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The Role of Trait Sociability, Peer Alcohol Use, and Alcohol-Related Consequences in the Trajectory of Alcohol Use

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THE ROLE OF TRAIT SOCIABILITY, PEER ALCOHOL USE, AND ALCOHOL-RELATED CONSEQUENCES IN THE TRAJECTORY OF ALCOHOL USE

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ABSTRACT

Early adulthood is a critical period for the development of alcohol use behavior. Many individuals mature out of drinking in their late 20's, but some continue to drink heavily, which is associated with problematic use later in life. One factor that may influence the progression into alcohol use is the personality dimension of sociability. Sociability affects the degree of exposure to peer drinking, which is a known risk factor for alcohol use, but also may influence preference for alcohol beyond its relationship with peer drinking. Research suggests that alcohol enhances the pleasure of social experiences, and the personality dimension of sociability may be influence sensitivity to the socially rewarding effects of alcohol. Sociability may confer further risk for heavy alcohol use through its association with approach motivation. Avoidance of negative alcohol-related consequences plays a role in the maturation out of drinking, and individuals who are higher in sociability may be less motivated to avoid negative consequences of alcohol use. The present study examined whether sociability predicted increased levels of alcohol use over time as well as whether sociability interacted with alcohol-related consequences to predict changes in use over time. Archival data from the Minnesota Twin Family Study was used for the present study. Participants (N = 206) were recruited at age 17 and two follow-up assessments were conducted at 3-year intervals. Repeated Measures ANCOVAs were used to examine the effects of sociability, peer alcohol use, and alcohol-related consequences on changes in alcohol use across the three time points. Sociability was not related to changes in alcohol use over time. Interestingly, sociability was negatively associated with alcohol use at the second follow-up assessment. These results highlight the need for further research to clarify the relationship between sociability and alcohol use.

INTRODUCTION

Alcohol use has been evidenced by a wide body of research to be strongly linked to social behavior. One aspect of this association involves the influence that the immediate social environment exerts on drinking. For instance, individuals develop expectations about the effects of alcohol before they ever start drinking, suggesting that information from the social environment shapes beliefs about use (Christiansen, Smith, Roehling, & Goldman, 1989). Peers also exert an influence over drinking through exposure to peer alcohol use, explicit encouragement to drink, and conveyance of drinking-related norms (see review by Andrews & Hops, 2010). Though peers can substantially influence drinking behavior, such influences do not entirely account for alcohol's connection to the social environment. There is evidence that alcohol consumption increases prosocial behavior and enhances the pleasure of social experiences. For instance, one study found that consumption of alcohol facilitates objectively measured group bonding (Kirchner, Sayette, Cohn, Moreland, & Levine, 2006). Findings from the animal literature corroborate this finding, demonstrating that alcohol administration to rats facilitates social interaction, such as by increasing play behavior (Varlinskaya, Spear, & Spear, 2001). Experiencing these socially enhancing effects of alcohol likely leads to compelling positive beliefs about alcohol's effects.

The expectation of positive effects from a substance is important in motivating use, and these expectations are shaped by experience with use. Beliefs about the effects of alcohol mediate distal antecedents (e.g., genetics, personality, peer influences) in the prediction of alcohol use (Darkes, Greenbaum, & Goldman, 2004) and, therefore, factors that contribute to these beliefs are likely important in predicting use. The expectation for social enhancement from alcohol use is particularly influential in the reinforcement of drinking behavior and is

strengthened through continued drinking experiences (Smith, Goldman, Greenbaum, & Christiansen, 1995). Thus, the socially rewarding aspects of alcohol use may be important in the reinforcement of alcohol use behavior.

The personality dimension of sociability may be related to how sensitive one is to the socially rewarding effects of alcohol. For the purposes of the present study, sociability is defined as the degree to which an individual enjoys social interaction, desires the presence of others, values close relationships, and tends to be warm and affectionate. Sociability and related constructs (e.g., extraversion) have been observed to be related to alcohol use (Martsh & Miller, 1997; Cook, Young, Taylor, & Bedford, 1998), intentions to drink (Hampson, Andrews, Barckley, & Severson, 2006), and related problems (Kilbey, Downey, & Breslau, 1998; Wennberg, 2002). In addition, it has been observed that individuals who do not drink are more withdrawn than those who drink socially (Cook et al., 1998). Sociability likely affects the degree of exposure to peer drinking, which is a known risk factor for alcohol use. For instance, the number of substance-using peers in one's social network increases the likelihood of use (Ali & Dwyer, 2010), as does participating in a sorority or fraternity (Park, Sher, & Krull, 2008). It is possible that, in addition to sociability's effect on drinking through peers, individuals who are high in sociability find alcohol's social enhancement effects to be more rewarding and pleasurable than those low in sociability. Given the importance of alcohol's social enhancement effects in the reinforcement of use, sensitivity to such social reward may be particularly important in the development of alcohol use behavior and persistence in drinking over time. Based on a review of the current literature, no research has yet examined this relationship while controlling for peer alcohol use.

Sociability may confer further risk for heavy alcohol use through its association with approach motivation (e.g., Carver & White, 1994). Behavioral approach is thought of as a basic brain system that underlies more general personality traits (Gray, 1987) and has been consistently shown to have a strong connection with constructs similar to sociability (Corr, 2002; Elliot & Thrash, 2002). Propensity towards approach motivation is associated with a range of substance use behaviors, including sensitivity to alcohol cues, use, and problems (Knyazev, 2004; Franken & Muris, 2006; Kambouropoulos & Staiger, 2001). Alcohol use implicates both behavioral approach and avoidance systems as use involves balancing pursuit of alcohol-related reward with avoidance of negative outcomes of use (e.g., health consequences, legal problems; Simons & Arens, 2007). Avoidance of negative alcohol-related consequences plays a role in adaptive modulation of drinking behavior (Barnett, Goldstein, Murphy, Colby, & Monti, 2006), while persistence in use despite consequences is a hallmark of problematic use (e.g., Cunningham, Blomqvist, Koski-Jannes, & Cordingley, 2004). Individuals who are high in sociability may be not only more sensitive to alcohol's socially rewarding effects, but also more strongly motivated to attend to the positive effects of alcohol than to the negative effects, leading to greater persistence in use despite consequences.

Early adulthood is a critical period for the development of alcohol use behavior. Developmental changes in neurobiology among young adults increase the propensity for risk-taking, reward sensitivity, and sensitivity to social cues, all of which are risk factors for substance use (Bennett & Baird, 2006; Insel & Fernald, 2004; Spear, 2000). Indeed, this group is associated with the most permissive drinking norms and highest rates of binge drinking of any age (Johnston, O'Malley, Bachman, & Schulenberg, 2008). Despite this heavy use, most young adults tend to reduce their alcohol use as they progress into the later 20's. However, some persist

in high levels of drinking, and this is associated with the development of alcohol use problems (O'Malley, 2004; Sloan, Grossman, & Platt, 2011). Given the sensitivity to social and rewarding stimuli among young adults as well as the socially rewarding nature of alcohol use, sociability may be particularly relevant in the reinforcement of drinking behavior among this age group. It is possible that sociability predicts higher rates of use and greater persistence in drinking over time and may provide insight about who is at risk for alcohol use problems.

The aim of the present study was to examine whether the personality trait of sociability confers risk for the progression into alcohol use, especially involving persistence in use despite negative alcohol-related consequences. It was predicted that sociability would interact with the experience of negative alcohol-related consequences to predict change in alcohol use over time. Particularly, it was expected that among those who experience more alcohol-related consequences, individuals higher in sociability would persist more in drinking over time. This relationship was examined while controlling for peer substance use to determine whether sociability is related to drinking beyond its relationship with peer influences on drinking.

METHODS

Participants

Archival data from the Minnesota Twin Family Study (MTFS) was used for the present study. The MTFS is a longitudinal study that recruited 4 cohorts of same-sex twins. Male and female same-sex twins were initially recruited at age 11 or 17. Each of these cohorts was assessed at approximately 3-year intervals. Participants were recruited by identifying potential twins through Minnesota state birth records. Public databases were used to obtain contact information for parents. Twins were excluded if they lived more than one day's drive from the site of the study, were adopted, or had a physical or mental handicap (as reported by their parent) that would prevent them from being able to complete the assessment. The sample to be used for the present study included twins in the male (N = 86) and female (N = 120) 17-year-old cohorts. Data was used from the Intake, Follow-up 1, and Follow-up 2 (see Table 1 for mean age at each time point). The ethnic composition of this sample was 96.6% Caucasian, 1.5% Native American, 1.0% Hispanic, .5% African American, and .5% mixed race or other.

There were 1,252 participants in the 17-year old cohort for the MTFS. However, much of the substance use data for these individuals was missing due to difficulties with computerized data collection. Participants who were missing data on any of the measures used in the analyses were excluded from the sample. There were 972 individuals who were excluded, leaving 280 individuals with complete data for the present study. T-tests were conducted to determine whether there were differences between individuals with complete data and those with missing data (see Table 2). Individuals with complete data had a higher proportion of females, a lower level of education, and higher scores on all alcohol-related measures.

Procedure

Details of the procedure followed in the MTFS can be found in other articles (Iacono, Carlson, Taylor, Elkins, McGue, 1999; Iacono & McGue, 2002). Only information that is relevant to the present sample will be described here. Participants completed assessments consisting of questionnaires and laboratory measures, which took up to 9 hours. At each assessment, participants signed a consent or assent form. Participants were paid at the end of each assessment. The MTFS data collection was approved by the University of Minnesota Institutional Review Board and carried out in compliance with its guidelines.

Measures

Social Closeness. Sociability was measured using the Social Closeness subscale (see Appendix C) of the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008), a widely-use measure of personality traits. High scores on this scale reflect higher levels of sociability, interpersonal warmth and affection, and enjoyment of close relationships. This scale has 21 items and is a subscale within of the broader dimension of Positive Emotionality. The subscale was computed by summing the items, excluding individuals who are missing responses for 2 or more items. The MPQ was obtained from the Intake assessment at age 17. Any MPQ data missing from this time point was obtained from Follow-up 1 at age 20 for males and Follow-up 2 at age 24 for females.

Alcohol use. The MTFS staff created a questionnaire assessing the quantity and frequency of alcohol use in the past 12 months (see Appendix D). Quantity of use was multiplied by frequency of use to summarize use patterns in the past 12 months. This method, referred to as the Quantity-Frequency (QF) measure of alcohol use, is commonly used to provide an estimate of average alcohol consumption over a specified period of time. The QF method provides a

reliable summary of alcohol use that is comparable to other measures of use (Sobell & Sobell, 1992; Sobell, Agrawal, Sobell, Leo, Young, Cunningham, & Simco, 2003). Data was collected from assessments at Intake, Follow-up 2, and Follow-up 2.

Demographics. Demographic information, including gender, age, ethnicity, and education level was assessed by self-report. Response options for education level included "1" = "less than high school," "2" = "high school or General Education Degree," "3" = "some college/business certificate/technical degree," "4" = "college degree," "5" = "some professional or graduate school."

Peer and co-twin alcohol use. Peer and co-twin alcohol use were measured using items from a questionnaire that assesses various aspects of alcohol use (e.g., access, peer influence, experiences when using), which was created by the MTFS staff (see Appendix E). Two items from this measure were used to assess peer use and two items assessed twin use ("Has your [best friend/twin] ever used alcohol?" and "When you drank alcohol during the past 12 months, how often did you drink with your [friends/twin]?"). Items assessing peer use and twin use were separately summed for analyses. This data was collected at Intake and Follow-up 1.

Alcohol-related consequences. The MTFS staff created a 6-item questionnaire measuring the experience of negative consequences that occurred as a result of drinking (see Appendix F). The items of this measure were summed for analyses. This data was collected at ages Intake and Follow-up 1. This measure demonstrated adequate reliability in the present sample ($\alpha = .69$).

Data analyses

The present sample is comprised of twin pairs and individuals whose twin was excluded from the sample due to missing data. When twins were recruited for the initial study, they were

assigned a Twin ID of either 1 or 2 to distinguish between members of a pair. The use of pairs violates the assumption of independence of observations, and thus one Twin ID was randomly selected and those individuals were included in the Primary Sample. In order to maximize the sample size for the primary analyses, the Primary Sample was comprised of the selected twins as well as all remaining individuals whose sibling was excluded due to missing data. This yielded a sample size of 206.

Predictor and criterion variables were examined to determine whether they were consistent with the basic assumptions of a Repeated Measures ANCOVA. Correlations among predictor and criterion variables were examined to determine whether expected relationships existed in the present sample. T-tests were conducted to determine whether female and male cohorts differed on the variables used in the study.

A series of Repeated Measures ANCOVAs were used to test the following hypotheses: 1) sociability predicts increases in alcohol use from Intake to Follow-up 1 and greater persistence in use from Follow-up 1 to Follow-up 2; 2) this effect persists when controlling for peer alcohol use; and 3) sociability interacts with alcohol-related consequences, such that individuals high in sociability and high in consequences persists in higher levels of use over time than those low in consequences. First, a model was tested with sociability predicting alcohol use over time. Next, peer alcohol use, co-twin alcohol use, and education level were added to this model. Finally, alcohol use consequences and the interaction between sociability and consequences were added to the model.

In order to determine whether the pattern of results from the primary analyses are similar across both twin samples, the analyses were replicated with individuals who had a Twin ID of 1

(Replication Sample 1; N = 143) and again with those with a Twin ID of 2 (Replication Sample 2; N = 137).

RESULTS

Descriptive statistics and correlations of predictor and criterion variables in the present study were examined (see Table 3). Notably, sociability was negatively related to alcohol use at Follow-up 2 (r = -.23, p = .001), which is in the opposite direction of the hypothesized relationship. Sociability was also negatively related to alcohol-related consequences at Follow-up 1 (r = -.22, p = .002).

The peer alcohol use variable from Intake was found to have skewness of -2.11 and kurtosis of 4.79. This variable was adjusted using a square transformation, which improved its normality (skewness = -1.37, kurtosis = 1.45). The transformed variable was used in the following analyses.

T-tests were conducted to determine whether key variables in the study differed by gender, and several significant differences were found (Table 4). Females were significantly higher than males in sociability (t(204)= -3.32, p = .001). Females were significantly lower than males in peer alcohol use at Follow-up 1 (t(204) = 7.37, p < .001), co-twin alcohol use at Follow-up 1 (t(204)= 2.26, p = .025), and alcohol use at Intake (t(204) = 3.40, p = .001), Follow-up 1 (t(204) = 6.13, p < .001), and Follow-up 2 (t(204) = 6.17, p < .001). Thus, gender was included as a covariate in all analyses.

A Repeated Measures ANCOVA was conducted to test the hypothesis that sociability predicts changes in alcohol use over time. This model included sociability and gender as predictors and alcohol use as the repeated measure (see Table 5). Results showed that alcohol use significantly differed over time (F(2,406) = 40.605, p < .001, η^2_p = .167), but there was no significant effect of sociability (F(2,406) = 1.14, p = .32, η^2_p = .006). Gender significantly predicted change in use over time (F(2,406) = 5.30, p = .005, η^2_p = .025).

Exploratory contrast comparisons were conducted to examine changes in mean alcohol use over time. Given that these analyses were conducted post hoc, the alpha level of these tests was adjusted using a Bonferroni correction to .017 (.05/3). Alcohol use significantly increased from Intake (M = 13.79, SE = .95) to Follow-up 1 (M = 24.71, SE = 1.14; $F(1, 203) = 71.70$, $p < .001$, $\eta^2_p = .261$), significantly decreased from Follow-up 1 to Follow-up 2 (M = 20.80, SE = .98; $F(1, 203) = 10.72$, $p = .001$, $\eta^2_p = .050$), and significantly increased from Intake to Follow-up 2 ($F(1,203) = 34.22$, $p < .001$, $\eta^2_p = .144$; see Figure 1). Changes in alcohol use over time demonstrated both a significant linear effect ($F(1,203) = 34.22$, $p < .001$, $\eta^2_p = .144$) and a significant quadratic effect ($F(1,203) = 46.42$, $p < .001$, $\eta^2_p = .186$).

In order to address the hypothesis that sociability predicts changes in alcohol use while controlling for the use of alcohol by peers, peer alcohol use, co-twin alcohol use, and education level were included in the Repeated Measures ANCOVA model in addition to sociability and gender (see Table 5). Peer alcohol use and co-twin use were measured at Intake and Follow-up 1, and measures from both time points were included in the model. Again, there was no significant effect of sociability in this model ($F(2,396) = 1.19$, $p = .305$, $\eta^2_p = .006$; see Figure 2), but there remained a significant effect of alcohol use over time ($F(2,396) = 42.03$, $p < .001$, $\eta^2_p = .175$). Peer alcohol use at Intake significantly predicted changes in alcohol use over time ($F(2,396) = 7.39$, $p = .001$, $\eta^2_p = .036$), and gender was marginally significant ($F(2,396) = 2.91$, $p = .056$, $\eta^2_p = .014$). No other predictors were significant in this model.

Exploratory contrasts were conducted to examine whether peer use at Intake predicted changes in alcohol use between each time point. A total of six comparisons were made in this set of post hoc analyses, and thus the alpha level was adjusted for these comparisons to a level of .008 (.05/6) using a Bonferroni correction. These analyses revealed that peer alcohol use at

Intake predicted significant changes in alcohol use between Intake and Follow-up 2 ($F(1,198) = 15.68$, $p < .001$, $\eta^2_p = .073$). The effect of peer use at Intake and Follow-up 1 was not significant at the adjusted alpha level ($F(1,198) = 5.23$, $p = .023$, $\eta^2_p = .026$). Peer use did not predict changes in alcohol use between Follow-up 1 and Follow-up 2 ($F(1,198) = 2.02$, $p = .157$, $\eta^2_p = .010$). T-tests were used to compare mean levels of alcohol use at each time point by high and low levels of peer use at Intake (Figure 3). Average alcohol use at Intake was significantly lower at low levels of peer use (M = 8.98, SE = 1.25) than at high peer use (M = 18.59, SE = 1.24; $t(410) = 1.53$, $p < .001$), whereas average use did not differ by level of peer use at Follow-up 1 ($t(410) = 1.53$, $p = .127$) or Follow-up 2 ($t(410) = 3.00$, $p = .999$).

Consistent with the hypothesis that sociability and alcohol-related consequences interact to predict changes in use, alcohol-related consequences measured at Intake and Follow-up 1 were added to the model, as well as the interaction of these predictors with sociability (see Table 5). Alcohol use ($F(2,388) = 42.68$, $p < .001$, $\eta^2_p = .180$) and peer alcohol use at Intake ($F(2,388) = 6.66$, $p = .001$, $\eta^2_p = .033$) remained significant in this model, and sociability remained non-significant ($F(2,388) = .1.56$, $p = .211$, $\eta^2_p = .008$). Alcohol-related consequences at Intake was a marginally significant predictor of change in alcohol use over time ($F(2,388) = 2.75$, $p = .065$, $\eta^2_p = .014$). There was not a significant effect of alcohol-related consequences at Follow-up 1 ($F(2,388) = 1.19$, p = .306, $\eta^2_p = .006$), nor was there a significant effect of the interaction between sociability and alcohol-related consequences at Intake ($F(2,388) = 2.17$, $p = .116$, $\eta^2_p = .011$) or Follow-up 1($F(2,388) = 1.75$, $p = .175$, $\eta^2_p = .009$).

Exploratory contrasts were conducted to examine whether alcohol-related consequences at Intake predicted changes in alcohol use between each time point. Alcohol-related consequences significantly predicted change in alcohol use between Intake and Follow-up 2

($F(1,194) = 5.72$, $p = .018$, $\eta^2_p = .029$, Figure 4), but not between other time points. However, after adjusting the alpha level to .017 (.008/6) to correct for the number of comparisons in this set of post hoc analyses, this effect was no longer significant. T-tests were used to compare mean levels of alcohol use at each time point by high and low levels of alcohol-related consequences at Intake. Average alcohol use at Intake was significantly lower at low levels of consequences (M = 10.63, SE = 1.22) than at high consequences (M = 16.71, SE = 1.25; $t(410) = 3.52$, $p < .001$), whereas average use did not differ by level of peer use at Follow-up 1 ($t(410) = .92$, $p = .356$) or Follow-up 2 ($t(410) = .07$, $p = .941$).

In order to determine whether this pattern of results is similar across siblings within twin pairs, the previously described analyses were conducted in Replication Samples 1 and 2. Descriptive statistics for Replication Samples 1 and 2 can be found in Table 6. The differences in results between these samples and the Primary Sample are highlighted below.

The results of repeated measures ANCOVAs in Replication Sample 1 were highly similar to that of the primary sample, though some small differences were observed. Alcohol-related consequences at Intake significantly predicted changes in alcohol use over time in this sample ($F(2,262) = 3.09$, $p = .047$, $\eta^2_p = .023$; Table 7), whereas alcohol-related consequences was only a marginally significant predictor in the Primary Sample. Additionally, gender was not a significant predictor in this sample, but was significant in the Primary Sample. Sociability remained a non-significant predictor.

Repeated measures ANCOVAs conducted in Replication Sample 2 showed a pattern of results that replicated some findings from the Primary Sample but also yielded some disparate results. The assumption of sphericity was violated in all of the repeated measures ANCOVA models, and Greenhouse-Geisser corrections were applied to all results of these models.

Sociability remained a non-significant predictor in all analyses with this sample. In the model examining sociability and gender as predictors, gender significantly predicted changes in alcohol use over time ($F(1.87, 250.58) = 2.20$, $p = .022$, $\eta^2_p = .028$), but became non-significant in the following models. In the Primary Sample, peer use at Intake was a strong predictor of changes in alcohol use, but was less predictive in Replication Sample 2. In the repeated measures ANCOVA model examining sociability, peer use, co-twin use, and education level as predictors, peer use at Intake was only marginally significant ($F(1.87,241.66) = 2.45$, $p = .092$, $\eta^2_p = .019$). When alcohol-related consequences and its interaction with sociability was added in the following model, peer use at Intake became non-significant ($F(1.85,231.46) = 2.13$, $p = .124$, $\eta^2_p = .017$; Table 8).

DISCUSSION

The present study examined whether sociability predicts greater increases in alcohol use and persistence in higher levels of use over time. The results did not provide support for this hypothesis. Examination of correlations revealed that sociability was negatively related to alcohol use at Follow-up 2, suggesting that it may have a protective effect on use during this period. While many studies have demonstrated a positive relationship between sociability and drinking behavior (e.g., Martsh & Miller, 1997; Cook et al., 1998; Littlefield, Sher, & Wood, 2009), others have found no relationship (e.g., Ibáñez, Moya, Villa, Mezquita, Ruipérez, & Ortet, 2010; LoCastro, Spiro, Monneilly, & Cirauio, 2000). The reason for these mixed findings is unclear. Sociability is conceptualized as a facet of the higher-order personality dimension of Positive Emotionality (e.g., Kotov, Gamez, Schmidt, & Watson, 2010), which has been found to be a resilience factor for substance use problems (Wills, Sandy, Yaeger, & Shinar, 2001) and may explain the negative correlation found in the present sample. Sociability is associated with traits that confer risk for use (e.g., approach, impulsivity, sensation seeking), but this effect may be attenuated by its association with traits that are negatively related to use (e.g., positive emotionality), resulting in a lack of relationship with alcohol use over time. It is also possible that sociability is related to substance use at both high and low levels of the trait, as introversion has also been linked with problematic alcohol use (e.g., Sher & Trull, 1994).

Another possible reason for the null findings is that the measure of sociability selected for the present study assesses a slightly different construct than those that have been shown to predict drinking. The construct of sociability used in the present study was selected because it measures the enjoyment of social interactions, presence of others, and closeness; however, other measures of sociability operationalize the construct differently. For example, extraversion as

measured by the Big Five Personality Inventory (John, Donahue, & Kentle, 1991) has been found to be associated with alcohol use (e.g., Martin, 2012). This construct measures "energetic approach towards the social and material world," (John, Naumann, & Soto, 2008), and contains the facets of gregariousness, assertiveness, activity, excitement-seeking, positive emotions, and warmth. Other measures that have been connected with drinking show a similarly broad conceptualization of this trait, such as the Revised NEO Personality Inventory (Costa & McCrae, 1992) and Eynsenck Personality Questionnaire (Eysenck, & Eysenck, 1975). It is possible that the dimensions of these traits that were not assessed in the present study account for the connection between sociability and drinking.

Regarding peer alcohol use, the results from the present study are consistent with literature that indicates that peer use is influential over the development of drinking habits, especially regarding onset of use. In the present sample, peer alcohol use had the most pronounced effect on use at Intake, which was collected around the age of 17. Individuals with fewer drinking peers at Intake drank less than those with more drinking peers, but increased to a similar level of alcohol use as those with more drinking peers at subsequent time points. Many young adults begin to drink alcohol regularly at this age (Johnston, et al., 2008), and the findings are consistent with literature that suggests that peer use is an important predictor of initiation of use and development of drinking habits (Colder & Chassin, 1999; Trucco, Colder, & Wieczorek, 2011). The data also suggest that peer use around the age of 17 is more influential over drinking patterns than peer use at the age of 20, which may indicate that peer influences at initiation of drinking are particularly influential over long-term drinking habits.

The experience of alcohol-related consequences was only a marginally significant predictor of changes in alcohol use in the present study. This effect appears to be driven by

differences in alcohol use between those with high and low levels of consequences at Intake. Individuals who experienced more consequences at Intake also drank considerably more at this time, but both groups drank similar amounts at subsequent time points. This may indicate that higher levels of consequences at Intake are reflective of earlier age of onset of regular use.

The lack of a strong relationship between consequences and drinking over time in the present study is not inconsistent with previous findings. While some research suggests that the experience of negative alcohol-related consequences leads to subsequent reductions in drinking (Barnett et al., 2006), other findings suggest that high levels of consequences are associated with heavy use and lack of action taken to change use (Blume, Schmaling, & Marlatt, 2006; Blume, & Marlatt, 2000). The effect of alcohol-related consequences on changes in drinking is likely moderated by other predictors (Merrill, Read, & Barnett, 2013; Vik, Culbertson, & Sellers, 2000).

The present study explored whether sociability interacted with the occurrence of alcohol-related consequences to predict increased trajectories of use. The results did not provide support for this hypothesis. While sociability is associated with approach motivation, which predicts problematic patterns of use (e.g., Murphy, Murphy, & Garavan, 2014), its association with traits that are protective against drinking (e.g., positive emotionality) may temper this association.

Limitations to the present study should be considered when interpreting the results. First, a majority of the MTFS sample that participated at the time points used in the present study is missing substance use data due to problems with computerized data collection. Individuals with complete data on all measures had higher scores on all alcohol-related measures than the individuals excluded due to missing data. Given that the relationship between sociability and alcohol use may differ at high and low levels of alcohol use, this may have affected the results.

Second, data collection for the MTFS sample began for the males 7 years before it began for the females. Thus, it is possible that there are cohort effects that differ by gender. Third, the measure of peer alcohol use in the present study was comprised of only two items. This measure had somewhat of a ceiling effect, with the majority of participants endorsing high levels of peer alcohol use, which was likely contributed to by the brevity of the measure. A more extensive assessment of peer alcohol use may have provided a more valid indicator of this construct. Similarly, the measure of alcohol-related consequences assessed whether specific consequences of use occurred in the past year, but did not assess their frequency of occurrence. The repeated experience of consequences is characteristic of problematic alcohol use, and this may not be well captured by the present scale due to the dichotomous response options. Thus, this scale may not sufficiently distinguish individuals who experience high and low levels of consequences. Finally, the ethnic composition of the sample was almost entirely Caucasian, which may limit the generalizability of the findings.

The present study sought to determine whether sociability was associated with increased levels of alcohol use over time while controlling for peer use, and whether sociability predicted greater persistence in use despite negative drinking consequences. However, results showed that sociability was unrelated to changes in alcohol use over time and did not interact with alcohol-related consequences. Future research should compare different measures of sociability in their prediction of alcohol use to determine whether the inconsistent findings are due to differences in the conceptualization of the construct. Further, the facets of sociability should be compared in their prediction of alcohol use. Specifically, it should be determined whether the relationship between sociability and drinking is driven by facets related to preference for closeness to others (e.g., warmth, gregariousness), or by its other facets (e.g., sensation-seeking, activity). It has

been theorized that the development of a drinking problem may lead to decreases in sociability over time, resulting in increased isolation (Sher & Trull, 1994). Thus, research should examine the relationship between sociability and drinking in both problematic drinkers and in individuals with healthier patterns of use. Further research on the relationship between sociability and alcohol use may provide a better understanding of the role of social reinforcement in the development of alcohol use behaviors and mechanisms by which the social environment confers risk for problematic use.

APPENDIX A

TABLES

Table 1

Sample size and age at each time point

		Intake		Follow-up 1		Follow-up 2	
	N	**M**	**SD**	**M**	**SD**	**M**	**SD**
Male	86	17.55	0.40	20.71	0.51	24.34	1.04
Female	120	17.47	0.49	20.63	0.55	24.90	0.63
Full Sample	206	17.50	0.46	20.66	0.53	24.67	0.87

Note. N refers to the number of individuals in the study (rather than number of twin pairs).

Table 2

T-tests examining differences in demographics and key study variables between participants who were not missing data and those who were missing data

	Present			Missing			
	n	**M/%**	**SD**	**n**	**M/%**	**SD**	**t**
Age IN	280	17.52	.44	972	17.46	.46	-1.84†
Age FU1	280	20.68	.52	831	20.67	.58	-.25
Age FU2	280	24.68	.84	887	24.71	1.01	.46
Sex (% female)	280	.59	.49	914	0.51	.50	-2.56*
Education	280	2.57	.68	820	2.73	.60	3.43**
Sociability	280	54.04	8.43	931	54.06	8.60	.03
Peer use IN	280	7.15	1.15	912	4.24	2.47	-27.15***
Peer use FU1	280	7.42	.84	621	5.89	2.27	-14.70***
Twin use IN	280	5.40	1.66	909	3.28	2.09	-17.48***
Twin use FU1	280	5.60	1.43	621	4.54	1.80	-9.43***
Consequences IN	280	1.86	1.75	217	1.50	1.63	-2.34*
Consequences FU1	280	2.05	1.56	475	1.27	1.33	-7.32***
Alcohol use IN	280	14.55	14.66	598	8.94	14.83	-5.24***
Alcohol use FU1	280	23.99	17.14	745	16.39	16.53	-6.49***
Alcohol use FU2	280	20.39	14.94	793	14.69	15.21	-5.41***

Note. IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2. Education level is coded as: 1 = less than high school; 2 = high school or General Education Degree; 3 = some college/business certificate/technical degree; 4 = college degree; 5 = some professional or graduate school.
† $p < .07$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3

Correlations and descriptive statistics of predictor and criterion variables

	M/%	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Sociability	54.32	8.36	--										
2. Peer Use IN	6.99	1.38	-.03	--									
3. Peer Use FU1	6.68	1.55	.01	.04	--								
4. Consequences IN	1.84	1.84	-.11	.16*	.06	--							
5. Consequences FU1	2.08	1.68	-.15*	.08	.03	.36***	--						
6. Twin Use IN	4.89	1.93	-.01	.22**	.03	.13	.12	--					
7. Twin Use FU1	5.43	1.57	.05	.09	.24**	-.02	.14*	.41***	--				
8. Education level	2.56	.68	.10	-.02	.13	-.13	.02	-.05	.02	--			
9. Sex (% female)	.58	.49	.23**	.12	-.46***	-.02	-.01	.03	-.16*	.04	--		
10. Alcohol Use IN	13.79	13.96	-.15*	.33***	.12	.36***	.28***	.21**	.12	-.17*	-.23**	--	
11. Alcohol Use FU1	24.71	17.76	-.11	.06	.20**	.16*	.28***	.07	.20**	-.01	-.39***	.31***	--
12. Alcohol Use FU2	20.80	15.41	-.22**	-.02	.21**	.11	.25***	.10	.16*	-.09	-.40***	.30***	.47***

Note. IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2. Education level is coded as: 1 = less than high school; 2 = high school or General Education Degree; 3 = some college/business certificate/technical degree; 4 = college degree; 5 = some professional or graduate school.
* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4

T-tests examining differences in predictor and criterion variables by gender

	Male		Female		
	M	**SD**	**M**	**SD**	**t**
Sociability	52.09	8.18	55.92	8.16	-3.32**
Consequences IN	1.90	1.81	1.81	1.86	0.34
Consequences FU1	2.09	1.75	2.07	1.64	0.11
Peer use IN	6.79	1.62	7.13	1.16	-1.64
Peer use FU1	7.52	0.85	6.08	1.66	7.37***
Twin use IN	4.84	1.99	4.93	1.90	-0.35
Twin use FU1	5.72	1.66	5.23	1.48	2.26*
Education level	2.52	0.65	2.58	0.71	-0.62
Alcohol use IN	17.59	16.68	11.06	10.91	3.40***
Alcohol use FU1	32.97	19.60	18.79	13.58	6.13**
Alcohol use FU2	28.00	17.72	15.64	10.99	6.17***

Note. IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2. Education level is coded as: 1 = less than high school; 2 = high school or General Education Degree; 3 = some college/business certificate/technical degree; 4 = college degree; 5 = some professional or graduate school.
* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 5

Repeated measures ANCOVAs examining predictors of changes in alcohol use over time

	SS	df	MS	F	η^2_p	*p*
Model 1						
Time	12666.60	2	6333.30	40.605	.167	.000
Time * Soc	355.97	2	177.99	1.141	.006	.320
Time * Sex	1653.99	2	826.99	5.302	.025	.005
Error(Time)	63325.26	406	155.97			
Model 2						
Time	12675.27	2	6337.64	42.029	.283	.000
Time * Soc	358.82	2	179.41	1.190	.013	.305
Time * Sex	877.58	2	438.79	2.910	.026	.056
Time * Peer IN	2229.92	2	1114.96	7.394	.074	.001
Time * Peer FU1	87.76	2	43.88	.291	.003	.748
Time * Twin IN	287.91	2	143.96	.955	.009	.386
Time * Twin FU1	532.81	2	266.40	1.767	.016	.172
Time * Edu	533.50	2	266.75	1.769	.016	.172
Error(Time)	59713.64	396	150.79			
Model 3						
Time	12711.99	2	6356.00	42.683	.180	.000
Time * Soc	464.59	2	232.29	1.560	.008	.211
Time * Sex	962.07	2	481.03	3.230	.016	.041
Time * Peer IN	1984.39	2	992.19	6.663	.033	.001
Time * Peer FU1	151.09	2	75.54	.507	.003	.603
Time * Twin IN	189.07	2	94.54	.635	.003	.531
Time * Twin FU1	338.66	2	169.33	1.137	.006	.322
Time * Edu	392.01	2	196.00	1.316	.007	.269
Time * Conseq IN	819.84	2	409.92	2.753	.014	.065
Time * Conseq FU1	353.30	2	176.65	1.186	.006	.306
Time * Soc * Conseq IN	645.83	2	322.91	2.168	.011	.116
Time * Soc * Conseq FU1	520.69	2	260.35	1.748	.009	.175
Error(Time)	57778.33	388	148.91			

Note. Time = Time point; Soc = Sociability; Peer = Peer alcohol use; Twin = Twin alcohol use; Edu = Education level; Conseq = Alcohol-related consequences; IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2.

Table 6

Descriptive statistics of predictor and criterion variables for replication samples.

	Replication Sample 1		Replication Sample 2	
	M/%	**SD**	**M/%**	**SD**
Sociability	54.64	8.22	53.42	8.63
Peer Use IN	6.92	1.47	7.23	.98
Peer Use FU1	6.74	1.55	6.66	1.69
Consequences IN	1.83	1.93	2.07	1.77
Consequences FU1	2.15	1.70	2.26	1.88
Twin Use IN	4.99	1.95	5.31	1.85
Twin Use FU1	5.59	1.55	5.50	1.46
Education	2.62	.65	2.52	.71
Sex (% female)	.60	.49	.58	.50
Alcohol Use IN	13.66	13.76	15.47	15.54
Alcohol Use FU1	22.80	14.64	25.23	19.39
Alcohol Use FU2	20.45	15.85	20.32	13.98

Note. IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2.

Table 7

Replication Sample 1 repeated measures ANCOVA examining predictors of change in alcohol use over time

	SS	**df**	**MS**	**F**	η^2_p	***p***
Time	6266.93	2	3133.47	23.72	.153	.000
Time * Soc	232.71	2	116.36	.88	.007	.416
Time * Sex	46.87	2	23.44	.18	.001	.838
Time * Peer IN	2321.22	2	1160.61	8.78	.063	.000
Time * Peer FU1	51.55	2	25.78	.20	.001	.823
Time * Twin IN	224.92	2	112.46	.85	.006	.428
Time * Twin FU1	130.57	2	65.29	.49	.004	.611
Time * Edu	271.83	2	135.92	1.03	.008	.359
Time * Conseq IN	815.59	2	407.80	3.09	.023	.047
Time * Conseq FU1	156.71	2	78.35	.59	.005	.553
Time * Soc * Conseq IN	266.57	2	133.29	1.01	.008	.366
Time * Soc * Conseq FU1	78.16	2	39.08	.30	.002	.744
Error(Time)	34618.72	262	132.13			

Note. Time = Time point; Soc = Sociability; Peer = Peer alcohol use; Twin = Twin alcohol use; Edu = Education level; Conseq = Alcohol-related consequences; IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2.

Table 8

Replication Sample 2 repeated measures ANCOVA examining predictors of change in alcohol use over time

	SS	**df**	**MS**	**F**	η^2_p	***p***
Time	6418.15	1.852	3466.07	21.27	.145	.000
Time * Soc	460.62	1.852	248.75	1.53	.012	.221
Time * Sex	606.26	1.852	327.41	2.01	.016	.140
Time * Peer IN	644.17	1.852	347.88	2.14	.017	.124
Time * Peer FU1	92.23	1.852	49.81	.31	.002	.720
Time * Twin IN	153.31	1.852	82.80	.51	.004	.588
Time * Twin FU1	616.86	1.852	333.13	2.04	.016	.136
Time * Edu	498.74	1.852	269.34	1.65	.013	.196
Time * Conseq IN	775.81	1.852	418.97	2.57	.020	.083
Time * Conseq FU1	239.76	1.852	129.48	.80	.006	.444
Time * Soc * Conseq IN	282.91	1.852	152.78	.94	.007	.387
Time * Soc * Conseq FU1	165.48	1.852	89.36	.55	.004	.565
Error(Time)	37720.11	231.463	162.96			

Note. Time = Time point; Soc = Sociability; Peer = Peer alcohol use; Twin = Twin alcohol use; Edu = Education level; Conseq = Alcohol-related consequences; IN = Intake; FU1 = Follow-up 1; FU2 = Follow-up 2.

APPENDIX B

FIGURES

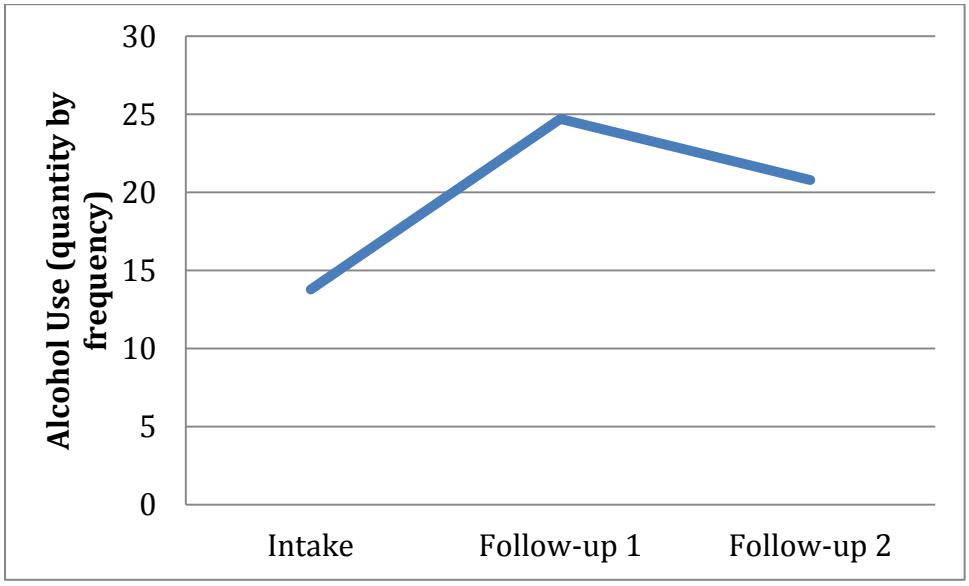

Figure 1. Mean levels of alcohol use over time.

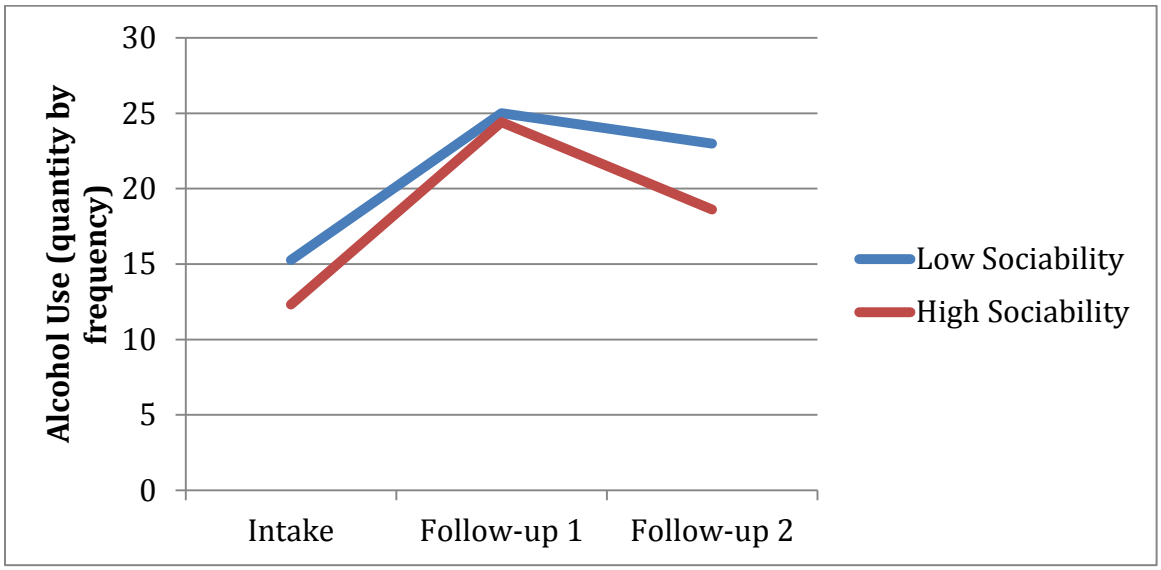

Figure 2. Mean levels of alcohol use over time by high and low levels of sociability.

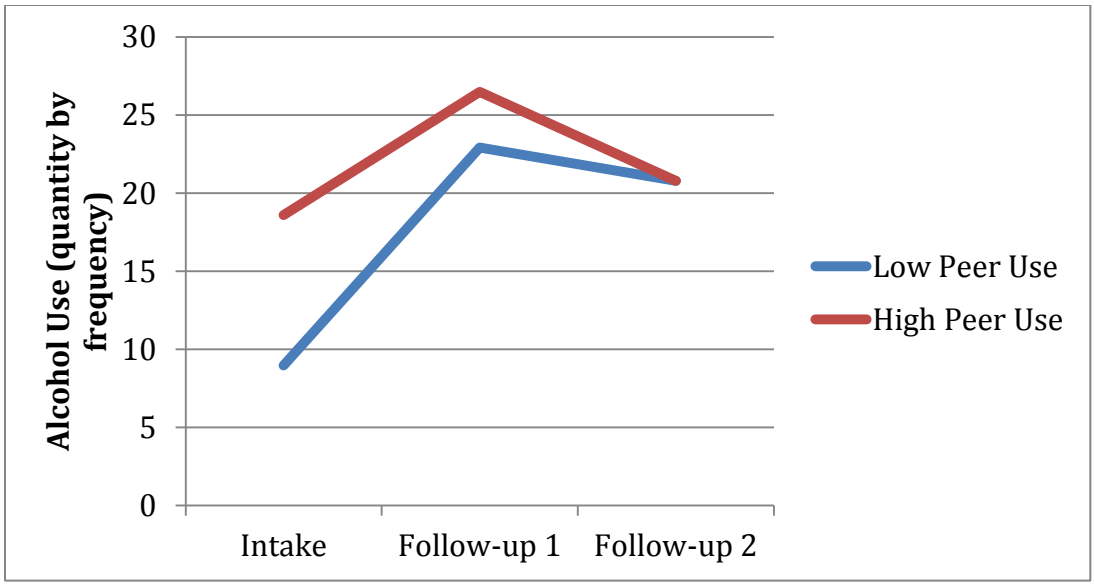

Figure 3. Mean levels of alcohol use over time by high and low levels of peer alcohol use.

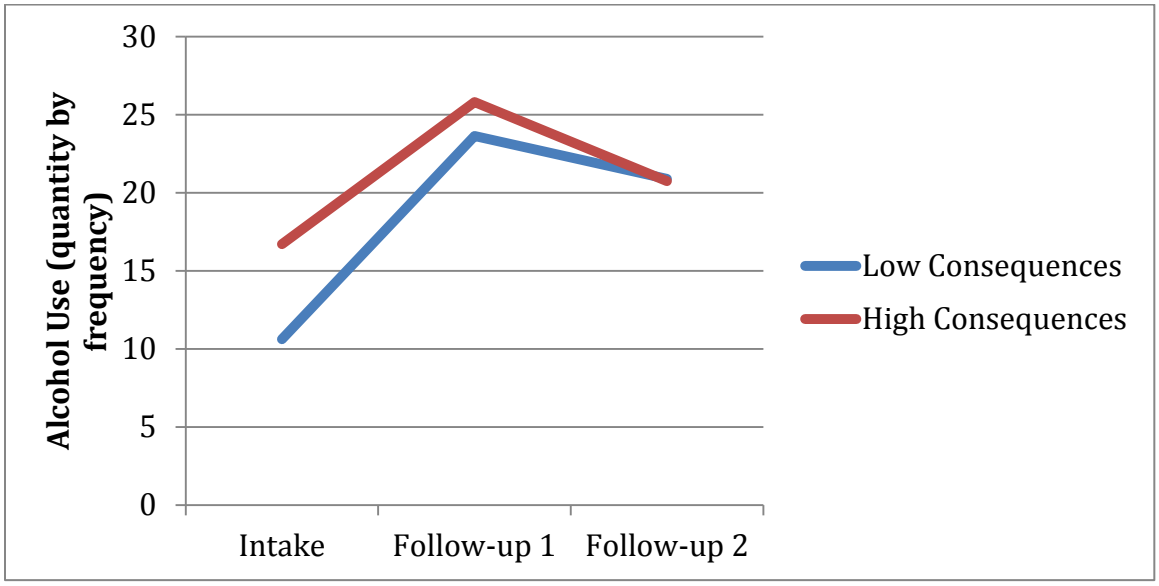

Figure 4. Mean levels of alcohol use over time by high and low levels of alcohol-related consequences.

APPENDIX C

MPQ SOCIAL CLOSENESS SCALE

These items are statements that you might use to describe your opinions, interests, or feelings. In front of most of the items there is a scale like this: T t f F. The meaning of the four possible answers is given below:

T = Definitely true

t = Probably true

f = Probably false

F = Definitely false

So, if the statement or item is definitely true for you, then you should circle T like this: (T) t f F. If the statement or item is probably true or true for you (or more true than false) then you should circle the t like this: T (t) f F.

Some items contain two statements or two alternatives, marked A or B. In front of these items is a scale like this: A a b B. For these items, the meaning of the four possible answeres is as follows:

A = Definitely A

a = Probably A

b = Probably B

B = Definitely B

So, if you think Alternative B is probably correct for you, but you aren't sure enough to be definite, then circle b like this: A a (b) B.

Please answer every question—even if you are not entirely sure which answer is right for you. Read each item carefully; for example, some items ask you to choose which alternative you would dislike more- not the one that you would prefer.

Circle one letter:

T t f F 1. I usually like to spend my leisure time with friends rather than alone.

T t f F 2. I could be happy living by myself in a cabin in the woods or mountains.

A a b B 3. When I am unhappy about something, (A) I tend to seek the company of a friend, (B) I prefer to be alone.

T t f F 4. I prefer not to "open up" too much, not even to friends.

T t f F 5. I am a warm person rather than cool and detached.

T t f F 6. I am usually happier when I am alone.

T t f F 7. I prefer working with people to working with things.

T t f F 8. I have few or no close friends.

T t f F 9. I am more of a "loner" than most people.

T t f F 10. Often I go a whole morning without wanting to speak to anyone.

T t f F 11. For me one of the most satisfying experiences is the warm feeling of being in a group of good friends.

T t f F 12. I prefer to work alone.

T t f F 13. When I have a problem I prefer to handle it alone.

T t f F 14. I am rather aloof and maintain distance between myself and others.

T t f F 15. I am happiest when I see people most of the time.

T t f F 16. I tend to keep my problems to myself.

T t f F 17. I often prefer not to have people around me.

T t f F 18. Without close relationships with others my life would not be nearly as enjoyable.

APPENDIX D

ALCOHOL USE ITEMS

1. In the past 12 months, how often on average have you drunk any alcohol (had any alcohol to drink)?

0 = Never

1 = Less than once a year

2 = Less than once a month but at least once a year

3 = About once a month

4 = 2 or 3 times a month

5 = 1 or 2 a week

6 = 3 or 4 times a week

7 = Nearly every day

8 = Every day

9 = 2 times a day

10 = 3 or more times a day

2. How much did you have on average each time you drank during the past 12 months? _____

(Responses range from 0-30)

APPENDIX E

PEER ALCOHOL USE ITEMS

1. Has your best friend ever used alcohol?

    1 = Never

    2 = Yes: not within past 12 months

    3 = Yes: once in a while the past 12 months

    4 = Yes: a lot in past 12 months

    5 = I don't know

2. When you drank alcohol during the past 12 months, how often did you drink with your friends?

    1 = Nearly every time or every time,

    2 = About half the time,

    3 = Less than half the time,

    4 = Never or almost never

APPENDIX F

ALCOHOL-RELATED CONSEQUENCES ITEMS

Response options are No/Yes:

1. One thing that happened to me when I used alcohol was I passed out and couldn't remember what I did.

2. One thing that happened to me when I used alcohol was I became sick and vomited.

3. One thing that happened to me when I used alcohol was I felt depressed or sad.

4. One thing that happened to me when I used alcohol was I felt mad or angry.

5. One thing that happened to me when I used alcohol was I felt confused or scared.

6. One thing that happened to me when I used alcohol was I got into trouble with my parents.

APPENDIX G

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Office of the Vice President for Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 09/30/2014

To: Allison Moltisanti

Address: Department of Psychology, 1107 West Call Street, Tallahassee, FL 32306-4301

Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
The role of trait sociability, peer alcohol use, and alcohol-related consequences in the trajectory of alcohol use

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 09/29/2015 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Jeanette Taylor , Advisor
HSC No. 2014.13447

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BIOGRAPHICAL SKETCH

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