Words: 7,470

Tables: 5

Figures: 3

Title

Discrete emotions and global affect: Applying empirically driven approaches to experience sampling data to model state and trait affective structure and affect-alcohol use associations in a heavy drinking young-adult sample

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This research was supported in part by grants from the National Institute on Alcohol Abuse and Alcoholism (L30AA027041: PI, Emery) and the Center for Brain and Behavior Research (PI: Emery). Address correspondence concerning this article to Noah N. Emery; E-mail: noah.emery@colostate.edu. Conflict of interest statement: On behalf of all authors, the corresponding author states that there is no conflict of interest.

Abstract

Affective functioning is central to most contemporary models of alcohol use. However, the affective structure at the within- and between-person levels is rarely investigated nor is the differential predictive value of specific affect dimensions assessed across state and trait formats. We examined a) the structure of state and trait affect using experience sampling methodology (ESM) and b) predictive associations between the empirically derived affect facets and alcohol use. Participants were 92 heavy drinking college students aged 18-25 who completed 8 momentary assessments of their affect and drinking a day for 28-days. We found evidence for a single positive affect factor at both the within- (i.e., state) and between-person (i.e., trait) levels. We found a hierarchical factor structure for negative affect, represented by a general, superordinate dimension as well as facet-level sadness, anxiety, and anger dimensions. Associations between affect and alcohol use differed across trait and state levels and across specific types of negative affect. Lagged state positive affect, negative affect, and sadness as well as trait positive affect and sadness were inversely associated with drinking. Lagged state anxiety was positively associated with drinking. Thus, our study demonstrates how associations between drinking and affect can be studied in relation to general (e.g., general negative affect) and more specific aspects of affective experiences (e.g., sadness versus anxiety) concurrently within the same study and across trait and state levels of assessment.

Keywords: experience sampling methodology, positive affect, negative affect, college students, alcohol use

Discrete emotions and global affect: Applying empirically driven approaches to experience sampling data to model state and trait affective structure and affect-alcohol use associations in a heavy drinking young-adult sample

Affective functioning figures prominently in many etiological models of alcohol use (Kassel & Veilleux, 2010). Theoretical accounts of the relationship between affect and drinking suggest that alcohol is often consumed as a form of affect regulation due to the positive and negative reinforcing qualities of alcohol (Cooper et al., 1995; McCarthy et al., 2010; Sher & Grekin, 2007). A central premise of these models is that those who use alcohol to regulate their emotions become motivated to consume alcohol when they experience heightened levels of affective arousal (Cooper et al., 2015; Sher & Grekin, 2007). Daily-process research on associations between global negative affect and alcohol consumption shows that higher daily and weekly negative affect is associated with increased drinking frequency (Armeli et al., 2010), consuming more drinks (Armeli et al., 2000; Grant et al., 2009; Mohr et al., 2005; Simons et al., 2005; Simons et al., 2014), greater intoxication (Simons et al., 2010), and experiencing more alcohol-related problems (Simons et al., 2005; Simons et al., 2014). Meanwhile, global daily positive affect is associated with increased likelihood of drinking later that night (Simons et al., 2014), greater intoxication (Simons et al., 2010), consuming more drinks during drinking episodes (Emery & Simons, 2020; Simons et al., 2014) but not directly associated with increased alcohol-related problems (Simons et al., 2010; Simons et al., 2014).

However, associations between negative affect and alcohol consumption are complex and prior research in this area indicates mixed and, in some cases, conflicting results (Colder et al., 2010; Kassel & Veilleux, 2010). It is not uncommon for experience sampling method (ESM) studies examining the within-person association between negative affect and drinking to report

null (Dvorak & Simons, 2014; Thomas et al., 2014), fairly modest effects (Armeli et al., 2008; Hussong, 2007; Simons et al., 2010), or even inverse associations with drinking (Patrick et al., 2016; Simons et al., 2005). Some researchers suggest that one reason for the inconsistent findings could be related to affect specificity, such that discrete emotion states may uniquely prompt affect-regulation motivated drinking (Hussong & Chassin, 1994). Consistent with this argument, studies have shown that some discrete emotions differentially predict alcohol consumption. For example, some studies support associations between alcohol consumption and forms of anxiety (e.g., nervous, fear) and not anger or sadness (Armeli et al., 2008; Hussong et al., 2005; Swendsen et al., 2000); in contrast, others support associations between anger or sadness and alcohol use, but not forms of anxiety or stress (Gottfredson & Hussong, 2011; Gould et al., 2012; Hussong et al., 2001). Meanwhile, some studies even suggest that increased anxiety or sadness paradoxically exhibit protective effects against drinking (Grant et al., 2009; Hussong et al., 2001). These studies show, at least in part, that discrete emotions may exhibit differential associations with alcohol consumption at the event-level. On balance, there appears to be evidence for both global affect and discrete emotions having unique predictive value in the context of alcohol use. However, to our knowledge, no studies both a) model the within- and between-persons structure of affect in a heavy drinking sample and then b) test associations between the empirically derived affective dimensions and alcohol use both prior to and during drinking episodes.

There is some contention among affective scientists regarding how to best conceptualize and assess state and trait affective experiences. That is, questions remain about whether affect is best characterized as discrete emotional experiences (e.g., anger, sadness, joy), global valence-based feeling states (i.e., positive affect, negative affect), or an integration of both discrete and

global dimensions. Evidence from studies using factor analysis suggests that affect can effectively be characterized as two basic dimensions: positive and negative affect (Crawford & Henry, 2004; Watson & Clark, 1994; Watson et al., 1988). However, emotion researchers point to experimental research showing anxiety, sadness, anger, and happiness can be manipulated independently from one another (Lench et al., 2011) and have unique psychophysiological profiles (Künecke et al., 2014; Rainville et al., 2006). Other research has put forth models with both a discrete emotion structure and a global structure (Watson & Clark, 1994; Watson et al., 1988). However, there is a lack of consensus in the field (Weidman et al., 2017) and little prior research has examined affect structure using intensive longitudinal methods to capture dynamic affective experiences. The current research addresses the lack of consensus by conceptually replicating and extending research on the structure of trait and state affect across time using intensive longitudinal data and examining the relationship of empirically derived facets with an outcome of interest, namely alcohol consumption.

A recent study by Jacobson et al. (2020) extended prior longitudinal research (e.g., Charles et al., 2019) by taking a novel approach to integrate models of affect and inform future affective assessment. In it, researchers applied a multistep exploratory and confirmatory multilevel factor analytic approach to daily diary data from 176 participants who completed the Positive Affect Negative Affect Schedule (PANAS; Watson & Clark, 1994) once a day for 50 days. Importantly, this approach allowed for the simultaneous estimation of trait factors (i.e., between-person factor analysis) and state factors (i.e., within-person factor analysis) from the multiple repeated measures. The results provided support for a two-factor solution of trait affect reflecting positive and negative affect dimensions, and an eight-factor solution of state affect reflecting the emotions: distressed, enthusiastic, proud, angry, sad, scared, attentive, and anxious.

Taken together, these results suggest that global trait positive affect and negative affect can be used to describe differences across people, but at least eight discrete emotion states are experienced within-persons across time. While measures of affect are often included in alcohol studies using experience sampling and ecological momentary assessment methods (Dora et al., 2022), the affective structure at the between- and within-person levels has not been thoroughly investigated in the context of heavy drinking. Thus, given the centrality of affect in models of alcohol use coupled with the ubiquity of affect measures in alcohol research, it is necessary to better understand the affective structure in this population and examine associations between the empirically derived affect facets and alcohol use – an outcome where affective functioning is particularly relevant.

Current Study Goals and Contributions

In the current study, we address gaps in the literature by applying empirically driven approaches to model the state (i.e., within) and trait (i.e., between) affective structure in a heavy drinking young-adult sample. This approach is useful for integrating trait and state models of affect and for informing assessment efforts for both cross-sectional and longitudinal research, which is an important consideration given that affect assessment approaches continue to vary considerably across studies (Weidman et al., 2017). To accomplish this, we followed the procedures of Jacobson et al. (2020) and applied exploratory and confirmatory multilevel factor analysis to experience sampling data to test a series of affective structures at the within- and between-person levels. After this, we use the empirically derived affective structure to predict alcohol use at both the within- and between-person levels using an autoregressive multilevel structural equation modeling approach. This approach allows us to model shifts in the intensity of affective experiences and how those are related to individual decisions to drink at a given

moment and patterns in drinking across people. Given this is a data driven approach, we do not put forth formal directional hypotheses.

Method

Participants

An initial sample of 102 undergraduate students aged 18-25 was enrolled in the ESM study. Inclusion criteria consisted of reporting drinking at a moderate or higher level during the past 90 days (i.e., 7+ standard drinks per week for females or 14+ standard drinks per week for males; U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Participants data were excluded from the final sample if they provided less than 7 days of data or had less than 10% compliance with the survey protocol while they were enrolled in the study. Of the original sample, 10 participants dropped out for personal reasons or for technology-related issues and were excluded for not meeting the necessary data requirements. Of the remaining 92 participants, 58 (63%) were female, 97% were White, 1% were Asian American, 1% were multiracial, 1% identified as “other”, and 96% were non-Hispanic. The mean age of the sample was 20.17 (*SD* = 1.37). One previous manuscript has been published using these data (Emery & Simons, 2020). This study was not preregistered.

Procedure

Recruitment and initial screening. Participants were recruited using flyers, in-class announcements, and the university research pool. The initial screening consisted of an online consent form and a baseline assessment. Participants meeting the drinking level eligibility criteria were invited to enroll in the ESM study.

Experience sampling study. After providing their informed consent, participants attended an in-person lab session where they installed the ESM application on their personal cell

phones and received training on the ESM application that included discussion of the application functions, assessment timing, and survey questions. The ESM application was programmed using mEMA software (Tuomenoksa, 2013) developed by ilumivu Inc. The sampling protocol was based on Simons and colleagues (Simons et al., 2014). Participants completed assessments for a total of 28 consecutive days. Each day, they would receive 8 prompts at random times within 2-hour blocks between the hours of 10:00 a.m. and 2:00 a.m. Participants were advised they could skip prompts during the hours when they were sleeping or otherwise unavailable/when dangerous (e.g., while driving). Prompts presented brief (~ 2 min) assessments asking for participants to report on their behavior during the past 30 minutes. The 8 random prompts assessed affect and alcohol consumption throughout the day. In addition to the random prompts, a regular morning survey presented questions about alcohol consumption during the previous evening aimed at assessing the total number of drinks consumed. The current analysis only used data captured during random prompts because these were the only surveys that assessed affect and our aims are momentary in nature. Compensation was contingent on response rates, with $0.20 given per survey completed, for a possible total of up to $50. In addition, each completed survey earned the participant one entry into a drawing for $100.

Baseline Measures

Demographic information. Information was collected on participants' sex, age, year in school, race, and ethnicity.

Alcohol consumption. The Modified Daily Drinking Questionnaire (MDDQ; Dimeff et al., 1999) was used to assess participants' baseline alcohol consumption. The MDDQ presents participants with a blank grid representing a 7-day week and asks them to record the number of standard drinks (i.e., one standard drink = 1.5 ounces liquor, 5 ounces wine, or 12 ounces beer)

they have typically consumed on each day in a normal week over the past 90 days. This was used for descriptive purposes only.

Experience Sampling Measures

Affect. During random assessments, items from subscales of the Positive Affect Negative Affect Schedule-Expanded Form (PANAS-X; Watson & Clark, 1994) and Larsen and Diener's affect circumplex model (Larsen & Diener, 1992) were used to assess participants' experience of positive and negative affect during the previous 30 minutes. Nine items assessed negative affect: sad, blue, downhearted nervous, jittery, anxious, angry, hostile, and irritable. Five items from the assessed positive affect: happy, joyful, excited, energetic, and enthusiastic. Positive and negative affect items were rated on 7-point scales ranging from 1 (*not at all*) to 7 (*extremely*). The internal consistency and criterion validity of these scales in an experience sampling context are supported by previous research (Csikszentmihalyi & Larson, 1992; Emery & Simons, 2020; Simons et al., 2014).

Alcohol consumption. During random assessments, participants were asked to report the number of drinks they had consumed during the past 30 minutes. Responses were on an 8-point scale, ranging from 0 to 7+ standard drinks. Participants were provided with definitions of standard drinks during the initial training session. Previous research has demonstrated significant correspondence between self-reported alcohol consumption in an ESM study and transdermal alcohol monitoring (Simons et al., 2015), which supports the validity of this measure.

Alcohol use at the moment level is a relatively low-base rate behavior (Atkins et al., 2013; Horton et al., 2007). This produces datasets that are often highly skewed with many zeroes. This issue is even further exacerbated by intensive repeated assessments inherent to event-level studies (Atkins et al., 2013). In the current study we were interested in understanding

how facets of affect are associated with individual decisions to drink and patterns in drinking across people. Thus, given the skew of the momentary drinking data and insufficient variability in the count, especially at the high end of the scale (<2.5% of occasions where participants drank more than 2 standard drinks in the past 30 mins) coupled with the complexity of our models we opted to dichotomize drinking (0 = *non-drinking moment*, 1 = *drinking moment*) to increase interpretability. Dichotomous outcomes are commonly used outcomes in substance use research (e.g., Emery et al., 2021; Emery et al., 2020). In this context, the within-person momentary effects represent the probability of drinking at a given moment and the between-person effects represent the proportion of drinking moments during the sampling period.

Analysis Plan

The data were structured such that moments (within-person; Level 1) were nested within persons (between-person; Level 2) and analyzed using Mplus 8.1 (Muthén & Muthén, 2017). For clarity, “state" refers to factors varying within-person across time (L1) and "trait" signifies dispositional characteristics generated from multiple state assessments (L2). This study replicated and extended the analytic approach conducted by Jacobson et al. (2020). To address the study aims, we first examined intraclass correlations (ICCs) for the individual affect items to determine if there was sufficient variation present in the data at both the within- and between-person levels to justify multilevel modeling. Once confirmed, we ran two multilevel exploratory factor analyses (MEFA): one with positive affect items and another with negative affect items. MEFAs were run comparing 0, 1, and 2 latent variables on each level for positive affect and 0, 1, 2, and 3 latent variables on each level for negative affect due to the number of items available for each dimension of affect. Since some of the affect indicators exhibited skew, we used the robust weighted least squares estimator (WLSMV). Simulations show that WLSMV yields more

accurate factor loadings and testing of overall model fit than maximum likelihood approaches (i.e., ML, MLR) with skewed data (Li, 2014; YILMAZ, 2019). A recent review examining reporting practices for multilevel factor analysis found that the only appropriate model fit index for examining overall model fit in multilevel factor analyses was the standardized root mean square residual (SRMR), which is available for both within- and between-levels (Kim et al., 2016; Ryu & West, 2009). Therefore, we examined overall model fit using the within- and between-level SRMR along with eigenvalues (Kline, 2011) to identify the within- and between-person level factor structures for positive and negative affect. For ease of interpretation, we also report other fit indices (e.g., CFI) though these were not used to guide analytic decisions.

After selecting the best fitting factor structure for positive and negative affect from the MEFAs, we re-fit the data using multilevel confirmatory factor analysis (MCFA; see Figure 1) to be used as the measurement model in the multilevel structural equation models (MSEMs). We also examined the change in fit when adding second order latent variable to the MEFA to serve as superordinate general negative affect latent variables to test if an integrated model reflecting discrete emotions and global feeling states was tenable. We recognize that some believe estimating exploratory and confirmatory models in the same data is less than ideal. However, research suggests it is acceptable to fit both models to the same data in an effort to better understand the factor structure, as we attempt to accomplish here, given differences in how cross-loadings are dealt with between the two techniques (Schmitt et al., 2018).

Next, we estimated two separate two-level autoregressive MSEMs with random intercepts and a random AR(1) slope (Asparouhov et al., 2017) where alcohol use at both the within- and between-person levels was predicted from the latent affect variables (see Figure 1). This approach uses the Bayes estimator with default non-informative priors. The calculation of

Bayesian credible intervals provides a more robust test of statistical significance because repeated sampling of the data results in accurate estimation of asymmetrical confidence intervals that reflect that true distribution of the parameter estimates. Further, Bayesian estimation can be appropriately utilized with hierarchical data (van de Schoot & Depaoli, 2014). Alcohol use was specified as dichotomous, thus effects estimated with the probit link function. The advantage of probit models is the ability to calculate the predicted probability of endorsing the outcome at each value of the predictor using z scores, which results from the treatment of errors in probit models as normally distributed, in contrast to logistic models which treat the distribution of the error as logistic. The models contained within-person affect at the previous moment predicting alcohol use at the next moment (i.e., lagged effects). These latent factors were lagged within-day (i.e., between 10:00 a.m. and 2:00 a.m.) to focus on within-day next-moment associations and avoid lengthy between-day lags in analyses. Same moment (i.e., concurrent) affect latent factors were also included in the model. Importantly, concurrent affect could be assessed during drinking episodes. Random intercepts allowed levels of affect to vary between participants. An autoregressive effect for alcohol use was also included such that that alcohol use at the current moment (time *t*) was regressed on alcohol use at the previous moment (time *t*-1). Six orthogonal day-of-the-week indicators were included as exogenous covariates with direct paths to alcohol consumption at Level 1. The inclusion of day-of-the-week addresses daily variation drinking and may reduce serial auto-correlation across days (cf. Mohr et al., 2001). At Level 2, sex was included as an exogenous covariate with a direct path to alcohol consumption to account for sex differences in alcohol use (Emery & Simons, 2020; Simons et al., 2014). At both levels, all lagged and concurrent latent affect factors were correlated.

Results

There was a total of 2,576 possible person-days (i.e., 92 participants x 28 days). However, due to various difficulties in data collection (e.g., application malfunctions, machine damage or loss, participant attrition) the dataset contained 1,985 person-days (77.06% of the possible person-days). Participants completed surveys on an average of 21.58 days (*SD* = 8.36). Participants had adequate compliance with the random *in situ* assessments completing 76.05% (*n* = 10,199) of eligible signals (*n* = 13,411; i.e., times when the app was functional, and the participant could therefore receive the signal). We restricted the person-days included in the analysis to those days in which participants completed at least 3 random assessments. This was selected to exclude days with poor protocol adherence and ensure enough observations for moment-to-moment lagged effects on each person-day. Thus, there were 1,709 person-days (86.10% of total person-days) available for full analysis.

Overall participant compliance was inversely correlated with past 90-day alcohol use at baseline (*M* = 19.21, *SD* = 12.72; *r* = -0.21, *p* = .042), showing that those with higher alcohol consumption prior to beginning the ESM study exhibited poorer compliance to the ESM protocol. Compliance was not related to between-person level aggregates of affect or drinking during the study (*p*s > .07). Participants reported drinking on 37.41% (*n* = 547) of analysis days. Participants' number of drinks across days ranged from 0-25 or more. Participants averaged 5.73 (*SD* = 4.69) standard alcoholic beverages per drinking day. Table 1 presents descriptive statistics for all study variables. Table 1 also presents ICCs for each of the affect indicators. Cutoffs for ICCs are 0.1 for small, 0.3 for moderate, 0.5 for large (Arend & Schäfer, 2019). All ICCs were in the small to moderate range (range: 0.21 to 0.41), indicating sufficient within- and between-level variation on all affect variables for multilevel analyses.

Multilevel Exploratory Factor Analyses

Model fit for the MEFAs is presented in Table 2. For positive affect, a 1 factor solution with all 5 positive emotions fit best on both the within- and between-levels. The 1 factor solution had excellent within- and between-SRMR values. The 1 factor solution also produced higher eigenvalues on both levels than for the 2 or 0 factor solutions, which had eigenvalues less than 1. For negative affect, the 3-factor solution fit the best on both the within- and between-levels. Similar to positive affect, within- and between-level SRMRs were excellent, and the eigenvalues suggested that 3 factors best fit the negative affect items. However, the 1 factor solution also fit well in the MEFA for negative affect, which supported our decision to also examine a second-order latent variable for negative affect at the MCFA stage. Table 3 presents the standardized factor loadings for the selected (1 factor positive affect: 3 factors negative affect) model. Given the positive affect items loaded onto a single factor, we will refer to this factor as "positive affect." An examination of the items that loaded most strongly onto each factor for negative affect best represent, "sadness," "anxiety," and "anger." Items loaded strongly onto a single factor without having notable cross-loadings with one exception. The lone exception was the item "jittery" which loaded strongly on both anxiety and anger at the between-person level despite exclusively loading on anxiety at the within-person level. We opted for consistency and assigned jittery to anxiety at both levels.

Multilevel Confirmatory Factor Analysis

Table 4 presents the within- and between-level standardized factor loadings for the MCFA models. Model fit for the first-order model was good to excellent (SRMR-within = 0.03; SRMR-between = 0.07). All items loaded strongly and significantly onto their latent variable. Next, an MCFA with the added second-order latent variables for negative affect was estimated. All three first-order latent negative affect variables loaded strongly and significantly onto the

second-order latent negative affect variable and model fit remained in the good to excellent range (SRMR-within = 0.04; SRMR-between = 0.07).

Multilevel Structural Equation Models

First order model. To examine the effects of the empirically derived latent affect variables on alcohol use, two autoregressive MSEMs were estimated. The first contained first order latent affect factors of both previous moment and concurrent positive affect, sadness, anxiety, and anger predicting alcohol use (i.e., direct paths). Alcohol use was specified as a dichotomous variable and effects estimated with the probit link function. At Level 1, six orthogonal day-of-the-week indicators were included as exogenous covariates with direct paths to alcohol consumption. At Level 2, sex was included as an exogenous covariate with a direct path to alcohol use and correlated with the latent affect factors. At both levels, all latent affect factors were correlated. In a model such as this, all the paths are estimated simultaneously, and each path coefficient represents a semi-partial estimate. Model estimates are in Table 5.

At the moment-level (L1), there were significant inverse within-person effects of previous moment positive affect and previous moment sadness on the probability of drinking at the next moment. Previous moment anxiety and autoregressive alcohol use both exhibited positive effects on the probability of drinking at the next moment, while previous moment anger was not associated with drinking at the next moment. All forms of current affect displayed significant associations with the probability of drinking at that same moment. That is, current moment positive affect, sadness, and anger were positively linked to current drinking and current moment anxiety was inversely related to current drinking. See Figure 2 for the range of probit-based probability of drinking at each level of the first-order latent affect factors. All latent affect factors were significantly correlated (*p*s < .001). At the previous moment, positive affect was

inversely correlated with sadness (r = –0.34), anxiety (r = –0.17), and anger (r = –0.25). Sadness was positively correlated with both anxiety (r = 0.44) and anger (r = 0.46). Anxiety was positively correlated with anger (r = 0.41). At the current moment, positive affect was inversely correlated with sadness (r = –0.30), anxiety (r = –0.17), and anger (r = –0.19). Sadness was positively correlated with both anxiety (r = 0.49) and anger (r = 0.52), and anxiety was positively correlated with anger (r = 0.49). Latent affect factors exhibited moderate to strong autocorrelations (i.e., previous moment correlated with current moment): positive affect (r = 0.60), sadness (r = 0.44), anxiety (r = 0.54), and anger (r = 0.39). Lastly, latent affect factors also exhibited small cross-lagged effects across time. Previous moment positive affect was inversely correlated with current moment sadness (r = –0.16), anxiety (r = –0.08), anger (r = –0.09). Previous moment sadness was positively correlated with both current moment anxiety (r = 0.22) and anger (r = 0.25) and inversely correlated with current moment positive affect (r = –0.19). Previous moment anxiety was positively correlated with current moment sadness (r = 0.21) and anger (r = 0.22) while inversely correlated with current moment positive affect (r = –0.07). Finally, previous moment anger was positively correlated with both current moment anxiety (r = 0.26) and inversely correlated with current moment positive affect (r = –0.11).

At the between-person level (L2), trait positive affect exhibited a large and trait sadness displayed a moderate effect on the proportion of drinking moments during the sampling period. Neither trait anxiety nor anger exhibited significant effects on drinking. Sex had a moderate positive effect on drinking such that males drank more often than females during the sampling period. Similarly, male sex was correlated with more trait positive affect (r = 0.21, p = .029). However, sex was not correlated with any other forms of trait affect (ps > .194). Unlike effects at the within-person level, only forms of trait negative affect were correlated (ps >.001).

Specifically, sadness was positively correlated with anxiety (r = 0.59) and anger (r = 0.61), and anxiety and anger positively correlated (r = 0.79). Trait positive affect was not correlated sadness (r = –0.08, p = .258), anxiety (r = –0.13, p = .160), or anger (r = 0.02, p = .452).

Second order model. The second model contained a second order latent affect factor representing overall negative affect at both previous moment and current moment comprised of the first-order sadness, anxiety, and anger latent factors. Second order negative affect and first-order positive affect each had direct paths to alcohol use. As with the first order model, alcohol use was specified as a dichotomous variable and effects estimated with the probit link function. At Level 1, six orthogonal day-of-the-week indicators were included as exogenous covariates with direct paths to alcohol consumption. At Level 2, sex was included as an exogenous covariate with a direct path to alcohol use and correlated with the latent affect factors. At both levels, the second-order negative affect and first order positive affect latent factors were correlated. Second-order model estimates are in Table 5. All estimates are semi-partial effects.

At the moment-level (L1), previous moment positive and negative affect each displayed significant inverse effects on the probability of drinking at the next moment. In contrast, current moment positive and negative affect were positively associated with the probability of drinking at that moment. See Figure 3 for the range of probit-based probability of drinking at each level of the positive and negative affect factors. Autoregressive alcohol use similarly exhibited a positive effect on the probability of drinking at the next moment. All latent affect factors were significantly correlated (ps < .001). Positive affect was inversely correlated with negative affect at both the previous moment (r = –0.40) and current moment (r = –0.33). Strong autocorrelations were exhibited for positive (r = 0.60), and negative affect factors (r = 0.65). Lastly, positive affect and negative affect factors also exhibited small cross-lagged effects across time. Previous

moment positive affect was inversely correlated with current moment negative affect (r = –0.21) and previous moment negative was inversely correlated with current moment positive affect (r = –0.19).

At the between-person level (L2), trait positive affect exhibited a large effect on the proportion of drinking moments during the sampling period, while trait negative affect was not significantly associated with drinking. Sex had a moderate positive effect on drinking such that males drank more often than females during the sampling period. Likewise, male sex was correlated with more trait positive affect (r = 0.19, p = .041). However, sex was not correlated with trait negative affect (r = –0.08, p = .257) nor were trait positive affect and negative affect correlated (r = –0.05, p = .378).

Discussion

Our study goals were to explicate a) affective factor structures across the within- and between-person levels and b) prospective and concurrent associations for affective dimensions identified in our factor analyses with alcohol use. As reviewed, a lack of consensus regarding affective classification continues to contribute to inconsistencies in assessment approaches across studies, with little prior work examining factor structure similarity across within- and between-person levels of analysis (Jacobson et al., 2020; Weidman et al., 2017) and none using the empirically derived facets to predict behavior patterns in a relevant sample. Our results indicate that in a heavy drinking sample of young adults both positive and negative affect factor structures were similar across analysis levels. First, we found evidence for a unidimensional positive affect factor at both the within- (i.e., state) and between-person (i.e., trait) levels. A more nuanced factor structure for negative affect was observed represented by a general, superordinate dimension (i.e., second order) as well as facet level sadness, anxiety, and anger dimensions. As

discussed subsequently, these results for negative affect are especially informative for reconciling discrepancies in the literature regarding whether assessment approaches should focus on capturing general negative affect or more specific, distinct negative affect facets in a sample with strong theoretical links between affect and behavioral health decisions (e.g., Cooper et al., 2015; McCarthy et al., 2010). These results also provide insights into how these affect models can sharpen understanding of affect-alcohol use associations. Consistent with prior work, associations with alcohol use differed in important ways when examining associations for affective trait versus state ratings for positive affect in particular (e.g., Colder et al., 2010; Simons et al., 2014), with interrelated negative affect facets also showing distinctive associations with alcohol use associations (Hussong et al., 2001). Other aspects of results that were anticipated included participants identifying their sex as male reporting higher levels of drinking.

Affective Assessment in Alcohol Research

Similar to other research indicating that different positive emotional experiences are closely interrelated (Fredrickson, 2013; Stanton et al., 2021), we found evidence for a unitary dimension reflecting high-arousal positive emotional experiences (e.g., feeling happy, excited) which is consistent with the scale from which the positive emotion items were derived (Watson & Clark, 1994). Findings for negative affect are consistent with prior structural research indicating at least three specific facets of sadness, anxiety, and anger within the broad negative affect domain (Shackman et al., 2016; Watson & Stanton, 2017). Importantly though, our results indicate that when assessing both within- and between-person affect, there are multiple levels of specificity for characterizing negative affect that can be valid and useful. Specifically, a hierarchical model represented by both a) a broad, global dimension *as well as* b) specific emotion facet dimensions can be applied when studying both trait and state negative affect. Our findings and viewing

negative affective experiences as having a hierarchical structure may be useful for reconciling debates in the alcohol literature regarding whether affective assessment and classification should focus on broader (general negative affect) or more specific negative affect experiences (a focus on discrete negative emotions or facets) when studying alcohol use and other aspects of behavioral health.

As our findings illustrate, researchers could examine associations with other study variables in relation to general negative affect ratings and/or with more specific negative affect facets depending on their study goals. In other words, it may not be necessary to "pick" only a single level of breadth (global vs. more specific negative affect ratings) on which to focus analyses. Our set of results predicting alcohol use demonstrate this, as associations for global affective ratings were informative for providing a general sense of how negative affect is broadly related to alcohol use; however, examining associations for specific types of negative affect also showed meaningful differences in their links with alcohol use in many cases, as we discuss in more detail below. There are numerous other instances where this may be helpful. For example, research interested in the predicting relapse among those in early recovery from alcohol use disorder might opt to focus on a broad negative affect domain. This is because early recovery is an emotionally vulnerable time characterized by greater negative affect overall, regardless of facet (Koob, 2013; Sher & Grekin, 2007; Sinha, 2012), and those in early recovery tend to struggle identifying specific negative emotions (Emery et al., 2022; Thorberg et al., 2019). However, researchers interested in how alcohol impacts the emotional landscape of people after they drank may opt for discrete affect dimensions to fully understand the nuance in affective shifts post-drinking.

It should be noted that our results differed in some ways from recent work by Jacobson et al. (2020). These discrepancies may be due to slightly different sets of affect adjectives being used across studies as well as our differences in both study design and sample characteristics. Specifically, Jacobson et al. (2020) present evidence that the between-person structure of affect reflects a broad positive versus negative affect distinction, but that a greater number of discrete affective dimensions can be identified at the within-person level (e.g., distress, anger, sadness, feeling scared, anxiousness). Still, there are commonalities across studies, including sadness, anger, and anxiety appearing to be core negative affective dimensions within-persons. Clearly, more research is needed in other samples and contexts, but again, a key take home of our results is that negative affect can be represented by both a general domain and more specific dimensions rather than only one level of specificity versus another.

Sharpening Understanding of Affect and Alcohol Use Associations

General Positive Affect

Returning to our second study aim, our analyses examining momentary positive affect and alcohol use associations show that *lower-than-average* positive affect at the previous moment increases the probability of drinking at the next moment and drinking moments are characterized by *higher-than-average* positive affect. Taken together, this pattern suggests that low positive affect might serve as a stimulus to drink and drinking events are, in turn, associated with increased positive affect. In fact, as shown in Figures 2 and 3, there was over a 75% probability that moments characterized by the highest levels of positive affect (i.e., positive affect = 6 or above out of 7) were drinking moments. At the between-person level, trait positive affect exhibited a strong inverse relationship with trait alcohol consumption. This pattern replicates prior work that shows positive affect’s inverse between-person association with alcohol use

(Emery & Simons, 2020; Simons et al., 2014) and cannabis use (Emery et al., 2020) and is consistent with research suggesting that positive reinforcement (i.e., using to increase positive mood levels when they are low or increase their duration) is a leading mechanism facilitating increased alcohol use in youth (Chassin et al., 2013; Emery & Simons, 2020; Howard et al., 2015).

Low positive affective functioning is the defining feature of anhedonia (the impaired capacity to experience pleasure; Snaith et al., 1995). Anhedonia is associated with a number of adverse health consequences, such as increased risk for physical health problems and chronic pain (Pettit et al., 2001; Zautra et al., 2005); anxiety and depression (Durbin et al., 2005; Genĉöz, 2002); and deployment of poor coping strategies (e.g., avoidance, isolation; Campos et al., 2004). Not surprisingly, anhedonia is associated with substance use at every stage of the continuum from initiation to escalation to relapse (Garfield et al., 2014). Anhedonia can be acquired from chronic substance use resulting in a blunting of the reinforcing effects of daily non-substance related activities (Koob & Le Moal, 2008) making it a key facilitator of increasingly heavier use patterns. On the whole, the pattern of results observed here are in line with a growing body of literature suggesting low positive affect is an important risk factor for substance use in youth with research demonstrating low trait positive affect's role in the development of heavy substance use (Colder & Chassin, 1997; Emery & Simons, 2020; Lopez-Vergara et al., 2016; Simons et al., 2014; Wills et al., 1999), maintenance of substance use disorder (Emery et al., 2020; Simons et al., 2014), and interference with substance use treatment in youth (Emery et al., 2021). This study extends this work by demonstrating the momentary effects of low positive affect on individual drinking decisions and the markedly high positive affect associated with subsequent drinking events.

It is important to note that the momentary effects seen here are different than the daily effects observed in the parent study's findings (Emery & Simons, 2020), and in a recent meta-analysis using these data (Dora et al., 2022) where daily positive affect was positively related to drinking. There are several potential reasons for this including differences in analytic approach and levels of analysis (i.e., day-level vs. moment-level). That is, positive affect's association with alcohol use appears to change in direction at different levels of analysis (i.e., Simpson's paradox), such that positive affect is inversely associated with alcohol use at the moment- and person-levels and positively associated with alcohol use at the day-level.

General Negative Affect and Negative Affect Facets

The literature has been mixed regarding association for global negative affect with drinking in young adults (e.g., Patrick et al., 2016; Simons et al., 2014). Our results indicated that greater general negative affect ratings (reflecting a superordinate second order factor) at the previous moment was associated with a decreased probability of drinking at the next moment and drinking events were characterized by increased negative affect. In other words, by examining both concurrent and lagged associations, these results indicate that participants reported lower negative affect in the hours before a drinking episode and an increase in negative affect during drinking events. In tandem, these momentary effects suggest that negative emotions decreased the probability someone opts to drink at the next moment and drinking events, in turn, associated with worsening negative affect. This is contrary to what self-medication and negative reinforcement models would suggest (e.g., McCarthy et al., 2010; Sher & Grekin, 2007); yet, consistent with some event-level alcohol research has found similar patterns (e.g., Simons et al., 2010). However, given the complexities of the models, further research examining this chain of events is warranted.

Next, our analyses focused on the specific negative affective facets of sadness, anxiety, and anger (i.e., first order model). Here we found an inverse relationship between sadness at the previous moment and the probability of drinking at the next moment and that drinking events were characterized by increased sadness, similar to the pattern exhibited by general positive affect. Previous moment anger was not associated with the probability of drinking at the next moment, but drinking moments were characterized by increased anger. Neither of these sets of results is consistent with negative reinforcement models. Instead, anxiety is the only negative affect facet that demonstrated a pattern of results in line with expectations that increased negative affective arousal should prompt use as put forth by these models. That is, previous moment anxiety was associated with an increased probability of drinking at the next moment, while drinking moments were characterized by decreased anxiety. Importantly, these unique patterns were obscured when using the general negative affect domain and is consistent with work noting the importance of examining how specific types of negative affect are associated with drinking, in addition to global negative affect (Wray et al., 2014). Similar issues have also been identified in other areas of substance use research examining associations with affect; for instance, the effects of cannabis use on affect showed no effect on general negative affect (Buckner et al., 2015) and was associated with an increase in anxiety when examined individually (Buckner et al., 2012). Moreover, these results indicate that is important to consider not just how distinct types of negative affect may be linked to drinking, but also to consider the *time course* of affect and drinking associations.

Alongside these findings for positive affect, these results focused on negative affect can inform future, novel intervention efforts targeting responses to momentary affective experiences. According to many theoretical perspectives, anxiety may represent a future-oriented variant of

negative affect that prepares one for a potentially challenging or stressful situation, whereas anger may occur *in response* to goal-attainment being thwarted, criticism from others, and so on (Watson & Stanton, 2017; Weidman et al., 2017). Therefore, studying distinctive, reciprocal pathways for discrete negative affective facets using within-person designs potentially can provide a finer-grained understanding for informing intervention in the context of addressing problematic alcohol use. Should these results be replicated in other studies, they would suggest that "in the moment" interventions potentially could target distinct emotional experiences at specific timepoints to reduce the risk of drinking. Currently, many existing smartphone-based interventions target general experiences of negative affect (Kazemi et al., 2017). These interventions have proven useful, but potentially could be enhanced by recognizing the different functions that distinct types of negative affect serve.

This pattern of findings could also be helpful for guiding initial case conceptualization and diagnostic efforts, where general tendencies often are a focus of assessment (e.g., clinicians assessing much a person tends to feel anxious, sad, or angry on average at the beginning of treatment). Specifically, based on these findings, individuals presenting for treatment who report tendencies toward feeling anxious may be more likely to report heavier drinking, compared to those reporting sadness or anger, an important factor to consider in treatment planning. Therefore, these findings indicate value in different ways for assessing both trait (for initial diagnosis and screening) and state ratings of negative affect (for sharpening intervention) when studying drinking related behaviors.

Limitations, Future Directions, and Conclusion

Our results advance knowledge both of a) affective assessment at the within and between-persons levels as well as b) how positive affect and different negative affective experiences are

associated with alcohol consumption. Although these findings bear important implications for guiding future work in both interrelated research areas, several study limitations are worth acknowledging. First, the sample for this study was almost entirely composed of White college students from a small Midwestern university; thus, generalization to other populations should be done with caution. This racial composition is likely due to the characteristics of the university and community where the sample was recruited – rural South Dakota. Although many of our findings make sense theoretically (e.g., inverse associations for trait positive affect with drinking in undergraduates), others are stand in contrast to the intuitive nature of drinking to cope (e.g., inverse associations between state sadness and drinking). Thus, it would be of value to evaluate the extent to which these patterns of findings replicate in other sample types (e.g., in treatment seeking samples of older adults) or if these associations vary as a function of sex or other identity characteristics, which the complexity of our models preclude. Second, extending our findings by examining factor analytic models including a broader range of affect adjectives could be useful. This is relevant to our assessment of positive affect in particular, which was assessed using 5 items largely representing high arousal positive affect. Although the field lacks a consensual taxonomy of positive emotional experiences, other positive affective states such as contentment and determination commonly are assessed in emotion research (e.g., Fredrickson, 2013; Jacobson et al., 2020; Stanton et al., 2021). Therefore, future research that potentially uses a large pool of distinct positive affect dimensions could provide insights into how different emotional experiences are associated with alcohol use. Feelings of contentment or peacefulness may serve different functions than high-arousal forms of positive affect as discussed (DeYoung, 2013; Fredrickson, 2013). Similarly, it is possible that other negative affect dimensions such as guilt or shame could be identified in our factor analyses had we administered a greater number of

negative affect adjectives. It also would be interesting to examine the degree to which affective factor structures are consistent across other rating types (e.g., past week ratings). Finally, although the intensive longitudinal, ESM-based approach used here was useful for examining both within- and between-person effects, our sample size was relatively small for estimating the latter.

Nonetheless, this study makes novel contributions by explicating the structure of affect at both the within- and between-person levels using an ESM design that may help to reconcile debates regarding the optimal methods for conceptualizing affect and assessing it within studies. Our findings also demonstrate how these affective models can be applied to sharpen knowledge on affect-alcohol use associations. We hope future research will build from these findings in the ways discussed to improve our understanding of affect structure across levels of analysis and to sharpen existing interventions for problematic alcohol use and its consequences.

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Table 1. Descriptive Statistics

Variables	**Source**	**Obs**	***M***	***SD***	**Range**	**Skew**	**ICC**
Happy	ESM	8,854	3.92	1.51	1-7	0.01	0.36
Joyful	ESM	8,854	3.64	1.59	1-7	0.14	0.40
Excited	ESM	8,852	3.44	1.66	1-7	0.02	0.36
Energetic	ESM	8,852	3.20	1.66	1-7	0.37	0.35
Enthusiastic	ESM	8,850	2.90	1.61	1-7	0.61	0.38
Sad	ESM	8,849	1.58	1.99	1-7	1.99	0.25
Blue	ESM	8,849	1.61	1.19	1-7	2.26	0.31
Downhearted	ESM	8,849	1.55	1.15	1-7	2.55	0.30
Nervous	ESM	8,849	1.75	1.32	1-7	2.02	0.27
Jittery	ESM	8,848	1.60	1.17	1-7	2.25	0.27
Anxious	ESM	8,848	2.00	1.61	1-7	1.58	0.41
Angry	ESM	8,848	1.31	0.87	1-7	3.63	0.20
Hostile	ESM	8,848	1.25	0.75	1-7	3.99	0.21
Irritable	ESM	8,846	1.54	1.11	1-7	2.46	0.25
Alcohol Use	ESM	8,815	0.28	0.95	0-7	4.32	–
Trait Alcohol Use	ESM	92	0.26	0.28	0-13	2.28	–
Age	Baseline	92	20.17	1.37	18-25	0.84	–
Baseline Alcohol Consumption	Baseline	92	19.22	12.72	7-58	1.62	–

Note: ICC = intraclass correlation. Obs = number of observations. At Level 1 this reflects the number of random prompts completed and at Level 2 this represents the number of persons in the sample. “Trait" signifies dispositional characteristics generated from multiple state assessments (L2).

Table 2. Multilevel exploratory factor analyses for positive and negative affect model fit

Positive Affect Models								
Within-Level Factors	Within-Level SRMR	Within-Level Eigenvalues	Between-Level Factors	Between-Level SRMR	Between-Level Eigenvalues	RMSEA	CFI/TLI	χ^2
1	**0.04**	**3.82**	**1**	**0.04**	**4.59**	**0.16[1]**	**.94, .87**	**(χ^2 (10) = 2145, p <.01)**
2	0.002	0.50	1	0.04	0.31	0.05[1]	1.0, .99	(χ^2 (6) = 141, p <.01)
0	0.00	0.28	1	0.04	0.06	0.03[1]	1.0, 1.0	(χ^2 (5) = 134, p <.01)
1	0.04	0.23	2	0.002	0.03	0.19[1]	.94, .80	(χ^2 (6) = 2005, p <.01)
2	0.002	0.18	2	0.001	0.01	0.02[1]	1.0, 1.0	(χ^2 (2) = 7.64, p < .05)
0	0.00	3.82	2	0.001	4.59	0.00[1]	1.0, 1.0	(χ^2 (1) = 0.18, p = .66)
1	0.04	0.50	0	0.00	0.31	0.12	.94, .76	(χ^2 (5) = 2005, p <.01)
2	0.002	0.28	0	0.00	0.06	0.00	1.0, 1.0	(χ^2 (1) = 7.44, p <.01)
Negative Affect Models								
Within-Level Factors	Within-Level SRMR	Within-Level Eigenvalues	Between-Level Factors	Between-Level SRMR	Between-Level Eigenvalues	RMSEA	CFI/TLI	χ^2
1	0.14	4.03	1	0.11	6.09	0.68 [.68, .68] p <.01	.00, -1.1	(χ^2 (72) = 142097, p <.01)
2	0.10	1.48	1	0.11	1.21	0.63 [.62, .63] p <.01	.00, -0.7	(χ^2 (72) = 142097, p <.01)
3	0.01	1.37	1	0.11	0.74	0.10 [.09, .10] p <.01	.98, .96	(χ^2 (72) = 142097, p <.01)
0	0.00	0.50	1	0.11	0.42	0.03 [.03, .03] p = 1.0	1.0, 1.0	(χ^2 (72) = 142097, p <.01)
1	0.14	0.41	2	0.06	0.22	0.73 [.73, .74] p <.01	0.0, -1.4	(χ^2 (72) = 142097, p <.01)
2	0.10	0.38	2	0.06	0.15	0.72 [.72, .72] p <.01	0.0, -1.3	(χ^2 (72) = 142097, p <.01)
3	0.01	0.34	2	0.06	0.11	0.14 [.14, .14] p <.01	.96, .92	(χ^2 (72) = 142097, p <.01)
0	0.00	0.27	2	0.06	0.04	0.03 [.03, .04] p = 1.0	1.0, 1.0	(χ^2 (72) = 142097, p <.01)
1	0.14	0.22	3	0.02	0.01	0.77 [.77, .77] p <.01	0.0, -1.6	(χ^2 (72) = 142097, p <.01)
2	0.10	4.03	3	0.02	6.09	0.77 [.77, .78] p <.01	0.0, -1.6	(χ^2 (72) = 142097, p <.01)
3	**0.01**	**1.48**	**3**	**0.02**	**1.21**	**0.16 [.16, .16] p <.01**	**1.0, .89**	**(χ^2 (72) = 142097, p <.01)**
0	0.00	1.37	3	0.02	0.74	0.02 [.01, .02] p = 1.0	1.0, 1.0	(χ^2 (72) = 142097, p <.01)
1	0.14	0.50	0	0.00	0.42	0.91 [.90, .91] p <.01	0.0, -2.6	(χ^2 (72) = 142097, p <.01)
2	0.10	0.41	0	0.00	0.22	0.95 [.95, .96] p <.01	0.0, -2.9	(χ^2 (72) = 142097, p <.01)
3	0.01	0.38	0	0.00	0.15	0.20 [.19, .20] p <.01	.97, .83	(χ^2 (72) = 142097, p <.01)

Note: SRMR = standardized root mean-square residual. Bold indicates the selected factor structure. RMSEA = root mean squared error of approximation. CFI = comparative fit index. TLI = Tucker-Lewis index. [1]Confidence intervals around RMSEA estimate not available for this model

Table 3. Multilevel exploratory factor analyses for positive and negative affect

Positive Affect Model		
	Within-Level	Between-Level
	PA	PA
Happy	**0.81**	**0.89**
Joyful	**0.88**	**0.95**
Excited	**0.88**	**1.00**
Energetic	**0.83**	**0.97**
Enthusiastic	**0.80**	**0.92**

Negative Affect Model						
	Within-Level			Between-Level		
	Sadness	Anxiety	Anger	Sadness	Anxiety	Anger
Sad	**0.71**	0.01	0.02	**0.86**	-0.05	0.11
Blue	**1.00**	-0.01	-0.07	**1.08**	0.02	-0.08
Downhearted	**0.74**	0.07	0.02	**0.87**	0.08	0.01
Nervous	0.07	**0.80**	-0.03	0.02	**0.7**	0.35
Jittery	-0.03	**0.76**	0.03	-0.08	**0.52**	0.61
Anxious	-0.002	**0.80**	0.02	0.01	**0.81**	-0.01
Angry	0.01	0.004	**0.83**	0.01	0.01	**0.97**
Hostile	-0.01	-0.04	**0.90**	0.03	-0.01	**0.95**
Irritable	0.08	0.03	**0.64**	0.02	0.16	**0.63**

Note: Bold indicates the items that load onto each factor. Estimates are standardized factor loadings. PA = positive affect.

Table 4. Multilevel confirmatory factor analysis factor loadings.

		2nd Order Model		**1st Order Model**	
		Within-Level			
		Positive Affect			
Factor	Variable	Factor Loading	Standard Error	Factor Loading	Standard Error
PA	**Happy**	**0.83**	**0.00**	**0.83**	**0.00**
PA	**Joyful**	**0.90**	**0.00**	**0.90**	**0.00**
PA	**Excited**	**0.86**	**0.00**	**0.86**	**0.00**
PA	**Energetic**	**0.81**	**0.00**	**0.81**	**0.00**
PA	**Enthusiastic**	**0.80**	**0.00**	**0.79**	**0.00**
		Negative Affect			
Factor	Variable	Factor Loading	Standard Error	Factor Loading	Standard Error
Sadness	**Sad**	**0.71**	**0.00**	**0.71**	**0.00**
Sadness	**Blue**	**0.90**	**0.00**	**0.90**	**0.00**
Sadness	**Downhearted**	**0.85**	**0.00**	**0.85**	**0.00**
Anxiety	**Nervous**	**0.85**	**0.00**	**0.85**	**0.00**
Anxiety	**Jittery**	**0.73**	**0.00**	**0.73**	**0.00**
Anxiety	**Anxious**	**0.81**	**0.00**	**0.80**	**0.00**
Anger	**Angry**	**0.81**	**0.00**	**0.81**	**0.00**
Anger	**Hostile**	**0.79**	**0.00**	**0.79**	**0.00**
Anger	**Irritable**	**0.77**	**0.00**	**0.76**	**0.00**
		2nd Order			
2nd order NA	**Sadness**	**0.80**	**0.00**		
2nd order NA	**Anxiety**	**0.56**	**0.00**		
2nd order NA	**Anger**	**0.67**	**0.00**		
		Between-Level			
		Positive Affect			
Factor	Variable	Factor Loading	Standard Error	Factor Loading	Standard Error
PA	**Happy**	**0.92**	**0.03**	**0.92**	**0.03**
PA	**Joyful**	**0.99**	**0.02**	**0.99**	**0.02**
PA	**Excited**	**0.99**	**0.01**	**0.99**	**0.01**
PA	**Energetic**	**0.94**	**0.03**	**0.94**	**0.03**
PA	**Enthusiastic**	**0.89**	**0.03**	**0.89**	**0.03**
		Negative Affect			
Factor	Variable	Factor Loading	Standard Error	Factor Loading	Standard Error
Sadness	**Sad**	**0.90**	**0.03**	**0.90**	**0.03**
Sadness	**Blue**	**0.99**	**0.01**	**0.99**	**0.01**
Sadness	**Downhearted**	**0.97**	**0.02**	**0.97**	**0.02**
Anxiety	**Nervous**	**0.95**	**0.02**	**0.95**	**0.02**
Anxiety	**Jittery**	**0.99**	**0.03**	**0.98**	**0.03**
Anxiety	**Anxious**	**0.62**	**0.06**	**0.63**	**0.06**
Anger	**Angry**	**0.96**	**0.02**	**0.96**	**0.02**
Anger	**Hostile**	**0.90**	**0.03**	**0.93**	**0.03**
Anger	**Irritable**	**0.99**	**0.05**	**0.78**	**0.01**
		2nd Order			
2nd order NA	**Sadness**	**0.77**	**0.05**		
2nd order NA	**Anxiety**	**0.96**	**0.05**		
2nd order NA	**Anger**	**0.80**	**0.05**		

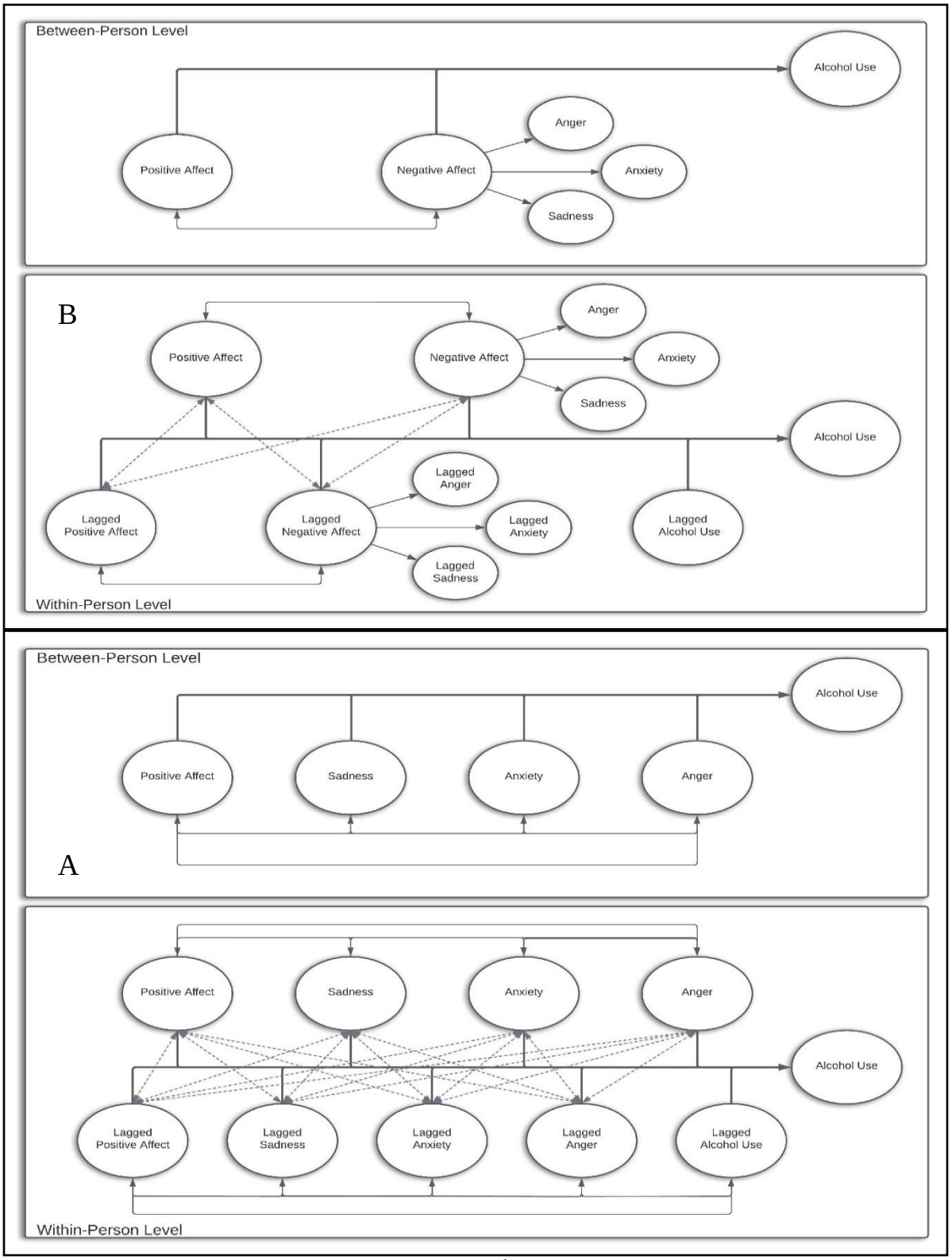
Note: Bold = significant effects. PA = positive affect. NA = negative affect. 1st order model fit: SRMR-within = 0.03, SRMR-between = 0.07. 2nd order model fit: SRMR-within = 0.04, SRMR-between = 0.07. All *p*-values < .001.

Table 5. Multilevel Structural Equation Models of Alcohol Use

Variable	*2nd order Model*				*1st Order Model*			
Within-Person (L1)	*β*	*PSD*	*p*	*95% CI*	*β*	*PSD*	*p*	*95% CI*
Lagged Positive Affect	**–0.16**	**.032**	**<.001**	**[–.23, –.10]**	**–0.14**	**.028**	**<.001**	**[–.20, –.09]**
Lagged Sadness	–	–	–	–	**–0.07**	**.030**	**.004**	**[–.14, –.02]**
Lagged Anxiety	–	–	–	–	**0.07**	**.035**	**.015**	**[.01, .14]**
Lagged Anger	–	–	–	–	–0.03	.030	.170	[–.09, .03]
Lagged Negative Affect	**–0.09**	**.045**	**.022**	**[–.18, –.01]**	–	–	–	–
Concurrent Positive Affect	**0.44**	**.030**	**<.001**	**[.38, .50]**	**0.42**	**.027**	**<.001**	**[.36, .47]**
Concurrent Sadness	–	–	–	–	**0.08**	**.033**	**.010**	**[.01, .14]**
Concurrent Anxiety	–	–	–	–	**–0.11**	**.036**	**<.001**	**[–.19, –.05]**
Concurrent Anger	–	–	–	–	**0.11**	**.028**	**<.001**	**[.05, .17]**
Concurrent Negative Affect	**0.13**	**.047**	**<.001**	**[.05, .23]**	–	–	–	–
Monday	–0.16	.018	.175	[–.05, .02]	–0.20	.016	.120	[–.05, .01]
Tuesday	–0.01	.018	.309	[–.05, .02]	–0.01	.017	.233	[–.05, .02]
Wednesday	0.01	.019	.283	[–.03, .05]	0.01	.018	.327	[–.02, .05]
Thursday	0.02	.018	.168	[–.02, .05]	0.01	.016	.199	[–.02, .05]
Friday	**0.08**	**.018**	**<.001**	**[.04, .11]**	**0.07**	**.017**	**<.001**	**[.04, .11]**
Saturday	**0.07**	**.016**	**<.001**	**[.03, .10]**	**0.06**	**.016**	**<.001**	**[.03, 0.09]**
Autoregressive Alcohol Use	**0.45**	**.024**	**<.001**	**[.39, .48]**	**0.44**	**.020**	**<.001**	**[.40, .48]**
Between-Person (L2)								
Positive Affect	**–0.71**	**.085**	**<.001**	**[–.86, –.52]**	**–0.68**	**.102**	**<.001**	**[–.86, –.46]**
Sadness	–	–	–	–	**–0.30**	**.130**	**.010**	**[–.56, –.05]**
Anxiety	–	–	–	–	0.39	.026	.057	[–.11, .90]
Anger	–	–	–	–	–0.17	.241	.220	[–.65, .29]
Negative Affect	–0.08	.136	.267	[–0.36, 0.18]	–	–	–	–
Sex	**0.37**	**.009**	**<.001**	**[0.18, 0.55]**	**0.38**	**.010**	**<.001**	**[.19, .57]**

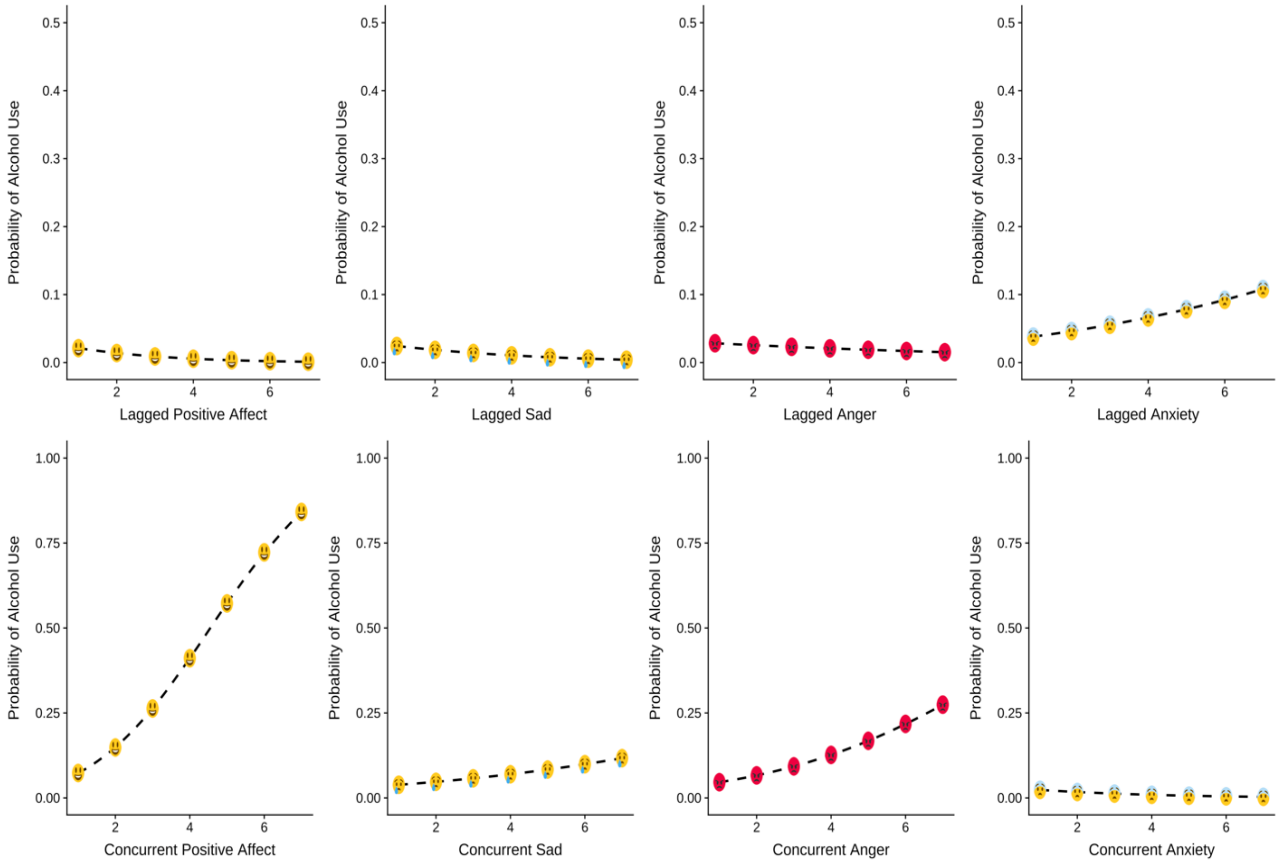
Note: N = 92, Observations = 10,199. Bold indicates significant effects. PSD = posterior standard deviation. Sex (male = 1, female = 0). CI = credibility interval. Orthogonal day-of-the-week indicators represent that day's effect compared with the reference day, Sunday. Model fit: SRMR-within = 0.03, SRMR-between = 0.06.

Figure 1. Conceptual Multilevel Structural Equation Models



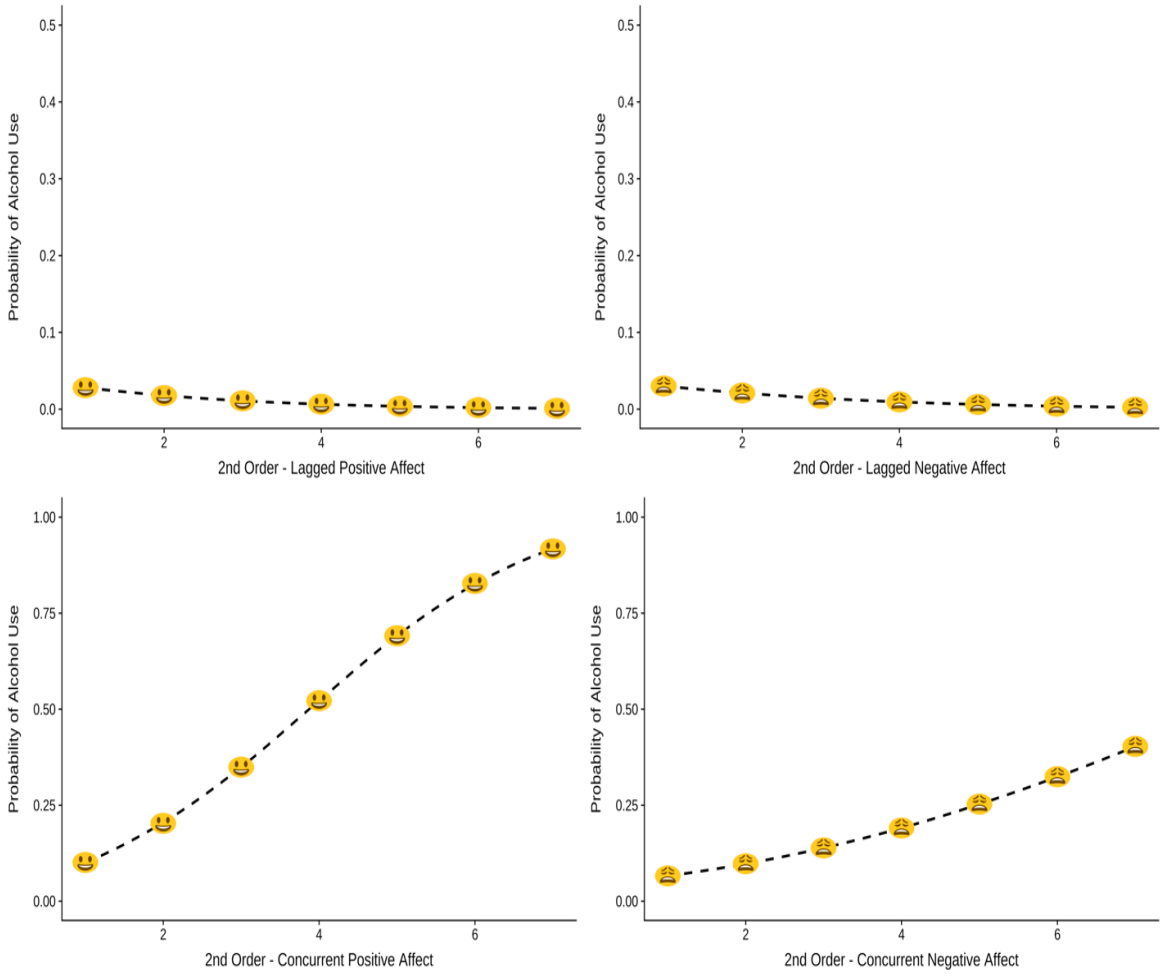
Note: Panel A = 1st Order Conceptual Model. Panel B = 2nd Order Conceptual Model. Autoregressive alcohol use, sex, and day of the week indicators are omitted for clarity. Dashed lines represent auto- and cross-lagged correlations. Solid lines represent direct paths and same-moment correlations.

Figure 2. First Order Structural Model Probit Probabilities



Note: Figure depicts the probability of drinking for each value endorsed across the range of values for the predictor (range = 1-7). Lagged = previous moment's affect predicting drinking at the next moment. Concurrent = same moment's affect predicting same moment drinking. Probabilities are not person-mean centered. For means and standard deviations individual emotions see Table 1.

Figure 3. Second Order Structural Model Probit Probabilities



Note: Figure depicts the probability of drinking for each value endorsed across the range of values for the predictor (range = 1-7). Lagged = previous moment's affect predicting drinking at the next moment. Concurrent = same moment's affect predicting same moment drinking. Probabilities are not person-mean centered. For means and standard deviations individual emotions see Table 1.