scores on a sociability measure, had stronger pleasant physiological and affective responses following alcohol consumption.

Expanding upon traditional TRT models, several theories also highlight the important role of cognitive processes in explaining the anxiolytic effects of alcohol. For example, The Self-Awareness Model (SAM; Hull, 1981) states that alcohol decreases an individual's self-awareness, thereby providing a source of psychological relief via reduction in sensitivity to cues regarding appropriate behavior and self-evaluative feedback of such behaviors. This may be particularly salient for individuals with SAD, as they are more likely to engage in self-monitoring behavior and decreasing awareness of their own behavior may help to lower the amount of anxiety and fear of evaluation that they experience in social situations. Similarly, the Attention Allocation Model (AAM; Steele & Josephs, 1988), theorizes that alcohol may reduce an individual's ability to process information in certain situations. Specifically, alcohol limits effortful processing of information, and as such attention is typically devoted to the most salient cues in the environment, an effect known as alcohol myopia (Battista et al., 2010). Indeed, research has demonstrated that alcohol reduces anxiety only in the presence of positive stimuli,

but not neutral stimuli under threat conditions (e.g., Curtin et al., 1998; Donohue et al., 2007). Finally, the Appraisal Disruption Model (ADM; Sayette, 1993) posits that alcohol serves as an anxiolytic by interfering with the appraisal of stressful information, and is more likely to reduce anxiety responses if it has been consumed prior to the initial appraisal of the stressor. The ADM further states that the likelihood of alcohol reducing distress is increased when appraisal processes are more impaired.

Taken together, these models are consistent with many other prominent theories of addiction (e.g., Baker et al., 1986; Baker et al., 2004; Cox & Klinger, 1988, 1990; Koob, 2013), which emphasize the importance of negative reinforcement pathways in the development and maintenance of problematic use, providing an intuitive explanation for the link between SAD and AUD. Indeed, individuals report both strong expectations that alcohol will reduce anxiety and stress (e.g., Lewis & O'Neill, 2000), and report drinking to cope with negative affect (e.g., Cooper et al., 1992). However, laboratory-based investigations of negative affect and alcohol consumption have resulted in mixed and often contradictory findings (Greeley & Oei, 1999; Sayette, 1999; Sher, 1987; Stritzke et al., 1996). Furthermore, evidence supporting tension-reduction hypotheses, with regard to reducing social anxiety, are also mixed (Battista et al., 2010). These inconsistent findings have led some researchers to suggest that alcohol's effect on negative affect is highly conditional upon both individual and situational factors (e.g., expectancies and stress-inducing environments; Greeley & Oei, 1999), requiring a theoretical model specific to the SAD and AUD relationship.

Biopsychosocial Model of Social Anxiety and Substance Use

Accordingly, Buckner and colleagues introduced a biopsychosocial model of social anxiety and substance use (Buckner et al., 2013; Buckner et al., 2021), integrating many

components of the models previously reviewed as well as adding factors that are specific to SAD. The biopsychosocial model includes major symptoms of social anxiety (i.e., physiological arousal, evaluation fears, low positive affect, perceived social deficits, and social avoidance) and coping motivated use (i.e., use to manage arousal, use to manage evaluation fears, use to increase positive affect, use for social facilitation, and use to avoid evaluation) that are thought to lead to reliance on substance use and subsequently disordered behavior (i.e., an AUD). Specifically, Buckner et al. (2021) introduced evidence supporting the theory that socially avoidant individuals who drink to cope with anxiety are more likely to experience increased alcohol-related problems (Collins et al., 2019). Although individuals with SAD who consumed alcohol prior to a speech task reported less anxiety while giving the speech, impartial observers rated the speeches of those who had consumed alcohol as worse than those who did not consume alcohol (Stevens et al., 2017). This outcome suggests that drinking to cope with social anxiety is not a successful long-term strategy, and calls into question why individuals with SAD continue to drink alcohol as an attempt to cope with their social anxiety.

Although the biopsychosocial model includes many of the considerations put forth by the other TRT-based and cognitive models reviewed, the inclusion of low positive affect as both a symptom and motivating factor for alcohol consumption among those with AUD is an important one, as individuals with SAD are characterized by high negative and low positive affect (Brown et al., 1998; Buckner et al., 2013; Kashdan & Collins, 2010), and those displaying such patterns of affectivity have shown increased substance use (Wills et al., 1999). Further, while the biopsychosocial model includes biological (e.g., biological vulnerability), demographic (e.g., sex, race, age), and social characteristics (e.g., context), a major limitation is the lack of consideration of individual characteristics such as personality and past experiences, including

history with alcohol. As such, alcohol outcome expectancies are an important component of alcohol related decision making that is lacking in the biopsychosocial model.

Although drinking motives and expectancies are thought to influence drinking behavior similarly, expectancies reflect motivational processes that are more contextual or situational, while drinking motives are more global or trait-based motivational processes. Research shows that expectancies moderate associations between motives and drinking behavior (e.g., Goldsmith et al., 2009; Hasking et al., 2011). Consequently, while drinking motives may predict general trends of who is more likely to consume alcohol, they lack the fine granularity that expectancies provide in predicting behavior that may be more context dependent and change from one situation to the next. For example, a person whose drinking is typically motivated by coping with anxiety is less likely to drink in a situation in which they expect doing so might make them more anxious. In such a situation, drinking motives would not be a good predictor of behavior. As such, the biopsychosocial model would benefit from the inclusion of expectancies, as they have the potential to increase the predictive utility of the model.

Unsurprisingly, most models of SAD and AUD comorbidity center around desires to alleviate the negative experience of social anxiety symptomatology. These models mostly conceptualize a causal association in which the predominantly negatively reinforcing effects of alcohol lead to increased use over time in those with SAD, to ameliorate symptoms of their social anxiety prior to and during stressful social situations that would normally elicit fear and discomfort. Although these models seem to make sense on their face, and epidemiological research and treatment studies appear to support a causal association between SAD and AUD, the results of research seeking to understand the reasons for this association have been mixed.

Mixed Findings

The link between social anxiety and self-reported quantity and frequency of alcohol consumption has been inconsistent; some studies have found a positive association (Levine & Schlauch, 2020; Neighbors et al., 2007), some a negative association (Eggleston et al., 2004; Ham & Hope, 2006; LaBrie et al., 2008; Stewart et al., 2006; Tran et al., 1997), and many no association at all (Anderson et al., 2011; Buckner et al., 2011; Buckner et al., 2006; Buckner & Heimberg, 2010; Gilles et al., 2006; O'Grady et al., 2011). Due to the intertwined nature of SAD, AUD, and other comorbid psychopathology it is difficult to untangle the factors at play which help to simultaneously explain the high rates of comorbidity between SAD and AUD and the large number of null findings between social anxiety and alcohol consumption in the literature.

Further complicating the issue, experimental research applying theoretical models of SAD and AUD to alcohol behavior have also produced mixed results. In a test of the SMH, Chutuape and de Wit (1995) found that alcohol reduced anxiety in socially anxious individuals, but did not find an increase among socially anxious individuals compared to healthy controls for whether and how much alcohol they chose to administer. In other words, while alcohol had an anxiolytic effect for those with SAD, they were no more likely to consume alcohol, or consume greater amounts of alcohol, than healthy controls. Other research conflicts with these findings; a review of the relationship between social anxiety and alcohol use, evaluating the SMH (Carrigan & Randall, 2003), concluded that there is support for the hypothesis that individuals with SAD use alcohol to reduce anxiety, but not for alcohol actually reducing anxiety. This conclusion was based on several studies showing that both placebo and alcohol reduced anxiety, and that placebo was as effective as alcohol (e.g., Abrams et al., 2001; Himle et al., 1999; Naftolowitz et al., 1994). Additionally, while some have found that social anxiety is positively associated with

alcohol consumption prior to a stressful task (Kidorf & Lang, 1999), others have not (Holroyd, 1978). In light of these mixed findings, and a failure to find differences in anxiety reduction between alcohol and placebo, many (e.g., Battista et al., 2010) have concluded that an individual's expectations about how alcohol will affect them (i.e., alcohol expectancies) are likely an important factor in understanding the relationship between SAD and AUD.

Alcohol Outcome Expectancies

Alcohol expectancy theory emerged after early research showed that consumption of alcohol is dependent upon the expectations of the drinker that alcohol will lead to positive or negative consequences (Marlatt et al., 1973). Later research expanded on this theory (e.g., Goldman & Rather, 1993) by adding updated concepts of memory and information processing describing mental processes related to alcohol expectancies. Broadly, alcohol expectancies are thought of as information in long-term memory "that reflects the reinforcement value of alcohol use" (Goldman et al., 1999, p. 216) and plays a role in cognitive processes such as decisions about whether to consume alcohol. Alcohol consumption is positively related to expectations of positive outcomes (e.g., anxiety reduction, relief from withdrawal, pleasure, or relaxation) and negatively associated with expectations of negative outcomes (e.g., clumsiness, poor concentration, rudeness, inefficiency, or carelessness; Brown et al., 1987; Brown et al., 1980; Christiansen & Goldman, 1983; Fromme & D'Amico, 2000; Fromme et al., 1993; Southwick et al., 1981). Further, positive expectancies are strongly associated with the development of alcohol dependence and negative treatment outcomes, including relapse to problematic drinking in adolescents, emerging adults, and adults (Christiansen et al., 1989; Kilbey et al., 1998; Marlatt & George, 1984).

In response to the mixed findings in the literature, it has been proposed that alcohol expectancies may act as a moderator of the association between social anxiety and alcohol use (Tran et al., 1997). Accordingly, socially anxious individuals are hypothesized to consume more alcohol in situations where they believe alcohol consumption will have positive results, such as increasing sociability at a party, and consume less alcohol in situations where they believe it will have negative effects, such as cognitive/behavioral impairment prior to giving a speech (Eggleston et al., 2004). This idea is consistent with research that found individuals with SAD drank less prior to giving a speech than prior to a reading task, and more after giving a speech than after a reading task (Abrams et al., 2002). These findings contradict the predictions of the Appraisal Disruption Model, which state that alcohol is more effective at reducing stress when consumed prior to a stressful event. Although these individuals were likely anxious about giving a speech, it may be that their fear of the alcohol negatively affecting their performance was more salient than possible reductions in anxiety resulting from alcohol consumption. However, evidencing the mixed nature of findings in the SAD-AUD literature, Kidorf and Lang (1999) found a positive association between social anxiety and alcohol consumption in a lab-based study in which participants consumed alcohol with the expectation they would be delivering a speech following the drinking period. Additionally, among male participants social assertiveness expectancies were positively associated with alcohol consumption. Despite alcohol expectancies being a strong predictor of alcohol consumption and related behaviors, research applying expectancies to better understand the association between SAD and AUD has produced further mixed results (e.g., Eggleston et al., 2004; Lewis & O'Neill, 2000; Tran et al., 1997). Some possible reasons for this include situational factors and context, as well as differing value judgments between what “good” and “bad” (i.e., desirable and undesirable) outcomes are.

For example, in a study of undergraduate students at a large southeastern public university (Levine & Schlauch, 2020), we found a significant three-way interaction between sociability expectancies, social anxiety (high/low), and speech condition (yes/no) predicting both approach and avoidance inclinations toward alcohol in a cue-reactivity task. Among those who did not give a speech there was not a significant interaction (nor main effects) between social anxiety and sociability expectancies; however, for those who gave a speech prior to completing the cue-reactivity task the interaction was significant such that, among those with high social anxiety, as sociability expectancies increased alcohol approach inclinations decreased and avoidance inclinations increased. Those with low social anxiety had inverse associations between sociability expectancies and alcohol approach and avoidance inclinations. These findings indicate the possibility that, contrary to individuals with lower levels of social anxiety, individuals with SAD who think that alcohol will make them more sociable during a stressful situation are less likely to consume alcohol, possibly due to fears of negative evaluation in response to contemplating being more outgoing, or perhaps simply wanting to avoid being social. These findings are in contrast to those of Kidorf and Lang (1999), suggesting that sociability expectancies may function differently before versus after giving a speech and further highlighting the importance of context. Interestingly, tension reduction expectancies were not significantly associated with alcohol approach or avoidance inclinations, either as a main effect or interaction with social anxiety. This highlights the potential importance of domain specific expectancies (rather than "good" or "bad") in SAD AUD associations, as well as associations that may not initially appear to make sense, as the situational influence of expectancies on decisions made around drinking behavior may be more salient among individuals with SAD and have a larger impact on alcohol-related outcomes.

Considering these findings within the broader context of prior research, and the inconsistencies found in the SAD and AUD literature, this research helps to highlight the complexity of human behavior and the potential limitations of explaining behavior for all or many using one broad theory. Many variables could have been operationalized differently in this and other studies that may have significantly altered outcomes. The TRT and cognitive based models reviewed earlier provide valuable insight into how and why those with SAD are likely at higher risk for developing AUD during their lifetime. For example, TRT based models seek to explain why individuals consume alcohol, while cognitive based models help to explain how the anxiolytic properties of alcohol might function while they are consuming alcohol. The newer biopsychosocial model of SAD and AUD combines these factors, and importantly adds low positive affect as a motivating factor for alcohol consumption. Ultimately, given the extremely situational nature of SAD, associations between SAD and AUD are likely highly individual and largely influenced by how the individual thinks alcohol will affect them in their current situation. However, when boiled down, these theories are all essentially grasping to explain a phenomenon in which people who are suffering seek amelioration and relief. Given the factors reviewed, it may be that one predominant universal theory or model of SAD and AUD (or AUD and many other comorbid psychiatric disorders) is not adequate to explain the unique learning of an individual resulting from their early direct and indirect experiences and contributing to the development of maladaptive behavior patterns. Thus, if a universal model is not appropriate or applicable to understanding heterogeneous disorders such as SAD and AUD, it follows that careful examination of specific factors implicated in this association may prove fruitful in advancing the field.

Proposed Study

The purpose of the current study was to examine the utility of specific factors (i.e., sociability expectancies) that may increase understanding of AUD etiology among people experiencing symptoms of social anxiety. By using a laboratory-based pseudo-naturalistic study design that gave participants the opportunity to consume as much or as little alcohol as desired after performing a speech, the aim was to replicate and extend the findings of our previous study (i.e., sociability expectancies moderating the effect of social anxiety on alcohol approach and avoidance inclinations; Levine & Schlauch, 2020). The current study sought to determine whether sociability expectancies would moderate the effect of social anxiety on the amount of alcohol consumed during an ad-lib drinking alcohol taste test. This was done by recruiting undergraduate students and having them complete a laboratory-based alcohol taste test conducted after a social stressor speech task and measuring how much alcohol they consumed.

Aim 1. To determine whether sociability expectancies moderate the association between social anxiety and alcohol consumption during an ad-lib taste test following a social stressor speech task. Hypothesis 1: among those with low sociability expectancies, social anxiety will be positively associated with alcohol consumption.

Chapter Two:

Method

Participants

Fifty-two (N=52) undergraduate students at the University of South Florida between the ages of 21-25 were recruited using the undergraduate psychology research pool (SONA) and flyers posted on campus seeking participants for an in-lab study. As prior research has indicated that even those who experience symptoms of social anxiety at sub-clinical levels are at increased risk of developing AUD later in their life (Crum & Pratt, 2001), individuals were recruited along the full spectrum of SAD symptom presentation. This was done to allow for examination of the interaction between sociability expectancies and social anxiety symptoms at varying levels of symptom presentation, and to determine regions of significance representing at which levels sociability expectancies influence alcohol consumption differently among those with higher versus lower social anxiety. Following the recruitment of participants, the distribution of scores on the SIAS was evaluated to ensure that participants with higher social anxiety were adequately represented. The distribution of scores was compared with a distribution of data from more than 1400 students collected at the University of South Florida between 2016 and 2018. The mean SIAS score in that sample was 29.42 with a standard deviation of 13.95. Following a normal distribution, 15.9% of participants in the current study should have a SIAS score of 44 (i.e., one standard deviation above the mean) or greater.

Inclusion criteria were: (a) must be a USF student between the ages of 21-25 years old (b) must have consumed alcohol in the last 30 days. Exclusion criteria were: (a) currently taking medication to treat symptoms of anxiety (e.g., SSRIs, Benzodiazepines) (b) an allergy to alcohol (c) self-reported confirmed pregnancy or reason to suspect current pregnancy (d) currently seeking or receiving treatment for their alcohol use (e) consuming alcohol on the day of the study prior to arriving at the lab.

The average age of participants was 21.81 years (SD = 1.23), with 65% of them male. Approximately 26% identified their ethnicity as Hispanic and 68% identified their race as White (13% Black and 6% Asian). See table 1 for demographic information. Participants reported drinking alcohol an average of 1.34 times per week (SD = 1.30), consuming an average of 4.13 drinks per drinking occasion (SD = 2.38), and had a mean AUDIT score of 8.57 (SD = 6.00). See table 2 for means, standard deviations, and correlation matrix for alcohol related variables.

Measures

Alcohol Use Disorders Identification Test. The Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) is a brief 10-item measure frequently used to screen for potentially hazardous drinking. The AUDIT assesses the average quantity and frequency of alcohol consumed, drinking behaviors, and problematic outcomes related to drinking; a score of 8 or higher is considered indicative of problematic use.

Approach and Avoidance of Alcohol Questionnaire. The Approach and Avoidance of Alcohol Questionnaire is a 19-item craving measure (McEvoy et al., 2004) that assesses approach and avoidance inclinations toward consuming alcohol over the last week. Participants were asked to rate how much they agreed with each statement (e.g., “I wanted to drink as soon as

I have the chance" and "I deliberately occupied myself so I would not drink alcohol.") on a scale of 0 (Not at All) to 8 (Very Strongly).

Comprehensive Effects of Alcohol. The Comprehensive Effects of Alcohol (CEOA; Fromme et al., 1993) questionnaire is a 38-item measure that assess alcohol outcome expectancies. The CEOA has 7 sub-scales that cover positive (i.e., sociability, tension reduction, liquid courage, and sexuality) and negative (i.e., cognitive and behavioral impairment, risk and aggression, and self-perception) expectancies. Respondents indicated to what extent they agreed or disagreed (i.e., Disagree, Slightly Disagree, Slightly Agree, Agree) that certain effects would happen to them if they were under the influence of alcohol. Items from the sociability scale (e.g., "I would act sociable" and "It would be easier to talk to people") were used to explore the primary aim.

Demographics. Demographic information including gender, age, race, ethnicity, employment status and income, and education were collected using a self-report questionnaire.

Depression Anxiety Stress Scales. The short version of the Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995) is a 21-item measure that assesses depression, anxiety, and stress that was proposed at the same time as the original 42-item version. The DASS-21 correlates strongly with the original DASS, as well as other measures of depression, anxiety and stress, has cleaner factor loadings than the original measure, and is valid and reliable for use in clinical and non-clinical samples (Antony et al., 1998).

Drinking History Questionnaire. Alcohol use was assessed using the Drinking History Questionnaire (DHQ). The DHQ is a 10-item survey based on work by Cahalan et al. (1969) that

measures an individual's quantity and frequency of current and past alcohol use and their subjective experiences and beliefs related to their own use.

Modified Drinking Motives Questionnaire – Revised. The modified Drinking Motives Questionnaire – Revised (mDMQ-R; Grant et al., 2007) is a 28-item measure that assesses five different motivations to use alcohol: enhancing social experiences, peer pressure to use alcohol, enhancing positive emotions, coping with anxiety, and coping with depression.

Positive and Negative Affect Schedule. The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) was used to assess affect. The PANAS is a 20-item self-report measure that assesses positive (PA) and negative (NA) affect. Participants indicated how much they were experiencing 20 emotions measured by the PANAS by rating each one on a 5-point scale ranging from 1 (very slightly or not at all) to 5 (extremely). The PA and NA subscales of the PANAS have been shown to be reliable (Watson et al., 1988), and the instrument may be used to assess different periods of time (e.g., in the moment, today, past few days, past few weeks, in general).

Rutgers Alcohol Problem Index. The 18-item Rutgers Alcohol Problem Index (RAPI; Neal et al., 2006) is a revised version of the original 23-item RAPI (White & Labouvie, 1989) that assesses problematic drinking among adolescents. The RAPI asks respondents to indicate on a scale of 0 (Never) to 4 (More than 10 times) how often certain alcohol-related consequences (e.g., "Went to work or school high or drunk," "Had withdrawal symptoms, that is, felt sick because you stopped or cut down on drinking," and "Had a fight, argument, or bad feelings with a friend") they have experienced in the last 3 years as a result of their alcohol use.

Social Interaction Anxiety Scale. The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) is a 20-item measure of social anxiety that assesses fears of social interaction. Participants were asked to indicate to what extent a list of statements (e.g., "I find myself worrying that I won't know what to say in social situations" and "I feel I'll say something embarrassing when talking") is characteristic or true for them on a scale of 0 (Not at all characteristic or true of me) to 4 (Extremely characteristic or true of me).

Social Phobia Scale. The Social Phobia Scale (SPS; Mattick & Clarke, 1998) is a 20-item measure of social anxiety that assesses fears of evaluation during routine activities. Participants were asked to indicate to what extent a list of statements (e.g., "I worry about shaking or trembling when I'm watched by other people" and "I get tense when I speak in front of other people") is characteristic or true for them on a scale of 0 (Not at all characteristic or true of me) to 4 (Extremely characteristic or true of me).

Subjective Units of Distress Scale. The Subjective Units of Distress Scale (SUDS; Wolpe, 1969) is a measure that is commonly used in clinical and research settings to assess levels of distress and changes in distress. Participants were asked to indicate how they were feeling in the moment on a scale of 0 (Totally relaxed) to 100 (Highest distress / fear / anxiety / discomfort that you have ever felt). The SUDS was used to measure distress before and after the social stressor speech task.

State Social Anxiety. This brief 3-item measure of state social anxiety (SA3; Goodman et al., 2018) is used to assess social anxiety in the moment. Items include, "I worried about what other people thought of me," "I was worried that I would say or do the wrong things," and "During the interaction, I felt anxious/nervous." This measure was used to assess state social anxiety before and after the social stressor speech task.

Procedure

Initial study eligibility (not including consuming alcohol on the day of the study prior to arriving at the lab) was determined using the SONA online prescreening survey, for participants recruited via SONA, and a Qualtrics survey for those recruited via flyers. Eligible participants were provided with a description of the study prior to signing up, and then given the opportunity to sign up for a specific time slot; study sessions were conducted during the evening between 4:00 PM and 7:00 PM to minimize the likelihood that participants would be concerned that their alcohol consumption would affect their ability to attend classes or other responsibilities. Additionally, the study was only conducted on Mondays, Tuesdays, and Wednesdays to control for weekly patterns of drinking wherein college students consume more alcohol on Thursdays and Fridays than other weekdays (e.g., Del Boca et al., 2004; Finlay et al., 2012; Maggs et al., 2011). Members of the study staff conducting the study were two undergraduate research assistants (one female and one male) and the principal investigator (male graduate student). Upon arrival to a reception area of the lab, participants were asked to confirm: (a) their age by showing valid government issued identification (b) that they were not currently pregnant or did not suspect that they were currently pregnant (c) that they were not allergic to alcohol (d) that they had not consumed any alcohol that day. Next, participants were led to the simulated bar lab, which was decorated with alcohol posters and signs, and furnished with tables and chairs and a bar with barstools. Behind the bar, there were shelves of wine and spirits bottles filled with appropriately colored liquids to appear as though they contained alcohol. Participants then gave informed consent, and completed the study were compensated with SONA research credits (for SONA participants) or a $20 Amazon gift card (for flyer participants).

After being consented, participants completed baseline measures, with the SUDS and SA3 being completed last. After completing the SUDS participants were informed that they had 5 minutes to prepare a 5-minute speech on public speaking, that the research staff member conducting the study would rate them during their speech, and that they would be video recorded to facilitate ratings by other members of the research staff later. After the 5-minute preparation period participants delivered their speech, during which the research staff member completed a rating form that directed them to write statements specified on the form, and circle rating options, at set intervals to standardize how participants were rated. After finishing the speech, participants completed the SUDS and SA3 again to measure changes in distress and state social anxiety. The procedure of this speech task was successfully used in our prior study to induce a significant increase in distress.

After completion of the second SUDS and SA3 ratings, participants completed an alcohol taste-test ad-lib drinking task, using non-alcoholic beer, based on the work of Marlatt and colleagues (1973). Non-alcoholic beer was used to minimize participant risk and burden (e.g., females consuming alcohol when they are unknowingly pregnant or preventing participants from driving after the study); non-alcoholic beer has successfully been used as a proxy for beer containing alcohol with minimal detection (i.e., 4-8%) by participants in prior research (e.g., Carter et al., 1998; Roehrich & Goldman, 1995; Tan & Goldman, 2015). Participants were presented with two carafes labeled “A” and “B” filled with 355 milliliters each of two different types of non-alcoholic beer, two empty glasses labeled “A” and “B,” and a taste rating form that captured opinions of the two beers in categories including taste (“How does this product taste?”), smell (“How appealing is the aroma of this product?”), and appearance (“How appealing is the color of this product?” and “How appealing is the consistency of this product?”). Participants

were instructed to pour the beer from the carafes to the corresponding glass and to sample as much of each beer as needed to accurately complete the rating form. The research staff member then left the room for 10 minutes while the ratings were completed, returning half-way through after 5 minutes to check in. Following the 10-minute ad-lib drinking task, participants indicated the percentage of alcohol by volume (ABV) they thought each beer contained; they were then debriefed about the purpose of the study and the use of non-alcoholic beer. After they left the lab total volume of beer consumed was measured in milliliters with graduated cylinders and used as the dependent variable for aim 1.

Data Analysis

Preliminary Analyses. Prior to analyses, all variables were examined for outliers and violations of normality. Outliers with values outside of the median ± two interquartile ranges (IQRs) were reined in and replaced with the value of the median ± two IQRs. Additionally, those who indicated that either beer contained less than 1% ABV were excluded from analyses. A dependent sample t-test was conducted to determine whether there was a significant difference in distress (SUDS ratings) or state anxiety (SA3 ratings) between pre- and post-speech measurements.

Aim 1. To determine whether sociability expectancies moderate the association between social anxiety and alcohol consumption during a taste test following a social stressor speech task. To test hypotheses 1 (that among those with low sociability expectancies, social anxiety will be positively associated with alcohol consumption) multiple regression was used with the main of effects of social anxiety and sociability expectancies and the interaction term between them entered into the equation as independent variables. Social anxiety and sociability expectancies were centered on the mean prior to creating the interaction term. The dependent variable was the

volume of beer in milliliters consumed during the 10-minute taste test. The interaction was not probed further, as the results were not significant. Subsequently, multiple regression was conducted to test the main effects of social anxiety and sociability expectancies.

Power Analysis. A power analysis was conducted for the primary aim using G*Power 3.1.9.4 to determine the appropriate sample size needed for the current study. Based on our previous study, which showed that sociability expectancies moderated the association between social anxiety and alcohol approach and avoidance inclinations, we used an effect size of $f^2 = 0.30$, which was the mean average of the effect sizes for approach ($f^2 = 0.36$) and avoidance ($f^2 = 0.24$). The power analysis indicated that with an effect size of 0.30 a sample of 41 would be needed to detect a significant effect at an alpha level of .05 with .80 power. Based on prior research indicating that between 4% and 8% of participants would successfully detect that the beer used in this study was non-alcoholic, the proposed recruitment of 50 was estimated to result in a sample size of between 46 (power = .86) and 48 (power = .88) for analyses after accounting for participants excluded due to indicating that they believed either beer was less than 1% ABV.

Chapter Three:

Results

Non-alcoholic beer deception check

A total of 52 participants were recruited and completed the study. Of those, 5 accurately guessed that at least one of the beers was less than 1% ABV and were not included in data analyses, leaving a sample of 47 that was analyzed.

Social Anxiety Distribution

Based on the current sample of 47 participants, 15.9% (i.e., 7) of them needed to have a SIAS score of 44 or below for the sample to be considered representative of the general student population. As the current sample contained 7 participants with a SIAS score of 44 or higher, it is considered a representative sample. See figure 1 for a histogram of SIAS scores.

Manipulation Checks

A dependent samples t-test was conducted to compare pre-speech SUDS ratings with post-speech SUDS ratings. The results indicated that participants were significantly more distressed following the speech (M = 40.85, SD = 18.51) than prior to the speech (M = 20.43, SD = 14.33), $t(46) = -9.91$, $p < .001$, see figure 2.

A dependent samples t-test was also conducted comparing pre- and post-speech scores on the 3-item social anxiety measure. The results indicated that participants rated themselves as

experiencing significantly higher state social anxiety following the speech (M = 7.51, SD = 3.01) than prior to the speech (M = 5.98, SD = 2.40), $t(46) = -5.71$, $p < .001$, see figure 3.

Aim 1

Multiple regression was conducted to test hypothesis 1, that the interaction between sociability expectancies and social anxiety would predict the amount of alcohol consumed such that, among those with low sociability expectancies, social anxiety will be positively associated with alcohol consumption. The findings were non-significant (B = -0.41, SE = 0.51, p = .424), indicating that the interaction between sociability expectancies and social anxiety did not predict the amount of alcohol consumed. Subsequently, the interaction term was removed, and multiple regression analysis was conducted to test the significance of the main effects for sociability expectancies and social anxiety predicting alcohol consumption; sociability expectancies were significant (B = 11.31, SE = 5.58, p = 0.049), however, social anxiety was not (B = -3.21, SE = 1.75, p = .073). See table 3 for full regression models, and figure 4 for a graph of the interaction.

Exploratory

Cross-sectional Exploration of Aim 1. The first exploratory analysis was conducted to determine whether the interaction between social anxiety and sociability expectancies predicted cross-sectional data reported for drinks per week. Multiple regression indicated that the interaction was not significant (B = 0.01, SE = 0.03, p = .865). Subsequently, the interaction term was removed, and multiple regression analysis was conducted to test the significance of main effects for sociability expectancies and social anxiety predicting drinks per week; the main effects for sociability expectancies (B = 0.06, SE = 0.277, p = .840) and social anxiety (B = -

0.13, SE = 0.09, p = .148) were both non-significant. See table 4 for full regression models, and figure 5 for a graph of the interaction.

Expectancies. Based on the literature reviewed earlier supporting tension reduction theories, multiple regression was conducted to test the exploratory hypothesis that the interaction between tension reduction expectancies and social anxiety would predict the amount of alcohol consumed. The findings were non-significant (B = -0.52, SE = 0.83, p = .533). Subsequently, the interaction term was removed, and multiple regression was conducted to test the main effects of tension reduction expectancies (B = 18.21, SE = 11.13, p = .109) and social anxiety (B = -2.67, SE = 1.77, p = .138); results indicated that neither were significant predictors of the amount of alcohol consumed. See table 5 for full regression models, and figure 6 for a graph of the interaction.

Social Anxiety Cutoff Score. Next, the data were explored using an SIAS cutoff score (i.e., greater than or equal to 34; Heimberg et al., 1992) that approximates a clinical diagnosis, in order to facilitate the examination of distress among those meeting "diagnostic criteria" for SAD. Psychometric evaluations have supported this cutoff score (Brown et al., 1997; Rodebaugh et al., 2006), with Rodebaugh et al. finding that "diagnoses" among college students were 95% accurate, with a 0.1% false positive rate and a 5% false negative rate. Examination revealed a "clinical" subsample of 16 participants with a mean SIAS score of 43.69 (SD = 7.41; minimum = 36, maximum = 61) and a mean distress rating of 46.56 following the speech task (i.e., SUDS rating; SD = 16.91).

Biopsychosocial model. Next, theories postulated by the biopsychosocial model were tested, namely that socially anxious individuals use alcohol to increase low positive affect and to cope with high negative affect. The first analysis examined whether positive affect moderated the

association between social anxiety and alcohol consumption using multiple regression; the findings were significant (B = -0.64, SE = 0.21, p = .004; see table 6 for full regression model and figure 7 for graphical representation). Follow-up analyses indicated that among those with high positive affect, social anxiety was negatively associated with the amount of alcohol consumed (B = -8.80, SE = 2.91, p = .004); among those with low positive affect, social anxiety was positively associated with alcohol consumption (B = 7.08, SE = 3.33, p = .039). The next analysis examined whether negative affect moderated the association between social anxiety and alcohol consumption using multiple regression; the findings were not significant (B = 0.21, SE = 0.38, p = .575; see table 7 for full regression model and figure 8 for graphical representation). Subsequently, the interaction term was removed from the model and multiple regression was conducted to test the main effects of social anxiety (B = -2.85, SE = 1.84, p = .129) and negative affect (B = 3.65, SE = 5.51, p = .511), neither of which were significant.

Table 1
Demographic Characteristics

Variable	
Age	
Mean (SD)	21.81 (1.23)
Range	21 - 25
Gender	
Male	65%
Race	
Black	12.8%
White	68.1%
Asian	6.4%
Pacific Islander	2.1%
Bi-racial	4.3%
Multi-racial	2.1%
Other	4.3%
Ethnicity	
Hispanic	25.5%

Table 2

Correlations and Means of Alcohol and Related Variables

Variable	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11
1 Alcohol Consumed	277.15 (179.52)	---										
2 Drink Quantity	4.13 (2.38)	**.39**	---									
3 Drink Frequency	1.34 (1.30)	**.45**	.19	---								
4 Alcohol Problems	8.78 (7.95)	**.30**	**.68**	**.42**	---							
5 Social Anxiety	27.12 (14.70)	-.21	-.13	-.22	.03	---						
6 Positive Affect	35.30 (8.62)	**.32**	**.32**	**.29**	.29	-.27	---					
7 Negative Affect	15.15 (4.92)	.04	.08	.27	**.45**	.24	.06	---				
8 Sociability Expectancies	18.40 (4.61)	.24	.11	-.01	.19	.18	**.30**	.01	---			
9 Tension Reduction Expectancies	5.04 (2.36)	.23	-.03	.09	.02	.05	.02	-.08	**.43**	---		
10 Coping Motives	8.94 (3.70)	**.35**	**.41**	.15	**.47**	-.01	**.31**	.24	**.38**	.27	---	
11 Distress	40.85 (18.51)	-.14	.01	.01	.06	**.39**	-.10	**.37**	-.08	-.13	.23	---
12 State Social Anxiety	7.51 (3.01)	-.12	.09	-.03	.14	**.55**	-.17	.27	.13	.03	.19	**.79**

Notes: Drink Quantity = drinks per drinking occasion; Drink Frequency = drinking occasions per week; Alcohol Problems measured using the Alcohol Use Identification Test; Social Anxiety measured with the Social Interaction Anxiety Scale; Positive and Negative Affect measured with the Positive and Negative Affect Schedule; Sociability and Tension Reduction Expectancies measured with the Comprehensive Effects of Alcohol questionnaire; Coping Motives measured with the Drinking Motives Questionnaire; Distress measured by the Subjective Units of Distress Scale post-speech; State Social Anxiety measured with the 3-item State Social Anxiety measure post-speech; **bolded correlation coefficients** significant at $p < .05$.

Table 3

Regression Models of Sociability Expectancies and Social Anxiety Predicting the Amount of Alcohol Consumed

						95% CI B	
R^2	Predictor	B	SE	t	p	Lower	Upper
0.14	Alcohol Consumed (Constant)	-45.46	272.22	-0.17	.868	-594.44	503.52
	Sociability Expectancies	21.79	14.14	1.54	.131	-6.72	50.30
	Social Anxiety	4.82	10.11	0.48	.636	-15.57	25.21
	Sociability Expectancies x Social Anxiety	-0.41	0.51	-0.81	.424	-1.43	0.61
0.13	Alcohol Consumed (Constant)	156.03	107.88	1.45	.155	-61.38	373.44
	Sociability Expectancies	11.32	5.58	2.03	.049	0.08	22.56
	Social Anxiety	-3.21	1.75	-1.84	.073	-6.74	0.32

Table 4

Regression Models of Sociability Expectancies and Social Anxiety Predicting Drinks per Week

						95% CI B	
R^2	Predictor	B	SE	t	p	Lower	Upper
0.22	Drinks per Week (Constant)	10.69	13.61	0.79	.437	-16.77	38.14
	Sociability Expectancies	-0.05	0.71	-0.08	.939	-1.48	1.37
	Social Anxiety	-0.21	0.51	-0.42	.676	-1.23	0.81
	Sociability Expectancies x Social Anxiety	0.01	0.03	0.17	.865	-0.05	0.06
0.22	Drinks per Week (Constant)	8.56	5.36	1.60	.117	-2.24	19.35
	Sociability Expectancies	0.06	0.28	0.20	.840	-0.50	0.61
	Social Anxiety	-0.13	0.09	-1.47	.148	-0.30	0.05

Table 5

Regression Models of Tension Reduction Expectancies and Social Anxiety Predicting the Amount of Alcohol Consumed

						95% CI B	
R^2	Predictor	B	SE	t	p	Lower	Upper
0.11	Alcohol Consumed (Constant)	195.84	127.25	1.54	.131	-60.96	452.64
	Tension Reduction Expectancies	31.36	23.74	1.32	.194	-16.54	79.27
	Social Anxiety	-0.10	4.46	-0.02	.982	-9.09	8.89
	Tension Reduction Expectancies x Social Anxiety	-0.52	0.82	-0.63	.533	-2.20	1.15
0.10	Alcohol Consumed (Constant)	259.59	76.30	3.40	.001	105.71	413.47
	Tension Reduction Expectancies	18.21	11.13	1.63	.109	-4.23	40.65
	Social Anxiety	-2.67	1.77	-1.51	.138	-6.23	0.89

Table 6

Regression Model of Positive Affect and Social Anxiety Predicting the Amount of Alcohol Consumed

						95% CI B	
R^2	Predictor	B	SE	t	p	Lower	Upper
0.27	Alcohol Consumed (Constant)	-279.79	178.96	-1.56	0.125	-640.69	81.12
	Social Anxiety	14.61	5.65	2.59	0.013	3.22	26.01
	Positive Affect	22.72	6.3	3.61	0.001	10.02	35.42
	Positive Affect x Social Anxiety	-0.64	0.21	-3	0.004	-1.08	-0.21

Table 7

Regression Models of Negative Affect and Social Anxiety Predicting the Amount of Alcohol Consumed

						95% CI B	
R^2	Predictor	B	SE	t	p	Lower	Upper
0.06	Alcohol Consumed (Constant)	401.32	202.13	1.99	.054	-6.31	808.95
	Social Anxiety	-6.24	6.27	-1.00	.325	-18.89	6.41
	Negative Affect	-3.21	13.36	-0.24	.811	-30.14	23.73
	Social Anxiety x Negative Affect	0.22	0.39	0.57	.575	-0.56	1.00
0.05	Alcohol Consumed (Constant)	299.33	90.25	3.32	.002	117.44	481.21
	Social Anxiety	-2.86	1.85	-1.55	.129	-6.58	0.86
	Negative Affect	3.65	5.51	0.66	.511	-7.46	14.77

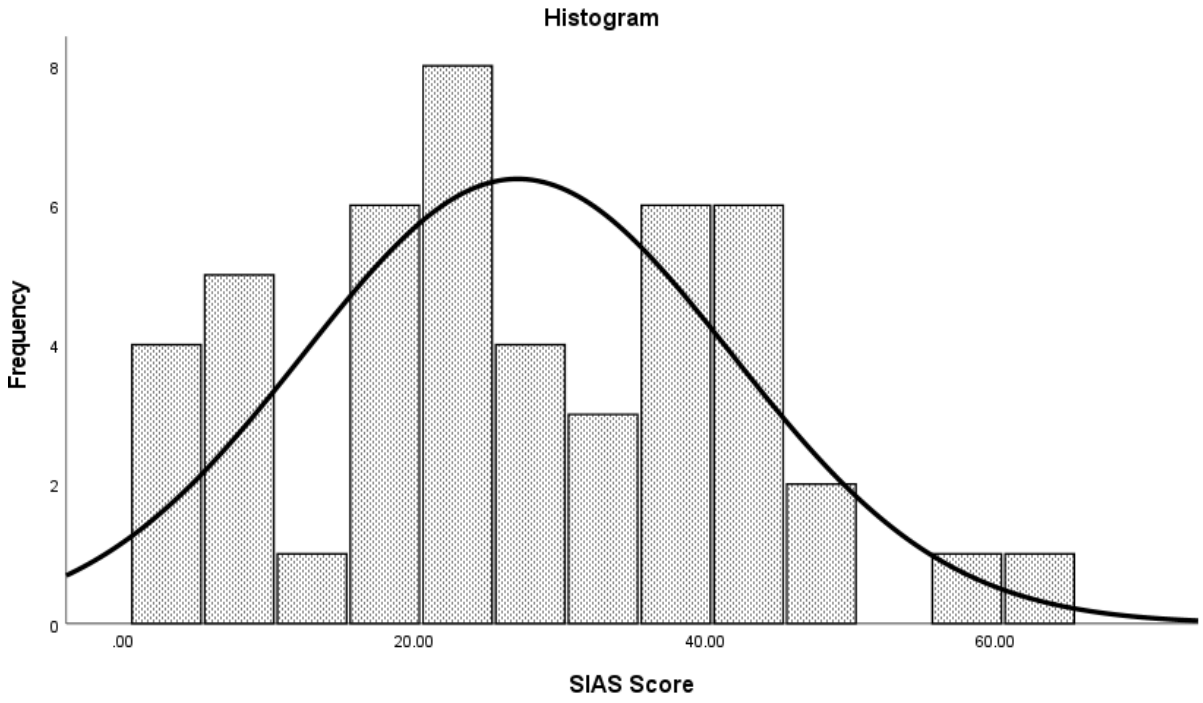

Figure 1. Distribution of SIAS Scores

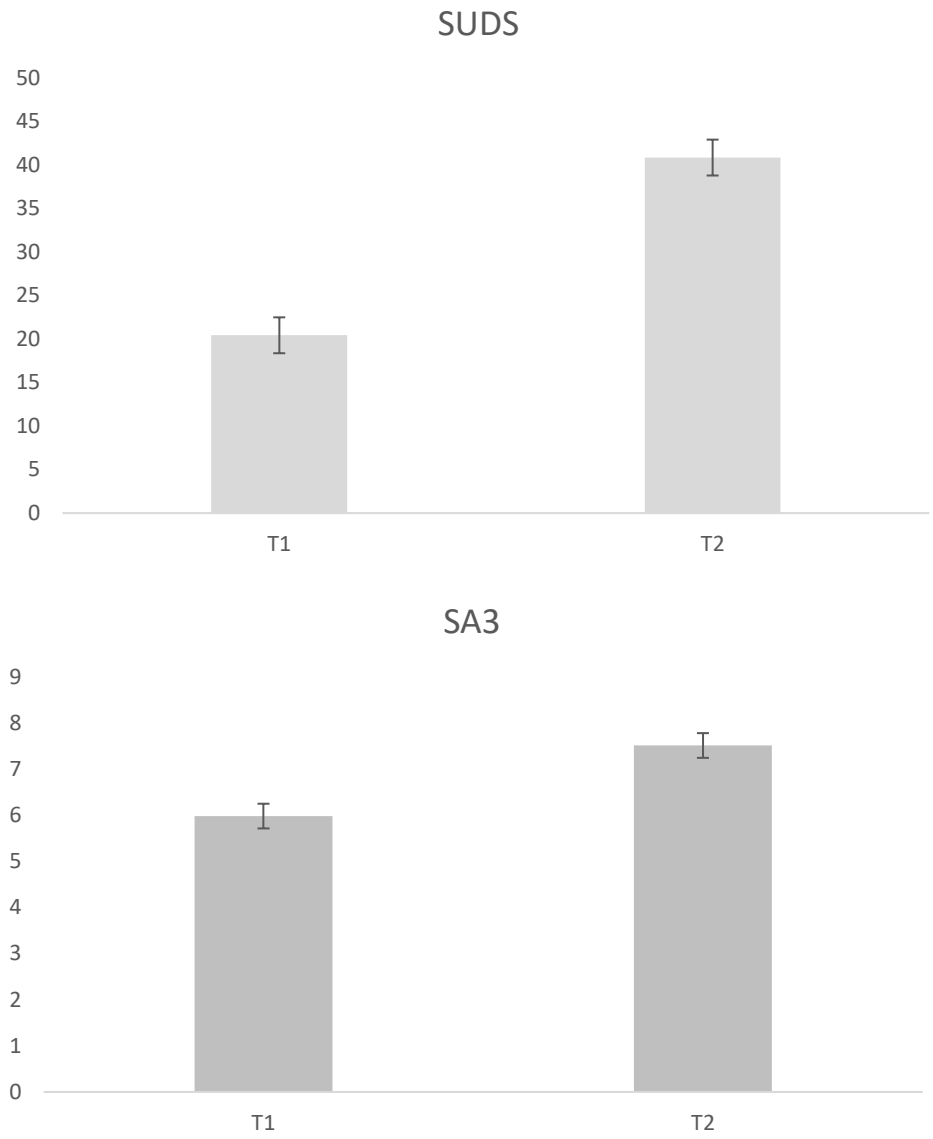

Figure 2. Pre- and Post-speech Values for Subjective Units of Distress and the 3-item Social Anxiety Measure

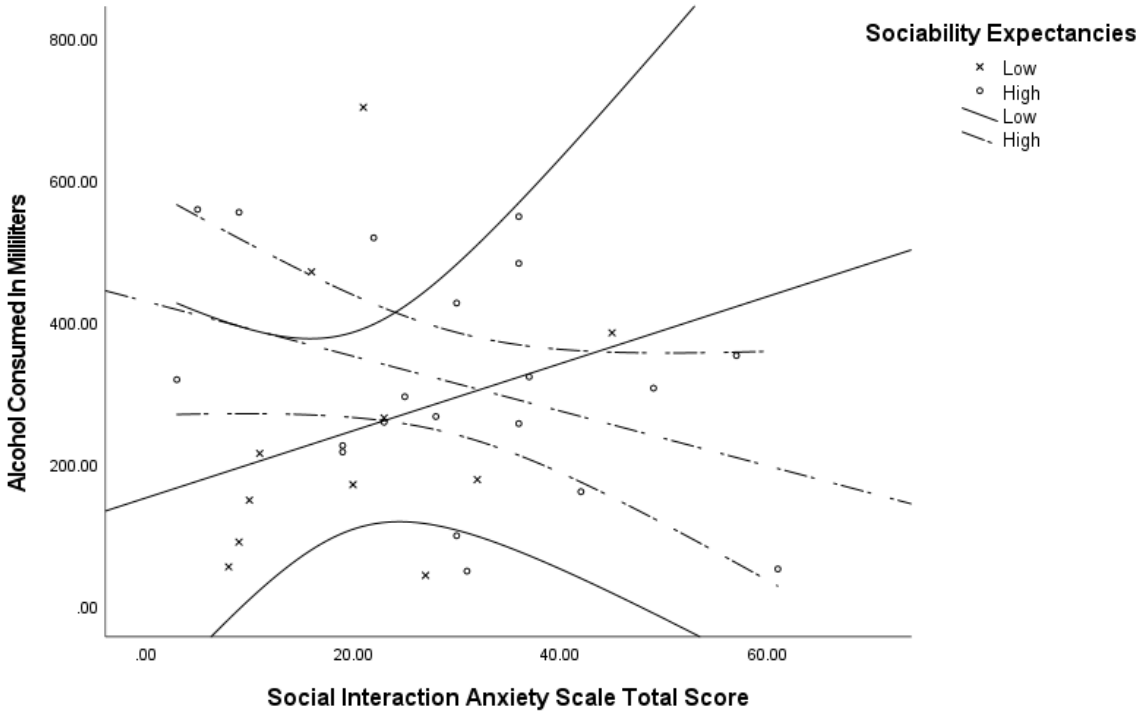

Figure 3. Interaction between Social Anxiety and Sociability Expectancies Predicting Alcohol Consumed

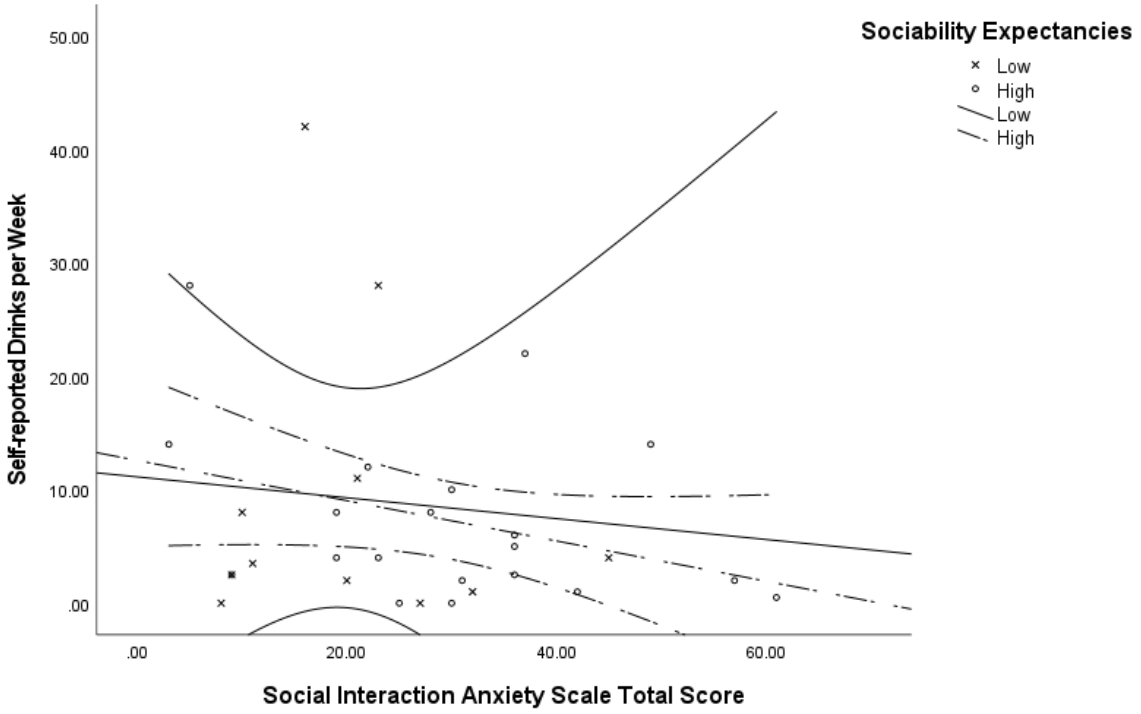

Figure 4. Interaction Between Social Anxiety and Sociability Expectancies Predicting Drinks per Week

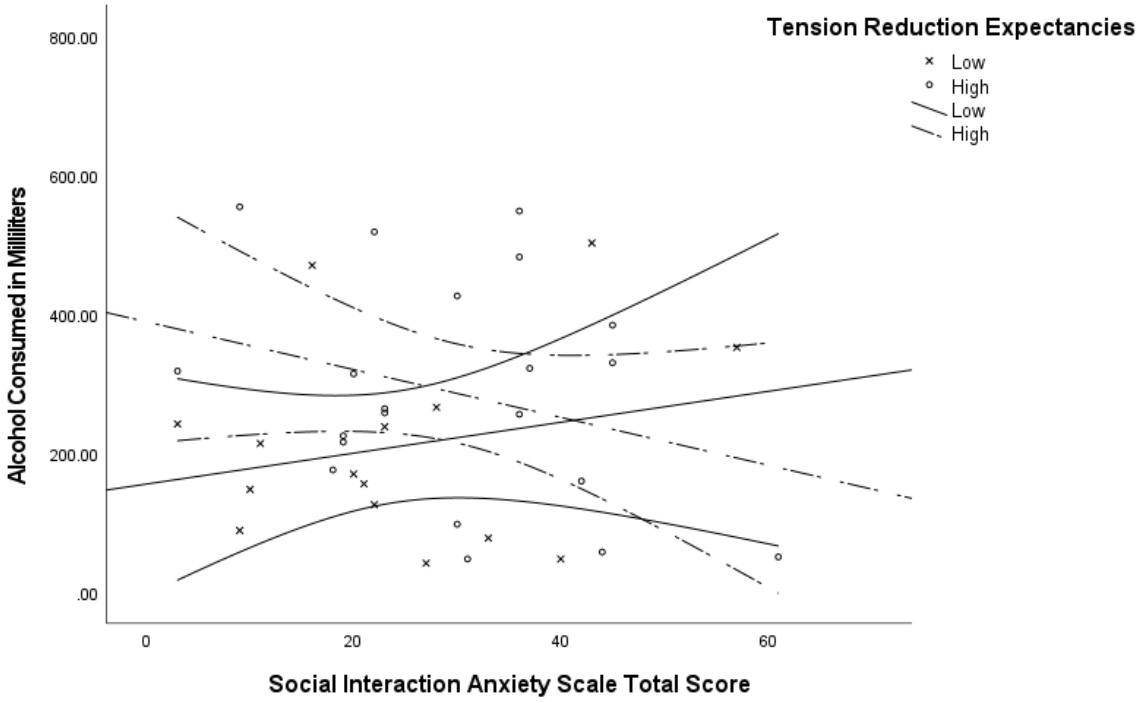

Figure 5. Interaction between Social Anxiety and Tension Reduction Expectancies Predicting Alcohol Consumed

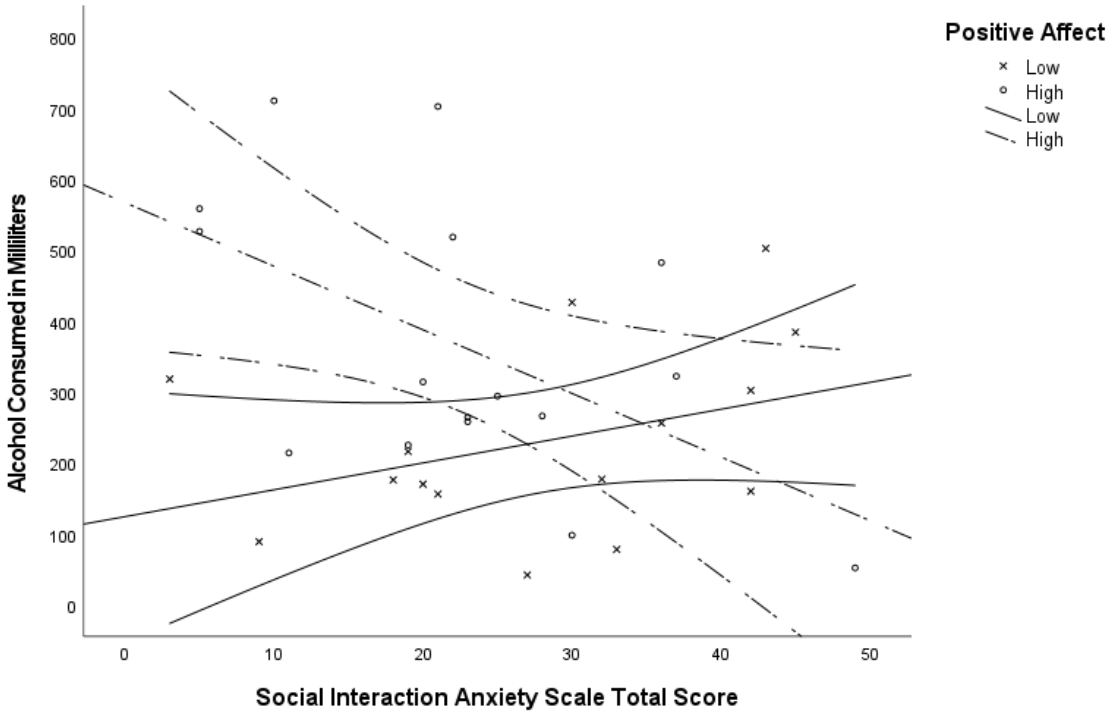

Figure 6. Interaction Between Social Anxiety and Positive Affect Predicting Alcohol Consumed

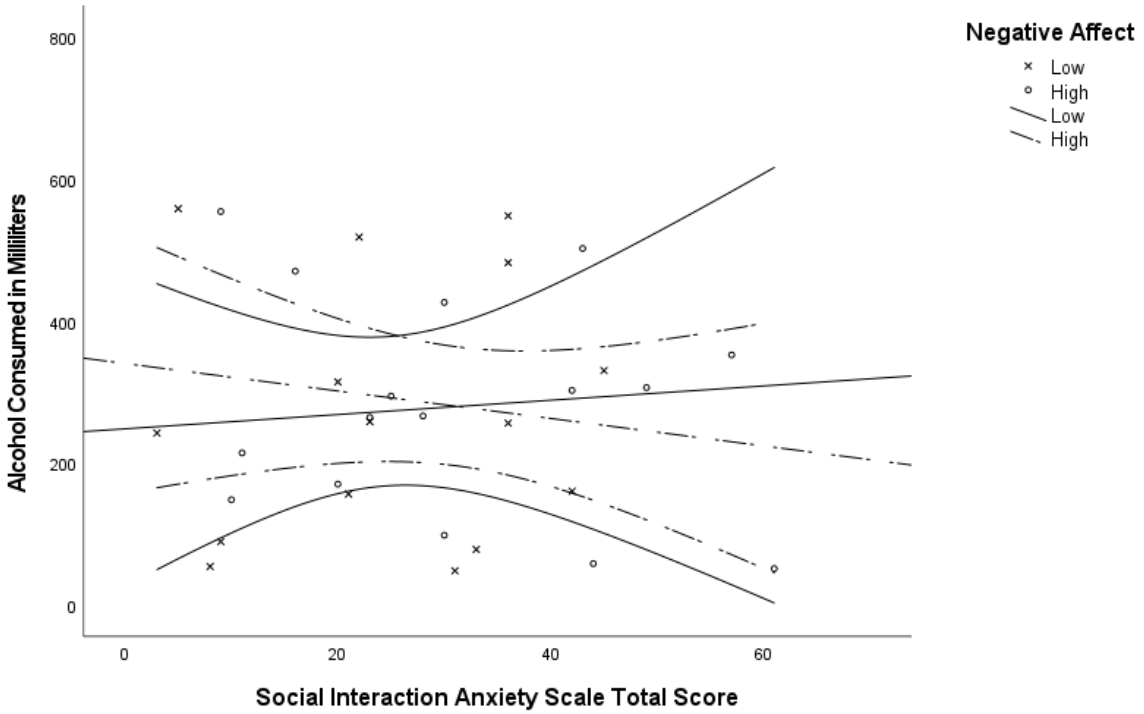

Figure 7. Interaction Between Social Anxiety and Negative Affect Predicting Alcohol Consumed

Chapter Four:

Discussion

The current study sought to elucidate mixed findings in the literature regarding associations between social anxiety and alcohol consumption. Specifically, although some studies have found positive associations using cross-sectional self-reported survey data (Levine & Schlauch, 2020; Neighbors et al., 2007), others have found negative associations (Eggleston et al., 2004; Ham & Hope, 2006; LaBrie et al., 2008; Stewart et al., 2006; Tran et al., 1997), and many studies have found no association at all (Buckner et al., 2011; Buckner et al., 2006; Buckner & Heimberg, 2010; Gilles et al., 2006; O'Grady et al., 2011). In a previous study conducted using experimental methods (Levine & Schlauch, 2020), we found that sociability expectancies moderated the association between social anxiety and cue-elicited desires to consume and avoid consuming alcohol (i.e., craving; Breiner et al., 1999; McEvoy et al., 2004) following a social stressor speech task. Specifically, among those with high social anxiety there was a negative association between sociability expectancies and desire to consume alcohol, and a positive association between sociability expectancies and desire to avoid consuming alcohol. These findings suggest that people with high social anxiety and high sociability expectancies may be less likely to consume alcohol in stressful situations. While these findings were the result of exploratory analyses, they were contrary to what we would have expected to find, as "positive" expectancies have been associated with higher alcohol consumption. To explain these results, we hypothesized that individuals with high social anxiety may have been fearful of being

more social, as increased interaction may result in greater fear of being evaluated by others, thus leading them to want to drink less.

The current study sought to replicate and extend these findings to see if, in addition to craving, they apply to alcohol consumption in a stressful situation; utilizing a pseudo-naturalistic study design, in a simulated bar setting, participants completed an in-vivo alcohol "taste test" following a social stressor speech task. It was hypothesized that, among those with low sociability expectancies, social anxiety would be positively associated with alcohol consumption. This hypothesis was not supported, as the interaction between sociability expectancies and social anxiety predicting alcohol consumption was not significant. Follow-up analyses indicated that the main effect of social anxiety was also not significantly associated with alcohol consumption; however, there was a positive association between the main effect of sociability expectancies and alcohol consumption, suggesting that sociability expectancies predict alcohol consumption similarly in those with elevated social anxiety and the general population.

One possible reason for this discrepancy between the prior study findings and the current findings may be due to how social anxiety was operationalized across the two studies. Levine and Schlauch (2020) used a two-group design in which participants with high (i.e., combined score of greater than 53 on the SIAS and SPS) and low social anxiety (i.e., combined score of less than 33 on the SIAS and SPS) were recruited. In the current study, we opted to recruit participants using social anxiety as a continuous variable and did not split participants into extreme groups. As past research has shown that even sub-clinical levels of social anxiety predict future problematic alcohol use (Crum & Pratt, 2001), this was done in order to investigate at what level of social anxiety expectancies might start to differentially predict the amount of alcohol consumed, as opposed to comparing individuals with low and high social anxiety which

would leave such important information out. However, it is unlikely that this methodological choice contributed to the non-significant results, as many studies utilizing the same measure of social anxiety (i.e., the SIAS) have not found an association between social anxiety and alcohol use, regardless of whether they recruited participants along the full spectrum of social anxiety (e.g., Buckner et al., 2006; Gilles et al., 2006), or using high and low social anxiety groups (Buckner et al., 2011; Buckner et al., 2006; Buckner & Heimberg, 2010; Ham et al., 2005). Of note, these studies utilized undergraduate students as participants (as with this study), not individuals with a formal diagnosis of SAD. It may be that mixed findings in the literature are due in part to the use of samples not accurately representing the phenomenon that is being studied (i.e., drinking behaviors among those with SAD). Future research investigating alcohol use by socially anxious individuals would benefit from recruiting individuals who have explicitly met diagnostic criteria for SAD, alongside healthy controls, so that meaningful conclusions may be drawn.

Another design difference that may explain the difference in findings is the use of a cue-reactivity task versus an alcohol taste test. In the previous study, we measured craving by having participants indicate how much they would like to consume the alcoholic beverages they viewed images of; in the current study, participants consumed alcohol during a taste test and the outcome variable was how much alcohol they consumed. As such, it may be that the interaction between sociability expectancies and social anxiety differentially predicts craving versus alcohol consumption. A recent review (Jones et al., 2016) analyzed data from 12 lab-based studies that utilized ad-lib taste test drinking tasks, and found that craving was significantly associated with alcohol consumption; Pearson correlation coefficients for the association between craving and the amount of alcohol consumed in ad-lib drinking tasks have ranged from 0.32 (Leeman et al.,

2009) to 0.48 (Jones et al., 2013), representing a moderate effect size. Even assuming a correlation on the high end of the range (i.e., r = 0.48), that still results in only 23% of the variance in the amount of alcohol consumed being accounted for by craving ($R^2 = 0.23$). As such, the effect size is likely less than what was predicted, necessitating a larger sample size to successfully detect significant effects.

To better understand the data, additional exploratory analyses were conducted. First, to examine whether the interaction between sociability expectancies and social anxiety was significantly associated with the average number of alcoholic drinks per week that participants reported consuming, data from the baseline assessment on typical drinking patterns were entered as the outcome variable. The results were non-significant; further, subsequent analysis showed that the main effects of sociability expectancies and social anxiety were also non-significant. These findings are not surprising, as according to expectancy theory, contextual factors such as situation play an important role in determining alcohol related behaviors. Indeed, expectancies have been defined as "the probability held by the individual that a particular reinforcement will occur as a function of a specific behavior… in a specific situation" (Rotter, 1954; p. 107). Thus, outcomes of alcohol consumption can vary widely by environment and expectations of being more outgoing, energetic, and talkative may encourage drinking in social situations like parties and discourage drinking in situations like work functions.

The next exploratory analysis conducted examined the tension-reduction theory (Conger, 1956). A central tenet of the TRT is that alcohol functions as an anxiolytic, and as such people drink to reduce both tension and avoidance of situations that make them fearful and anxious. As fear of evaluation and avoidance of social situations are hallmark features of social anxiety, the TRT has been proposed as an etiological model of alcohol related behaviors among those with

social anxiety. To test this model, the interaction between social anxiety and tension reduction expectancies predicting the amount of alcohol consumed was examined; the results were not significant. Subsequent analysis indicated that the main effects for tension reduction expectancies and social anxiety were also non-significant.

These findings are part of a recent trend in lab-based studies challenging the hypothesis based on the TRT that individuals with elevated social anxiety consume alcohol to reduce their anxiety (i.e., tension). A recent review (Plebani et al., 2012) concluded that the, "sedative effects do not appear to be experienced as desirable or to motivate alcohol use even under conditions of anticipatory anxiety or for individuals high in trait anxiety" (p. 975). In a study wherein participants consumed alcohol following the completion of a social-stressor speech task, Corbin et al. (2008) found that participants evaluated sedating effects more negatively than stimulating effects, and expecting sedating effects did not predict the amount of alcohol consumed in the ad-lib drinking task. In a subsequent unpublished study, detailed in the Plebani et al. review (of which Corbin was a co-author), Corbin found that participants with high anxiety did not report higher sedation expectancies, and sedation was not associated with wanting more alcohol. Although these findings call into question the application of the TRT to understanding decisions to drink among those with high anxiety, it is possible that they may be due to methodological issues.

For example, a recent study (Haney et al., 2022) investigated mixed findings in associations between mood and alcohol consumption between lab and ecological momentary assessment (EMA) studies. They found that while happy and excited moods were negatively associated with alcohol consumption in the lab, they were positively associated with alcohol consumption among data reported via EMA. Of note, this study did not assess for strong aversive

moods such as anxiety or distress; however, it calls into question whether lab findings based on alcohol administration studies generalize to drinking behavior outside of the lab. Additionally, although manipulations commonly used, such as social stressor speech tasks, may significantly increase distress from pre- to post-speech, these methods may not present a sufficiently distressing situation which influences drinking behavior.

For example, even among 16 participants in the current study who met the clinical cutoff score for the SIAS which suggests a possible diagnosis of SAD, the mean distress rating was only 46.56, falling just below the qualitative label of "Moderate anxiety/distress, uncomfortable but can continue to perform" that corresponds with a rating of 50 on the SUDS. As it has been described (Heimberg et al., 1993) that high anxiety situations among those with social anxiety correspond with SUDS ratings of 75 or higher, it may be that it takes higher levels of distress for tension reduction expectancies to impact decisions about drinking behavior. As such, the conditions presented during the current study may not approximate the contexts supported by research in which people with social anxiety are motivated to drink in order to reduce their highly distressing anxiety (i.e., tension), including after an embarrassing event (O'Grady et al., 2011), coping in social situations (Buckner & Heimberg, 2010), and coping with negative emotions (Stewart et al., 2006). Indeed, a daily diary study (O'Grady et al., 2011) following participants for 30 days found that when analyzing drinking data for all time points there was no associaton between social anxiety and alcohol consumption; however, subsequent analysis revealed that, on days in which participants experienced an embarrassing event, social anxiety was associated with greater alcohol consumption that night. This indicates that, despite the recent findings of lab-based studies, in situations that are highly distressing tension reduction expectancies may play a role in alcohol consumption among those with social anxiety.

Future research utilizing social-stressor speech tasks and ad-lib drinking methodology may benefit from having several confederates present when conducting the study who inform participants that they will be evaluated and provided critical feedback, including a list of their weaknesses that should be improved, following the drinking period as this may elicit stronger feelings of anxiety in participants and thus more closely emulate situations in which socially anxious people drink to cope with distress.

Finally, additional hypotheses based on the biopsychosocial model (Buckner et al., 2013; Buckner et al., 2021) were examined. In addition to fear of evaluation, social anxiety is characterized by low positive affect and high negative affect (Brown et al., 1998; Kashdan & Collins, 2010). Accordingly, the biopsychosocial model emphasizes the important role of affect in the drinking behavior of individuals with social anxiety, stating that socially anxious individuals use alcohol to increase low positive affect and to cope with negative affect. Exploratory analyses found a significant interaction between positive affect measured at baseline and social anxiety, such that among those with high positive affect there was a negative association between social anxiety and alcohol consumption, and among those with low positive affect there was a positive association between social anxiety and alcohol consumption. This finding is consistent with the hypothesis put forth by the biopsychosocial model that individuals with social anxiety are motivated to use alcohol to increase low positive affect. Cross-sectional research (Buckner et al., 2019) has supported this theory, with mediation analyses indicating that social anxiety was indirectly associated with drinking problems via positive affect and drinking to increase positive affect. The finding that, among participants with low positive affect, social anxiety was positively associated with the amount of alcohol consumed provides contextual support for the postulate that people with social anxiety may drink to increase low positive

affect. Additionally, among those high in positive affect, social anxiety was negatively related to alcohol consumption, suggesting that high positive affect may act as a protective factor against drinking for individuals with social anxiety. The interaction between negative affect was also examined; however, the results were not significant. Subsequent analysis found that the main effects of negative affect and social anxiety were also not significant.

Limitations

While the current study has many strengths, it is not without limitations. A strength of the current study is the use of a well-validated laboratory paradigm to successfully increase distress and measure alcohol consumption. However, the current study lacks a control group of participants who did not complete a social stressor task prior to the ad-lib drinking task. The lack of a control group limits the ability to explain drinking behavior as a response to a stressful social situation, and to contrast how affect interacts with social anxiety to predict alcohol consumption in control versus social stressor conditions. Further, the study only measured affect at baseline and not after the speech task, therefore it is not known how the speech impacted the affect of participants and what effect that may have had on the exploratory analyses examining affect as it relates to the biopsychosocial model.

The current study also failed to measure certain factors that may have been related to the outcome variable. For example, research (Norberg et al., 2010) indicates that women with social anxiety have higher coping motives than men and drink more often to cope with aversive affect in negative situations, thereby increasing the likelihood that they experience alcohol-related problems. Gender was not considered in the design of this study and, accordingly, the study is neither balanced nor powered appropriately to include gender in analyses. Additionally, important contextual factors regarding the activities of participants following the study were not

measured such as having to go to work, having an evening class, needing to do homework or study for a test, or operating a motor vehicle. Lastly, with only 13 of 47 participants indicating that they drank beer most often when consuming alcohol, it is possible that drink preferences influenced the amount of alcohol participants consumed. As such, the internal validity of the study may have been improved by matching the type of alcoholic beverage in the taste test with the beverage of choice for each participant.

Conclusions

Despite these limitations, the current study contributes to the literature with results that are consistent with those hypothesized by the biopsychosocial model, namely that individuals with social anxiety are motivated to consume alcohol in part to increase low positive affect. Previous results supporting this theory are cross-sectional, and as such demonstrating this pattern utilizing an ad-lib drinking task is a valuable contribution. Additionally, the current study found that, among those with high positive affect, there was a negative association between social anxiety and alcohol consumption, suggesting the need to further investigate the role of positive affect in the social anxiety-drinking relationship. Considering these findings, additional research should be conducted using clinical samples of individuals meeting diagnostic criteria for SAD, and control groups, to further investigate the effect of positive affect on alcohol consumption among socially anxious individuals.

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APPENDIX A: IRB Approval Letter

UNIVERSITY of SOUTH FLORIDA

APPROVAL

December 17, 2021

Jacob Levine
4202 E Fowler Ave
PCD4118G
Tampa, FL 33620

Dear Mr. Levine:

On 12/16/2021, the IRB reviewed and approved the following protocol:

Application Type:	Initial Study
IRB ID:	STUDY003370
Review Type:	Expedited 7
Title:	The Effect of Stress on Alcohol Taste Preferences
Funding:	None
IND, IDE, or HDE:	None
Approved Protocol and Consent(s)/Assent(s):	• Protocol, Version 1, 12.16.21.docx; • Adult Signed ICF, Version 1, 12.6.21.pdf; Approved study documents can be found under the 'Documents' tab in the main study workspace. Use the stamped consent found under the 'Last Finalized' column under the 'Documents' tab.

Within 30 days of the anniversary date of study approval, confirm your research is ongoing by clicking Confirm Ongoing Research in BullsIRB, or if your research is complete, submit a study closure request in BullsIRB by clicking Create Modification/CR.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

Various Menzel
IRB Research Compliance Administrator

APPENDIX B: Informed Consent Form

Informed Consent to Participate in Research Involving Minimal Risk
Information to Consider Before Taking Part in this Research Study
Title: The Effect of Stress on Alcohol Taste Preferences.
Study # 3370

Overview: You are being asked to take part in a research study. The information in this document should help you to decide if you would like to participate. The sections in this Overview provide the basic information about the study. More detailed information is provided in the remainder of the document.

Study Staff: This study is being led by Jacob Levine who is a Graduate Student at The University of South Florida. This person is called the Principal Investigator. He is being guided in this research by Robert Schlauch. Other approved research staff may act on behalf of the Principal Investigator.

Study Details: This study is being conducted at the University of South Florida. The purpose of the study is to investigate how stress influences taste ratings and preferences for alcohol. The study will take place in a private room in the psychology building. Participation in this study will take approximately 1 hour. During this time, you will be asked to complete questionnaires, prepare and deliver a speech, and taste and rate 2 different types of beer.

Subjects: You are being asked to take part because you are a USF student between the ages of 21 and 25 who met the pre-screening criteria.

Voluntary Participation: Your participation is voluntary. You do not have to participate and may stop your participation at any time. There will be no penalties or loss of benefits or opportunities if you do not participate or decide to stop once you start. Your decision to participate or not to participate will not affect your student status, course grade, recommendations, or access to future courses or training opportunities.

Benefits, Compensation, and Risk: We do not know if you will receive any benefit from your participation. There is no cost to participate. You will earn a $20 Amazon gift card for your participation. This research is considered minimal risk. Minimal risk means that study risks are the same as the risks you face in daily life.

Confidentiality: Even if we publish the findings from this study, we will keep your study information private and confidential. Anyone with the authority to look at your records must keep them confidential.

Total Number of Subjects

About 50 individuals will take part in this study at USF.

Privacy and Confidentiality

We will do our best to keep your records private and confidential. Your name will not be associated with the data that you provide us today. We cannot guarantee absolute confidentiality. Your personal

information may be disclosed if required by law. Certain people may need to see your study records. These individuals include:

- The research team, including the Principal Investigator, study coordinator, and all other research staff.
- Certain government and university people who need to know more about the study. For example, individuals who provide oversight on this study may need to look at your records. This is done to make sure that we are doing the study in the right way. They also need to make sure that we are protecting your rights and your safety.
- Any agency of the federal, state, or local government that regulates this research. This includes the Department of Health and Human Services (DHHS) and the Office for Human Research Protection (OHRP).
- The USF Institutional Review Board (IRB) and its related staff who have oversight responsibilities for this study, and staff in USF Research Integrity and Compliance.

We may publish what we learn from this study. If we do, we will not include your name. We will not publish anything that would let people know who you are.

If completing an online survey, it is possible, although unlikely, that unauthorized individuals could gain access to your responses. Confidentiality will be maintained to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet. However, your participation in this online survey involves risks similar to a person's everyday use of the Internet. If you complete and submit an anonymous survey and later request your data be withdrawn, this may or may not be possible as the researcher may be unable to extract anonymous data from the database.

You can get the answers to your questions, concerns, or complaints.

If you have any questions, concerns or complaints about this study, call Jacob Levine at (813) 974-0839. If you have questions about your rights, complaints, or issues as a person taking part in this study, call the USF IRB at (813) 974-5638 or contact by email at RSCH-IRB@usf.edu.

Consent to Take Part in Research

I freely give my consent to take part in this study. I understand that by signing this form I am agreeing to take part in research. I have received a copy of this form to take with me.

_____ _____

Signature of Person Taking Part in Study Date

_____

Printed Name of Person Taking Part in Study

Statement of Person Obtaining Informed Consent

I have carefully explained to the person taking part in the study what he or she can expect from their participation. I confirm that this research subject speaks the language that was used to explain this research and is receiving an informed consent form in their primary language. This research subject has provided legally effective informed consent.

_____ _____

Signature of Person Obtaining Informed Consent Date

_____

Printed Name of Person Obtaining Informed Consent