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Ecological Evidence that Affect and Perceptions of Drink Effects Depend on Alcohol Expectancies

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Abstract

Aims—(1) To compare affective changes over drinking and non-drinking days among frequent drinkers. (2) To evaluate whether drinkers' expectations influence affective changes and perceived pleasure and relief from drinking.

Design—Observational study involving ecological momentary assessments collected via electronic diaries over the course of three weeks.

Setting—Drinkers' usual settings in Columbia, MO, USA.

Participants—400 adult, frequent drinkers, ages 18–70.

Measurements—Ecological assessments included morning reports, pre-drinking random prompts, user-initiated first-drink reports, and device-prompted follow-ups over drinking episodes. Participants rated positive (enthusiastic, excited, happy) and negative (distressed, sad) affect and perceived pleasure and relief from drinking in real time. A self-report questionnaire completed at baseline evaluated expectancies for enhanced sociability and tension reduction from drinking.

Findings—Relative to affective changes over non-drinking days, positive affect increased prior to drinking, 95%CI[.073,.102], and at first drink, 95%CI[.169,.254], whereas negative affect decreased prior to drinking, 95%CI[−.008,−.0005], and at first drink, 95%CI[−.148,−.079]. Sociability expectancies augmented increases in positive affect prior to drinking, 95%CI[.006,.024], and at first drink, 95%CI[.004,.159]). Sociability expectancies also enhanced perceived pleasure from first drinks, 95%CI[.046,.318]. Tension-reduction expectancies attenuated decreases in negative affect at first drink, 95%CI[−.137, −.027], but augmented perceived relief from first drinks, 95%CI[.001,.304].

Conclusions—Although theoretical models tend to focus on negative affective outcomes of drinking, changes in positive affect prior to drinking and early in drinking episodes are important

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for maintaining drinking behavior. Frequent drinkers' expectations for enhanced sociability or tension reduction from drinking influence their affective experiences over drinking days and perceptions of pleasure and relief from drinking.

Keywords

ecological momentary assessment; affect; substance use; alcohol expectancies

Alcohol is commonly consumed in times of celebration, to feel pleasure or to socialize and "fit in" (2,3), and relief of negative affect, e.g., drinking to "escape" or "feel numb," is often considered a key element in the etiology and maintenance of alcohol addiction (4–12). A developmental conceptualization of addiction etiology may point toward appetitive incentives as the initial motivation for drinking, with more advanced stages of disordered drinking characterized by negative affect or withdrawal-symptom avoidance (4,7,8,13). An inherent assumption of many theoretical models is that drinking results in affective changes (14). Despite this, there is little ecological evidence to support such a causal relationship.

Ecological momentary assessment (EMA) refers to a broad class of methods well-suited for measurement of affect, thoughts, symptoms, or behaviors expected to vary over time (15,16). Despite the advantages of EMA, there are limitations to the extant ecological studies of alcohol use and affect. End-of-day diary designs in which retrospective reports are made only once per day predominate over event- or time-based designs (17–19). Most EMA studies have focused on the affective antecedents of consumption rather than the affective outcomes, and EMA studies supporting a link between affect and subsequent drinking have generally collapsed reports into blocks based on time of day or day of the week, comparing weekday affect to weekend drinking levels (20) or daytime affect to nighttime drinking or problems (2,21).

A substantial body of research and theory suggests that individual differences in alcohol outcome expectancies may influence affective responses to alcohol (22). Individuals with positive alcohol expectancies associate drinking with desired outcomes (e.g., pleasure, relief). There is substantial variability in the degree to which individuals hold these expectations, and drinkers with strong positive alcohol expectancies are considerably more likely to develop alcohol use disorder symptomatology (23–25).

Some experimental laboratory protocols suggest that expectancies are one mechanism by which affect leads to alcohol consumption (26,27). However, few studies have directly tested the relation of expectancies to affective outcomes of substance use. Sher & Walitzer (1986) failed to find an effect of tension-reduction expectancies on the magnitude of stress-response dampening following administration of a moderate or high alcohol dose (9). Merrill & colleagues' (2009) study of ad lib drinking found that individuals with strong relief expectancies experienced more post-drinking negative affect (28), suggesting that expectancies may operate independent of immediate experience.

The Present Study

This ecological study compared positive and negative affective trajectories over drinking and non-drinking days in drinkers' natural environments with mixed-effects growth models and EMA methodology. In addition, this study examined whether affective trajectories and perceived drink effects were influenced by individual differences in alcohol expectancies. We anticipated:

1. Drinkers with stronger expectancies related to positively-valenced affective outcomes would be more likely to (a) report increased positive affect while drinking and (b) perceive their drinks as more pleasurable than drinkers whose expectations are less strong.
2. Drinkers with stronger expectancies related to relief of negatively-valenced affective outcomes would more likely to (a) report decreased negative affect while drinking and (b) perceive their drinks as more relieving than drinkers whose expectancies are less strong.

However, even if these anticipated effects were found, it would not be clear whether affective changes could be attributed specifically to drinking or whether the same affective trends would be observed on non-drinking days. Therefore, a second set of analyses statistically compared affective trajectories on drinking days relative to non-drinking days.

Methods

Participants and Procedure

This is a secondary analysis of a large, ecological sample of 404 current drinkers (4 drinking occasions in the past month) recruited via mass emails, print advertisements and flyers posted on public kiosks in Columbia, MO, USA. Prior manuscripts provide additional methodological details (29–34). The University of Missouri and Washington University School of Medicine Institutional Review Boards approved all procedures.

Palmtop computers (Palm m500, Palm Inc., Sunnyvale, CA) collected electronic data (ED) with software designed by Invivodata, Inc. (Pittsburgh, PA). **Pre-drinking ED reports.** Participants made morning reports each day upon waking, and ED's delivered random prompts (up to 5 per day). **Post-drinking ED reports.** Participants initiated reports after their first alcoholic beverage consumed each day. Any drink report initiated a sequence of ED-delivered drinking follow-ups. ED's delivered follow-ups 30 minutes after a drink report and hourly after that until the participant stopped reporting new drinks or indicated retiring for the evening. This sequence of drinking follow-ups pre-empted random prompts, and any random prompt occurring after any drinking was excluded from analyses to avoid confounding effects of alcohol. Therefore, random prompts are random samples of pre-drinking states in the present analyses.

Time-varying Assessments

Drinks consumed—For random prompts and follow-up drink reports, participants were asked, "Since the last recording, have you consumed alcohol?" followed by binary response

options (1=yes, 0=no). For all affirmative responses, a subsequent question asked, "Since the last recording, how many drinks have you had?" Response options ranged from 0 to 6 or more.

Estimated blood alcohol concentration (eBAC)—BAC was estimated for all drink reports and follow-ups using the Matthews & Miller (1979) formula which accounted for the cumulative number of drinks consumed, gender, weight, a population-averaged alcohol metabolism rate per hour, and time since initiation of drinking. This formula is shown to be superior to others in predicting BrAC for uncontrolled drinking episodes (36). Negative eBAC estimates were set to zero. Estimated BAC calculations assumed that the first drink was consumed over 20 minutes to avoid the unrealistic assumption of instantaneous absorption. This adjustment alters eBAC by a constant, affecting the magnitude of descriptive statistics but not changing the rank ordering of estimates.

Positive and negative affect—Reports of current mood were incorporated into all diary assessment types. Participants rated 5 mood states on a 5-point scale from 1 (*not at all*) to 5 (*extremely*). PA was assessed by 3 items (i.e., enthusiastic, excited, happy; $\alpha=.89$). NA was assessed by 2 items (i.e., distressed, sad; $\alpha=.70$).

Perceived drink effects—All user-initiated drink reports and any follow-up drinking assessments for which new drinks were reported included appraisals of drinks consumed. Participants were asked, "Was the last drink pleasurable?" (*pleasure*), "Did the drink relieve unpleasant feelings or symptoms?" (*relief*). Response options ranged from 1 (*not at all*) to 5 (*extremely*).

Context—Reports of context were made for random prompts and first-drink reports. Participants responded to the prompt, "Where is your current location?" by checking any of the applicable options (see Table 1 for descriptors). Dummy-coded responses were entered as a set in analyses with primary residence (home) as reference. Similarly, participants indicated who they had been with in the past 15 minutes. Dummy-coded responses were entered as a set with no one (alone) as reference. In order to decrease participant burden and encourage compliance, drink follow-up records did not inquire of social context, and location and present company variables were imputed from the first drink record that triggered the drinking follow-up assessments.

Time—The ED automatically recorded a time and date stamp for each diary assessment. These were used to create a dummy-coded day of the week variable, with Sunday as reference. Time and date stamps were also used to create time variables essential to the present analyses.

Time-invariant Assessments

All time-invariant (i.e., person-level) assessments were conducted at the initial laboratory session. Weight and gender (men=1, women=0) were used to calculate estimated BAC at the moment level. Other demographic information (e.g., race, ethnicity, age) was collected for sample description.

Alcohol expectancies—The Comprehensive Effects of Alcohol Questionnaire (1) assessed expectancies. Expectancy items began with the stem “If I were under the influence of alcohol...” and were rated on 4-point Likert scales ranging from 1 (*disagree*) to 4 (*agree*). The present analyses utilized the Sociability ($\alpha=.87$) subscale to assess positively-valenced outcomes (e.g., “...I would feel more energetic), and the Tension-reduction ($\alpha=.79$) subscale to assess relief of negatively-valenced outcomes (e.g., “...I would feel calm”).

Problematic Alcohol Involvement—The self-report questionnaire form of the Alcohol Use Disorders Identification Test (AUDIT) assessed degree of problematic alcohol involvement (37). Response options are coded from 0 to 4, with higher numbers signifying more problematic use. Responses are summed across 10 indicators of hazardous drinking including frequency of drinking, quantity of drinks consumed on a typical drinking day, heavy episodic drinking, and negative alcohol-related consequences.

Mixed-effects Growth Models

Mixed-effects growth models with momentary reports nested within participants were estimated in SAS 9.3 (SAS Institute Inc. 2012) using PROC MIXED. Discontinuous, piecewise growth (change) in affective states was modeled over drinking days. Time was coded such that the intercept (when all other predictors in the model = 0) represented drinkers’ affective states prior to initiation of drinking. Three time variables were created—*Pre*, *Drink*, and *Post*. *Pre* represents changes in affective states prior to initiation of drinking. *Drink*, represents change in affect at first drink. *Post* represents change in affect over drinking episodes.

An iterative model-building approach identified a functional form for growth models of PA and NA trajectories over drinking days (38). In short, increasingly complex models were compared by included and excluding fixed and random effects and comparing fit statistics (i.e., AIC, BIC and change in model deviance) between more and less complex models. “Random” effects allowed changes in affective states to vary across participants, whereas “fixed” effects assumed the general change trends were similar across participants. Model comparisons included quadratic terms for *Pre* and *Post* to examine whether changes in affective states were curved rather than strictly linear. Cross-level interactions between expectancies and time variables examined the influence of expectancies on affective changes before (*Pre*), at first drinks (*Drink*) and after drinking (*Post*). In a final step, time-varying covariates (e.g., eBAC, location) and time-invariant covariates (e.g., gender, AUDIT total score) were included. Continuous time-varying covariates were person-mean centered and time-invariant covariates were grand-mean centered.

A key step in assessing whether affective states are influenced by drinking was to account for general trends in affect on non-drinking days. Additional analyses were conducted on a combined dataset including all study days and a *Drinking-Day* variable (0=non-drinking day; 1=drinking day). Time was centered at the closest record prior to the average time of day for which drinking was generally initiated. A binary variable, *First*, indicated whether a record occurred before or after this timepoint (analogous to *Drink* in drinking day analyses)

and *Pre* and *Post* were calculated as before. Cross-level 2- and 3-way interactions between expectancies, growth parameters, and *Drinking Day* were tested.

Growth models for perceived pleasure and relief from drinking examined first-drink effects and the post-drinking trajectory, and therefore included only the *Post* growth parameter. An iterative model-building approach examined linear and quadratic growth terms. As in affective models, cross-level expectancy interactions were tested. Final models included person-centered PA, NA, and all covariates from previous models.

Results

Four-hundred participants drank during the course of the study (50% women; 86.0% White, 0.8% American Indian/Alaskan Native, 4.8% Asian, 3.3% Black, 0.3% Native Hawaiian/Pacific Islander, 5.0% another race, and 2.5% Hispanic or Latino ethnicity). Ages ranged from 18 to 70 ($M=23.4$; $SD=7.3$). Participants carried the ED for 21.11 days ($SD=2.58$), on average, and a total of 48,032 records were completed across 2,931 drinking days and 5,340 non-drinking days.

Baseline expectancy subscale scores were correlated, $r=.27$, $p<.001$. Mean sociability scores were 3.48 ($SD=.52$), and mean tension-reduction scores were 2.84 ($SD=.69$). Baseline AUDIT scores ranged from 2 to 29 ($M = 12.2$; $SD = 5.5$), with 78.2% of scores ≥ 8 , a level considered indicative of harmful alcohol use (37). ED data indicated that participants reported drinking on 7.51 days ($SD=4.41$), on average, across the study period and typically consumed 4.98 drinks per drinking occasion ($SD=4.54$). Data from drinking days included 12,514 non-drinking records and 9,517 drinking records.

Analyses for Drinking Days

Growth Models—Table S1 presents results of iterative model tests, and these are graphically presented in Figures S1 and S2. Variability in changes in affective states across participants highlights the substantial individual differences in affective change over drinking days. Model A of Tables 1 and 2 show overall estimates from best-fitting models of PA and NA, respectively. On average, PA increased significantly prior to drinking, $b=.014$, $p=.005$, with the rate of growth decelerating as initiation of drinking approached, $b=-.003$, $p<.001$. PA ratings significantly increased at first drink $b=.277$, $p<.001$, and decreased thereafter, $b=-.017$, $p<.001$. On average, NA decreased significantly prior to drinking $b=-.003$, $p=.042$, and at first drink, $b=-.126$, $p<.001$, but did not change thereafter, $p=.548$.

Expectancy Influences—Model B of Tables 1 and 2 included expectancy terms. Final models excluded nonsignificant interactions. Table 1, Model B, presents results for PA. As anticipated, increases in PA prior to drinking and at first drinks were greatest for drinkers with strong sociability expectancies ($b=.018$, $p<.001$; $b=.093$, $p=.017$). Conversely, PA was attenuated at first drinks for drinkers with strong tension-reduction expectancies, $b=-.059$, $p=.048$. The addition of covariates did not alter the pattern of results (Table 1, Model C).

Table 2, Model B, presents results for NA. Tension-reduction expectancies were not significantly associated with NA at the intercept, $p=.196$. Contrary to our anticipations,

decreases in NA at first drink were diminished for drinkers with strong tension-reduction expectancies, $b=.064$, $p=.002$. In contrast, decreases in NA at first drinks were greatest for drinkers with strong sociability expectancies, $b=-.080$, $p=.003$. The addition of covariates did not alter the pattern of results (Table 2, Model C).

Comparing Drinking and Non-Drinking Days

Growth Models—Table 3 presents models similar to those for the drinking day data, but now including all study days to compare results across drinking and non-drinking days. *Drinking Day* is interpreted as the difference in affective state at first drinks on drinking days, relative to a matched timepoint non-drinking days; *Drinking Day* $\times$ *Pre* is interpreted as the difference in affective changes prior to drinking relative to non-drinking days, and so on.

Changes in PA were specific to drinking days, as indicated by significant interactions between drinking day and time variables (Table 3, Model A; Figure 1, Panel A). PA generally increased prior to first drinks on drinking days, $b=.087$, $p<.001$, and decreased prior to a matched timepoint on non-drinking days, $b=-.074$, $p<.001$. On non-drinking days, drinkers generally experienced a small increase in PA at the matched timepoint, $b=.061$, $p<.001$, but this effect was significantly more pronounced for first-drink effects on drinking days, $b=.311$, $p<.001$. On non-drinking days, PA decreased later in the day, $b=-.012$, $p<.001$, but not more so than on drinking days, $p=.163$.

NA growth effects were also specific to drinking days (Table 3, Model C; Figure 1, Panel B). On non-drinking days, no time variables were significantly related to NA. In contrast, for drinking days, NA decreased prior to first drinks, $b=-.004$, $p=.028$, and at first drink, $b=-.113$, $p<.001$.

Expectancy Influences on PA and NA—We anticipated that expectancies would only influence affective states on drinking days, and our results were consistent with anticipated findings. Increases in PA prior to drinking and at first drinks were greatest for drinkers with strong sociability expectancies ($b=.015$, $p<.001$; $b=.081$, $p=.040$), and sociability expectancies were not related to affective changes on non-drinking days, $ps=.505$, $.652$. Decreases in NA at first drinks were attenuated for drinkers with strong tension-reduction expectancies, $b=.064$, $p=.011$, and tension-reduction expectancies were not significantly related to affective changes at a matched timepoint on non-drinking days, $p=.439$. To highlight the effect of alcohol expectancies on affective changes at first drinks, *Expectancy* $\times$ *First* $\times$ *Drinking Day* interactions are plotted in Figure 2. These graphs depict the change in PA and NA before and after first drinks (*Pre* and *Post*) compared to a matched timepoint on non-drinking days. Differences in affective changes for high and low alcohol expectancy groups (first and fourth quartiles) are shown.

Expectancy Influences on Perceived Drink Effects—Table S2 shows results of iterative models tests for perceived pleasure and relief. Intercepts for these models represent the perceived effect of the first drink in an episode, and the *Post* time variable represents changes in drink perceptions thereafter. On average, perceived pleasure decreased, $b=-.027$,

95% CI $[-.047, -.008]$, $p=.005$ and perceived relief did not significantly change over drinking episodes, $p=.101$. First drinks were rated as more pleasurable by drinkers with strong sociability expectancies, $b=.182$, 95% CI $[.046, .318]$, $p=.009$, and these drinkers also reported greater pleasure over drinking episodes, $b=.041$, 95% CI $[.001, .082]$, $p=.046$. First drinks were rated as more relieving of unpleasant feelings or symptoms for drinkers with strong tension-reduction expectancies, $b=.152$, 95% CI $[.001, .304]$, $p=.049$. The pattern of results did not change when including person-centered PA, NA and all other covariates from Tables 1 and 2.

Discussion

“The perception is not just of the experience, it is the experience” (Kirsch, 1999, p. 6).

While the belief that drinking is triggered by a desire to alter affective states is not new (4,6,14,40), the existing ecological evidence for a direct relationship between drinking and affective outcomes is lacking (15,41–43). The present study is the first to assess affective trajectories and perceptions of drink effects in tandem, in the natural environment. Additionally, this research examined the role of alcohol expectancies in these processes.

In general, PA increased and NA decreased prior to initiation of drinking. PA also increased and NA decreased upon consumption of the first drink in a drinking episode. Comparing affective trajectories on non-drinking days suggested that these changes were specific to drinking days. Although PA generally decreased over subsequent post-drinking timepoints, this effect was not different for drinking days relative to non-drinking days, and NA states did not change over post-drinking timepoints. As anticipated, drinkers with stronger sociability expectancies reported increased PA at first drinks and prior to initiation of drinking, but effects were not sustained across drinking episodes. Drinkers with stronger sociability expectancies also reported greater pleasure from drinks consumed.

Contrary to anticipated effects, stronger tension-reduction expectancies were associated with attenuated decreases in NA at first drinks. Yet, drinkers with stronger tension-reduction expectancies reported greater perceived relief from drinking. It is not clear why tension-reduction drinkers would report smaller initial decreases in NA after drinking, on one hand, and greater increases in perceived relief from drinks consumed, on the other. Although several post-hoc explanations are possible, we believe that general negative affectivity and differences in learning may account, in part, for these findings. Given that tension-reduction drinkers had higher levels of NA in general, it is plausible that any relief or change in NA would be more reinforcing to these drinkers than it would be for drinkers who generally do not experience NA. Another plausible explanation is that some characteristic of the learning process was different for tension-reduction drinkers. Perhaps their experiences with alcohol were especially rewarding early in their drinking careers, causing their expectancies for affective outcomes of drinking to persist into adulthood.

Design Considerations and Future Directions

Advantages of our methodological approach include enhanced external validity and temporal resolution, allowing for a direct comparison of post-drinking changes in PA and

NA relative to pre-drinking affective states without asking participants to retrospect on their experiences. Our statistical approach teased apart pre-drinking affective changes, initial effects of first drinks, and post-drinking affective changes. Including non-drinking days in the analysis provides a necessary basis for comparison. In addition, while prior research has measured subjective responses generally (e.g., How “high” do you feel right now?), our approach assessed in-the-moment perceived effects attributed specifically to drinking. However, the magnitude of effects was small, particularly for negative affect and relief outcomes. In addition, both reports of affective states and drink effects are subjective. Other methods of ambulatory assessment may be used in addition to self-report to measure physiological correlates of affective responses, such as electro-dermal activity, pulse-rate variability, respiration, hypothalamic-pituitary-adrenal axis activity (44).

Although expectancy measures often include subscales specifically related to relaxation and tension reduction, assessment of expectancies related to positive-affective change is typically combined in global subscales of positive effects (1,45). The present study utilized the Sociability subscale of the Comprehensive Effects of Alcohol Questionnaire (1) to test the influence of expectancies on PA, rather than combining positive effects into one global subscale that would also include tension-reduction, sexuality, and “liquid courage” factors. This yields the advantage of specificity, but our ability to compare our findings to those of prior studies is limited by the lack of research specifically relating expectancies to positive affective outcomes. Advances in assessment of expectancies via a multiaxial system (46) or task measures are promising new avenues for examining various positively-valenced outcomes of drinking.

Conclusions

As the body of ecological studies grows, so does the evidence that the relationship between affective states and substance use is not as straightforward as was once assumed (15). Results suggest that tests of the real-time affective antecedents and consequences of alcohol consumption and potential moderators of this effect are needed, and theoretical models could be revised or expanded in light of new evidence. Although theoretical models of alcohol-use motivation tend to focus on the role of NA, the present findings emphasize the potential importance of expectations for PA changes. In addition, anticipatory changes in PA or NA may play a key role perpetuating consumptive behavior (47), and drinkers’ expectations may influence these changes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Population average positive (A) and negative (B) affective growth over drinking and non-drinking days. On the horizontal axis, Time = 0 corresponds to the time of first drinks on drinking days or a matched timepoint on non-drinking days.

Figure 2.

Change in positive affect (top) and negative affect (bottom) pre/post first drinks (drinking days) or pre/post a matched timepoint (non-drinking days). Average pre/post differences for the lowest quartiles of sociability and tension-reduction expectancies are presented on the left. Average pre/post differences for the highest quartiles of sociability and tension-reduction expectancies are presented on the right.

Table 1
Fixed Effects of Piecewise, Discontinuous Multilevel Growth Models of Positive Affect Before and After Drinking

Parameter	Model A		Model B		Model C	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Affect prior to first drink (<i>Intercept</i>)	3.140***	[3.065, 3.216]	3.136***	[3.062, 3.211]	2.769***	[2.665, 2.873]
Time						
Pre-drinking linear growth (<i>Pre</i>)	0.014*	[0.004, 0.023]	0.013**	[0.004, 0.023]	0.011*	[0.002, 0.021]
Discontinuity at first drink (<i>Drink</i>)	0.277***	[0.238, 0.317]	0.277***	[0.238, 0.316]	0.217***	[0.177, 0.258]
Post-drinking linear growth (<i>Post</i>)	-0.017***	[-0.026, -0.008]	-0.017***	[-0.026, 0.008]	-0.042***	[-0.052, -0.032]
Pre-drinking quadratic growth (<i>Pre</i> ²)	-0.003***	[-0.003, -0.002]	-0.003***	[-0.003, -0.002]	-0.002***	[-0.003, -0.00]
Expectancies						
Sociability			0.300***	[0.155, 0.445]	0.192**	[0.048, 0.336]
Sociability × <i>Pre</i>			0.018***	[0.009, 0.027]	0.017***	[0.008, 0.026]
Sociability × <i>Drink</i>			0.093*	[0.017, 0.169]	0.102**	[0.026, 0.178]
Tension-reduction			-0.072	[-0.182, 0.038]	-0.033	[-0.138, 0.071]
Tension-reduction × <i>Pre</i>			-0.007	[-0.014, 0.000]	-0.005	[-0.012, 0.002]
Tension-reduction × <i>Drink</i>			-0.059*	[-0.118, -0.001]	-0.063*	[-0.121, -0.005]
Time-varying covariates						
Location (<i>Home = reference</i>)						
Work/School					0.009	[-0.035, 0.054]
Bar/Restaurant					0.174***	[0.134, 0.213]
Outside					0.107***	[0.074, 0.141]
Vehicle					0.206***	[0.167, 0.245]
Other Location					0.109***	[0.076, 0.141]
Present Company (<i>Alone = reference</i>)						
Partner/Spouse					0.083***	[0.051, 0.116]
Friend					0.287***	[0.260, 0.315]
Co-worker					0.051*	[0.002, 0.101]

Parameter	Model A		Model B		Model C	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Child			0.032		0.032	[-0.030, 0.094]
Parent			0.135***		0.135***	[0.075, 0.194]
Other Family			0.031		0.031	[-0.027, 0.088]
Other Person			0.054**		0.054**	[0.014, 0.093]
Day of the week (<i>Sunday = reference</i>)						
Monday			0.004		0.004	[-0.045, 0.053]
Tuesday			-0.002		-0.002	[-0.049, 0.044]
Wednesday			0.032		0.032	[-0.013, 0.077]
Thursday			0.007		0.007	[-0.036, 0.051]
Friday			0.106***		0.106***	[0.063, 0.148]
Saturday			0.130***		0.130***	[0.089, 0.171]
Estimated BAC			1.834***		1.834***	[1.548, 2.119]
Time-invariant covariates						
Gender (<i>Women = reference</i>)			0.070		0.070	[-0.057, 0.197]
AUDIT Total score			-0.008		-0.008	[-0.020, 0.004]
Age			-0.020***		-0.020***	[-0.028, -0.011]

Note. *b* = unstandardized estimate. CI = confidence interval.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2
Fixed Effects of Piecewise, Discontinuous Multilevel Growth Models of Negative Affect Before and After Drinking

Parameter	Model A		Model B		Model C	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Affect prior to first drink (<i>Intercept</i>)	1.610***	[1.552, 1.668]	1.612***	[1.554, 1.670]	1.776***	[1.690, 1.862]
Time (growth) parameters						
Pre-drinking linear growth (<i>Pre</i>)	-0.003*	[-0.007, 0.000]	-0.003	[-0.006, 0.000]	-0.001	[-0.004, 0.003]
Discontinuity at first drink (<i>Drink</i>)	-0.126***	[-0.154, -0.098]	-0.128***	[-0.155, -0.100]	-0.089***	[-0.118, -0.060]
Post-drinking linear growth (<i>Post</i>)	0.002	[-0.005, 0.010]	0.002	[-0.005, 0.010]	0.005	[-0.004, 0.013]
Expectancies						
Tension-reduction			-0.058	[-0.168, 0.053]	-0.072	[-0.188, 0.044]
Tension-reduction $\times$ <i>Drink</i>			-0.080**	[-0.133, -0.029]	-0.080**	[-0.132, -0.027]
Sociability			0.055	[-0.028, 0.139]	0.069	[-0.016, 0.153]
Sociability $\times$ <i>Drink</i>			0.064**	[0.024, 0.105]	0.064**	[0.023, 0.105]
Time-varying covariates						
Location (<i>Home = reference</i>)						
Work/School					0.092***	[0.053, 0.132]
Bar/Restaurant					-0.038*	[-0.073, -0.004]
Outside					-0.005	[-0.035, 0.025]
Vehicle					0.064***	[0.029, 0.099]
Other Location					-0.021	[-0.050, 0.008]
Present Company (<i>Alone = reference</i>)						
Partner/Spouse					-0.078**	[-0.078, -0.020]
Friend					-0.133***	[-0.133, -0.085]
Co-worker					-0.087	[-0.087, 0.001]
Child					-0.012	[-0.012, 0.098]
Parent					-0.089	[-0.089, 0.018]
Other Family					0.016*	[0.016, 0.118]
Other Person					-0.010	[-0.010, 0.059]

Parameter	Model A		Model B		Model C	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Day of the week (<i>Sunday = reference</i>)						
Monday			0.001	[−0.043, 0.044]		
Tuesday			0.019	[−0.023, 0.061]		
Wednesday			−0.014	[−0.055, 0.026]		
Thursday			−0.015	[−0.053, 0.024]		
Friday			−0.033	[−0.071, 0.004]		
Saturday			−0.088***	[−0.125, −0.051]		
Estimated BAC			−0.071	[−0.323, 0.180]		
Time-invariant covariates						
Gender (<i>Women = reference</i>)			−0.128*	[−0.232, −0.025]		
AUDIT Total score			0.017**	[0.007, 0.027]		
Age			0.007*	[0.000, 0.014]		

Note. *b* = unstandardized estimate. CI = confidence interval.

*
p < .05.
**
p < .01.

p < .001.

Table 3
Comparing Positive and Negative Affective Trajectories and Expectancy Effects for Drinking and Non-drinking Days

Parameter	Positive Affect			Negative Affect		
	Model A		Model B		Model C	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Time (growth)						
<i>Intercept</i>	2.816***	[2.742, 2.890]	2.817***	[2.744, 2.890]	1.727***	[1.668, 1.787]
<i>Pre</i>	-0.074***	[-0.086, -0.062]	-0.074***	[-0.086, -0.061]	0.000	[-0.003, 0.003]
<i>Pre</i> ²	-0.010***	[-0.011, -0.009]	-0.010***	[-0.011, -0.009]		
<i>First</i>	0.061***	[0.026, 0.095]	0.061***	[0.027, 0.343]	-0.008	[-0.035, 0.018]
<i>Post</i>	-0.012***	[-0.018, -0.006]	-0.013***	[-0.019, -0.006]	0.005	[-0.001, 0.011]
Drinking day						
<i>Drinking day</i> (Non-drinking day = reference)	0.311***	[0.274, 0.347]	0.307***	[0.271, 0.343]	-0.107***	[-0.135, -0.079]
<i>Drinking day</i> × <i>Pre</i>	0.087***	[0.073, 0.102]	0.087***	[0.072, 0.101]	-0.004*	[-0.008, 0.000]
<i>Drinking day</i> × <i>Pre</i> ²	0.008***	[0.006, 0.009]	0.008***	[0.006, 0.009]		
<i>Drinking day</i> × <i>First</i>	0.211***	[0.169, 0.254]	0.211***	[0.169, 0.254]	-0.113***	[-0.148, -0.079]
Expectancies						
<i>Sociability</i>	0.143	[0.000, 0.287]			0.024	[-0.065, 0.113]
<i>Sociability</i> × <i>Pre</i>	0.003	[-0.005, 0.011]			-0.003	[-0.007, 0.002]
<i>Sociability</i> × <i>First</i>	0.014	[-0.048, 0.077]			-0.012	[-0.050, 0.025]
<i>Sociability</i> × <i>Drinking day</i>	0.164***	[0.100, 0.227]			0.036	[-0.006, 0.077]
<i>Sociability</i> × <i>Pre</i> × <i>Drinking day</i>	0.015***	[0.006, 0.024]			0.005	[-0.001, 0.011]
<i>Sociability</i> × <i>First</i> × <i>Drinking day</i>	0.081*	[0.004, 0.159]			0.075**	[0.023, 0.126]
<i>Tension</i>	-0.021	[-0.130, 0.087]			0.029	[-0.089, 0.146]
<i>Tension</i> × <i>Pre</i>	-0.004	[-0.010, 0.003]			0.002	[-0.004, 0.008]
<i>Tension</i> × <i>First</i>	-0.013	[-0.059, 0.034]			-0.010	[-0.060, 0.040]
<i>Tension</i> × <i>Drinking day</i>	-0.076***	[-0.124, -0.028]			-0.082**	[-0.137, -0.027]
<i>Tension</i> × <i>Pre</i> × <i>Drinking day</i>	-0.004	[-0.010, 0.003]			-0.005	[-0.013, 0.002]

Parameter	Positive Affect				Negative Affect			
	Model A		Model B		Model C		Model D	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
<i>Tension × First × Drinking day</i>			−0.051	[−0.110, 0.007]			−0.059	[−0.125, 0.008]

Note. *b* = unstandardized estimate. CI = confidence interval. The pattern of results did not change when time-invariant and time-varying covariates from Tables 1 and 2 were included.

* $p < .05$.
** $p < .01$.
*** $p < .001$.