Psychological Assessment
2013, Vol. 25, No. 3, 780–795

1040-3590/13/$12.00 DOI: 10.1037/a0032542

The Subjective Effects of Alcohol Scale: Development and Psychometric Evaluation of a Novel Assessment Tool for Measuring Subjective Response to Alcohol

Meghan E. Morean
Yale University School of Medicine

William R. Corbin
Arizona State University

Teresa A. Treat
University of Iowa

Three decades of research demonstrate that individual differences in subjective response (SR) to acute alcohol effects predict heavy drinking and alcohol-related problems. However, the SR patterns conferring the greatest risk remain under debate. Morean and Corbin (2010) highlighted that extant SR measures commonly have limitations within the following areas: assessment of a comprehensive range of effects, assessment of effects over the complete course of a drinking episode, and/or psychometric validation. Furthermore, the consistent pairing of certain SR measures and theoretical models has made integration of findings difficult. To address these issues, we developed the Subjective Effects of Alcohol Scale (SEAS), a novel, psychometrically sound SR measure for use in alcohol administration studies. Pilot data ensured that the SEAS comprised a comprehensive range of effects that varied in terms of valence and arousal and were perceived as plausible effects of drinking. For validation purposes, the SEAS was included in a 2-site, placebo-controlled, alcohol administration study (N = 215). Exploratory and confirmatory factor analyses identified a 14-item, 4-factor model categorizing effects into affective quadrants (high/low arousal positive; high/low arousal negative). SEAS scores evidenced the following: (a) scalar measurement invariance by limb of the blood alcohol curve (BAC) and beverage condition; (b) good internal consistency; (c) convergence/divergence with extant SR measures, alcohol expectancies, and alcohol use; and (d) concurrent/incremental utility in accounting for alcohol-related outcomes, highlighting the novel high arousal negative and low arousal positive subscales.

Keywords: subjective response to alcohol, measurement invariance, measurement development, alcohol effects, alcohol expectancies

An extensive body of research suggests that subjective response (SR) to alcohol, which reflects individual differences in sensitivity to pharmacological alcohol effects, is an endophenotype associated with a range of negative consequences of alcohol use, including heavy drinking, the experience of negative social, legal, and health problems (e.g., fights, drunk driving, liver disease), and the development of alcohol use disorders (i.e., AUDs; King, de Wit, McNamara, & Cao, 2011; Morean & Corbin, 2010; Schuckit et al., 2009). The human response to alcohol has generally been conceptualized as biphasic in nature, with positive, arousing effects associated with the ascending limb of the blood alcohol curve (BAC) and negative, sedative effects accompanying the descending limb. Individual differences in sensitivity to alcohol effects across a drinking episode are thought to confer risk for heavy drinking and problems, although there continues to be controversy over the specific pattern or patterns of SR that confer the greatest risk. Over time, two prevailing theoretical models have emerged. The Low Level of Response Model (Schuckit, 2009) argues that a dampened response to the full range of alcohol effects is critical, while the Differentiator Model (Newlin & Thomson, 1990) maintains that individuals who experience increased positive effects on the ascending limb of the BAC and decreased negative effects on the descending limb are at greatest risk.

Recent reviews of the SR literature (Morean & Corbin, 2010; Quinn & Fromme, 2011) provide partial support for both the Low Level of Response (LLR) and Differentiator Models (DM). A sizeable number of studies have demonstrated that a LLR to alcohol, particularly on the descending limb, is associated with risk for problems. However, there is also research suggesting that high-risk individuals may experience a stronger stimulant response, particularly on the ascending limb. In their meta-analytic evaluation of the extant literature, Quinn and Fromme (2011) attempted to evaluate the veracity of the two models. However, the study came to a conclusion that has been echoed all too frequently in the SR literature: both models are correct, in part. When eval-

This article was published Online First May 6, 2013.

Meghan E. Morean, Department of Psychiatry, Yale University School of Medicine; William R. Corbin, Department of Psychology, Arizona State University; Teresa A. Treat, Department of Psychology, University of Iowa.

Correspondence concerning this article should be addressed to Meghan E. Morean, Department of Psychiatry, Yale University School of Medicine, Connecticut Mental Health Center, Office S-229, 34 Park Street, New Haven, CT 06519. E-mail: meghan.morean@gmail.com

uating SR by family history status across studies, Quinn and Fromme (2011) found support for the LLR Model; a positive family history of AUDs was associated with a blunted overall SR profile compared to a negative family history. However, when typical drinking patterns were evaluated, results supported the DM; heavier drinking was associated with increased stimulation on the ascending limb and decreased sedation on the descending limb. Quinn and Fromme (2011) concluded that the risk for problems associated with family history and heavy drinking may operate through separate pathways, resulting in distinct patterns of risk.

An additional recent study by King and colleagues (2011) aimed to settle the debate by executing a large, prospective, within-subjects, double blind, placebo controlled, multi-dose (placebo, .04 g%, .08 g%) alcohol administration study. Using this gold standard approach to assessment of SR, King and colleagues (2011) obtained results that challenged the fundamental assumption that a universal biphasic pattern of alcohol effects is experienced and suggested that both the LLR and DM require tweaking. Consistent with the first tenet of the DM, heavier drinkers experienced significantly stronger stimulant effects on the ascending limb than did lighter drinkers. Also consistent with the LLR model, heavier drinkers experienced decreased sedation compared to lighter drinkers, and this pattern was associated with increased drinking behavior over the course of a two-year follow-up. However, inconsistent with either model, risk for heavy drinking associated with a blunted experience of sedative effects spanned the full BAC; it was not confined to the descending limb. Furthermore, lighter drinkers experienced a pattern of increased sedative effects that onset early in the drinking episode and persisted throughout, with limited experience of positive, stimulant effects.

The studies conducted by Quinn and Fromme (2011) and King et al. (2011) were well executed and important. It merits note, however, that a number of inconsistencies and measurement limitations that were raised in the recent review by Morean and Corbin (2010) may have important implications for the conclusions that were drawn about the veracity of the LLR and DM within the aforementioned studies. The following represent four common limitations of extant SR studies that may limit our ability to test adequately theoretical models of interest. First, SR measures have been confounded with theoretical models, making evaluation of theoretical model veracity and integration of findings difficult. For example, the Subjective High Assessment Scale (SHAS; Schuckit & Gold, 1988) is typically used in studies evaluating the LLR; whereas the Biphasic Alcohol Effects Scale (BAES; Martin, Earleywine, Musty, Perrine, & Swift, 1993) is often used in studies evaluating the DM. Second, SR is often assessed on only one limb of the BAC. Third, and of central theoretical importance, although prior psychophysiological research suggests the pharmacological effects of alcohol are best conceptualized in terms of emotional valence and arousal (Stritzke, Lang, & Patrick, 1996; Stritzke, Patrick, & Lang, 1995), extant measures tend to confound the valence and arousal of effects. For example, current measures assess primarily positive, stimulant effects (e.g., sociable, happy); the potential importance of negative stimulant effects (e.g., anxiety and aggression) remains unknown. Furthermore, extant SR measures are largely unable to distinguish sedative alcohol effects that are likely to be experienced as aversive (e.g., alcohol-induced impairment; heavy head, slow thoughts) from those that may serve as negative reinforcers (e.g., relaxed, mellow). Finally, the interpretations of test scores proposed by the developers of most SR measures have not undergone sufficiently rigorous psychometric evaluation, which challenges the validity and reliability of score interpretations.

The current study was designed to create a novel SR measure—the Subjective Effects of Alcohol Scale (SEAS)—to addresses the aforementioned issues by (a) developing scale items that reflect comprehensive coverage of alcohol effects with respect to valence and arousal dimensions (i.e., high arousal positive/negative; low arousal positive/negative); (b) creating a brief, user-friendly instrument that permits multiple assessments of SR across the full drinking episode; and (c) conducting stringent psychometric evaluation of the proposed interpretation of SEAS scores (referred to in the remainder of the article as "SEAS scores").

The current study focuses on the psychometric validation of the SEAS, which was developed alongside a companion measure of alcohol expectancies (i.e., the beliefs individuals have about the probable effects of drinking alcohol) called the Anticipated Effects of Alcohol Scale (AEAS; Morean, Corbin, & Treat, 2012). The measures were developed during the same period of time but were developed independently of one another (e.g., the latent factor structure for each construct was evaluated separately) to address limitations associated with extant measures of each respective construct. To help bridge the research gap between survey-based research on expectancies and laboratory-based research on SR, the AEAS and SEAS were designed to complement one another to facilitate comparisons of the constructs. Among a number of corresponding features (please see the description of the AEAS within the Measures section of the present study), the SEAS and AEAS were developed using a common item set, with the prediction that a subset of overlapping items would be identified across the measures, thereby permitting direct comparisons between expectancies and SR. The development of the common item pool is described in detail in Morean et al., 2012. However, we briefly describe the item development process below as background for the current study.

The initial item set (N = 215) was assembled by the research team based on our belief that the words represented plausible outcomes of drinking. In total, 132 items were chosen from the Alcohol Expectancy Multiaxial Assessment (Goldman & Darkes, 2004) and 83 items were chosen from the Affective Norms for English Words (Bradley & Lang, 1999). Several pilot studies were run to determine the arousal and valence associated with each item as well as to gather student and expert opinions of the alcohol-relatedness of each item. Then, a systematic selection procedure was followed to ensure that the 40 items used for measurement development (10 per affective quadrant) represented a wide range of alcohol effects that varied in terms of valence and arousal, were rated as strongly associated with alcohol, and had linguistic features (e.g., readability) that would make the SEAS (and AEAS) accessible to a broad range of participants. The instructions, formatting, and response scale for the SEAS were modeled after the Biphasic Alcohol Effects Scale (Martin et al., 1993). A rating scale approach was chosen as the response format because it is easily understood by most participants and can be completed quickly, which was important given that the SEAS was designed to be administered multiple times. Baseline and post-beverage administration versions of the SEAS were created, allowing assessments of absolute SR and changes in the experience of effects from baseline.

In building our argument for the validity and reliability of the proposed interpretation of SEAS scores, we will present information from a range of psychometric analyses. First, the latent structure of the SEAS (Exploratory and Confirmatory Factor Analyses) will be discussed. As evidence for the internal consistency of the SEAS scores, Cronbach's alpha values then will be presented for each subscale. Next, we will present evidence for the invariance of the SEAS scores by limb of the blood alcohol curve and beverage condition (i.e., placebo and alcohol). Evidence of convergent and discriminant relationships between the SEAS scores, alternative measures of subjective response, and alcohol expectancies will then be presented. Evidence of test-criterion relationships between the SEAS scores and several cross-sectional alcohol-related outcomes then will be presented. Finally, evidence for the incremental utility of the SEAS scores in accounting for variance in cross sectional alcohol-related outcomes above and beyond two commonly used SR measures (i.e., the SHAS and the BAES) will be presented.

Method

Participants

Drinkers between the ages of 21 and 30 were recruited from college campuses and the greater communities of New Haven, Connecticut ($N = 112$), and Tempe, Arizona ($N = 132$), to participate in an alcohol-administration study designed to assess the impact of alcohol consumption on gambling persistence and betting behavior in a simulated bar setting. Eligibility was determined through a phone screen. Alcohol-related exclusion criteria included drinking < 3 drinks/week, medical contraindications and adverse reactions to alcohol, current/past enrollment in abstinence-based alcohol treatment, and pregnancy. Related to the gambling focus of the larger study, participants had to play poker at least once in the past year and could not be enrolled in abstinence-based gambling treatment.

Of the 520 individuals who completed the phone screen, 303 were eligible, and 217 were ineligible (120 for failure to meet the gambling-related criteria; 53 for drinking < 3 drinks/week; 29 for medical reasons; 9 for current or prior abstinence based treatment; 5 for being underage; and 1 for pregnancy). Although 244 participants completed the study sessions, 7 participants for whom the placebo manipulation was ineffective (i.e., they believed they had consumed no alcohol) ultimately were excluded from the validation analyses as were 22 participants from the alcohol condition whose breath alcohol levels (BrACs) were considerably less than the target of .08 g% (i.e., < .06 g%). Thus, the sample included in the analyses evaluating the reliability and validity of the proposed interpretation of SEAS scores comprised 215[1] participants (mean age 22.84[2.37]) who were predominantly male (74.40%), Caucasian (75.30%), single (91.40%), and college educated (94.70% with some college education; see Table 1 for participant demographics). Participants recruited from Arizona ($N = 102$) did not differ significantly from those recruited from Connecticut ($N = 113$) on any of the central study variables (i.e., assignment to placebo versus alcohol beverage condition; sex, monthly drinks, binge drinking, frequency of driving after drinking; alcohol-related problems) so data were analyzed from the full sample ($N = 215$). Bolstering our confidence that the gambling related criterion did not negatively impact the aims of the current study, individuals who were excluded based on the gambling criterion did not differ from participants with respect to weekly alcohol use or binge drinking frequency (total number of drinks per week for participants = 19.12[12.23]; for excluded individuals = 17.16[13.20], $p = .16$; binge episodes per week for participants = 1.65 [1.64]; for excluded individuals = 1.32[1.62], $p = .07$).

Procedure

Participants were scheduled to attend a beverage administration session and a follow up session in our simulated bar laboratory. Groups of 2–4 participants attended the beverage administration session. Participants were instructed to abstain from alcohol and non-prescription drugs for 24-hours and from eating for 4 hours prior to beverage administration. Use of nicotine products was not permitted during the protocol. Upon arrival, participants gave proof of their age via a valid photo ID, provided informed consent, and gave a baseline breathalyzer test (BrAC) to ensure they had not consumed any alcohol, and participants were weighed for purposes of alcohol dosing. Female participants provided a urine sample to ensure that they were not pregnant. Participants then completed a series of computerized tasks unrelated to the focus of this article. Participants and research assistants (who served as bartenders during the beverage administration) were blind to study condition. A research supervisor randomized the group of participants to receive either active placebo (BrAC < .001 g%) or alcohol (target BrAC = .08 g%) upon arrival at the lab and collected all BrAC readings.

Prior to beverage consumption and before entering the Bar Lab, participants completed baseline versions of the SEAS and BAES. During this time, the bar lab was prepped (i.e., music was cued, neon alcohol signs illuminated). Participants were escorted into the lab and served three drinks over thirty minutes (10 min/drink). Beverage consumption was followed by a 15 minute absorption period. Participants were informed that the research staff was developing a new measure of response to alcohol and that they would be asked to complete the measure several times over the course of the evening. Participants were thanked for their patience in assisting in this project.

Given evidence that SR to alcohol may peak up to 25 minutes before the peak BrAC is reached (Radlow & Hurst, 1985), participants reported their SR following the 15 minute absorption period, and BrAC was concurrently assessed. Participants completed the SEAS four additional times, separated by an average of 20 minutes. At the end of session 1, participants were scheduled for the 2-week follow-up (session 2). Placebo participants were then provided transportation home as were alcohol participants once their BrACs fell below 0.02 g%.

[1] Data from 108 participants who completed the alcohol administration study were also included in the Morean et al. (2012) study designed to validate the AEAS. These 108 participants represented 19.78% of the total sample used to validate the AEAS ($N = 546$). The following variables were assessed in both studies: alcohol expectancies, number of drinks consumed weekly, number of binge drinking episodes per month, and the experience of alcohol-related problems.

Table 1
Participant Characteristics

Characteristic	Current sample	By beverage condition: Placebo	By beverage condition: Alcohol
No. of participants	215	113	102
Age in years	22.84 (2.37)	22.87 (2.43)	22.83 (2.37)
Sex (% male)	74.40	75.68	75.00
Race (% Caucasian)	75.30	75.00	80.41
Marital status (% single)	91.40	92.00	90.80
Education (% with some college education)	94.70	94.60	94.90
Total drinks[a,b]	59.69 (46.50)	62.16 (50.37)	57.01 (46.51)
Binge episodes[a,b]	5.47 (4.73)	5.71 (4.68)	5.21 (4.79)
Driving after drinking[a,c] (% reporting ≥1 episode in 3 months)	45.00	43.10	47.00
Alcohol-related problems[a,c] (% reporting ≥1 problem in 3 months)	94.80	92.70	97.00

Note. The numbers in parentheses refer to standard deviations.
[a] Denotes variables that were log transformed to approximate a normal distribution. [b] Denotes self-reported drinking behavior over the past month. [c] Denotes that the experience of driving after drinking and alcohol-related problems were assessed over the past 3 months.

During Session 2, participants completed self-report measures and an interview of their drinking behavior over the month prior to the beverage administration session.

Session 1 Measures

The following were completed during the alcohol administration session.

The Subjective Effects of Alcohol Scale (SEAS). Figure 1 depicts the final 14-item SEAS derived from the 40-item version that was completed during the beverage administration sessions. Items marked with an asterisk comprise the 13 items that overlap with the AEAS.

The Subjective Intoxication Questionnaire (SI). The SI assessed participants' estimates of the number of drinks they consumed over the course of the drinking episode. This questionnaire was used to assess the effectiveness of the placebo manipulation.

The Biphasic Alcohol Effects Scale (BAES; Martin et al., 1993). The BAES assessed subjective experiences of alcohol stimulation (e.g., energized, talkative) and sedation (e.g., heavy head, slow thoughts). Participants rated the extent to which they experienced 14 alcohol effects on an 11-point rating scale from *not at all* (0) to *extremely* (10). Participants completed the BAES at baseline and during the second (Cronbach's α for stimulant subscale = .93; α for sedative subscale = .90) and fourth

Instructions: The following words describe feelings that are sometimes produced by drinking alcohol. On a scale of 1-10, please rate the extent to which you are feeling each of the following effects **at the present time**.

		Not At All				Moderately				Extremely		
1)	Relaxed*	0	1	2	3	4	5	6	7	8	9	10
2)	Wobbly*	0	1	2	3	4	5	6	7	8	9	10
3)	Lively*	0	1	2	3	4	5	6	7	8	9	10
4)	Secure	0	1	2	3	4	5	6	7	8	9	10
5)	Rude*	0	1	2	3	4	5	6	7	8	9	10
6)	Woozy*	0	1	2	3	4	5	6	7	8	9	10
7)	Fun*	0	1	2	3	4	5	6	7	8	9	10
8)	Calm*	0	1	2	3	4	5	6	7	8	9	10
9)	Aggressive*	0	1	2	3	4	5	6	7	8	9	10
10)	Dizzy*	0	1	2	3	4	5	6	7	8	9	10
11)	Demanding*	0	1	2	3	4	5	6	7	8	9	10
12)	Mellow*	0	1	2	3	4	5	6	7	8	9	10
13)	Funny*	0	1	2	3	4	5	6	7	8	9	10
14)	Talkative*	0	1	2	3	4	5	6	7	8	9	10

Figure 1. The Subjective Effects of Alcohol Scale (SEAS). The 13 items marked with an asterisk (*) denote the 13 items that overlap with the 22 item Anticipated Effects of Alcohol Scale (AEAS).

(α for stimulant subscale = .95; α for sedative subscale = .92) post-alcohol assessments.

The Subjective High Assessment Scale–7 Item (SHAS; Schuckit et al., 2000). The SHAS-7 assessed SR to 7 possible alcohol effects (e.g., high, confused, drunk). Participants rated the extent to which they experienced each effect using a 36-point visual analog scale. Participants completed the SHAS during the second (α = .91) and fourth (α = .91) post-alcohol assessments. The 7-item SHAS was chosen because it has been shown to have less error variance than lengthier versions.

Session 2 Measures

The following were completed during the follow-up session.

Timeline Follow-Back (TLFB; Sobell & Sobell, 2003). During the experimenter-administered TLFB interview, participants reported on the quantity and frequency of drinking during the past month using a calendar prompt with several memory aids (e.g., holidays) to facilitate accurate recall (α = .86). The total number of drinks participants consumed over the course of the month and the number of binge drinking episodes (4 drinks for women/5 drinks for men within 2 hours) were calculated from the TLFB.

Driving after drinking. Participants reported on the frequency with which they drove a motor vehicle after 1) consuming 2 or more drinks and 2) after consuming 4 or more drinks over the past 3 months. A composite variable reflecting the frequency of *any* driving after drinking was calculated for each participant (i.e., frequency of driving after 2 drinks + frequency of driving after 4 drinks).

The Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989). Participants rated how frequently they experienced 23 alcohol-related social/health problems over the past 3 months using the following prompts: never, 1–2 times, 3–5 times, 6–10 times, >10 times (α = .89).

The Anticipated Effects of Alcohol Scale (AEAS; Morean et al., 2012). The AEAS is a self-report measure of alcohol expectancies that was developed alongside the SEAS. To facilitate comparisons of expectancies and subjective response, the AEAS and SEAS share a response format, assess anticipated or actual alcohol effects on the ascending and descending limbs of the BAC, and assess anticipated or actual alcohol effects corresponding to a common blood alcohol level of .08% (i.e., the target dose in the SEAS study; an estimated blood alcohol level in the AEAS study). More specifically, the AEAS employs the same 11-point rating scale as the SEAS (ranging from *not at all* [0] to *extremely* [10]) to assess the extent to which participants believe that engaging in a binge drinking episode (4 drinks for women/5 drinks for men within 2 hours) will result in the experience of 22 possible alcohol effects (13 of the effects overlap with the content of the SEAS; see Figure 1). The National Institute on Alcohol Abuse and Alcoholism binge drinking criteria were specified because these drinking parameters approximate a blood alcohol level of .08 g% (i.e., the target blood alcohol level in the alcohol administration study) for men and women of average height and weight. Morean and colleagues (2012) proposed an interpretation of AEAS scores in which the 22 AEAS items comprise four subscales (i.e., high arousal positive, high arousal negative, low arousal positive, and low arousal negative). This interpretation has demonstrated strong psychometric properties across several large samples of young adults (*N* = 550) including excellent internal consistency and two-week test-retest reliability; measurement invariance for limb of the blood alcohol curve, gender, and drinking status; and convergent, discriminant, predictive, and incremental validity.

Data Analytic Plan

To evaluate the effectiveness of the placebo manipulation, descriptive statistics were computed to ensure that individuals in the placebo condition believed they had consumed alcohol. Seven individuals reported that they believed they had consumed no alcohol and were excluded from subsequent reliability and validity analyses. Independent samples t-tests were then conducted to evaluate the overall strength of the placebo manipulation relative to alcohol consumption. Next, a combination of exploratory factor analytic models as well as theoretically and data-driven confirmatory factor analytic models were used to develop the 14-item SEAS. Initially, an exploratory factor analysis of the 40-item SEASD (i.e., the SEAS for the descending limb) was conducted for a randomly selected 50% of the total sample (*n* = 107), with the intent to cross-validate the identified latent structure within the remaining 50% of the sample. Data from the descending limb were used for the initial factor analysis given concerns that data from the ascending limb may be more subject to expectancy effects due to the novel experience of participating in a simulated bar environment.[2] Factor solutions ranging from two to eight factors were considered. A combination of eigenvalues (>1), scree plots, model fit indices, the interpretability of the solutions, the number of items per factor, and consistency with theoretical predictions was used to identify possible latent factor structures for the SEAS. For any plausible factor solution, a confirmatory factor analytic model derived from the exploratory factor analysis (EFA) of the SEASD was fit to the second random sample (*n* = 108). If adequate fit was achieved within random sample 2, the model was then fit to the data from the ascending and descending limbs within the full sample (*n* = 215). After establishing the factor structure of the measure, the internal consistency of the proposed interpretation of SEAS scores was evaluated.

In order to make meaningful comparisons of SR across the ascending and descending limbs as well as by beverage condition, a multigroup confirmatory factor analysis (CFA) approach was used to evaluate measurement invariance (MI) of the SEAS scores for each of these constructs (Vandenberg & Lance, 2000). SEAS factor scores were then computed and the convergence and divergence of the SEAS scores with extant SR measures and with alcohol expectancies were then examined. Finally, multivariate regression analyses were conducted to evaluate the concurrent and incremental utility of the SEAS scores in accounting for the total number of drinks participants consumed per month, binge drinking frequency, frequency of driving after drinking, and the experience of alcohol-related problems.

[2] All analyses were also completed starting with the SEASA to ensure that the latent factor structure and factor indicators identified through EFA were similar irrespective of the starting point. The same factor structure was identified when starting with the SEASA, although loadings were slightly weaker for several items (e.g., mellow = .68; secure = .64).

Results

Efficacy of Random Assignment

No significant differences were observed by beverage condition on central study variables (see Table 1 for participant characteristics by beverage condition), ensuring that study results would not be accounted for by baseline differences in participant characteristics between the placebo and alcohol groups.

Placebo Manipulation Check

As expected given the simulated bar setting, the placebo manipulation worked very well. Participants for whom the placebo manipulation was effective estimated that they consumed 84% of the amount of alcohol estimated by alcohol participants (the estimate was 79% when the 7 placebo participants for whom the placebo manipulation was ineffective were included in the analysis). Despite the robust placebo effects, but consistent with our expectations, participants in the alcohol condition believed they consumed significantly more alcohol than placebo participants for whom the manipulation was effective (Ascending Limb Estimated Drinks: Alcohol = 3.33 drinks [SD = 0.83], Placebo = 2.82 drinks [SD = 0.92], F = 17.93, $p < .001$, Cohen's d = .58; Descending Limb Estimated Drinks: Alcohol = 3.33 drinks [SD = 0.87], Placebo = 2.72 drinks [SD = 1.06], F = 21.09 $p < .001$, Cohen's d = .63).

Creating SEASA and SEASD Scores

SR was assessed at 5 time points (not including baseline). Based on the study hypotheses and the biphasic nature of alcohol effects, different responses to alcohol were expected across the drinking episode. As such, ascending and descending limbs scores were calculated for each participant. First, the assessment time point at which each participant reached his or her peak BrAC was determined. Participants peaked at assessments 1 (28.70% of participants), 2 (48.50%), or 3 (22.80%). The mean peak BrAC was .079 (SD = 0.010). An analysis of variance (ANOVA) found that there were no differences in peak BrAC based on the time point at which peak was reached (time 1 = .081 [SD = 0.011); time 2 = .079 [SD = 0.011], time 3 = .079 [SD = .015], $F(98) = 0.30$, $p = .75$). Thus, for those peaking at time 1, we used only the data from time 1 for ascending effects, whereas data from the peak time point and the preceding point(s) were used to create ascending limb scores for those peaking at time 2 or 3. Participants' BrACs were universally descending by time 4, so data from time 4 and time 5 were averaged to create a composite descending limb score for each participant.

Ideally, SR should be assessed at equal BrACs on the ascending and descending limbs such that any observed differences are due to limb rather than BrAC. Across all study participants, a dependent samples t-test revealed a significant difference in mean BrAC by limb (ascending = .076 g% [SD = .012]; descending = .064 g% [SD = .012]; $t(115) = 13.49$, $p < .001$). Although statistically significant, the mean difference in BrAC by limb corresponded to approximately 25% of one standard drink (BrAC change = .006 [SD = .009]). Further strengthening our confidence in the ability to meaningfully assess SR across limbs of the blood alcohol curve, multivariate general linear models indicated that mean difference in BrAC by limb was not a significant predictor of SR on the ascending (p = .65) or descending limb (p = .48).

Evidence for the Validity of the SEAS Subscale Scores Based on Internal Structure

Exploratory factor analysis (EFA). We hypothesized that a four-factor solution would emerge across assessments of SR associated with the ascending (SEASA) and descending (SEASD) limbs, with subscales corresponding to the four quadrants of the valence by arousal affective space (i.e., High Arousal Positive, Low Arousal Positive, High Arousal Negative, and Low Arousal Negative). However, formal evaluation began with an EFA to examine the dimensionality of the 40 items in the absence of a priori restrictions, as well as to identify items that would not meet the simple structure requirements of confirmatory factor analyses (i.e., items that loaded strongly onto multiple factors).

Using MPLUS 6.12, an EFA model was fit to the SEASD data from a randomly selected subsample of 107 participants (50% of the total sample), with the intention to cross-validate the factor structure within the second half of the sample. Robust maximum likelihood estimation was used, as this estimation method is robust to nonnormality and produces a range of fit indices that are helpful in determining latent factor structure. An oblique rotation (i.e., Crawford–Ferguson Varimax [oblique]) was specified based on our expectations that some individual SR items and any resulting factors would be significantly correlated. Missing data were handled using Full Information Maximum Likelihood. Based on the study hypotheses and on the factor structures of existing SR measures, EFA was allowed to extract up to 8 factors.

Several indices influenced initial model selection (i.e., eigenvalues > 1, scree plot, model fit indices, number of items per scale, solution interpretability; Jöreskog & Sörbom, 1989; Tabachnick & Fidell, 2007). The following indices were employed to assess model fit: Bentler's comparative fit index (CFI), the Tucker–Lewis index (TLI), the root-mean-square error of approximation (RMSEA), and the standardized root-mean-square residual (SRMR). Goodness of model fit was evaluated using the following criteria: CFI and TLI indices > .90 (Bentler, 1990), RMSEA < .08 (Browne & Cudek, 1993; MacCallum, Browne, & Sugawara, 1996), and SRMR < .08 (Hu & Bentler, 1999; Newsome, 2012).

Consideration of the initial eigenvalues (five of which were > 1) and the associated scree plot suggested that the 3-, 4-, and 5- factor solutions merited further evaluation. None of the models evidenced adequate fit to the data when all 40 items were included, suggesting that some items would need to be systematically discarded. Within each model, items were retained if the latent factor accounted for at least 49% of the variance in the item (factor loadings ≥ .70), and no other latent factor accounted for more than 9% of the variance (cross-loadings < .30).

The viability of each model was then evaluated based on a combination of consistency with theoretical predictions, the number of items comprising each factor, and general factor interpretability. Based on the hypothesized four factor structure, the 4-factor model was considered first. The model contained a total of 14 items that comprised two positive and two negative factors. Three of the four factors mapped nicely onto the quadrants of affective space: high arousal positive (HIGH+; fun, lively, talkative, funny), low arousal positive (LOW+; mellow, relaxed, calm, secure), and high arousal negative (HIGH−; demanding, rude, aggressive). The factor best corresponding to the low arousal negative quadrant (LOW−; woozy, dizzy, wobbly) included one "borderline" item that had been rated as falling just within the high arousal quadrant during instrument development (dizzy). However, each subscale was clearly distinguishable from the others based on arousal and valence (e.g., the arousal level of all items in the LOW− quadrant were lower than those falling in the HIGH− quadrant; see Figure 2). There were two significant correlations among the SEAS factors (HIGH+ with LOW+ [.602]; HIGH− with LOW− [.524]), but the magnitudes of the correlations were below criteria for indicating problems with multicollinearity ($r > .80$ Meyers, Gamst, & Guarino, 2006). The mean alcohol relatedness score of the 14 items (6.90 [*SD* = .92]) indicated that the average item fell within the quartile of words most strongly related to alcohol.

The 3-factor and 5-factor models models were considered next. The 3-factor model was discarded based on the following rationale. First, the model did not reflect a comprehensive range of alcohol effects. Specifically, there was no factor corresponding to high arousal positive effects (e.g., stimulation), which have consistently been identified as a critical aspect of subjective response to alcohol. Second, in order to be considered a proper subscale and to permit estimation of latent variables (Jöreskog & Sörbom, 1989), a latent factor must comprise at least 3 items. One of the three factors comprised a single item (i.e., daring) and was therefore not viable. The 5-factor model was also rejected. One of the latent factors identified in the 5-factor model did not contain any items that loaded strongly enough onto the factor to be retained (e.g., the strongest loading was .50 with an associated cross-loading of .40). Second, the four viable factors were not unique. Rather, they were the same as those identified within the four-factor model. As such, the 4-factor model was selected for further development.

Confirmatory factor analysis (CFA). Based on study hypotheses and the identified structure from the EFA, a 14-item four-factor CFA model was cross-validated within Random Sample 2 ($N = 108$). For each of the factors identified within the EFA, the highest loading indicator defined the factor metric. Based on the EFA, the factors were allowed to correlate based on valence (e.g., HIGH+ and LOW+). Robust maximum likelihood estimation was specified. The goodness-of-fit indices indicated excellent model fit for the four-factor solution within Random Sample 2 ($\chi^2(71) = 74.94$, SRMR = .047, RMSEA = .023 [90% CI = 0.00–.061], TLI = .995, CFI = .996), and no modification indices were present. The CFA model was then fit to the descending limb data from the full sample ($\chi^2(71) = 96.734$, SRMR = .049, RMSEA = .041 [90% CI = 0.016–0.060], TLI = .975, CFI = .980; See Table 2 for SEASA and SEASD factor loadings for the full sample). In preparation for

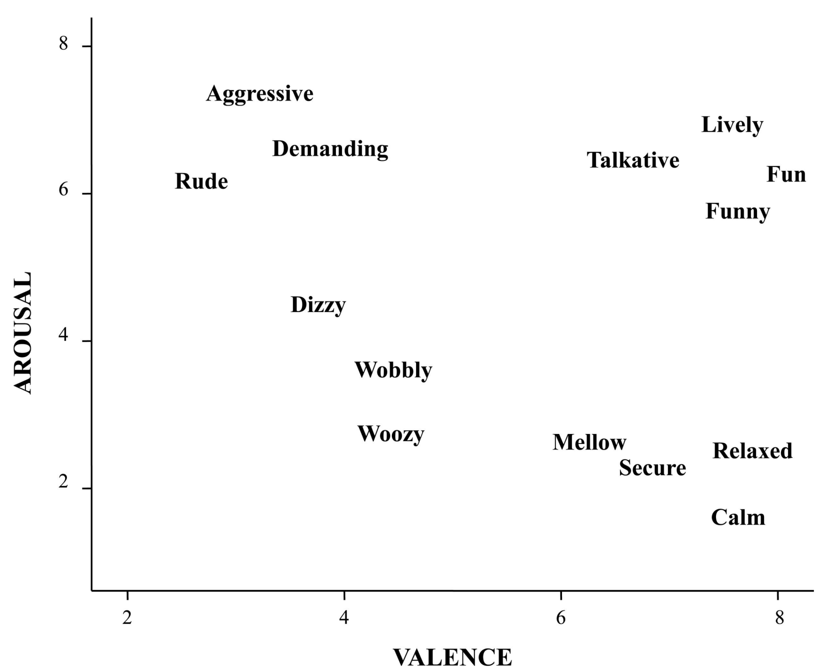

Figure 2. The 14 items of the Subjective Effects of Alcohol Scale (SEAS) plotted by arousal and valence ratings. The 14 SEAS items are plotted by the valence and arousal ratings provided by 50 participants who completed a pilot study that occurred during the item development stage and that was designed to establish the affective norms of the SEAS items. All words were presented in counterbalanced blocks for valence and arousal, and participants rated the affective connotations of each word using a 9-point graphic emotion rating scale (Self Assessment Manikin; Bradley & Lang, 1994).

Table 2
Confirmatory Factor Analytic Indicator Loadings When the 4-Factor SEAS Model Was Fit to the SEAS-Ascending and SEAS-Descending Limb Data From the Full Sample and Internal Consistency Coefficients for the Resulting SEAS Subscales

	Confirmatory factor analysis indicator loadings							
	Ascending limb				Descending limb			
Items by subscale	Estimate	*SE*	Est./*SE*	StdYX	Estimate	*SE*	Est./*SE*	StdYX
High Arousal Negative								
Demanding	1			.845	1			.888
Rude	.802	.151	5.298	.766	.817	.166	4.931	.802
Aggressive	1.086	.149	7.310	.687	1.017	.121	8.424	.736
Low Arousal Negative								
Woozy	1			.832	1			.839
Dizzy	.806	.089	9.057	.847	.844	.077	10.982	.851
Wobbly	.940	.098	9.586	.866	.830	.069	11.985	.916
High Arousal Positive								
Fun	1			.930	1			.957
Lively	.969	.050	19.354	.885	.810	.040	20.121	.878
Funny	1.039	.050	20.764	.881	1.012	.029	35.339	.929
Talkative	.933	.062	14.972	.811	.813	.048	17.032	.816
Low Arousal Positive								
Mellow	1			.647	1			.713
Secure	.918	.155	5.938	.650	.952	.120	7.913	.713
Relaxed	1.026	.131	7.857	.785	1.051	.137	7.687	.822
Calm	.971	.126	7.682	.706	1.171	.130	8.982	.886
	Internal consistency							
SEAS subscales								
High Arousal Negative α	.800				.840			
Low Arousal Negative α	.879				.892			
High Arousal Positive α	.929				.940			
Low Arousal Positive α	.799				.863			

Note. Full sample $N = 215$. Bold SEAS items are factor metric items. *SE* = standard error; Est./*SE* = a ratio of the factor estimate and the standard error; StdYX = standardized factor loading; SEAS = Subjective Effects of Alcohol Scale.

testing MI, the model also was fit to the ascending limb data for the full sample as well as to the baseline data. Model fit was good for both the ascending limb ($\chi^2(71) = 134.286$, SRMR = .058, RMSEA = .064 [90% CI = 0.047–0.080], TLI = .935, CFI = .949) and baseline ($\chi^2(71) = 119.436$, SRMR = .060, RMSEA = .056 [90% CI = 0.038–0.074], TLI = .922, CFI = .939). In sum, all prerequisites for testing MI were met: (a) model fits were acceptable for assessments of SR at baseline and on the ascending and descending limbs, respectively; (b) all freely estimated factor loadings were significant; and (c) there were no problems identified via the modification indices.

Evidence for the internal consistency of the SEAS scores. Prior to conducting measurement invariance analyses, Cronbach's alpha values were examined to ensure that the proposed interpretation of SEAS scores evidenced adequate internal consistency. The SEAS scores demonstrated good to excellent internal consistency, with alpha values ranging from .80 to .94 across subscales (see Table 2).

Measurement invariance. In order to assess SR on the ascending and descending limb in a meaningful way and to make valid mean level comparisons, it is essential that the scales associated with each limb measure the same constructs (Byrne & Watkins, 2003; Chen, 2008; Widaman & Reise, 1997). Thus, a multigroup CFA approach was employed to evaluate measurement invariance (MI). First, *configural invariance* (i.e., invariance of the latent factor structure) was tested to establish whether the same four-factor structure fit the data well across the ascending and descending limbs. Establishing configural invariance requires meeting the following criteria: the CFA model must fit the data well, the loadings of all items comprising the latent factors must be significant on the ascending and descending limbs, and the correlations among latent factors must not be so strong as to indicate collinearity (Davidov, 2009; Steenkamp & Baumgartner, 1998). Second, *metric invariance* (i.e., invariance of factor loadings) was tested to establish whether the strength of the relationships of the latent factors to their constituent items was comparable across the ascending and descending limbs. Finally, *scalar invariance* (i.e., invariance of the intercepts) was tested to establish whether the mean responses for corresponding items on the two limbs were equal when the value of the latent variable (i.e., the mean) was held constant. In other words, scalar invariance examines whether the items' origins are invariant by limb. Establishing scalar invariance is necessary to ensure that limb-specific differences in factor scores reflect underlying differences in latent factor means rather than measurement bias (Chen, 2008; Steenkamp & Baumgartner, 1998; Widaman & Reise, 1997).

Configural invariance. See Table 3 columns labeled "BAC limb" for a summary of MI across BAC limbs. A two-group CFA model was specified in Mplus to fit the 4-factor model to

Table 3
Evaluation of Measurement Invariance by Limb of the BAC and Beverage Condition

	BAC limb (ascending vs. descending)				Beverage condition (placebo vs. alcohol)			
	Model fit indices				Model fit indices			
Level of MI established	CFI	TLI	RMSEA	SRMR	CFI	TLI	RMSEA	SRMR
Configural invariance	.966	.956	.054	.054	.958	.946	.058	.059
Metric invariance								
Step 1. Model fit	.964	.957	.053	.058	.958	.950	.056	.064
Step 2. Δ in fit from configural model	−.002	.001	−.001	.004	.000	.004	−.002	.005
Scalar invariance								
Step 1. Model fit	.947	.940	.060	.058	.947	.942	.061	.073
Step 2. Δ in fit from metric model	−.017	−.017	.007	.000	−.011	−.008	.005	.009

Note. BAC = blood alcohol curve; MI = measurement invariance; CFI = Bentler's comparative fit index; TLI = Tucker–Lewis index; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual.

the SEASA and the SEASD data simultaneously.[3] Observed dependent variables were continuous, so maximum likelihood estimation (MLR) with robust standard errors and chi-squares was used (ESTIMATOR = MLR). The factor loadings of the four factor metrics (i.e., the highest loading items for each factor) were set to 1.0, and the factor means were set to 0. All remaining model parameters (e.g., factor loadings, intercepts, variances, covariances, etc.) were freely estimated. The resulting model evidenced good fit ($\chi^2(142) = 229.56$, SRMR = .054, RMSEA = .054[90% CI = .040–.066], TLI = .956, CFI = .966). All items significantly loaded onto their respective factors on both limbs. As expected, the HIGH+ and LOW+ subscales as well as the HIGH− and LOW− were significantly correlated (*r*s = .607 and .508, respectively), but the magnitude of these correlations was below the established criteria for multicollinearity ($r > .80$; Meyers et al., 2006; $r > .90$; Tabachnick & Fidell, 2007). The fit of the configurally invariant model served as a benchmark against which the fit of the metric invariant model was evaluated.

Metric invariance. The factor loadings of matching items on the SEASA and the SEASD were constrained to equality (e.g., factor loadings of "sociable" on the SEASA and SEASD were set to be equal), and the latent factor means were set to zero. A series of statistical cutoffs established by Chen (2007) indicates that non-invariance exists in cases where the decrement in model fits exceed the following criteria; SRMR ≥ .030, RMSEA ≥ .015, or CFI ≥ −.01. Based on these cutoffs, the resulting model did not evidence a significant decrement in fit ($\chi^2(152) = 244.97$, SRMR = .058, RMSEA = .053 [90% CI = .041–.065], TLI = .957, CFI = .964) when compared to the configurally invariant model (ΔSRMR = .004; ΔRMSEA = −.001; ΔCFI = −.002). Thus, individual items related to their respective latent factors similarly across BAC limbs.

Scalar invariance. Factor loadings and intercepts (item means) of matching items on the SEASA and SEASD were constrained to equality while allowing the latent factor means to be freely estimated. Chen (2007) suggested unique cutoffs for change in fit indices when evaluating scalar invariance, with changes in CFI ≥ −.010 accompanied by a change in SRMR ≥ .010 or RMSEA ≥ .015 indicating non-invariance. Based on these indices, the resulting model evidenced no significant decrement in fit ($\chi^2(162) = 298.27$, SRMR = .058, RMSEA = .063 (90% CI = .051–.074), TLI = .940, CFI = .947) when compared to the model testing metric invariance (ΔSRMR = .000, ΔRMSEA = .007; ΔCFI = −.017). Thus, there was no evidence of measurement bias with respect to the individual items comprising the latent factors.

Measurement invariance by beverage condition. Using the same CFA multigroup approach described above, configural, metric, and scalar MI were also established for beverage condition (see columns labeled "Beverage Condition" in Table 3 for a summary of MI by beverage condition). Given that scalar invariance was achieved across BAC limbs, the MI model for beverage condition was run using the combined SEASA and SEASD data with beverage condition identified as the grouping variable.

Computation of factor scores. A summary scale approach to scoring the SEAS, in which subscale scores are computed from raw item responses, inherently gives all items on a given factor equal weight or "importance" (i.e., all factor loadings are essentially set to 1). However, as demonstrated by the CFA, individual items actually vary in the strength of their relation to the latent factor (i.e., have different factor loadings) such that certain items are functionally more "important" than others. Unlike summary scores, factor scores derived from the CFA provide information about participants' positions on each factor based on their responses to the individual items comprising the subscale. Thus, factor scores derived within Mplus (using the modal posterior estimator) were used in all subsequent analyses.[4]

[3] We tested measurement invariance by limb of the blood alcohol curve by simultaneously fitting a CFA model to the SEAS data from the ascending and descending limbs while successively constraining parameters to test for different levels of invariance (i.e., configural, metric, scalar). To account for the repeated measures nature of the data, we used the CLUSTER command within Mplus. To ensure that the repeated measures nature of the data was taken into account when standard errors and tests of model fit were computed, the analysis type was specified as "COMPLEX."

[4] Bivariate correlations between corresponding SEAS subscale scores derived using Mplus factor scores and SEAS subscale scores derived using a summary approach ranged from .89 to .99 (mean across bx;1subscales = .97), suggesting that the summary scores are close approximations of latent factor scores.

Evidence for the Validity of the Proposed Interpretation of SEAS Subscale Scores Based on Relations With Other Variables

Convergent and discriminant evidence (see Table 4). Bivariate correlations were used to examine the convergence and divergence of associations of the SEAS with two extant SR measures [(BAES (Martin et al., 1993); SHAS (Schuckit et al., 2000)] and with a measure of alcohol expectancies (AEAS; Morean et al., 2012), with a focus on limb-congruent relationships (i.e., correlations between ascending limb SEAS scores and ascending limb BAES/SHAS/AEAS scores; descending limb SEAS scores with descending limb BAES/SHAS/AEAS scores). With respect to the alternative measures of SR, strong correlations were observed between the SEASA HIGH+ subscale scores and the BAES stimulation subscale scores as anticipated. In addition, moderate to strong correlations were observed among the SEAS LOW− subscales, BAES sedation subscales and the SHAS. Highlighting the novelty of the SEAS HIGH− subscales, correlations with the BAES sedation and SHAS subscales were small to moderate, and correlations with BAES stimulation were either non-significant or small. Highlighting the novelty of the SEAS LOW+ subscales, there was a small inverse relation with BAES sedation on the ascending limb and scores were unrelated to the SHAS across both limbs. These results are in line with prior research suggesting that negatively reinforcing effects are distinct from sedation as measured by the BAES (Wiers, 2008). Perhaps on the basis of their shared positive valence, the SEAS LOW+ subscale scores were correlated strongly with BAES stimulation though the shared variance of the two measures was only 25%.

Relationships between the SEAS and alcohol expectancies were consistent with the notion that the effects of alcohol individuals actually experience during a drinking episode are distinct, yet related to, the effects of alcohol they anticipate experiencing. Correlations between corresponding SEAS and AEAS subscale scores (e.g., SEASA HIGH+ with AEASA HIGH+) subscales ranged from .45 to .64 across the ascending and descending limbs.

Test-criterion evidence.

Concurrence. Using multiple regression, we evaluated the cross-sectional relations among the SEAS subscale scores and the following variables: (a) the total drinks consumed over the past month, (b) binge drinking episodes over the past month, (c) the frequency of driving after drinking (past 3 months), and (d) the experience of alcohol-related problems (past 3 months). First, models were run examining the relationship between the drinking outcomes and absolute SR scores (i.e., participants' SR on the ascending and descending limb not accounting for baseline affective experience). To account for the potential impact of participants' subjective experience prior to beverage consumption, the relationships between SEAS change scores (i.e., SEASA–SEAS baseline; SEASD–SEAS baseline) and drinking outcomes were also evaluated. Based on the well-established relationship between gender and alcohol-related outcomes, sex was entered as a covariate at Step 1 of each regression model. For the models assessing driving after drinking and alcohol-related problems, the typical number of drinks participants consumed per drinking occasion was also included as a covariate at Step 1. The ascending or descending SEAS scores (or corresponding change scores) were entered simultaneously in Step 2 of the regression models. To facilitate the interpretation of results, separate models were run for the placebo and alcohol conditions.

Within the placebo condition, none of the absolute SEAS subscale scores or the corresponding SEAS subscale change scores accounted for significant variance in any outcome assessed. Within the alcohol condition, SEAS scores (absolute and/or change scores) accounted for significant variance in total monthly drinks, binge drinking frequency, the frequency of driving after drinking, and the experience of alcohol-related problems (see Table 5). Absolute SEAS and change scores accounted for a comparable level of variance in monthly drinks and binge drinking frequency

Table 4
Bivariate Correlations Between SEAS Subscales, Alternative Measures of Subjective Response, and Alcohol Expectancies

	Ascending Limb assessments				Descending Limb assessments			
	Subjective response measures			Alcohol expectancies	Subjective response measures			Alcohol expectancies
Subscale	BAES Stim.	BAES Sed.	SHAS	AEASA	BAES Stim.	BAES Sed.	SHAS	AEASD
SEASA HIGH−	**.09**	**.40*****	**.24*****	**.54*****	.14*	.29***	.23***	.56***
SEASA LOW−	**.06**	**.59*****	**.46*****	**.49*****	.06	.51***	.43***	.44***
SEASA HIGH+	**.80*****	**−.12**	**.22*****	**.45*****	.70***	−.10	.16*	.53***
SEASA LOW+	**.53*****	**−.14***	**.06**	**.58*****	.45***	−.16*	.02	.56***
SEASD HIGH−	.18**	.38***	.28***	.58***	**.18****	**.34*****	**.28*****	**.64*****
SEASD LOW−	.05	.53***	.45***	.40***	**.01**	**.61*****	**.50*****	**.46*****
SEASD HIGH+	.72***	−.14*	.16*	.37***	**.83*****	**−.16***	**.10**	**.50*****
SEASD LOW+	.45***	.01	.10	.41***	**.51*****	**.00**	**.05**	**.51*****

Note. Sample sizes ranged from 212 to 215 participants for each correlation. The correlations in bold reflect limb-consistent effects (i.e., SEASA with other subscale scores obtained on the Ascending Limb). Note that the SEAS and AEAS share subscales (i.e., HIGH−, LOW−, HIGH+, LOW+), so the correlations in this table reflect the relationship between corresponding subscales (e.g., SEASA HIGH+ with AEASA HIGH+). BAES Stim. = Biphasic Alcohol Effects Scale, Stimulant subscale; BAES Sed. = Biphasic Alcohol Effects Scale, Sedative subscale; SHAS = Subjective High Assessment Scale; AEASA = Anticipated Effects of Alcohol Scale, Ascending Limb; AEASD = Anticipated Effects of Alcohol Scale, Descending Limb; SEAS = Subjective Effects of Alcohol Scale; SEASA = Subjective Effects of Alcohol Scale, Ascending Limb; SEASD = Subjective Effects of Alcohol Scale, Descending Limb.
* $p < .05$. ** $p < .10$. *** $p < .001$.

Table 5
Multiple Regression Analyses Demonstrating the Concurrent Validity of the SEAS in the Alcohol Condition

		Monthly drinking (total drinks)				Binge drinking (4/5 drinks for women/men in 2 hr)				Driving after drinking				Alcohol problems			
		Absolute SR		Δ From baseline		Absolute SR		Δ From baseline		Absolute SR		Δ From baseline		Absolute SR		Δ From baseline	
Step	Predictors	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
	SEAS Ascending Limb subscales																
Step 1	Covariates	.05*		.05*		.01		.01		.03		.03		.06*		.06*	
	Drinks per occasion	—		—		—		—			.17		.17		.29**		.29**
	Sex		−.25*		−.25*		−.15		−.15		−.10		−.10		.02		.02
Step 2	SEASA	.09**		.10**		.08*		.11**		.07*		.05		.09**		.00	
	HIGH−		.40***		.38**		.36**		.36**		−.05		−.17		.24*		.13
	LOW−		−.27*		−.36***		−.28**		−.39***		−.26*		−.19		−.01		−.06
	HIGH+		−.04		−.01		−.06		.00		.31*		.09		.12		−.02
	LOW+		.08		.15		.07		.09		−.34*		−.19		−.22†		−.08
	SEAS Descending Limb subscales																
Step 2	SEASD	.13***		.12**		.11**		.12**		.00		.00		.06		.00	
	HIGH−		.38***		.32**		.36***		.32**		−.02		−.08		.29*		.17
	LOW−		−.31**		−.37***		−.29**		−.36***		−.09		−.10		.01		−.11
	HIGH+		−.05		−.02		−.08		−.01		.13		.04		.08		−.05
	LOW+		−.04		.00		−.02		−.03		−.02		.03		−.05		.16

Note. Step 1 variables included sex for all models. The typical number of drinks consumed per drinking occasion were also included in Step 1 for the models assessing driving after drinking and alcohol problems. Step 2 variables were the SEAS subscales (absolute or change from baseline). Dashes denote that the variable Drinks per occasion was not included as a covariate in the analysis. SEAS = Subjective Effects of Alcohol Scale; HIGH− = high arousal negative; LOW− = low arousal negative; HIGH+ = high arousal positive; LOW+ = low arousal positive; SEASA = Subjective Effects of Alcohol Scale, Ascending Limb; SEASD = Subjective Effects of Alcohol Scale, Descending Limb; SR = subjective response.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

(Monthly Drinks [SEASA absolute = 9.40%, change scores = 10.00%; SEASD absolute = 13.20%, change scores = 12.20%]; Binge Drinking [SEASA absolute = 7.80%, change scores = 10.50%; SEASD absolute = 11.00%, change scores = 12.30%]). An examination of the significant regression coefficients indicated that experiencing stronger HIGH− effects (or experiencing larger increases in high arousal negative effects from baseline) and weaker LOW− effects (or a less dramatic increases in LOW− effects from baseline) was universally associated with heavier drinking. Regarding driving after drinking, absolute SEASA scores uniquely accounted for 7.00% of the variance. The regression coefficients indicated that experiencing stronger HIGH+ after consuming alcohol coupled with weaker LOW− and LOW+ effects was associated with more frequent driving after drinking. A different pattern of results emerged with respect to alcohol-related problems. Absolute SEASA (9.00%) and SEASD (5.60%) scores accounted for variance in the experience of problems, with stronger experiences of HIGH− effects associated with more alcohol-related problems.

Incremental evidence (see Table 6). Hierarchical multiple regression analyses were used to examine whether the proposed SEASA and SEASD scores (absolute and change scores), respectively, were able to account for incremental variance in alcohol-related outcomes above and beyond two commonly used SR measures—BAES and the SHAS. With the exception of the addition of the BAES and SHAS subscales to Step 1 of the regression models, the regression models mirrored those described above in the concurrent evidence section. The SEASA and SEASD (absolute and change scores) accounted for an additional 6.60% to 18.70% of the variance in total monthly drinks and binge episodes. The SEASA absolute and change scores accounted for an additional 8.20% and 7.50% of the variance in driving after drinking, respectively. The absolute SEASA (8.00%) and SEASD (6.50%) scores accounted for an incremental variance in alcohol-related problems. In general, the pattern of findings mirrored those for concurrent validity. However, two findings merit note. First, more frequent alcohol-related problems were associated with stronger experiences of HIGH− and weaker experiences of LOW+ effects. Second, a novel effect emerged on the descending limb suggesting that heavier monthly drinking was associated with experiencing stronger absolute HIGH+ effects in addition to stronger HIGH− and weaker LOW− effects.

Discussion

By employing recent conceptual and statistical advances in approaches to measurement development, we built upon the strengths of extant SR measures to develop a novel, theoretically and psychometrically sound alcohol-specific measure of SR. Developing and validating the SEAS occurred in three stages: item set development, instrument development (e.g., choosing the format for response options), and psychometric validation. The SEAS has several notable strengths associated with each stage of its development. Regarding development of the initial item set, which was used to develop the SEAS (and the AEAS), items were purposefully selected to sample the full range of alcohol-induced affective experiences. Thus, in addition to the types of high arousal positive (e.g., talkative, funny) and/or low arousal negative effects (e.g., woozy, wobbly) captured by commonly used SR measures including the BAES and the SHAS, the SEAS assesses novel high arousal negative (e.g., rude, aggressive) and low arousal positive (e.g., relaxed, mellow) effects. A second key strength of the item set is that great care was taken to ensure that all items reflected plausible outcomes of drinking; a sample of college students and a panel of experts in the alcohol field concluded that the items were highly alcohol-related. Finally, the linguistic features of all items were considered when selecting the 40 items for measurement development. When synonymous words were being considered for inclusion (e.g., tired versus exhausted), the more accessible word was chosen so that the new measure could be used with a wide range of participants (e.g., 5th grade reading level and above) without modifications.

Most notable among the SEAS structural design features, its rating scale approach was easily understood by participants. Participants were also able to complete the lengthier 40-item version of the SEAS rather quickly. This suggests that the final 14-item version will pose very minimal participant burden even if it is administered several times to capture SR over the full course of a drinking episode.

When considering the strengths of the validation stage, the proposed interpretation of subscale scores underwent the most extensive psychometric evaluation of any SR measure to date. Regarding internal structure, the 4-factor EFA model was largely consistent with study hypotheses and resulted in good to excellent model fit when a CFA approach was implemented. Utilizing advances in test theory and statistical approaches, the current study established scalar measurement invariance (MI) for the proposed SEAS subscale scores by limb of the BAC and beverage condition. As such, we ensured, for the first time, the ability to make valid mean-level comparisons of the SEAS subscale scores across the ascending and descending limbs of the BAC and across placebo and alcohol conditions. Although differences in SR by BAC limb and beverage condition have been identified in prior research, the fact that the statistical basis necessary to make such comparisons had yet to be established raises serious concerns about the interpretability of prior research findings. It is impossible to know whether the group-level differences in SR that have been identified reflect "true" differences or are the result of measurement bias arising from violations of MI. Equally problematic, it is impossible to know whether prior null findings (which are unlikely to have been published) have accurately indicated the absence of differences or have, in fact, reflected group-specific discrepancies in internal structure or other sources of measurement bias.

Evidence for the reliability and validity of the proposed SEAS subscale scores was gathered from a number of sources. Internal consistency coefficients indicated that the SEAS scores were reliable on the ascending and descending limbs (mean Cronbach's α on the ascending limb = .850; descending limb = .884). Evidence for the convergence and divergence of the SEAS subscale score interpretations was obtained by examining relations between SEAS subscale scores, alternative SR measures (i.e., the BAES and SHAS), and a measure of alcohol expectancies (AEAS). When considering the relationships with extant SR measures, the most noteworthy findings were those associated with the novel HIGH− and LOW+ subscales. Highlighting the absence of the assessment of HIGH− effects within extant SR measures, the HIGH− SEAS subscale scores were significantly related only to alternative SR subscales reflecting negative sedative effects. Emphasizing the

Table 6
Multiple Regression Analyses Demonstrating the Incremental Validity of the SEAS in the Alcohol Condition

		Monthly drinking (total drinks)				Binge drinking (4/5 drinks for women/men in 2 hr)				Driving after drinking				Alcohol problems			
		Absolute SR		Δ From baseline		Absolute SR		Δ From baseline		Absolute SR		Δ From baseline		Absolute SR		Δ From baseline	
Step	Predictors	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
	SEAS Ascending Limb subscales																
Step 1	Covariates	.07*		.07*		.00		.00		.00		.00		.08*		.08*	
	Drinks per occasion	—		—		—		—			.17		.17		.27*		.27*
	Sex		−.22*		−.22*		−.09		−.09		−.09		−.09		.04		.04
	BAES Stim.		.15		.15		.08		.08		.03		.03		.15		.15
	BAES Sed.		.09		.09		.09		.09		−.04		−.04		.27*		.27*
	SHAS		−.22†		−.22†		−.20		−.20		−.04		−.04		−.18		−.18
Step 2	SEASA	.09*		.09*		.07*		.10**		.08*		.08*		.08*		.00	
	HIGH−		.32**		.37**		.30*		.35**		−.07		−.17		.23*		.13
	LOW−		−.22*		−.33**		−.28*		−.41***		−.34**		−.28*		−.02		−.11
	HIGH+		−.17		−.06		−.11		.02		.26		.06		.12		−.06
	LOW+		.02		.14		.00		.08		−.34**		−.21†		−.29*		−.08
	SEAS Descending Limb subscales																
Step 1	Covariates	.07*		.07*		.00		.00		.01		.01		.08*		.08*	
	Drinks per occasion	—		—		—		—			−.12		−.12		.35**		.35**
	Sex		−.18		−.18		−.07		−.07		.20		.20		.03		.03
	BAES Stim.		.18		.18		.09		.09		−.07		−.07		.05		.05
	BAES Sed.		.08		.08		.05		.05		−.08		−.08		.19		.19
	SHAS		−.20		−.20		−.16		−.16		−.10		−.10		−.09		−.09
Step 2	SEASD	.19***		.14***		.16***		.13**		.02		.01		.07*		.00	
	HIGH−		.42***		.34*		.42***		.34**		−.04		−.10		.26*		.15
	LOW−		−.29*		−.34**		−.30**		−.37**		−.17		−.22		.06		−.16
	HIGH+		.41*		−.09		.34*		−.07		.33		.05		.32		.04
	LOW+		.04		.02		−.02		−.03		−.03		.07		−.10		.13

Note. Step 1 variables included sex, BAES stimulation, BAES sedation, and the SHAS for all models. The typical number of drinks consumed per drinking occasion were included in Step 1 for the models assessing driving after drinking and alcohol problems. Step 2 variables were the SEAS subscales (absolute or change from baseline). Dashes denote that the variable Drinks per occasion was not included as a covariate in the analysis. SEAS = Subjective Effects of Alcohol Scale; BAES Stim. = Biphasic Alcohol Effects Scale, Stimulant subscale; BAES Sed. = Biphasic Alcohol Effects Scale, Sedative subscale; SHAS = Subjective High Assessment Scale; HIGH− = high arousal negative; LOW− = low arousal negative; HIGH+ = high arousal positive; LOW+ = low arousal positive; SEASA = Subjective Effects of Alcohol Scale, Ascending Limb; SEASD = Subjective Effects of Alcohol Scale, Descending Limb; SR = subjective response.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

novel coverage of LOW+ effects by the SEAS, LOW+ subscale scores were unrelated or inversely related to subscales reflecting negative sedative effects (SHAS; BAES sedation). These findings emphasize the lack of coverage of LOW+ effects by the most commonly used SR measures and are consistent with previous research suggesting that negatively reinforcing effects (i.e., relaxed, mellow) are experienced as positive affective experiences that are distinct from the negative affective experience of sedation (Weirs, 2008). Although a more thorough investigation of the relationship between SR (assessed by the SEAS) and alcohol expectancies (assessed by the AEAS) was beyond the scope of the current study, the relationships identified between these constructs were largely consistent with the notion that expectations and subjective experience are overlapping yet distinct constructs. These findings suggest that future research examining discrepancies between expectancies and subjective response may yield important knowledge regarding mechanisms of risk and potential targets for prevention and intervention.

Providing concurrent evidence for the validity of the SEAS test score interpretations (and highlighting the importance of the novel HIGH− and LOW+ subscales), absolute SEAS scores and/or SEAS change scores from baseline accounted for significant variance in several alcohol-related outcomes (see Table 5). Experiencing stronger HIGH− (e.g., aggressive, rude) and weaker LOW− effects (e.g., woozy, wobbly) was associated with heavier drinking across the ascending and descending limbs. Furthermore, experiencing stronger HIGH+ effects in combination with weaker LOW− and LOW+ effects was associated with more frequent driving after drinking. Finally, experiencing stronger acute HIGH− effects on the ascending limb was associated with more frequent alcohol-related problems. Providing direct statistical evidence of the unique contributions of the SEAS scores, the HIGH− and LOW− subscales incrementally accounted for 7%–19% of the variance in monthly drinks and binge drinking frequency above and beyond the most commonly used extant SR measures (i.e., BAES; SHAS; see Table 6). Although the HIGH+ subscale was not associated concurrently with drinking, experiencing stronger HIGH+ effects on the descending limb incrementally was associated with heavier monthly drinking. With respect to risk for driving after drinking, weaker experiences of sedation (both LOW+ and LOW−) were associated with more frequent driving after drinking. Highlighting the novel HIGH− and LOW+ subscales, experiencing stronger HIGH− and weaker LOW+ effects on the ascending limb was associated with more alcohol-related problems.

Limitations

Although there are a number of strengths of the current study, several limitations merit note. It is important to acknowledge that the evidence for the validity of the proposed interpretation of the SEAS subscales was based on cross-sectional data. Future longitudinal studies are needed to evaluate whether the SEAS scores remain invariant over time (i.e., the meaning of the construct is stable) and whether the SEAS scores are able to prospectively predict alcohol-related outcomes of interest.

To ensure that the amount of alcohol served during the alcohol administration study would not exceed participants' typical drinking behavior, eligibility was contingent on consumption of ≥ 3 drinks on at least one occasion per week during the past 3 months. Therefore, it is unclear to what extent the proposed interpretation of the SEAS scores would generalize to lighter drinkers. It is possible, for example, that some of the effects of alcohol that are thought to accompany intoxicating doses of alcohol (e.g., wobbly, aggressive) may be less relevant to lighter drinkers. Future research evaluating SR to a low dose of alcohol (e.g., .02 g%) using the SEAS may help to clarify this issue.

It is also important to acknowledge the fact that the data used within the current study were obtained as part of a larger study designed to assess the effects of alcohol on gambling behavior on a video poker task. As such, participants had to report playing poker at least once in the past year to be eligible for the study. Therefore, it is possible that the proposed interpretation of the SEAS scores may have been influenced by the gambling-related exclusion criterion. Providing evidence that the proposed test score interpretations may generalize to non-poker playing young adults, independent samples t-tests demonstrated that neither total alcoholic beverages consumed per week nor binge drinking frequency differed between study participants and individuals who were excluded based on the gambling criterion.

A limitation related to the assessment of driving after drinking also merits note. Participants were asked to report the frequency with which they operated a motor vehicle after consuming either 2 or 4 alcoholic beverages, but no time frame was specified (e.g., How many times did you operate a vehicle within 2 hours of drinking 2/4 drinks?). Given that blood alcohol level varies as a function of the number of drinks consumed and the passage of time, it is not possible to estimate precisely the extent to which participants were intoxicated.

Finally, it is important to note several possible limitations to generalizability based on the characteristics of our study sample. First, the sample was highly educated and was majority Caucasian and male. Future research is needed to determine the extent to which the proposed interpretation of SEAS scores will generalize to more heterogenous populations. Generalizability also may be compromised by the restricted age range of the study sample used in the current study. Given the high prevalence of heavy drinking and negative alcohol-related consequences, and the high rates of alcohol use disorders during emerging adulthood, a decision was made to develop and validate the SEAS for use with young adults. In the current study, 90% of participants had reached the legal drinking age in the United States within the past 5 years (mean age $= 22.85[SD = 2.37]$). However, it is unclear how well the interpretation of SEAS scores proposed within the current study would generalize to other age groups, including underage drinkers. Understanding early SR is key to the development of a comprehensive model of alcohol use but is complicated to assess; serving alcohol to underage drinkers poses ethical concerns and is not permitted within the United States. To address this issue to the best of our ability, we have recently launched a study that uses a version of the SEAS that has been modified to assess retrospectively adolescent SR at two time points: the very first and most recent drinking experiences. Future alcohol administration studies conducted in countries where the legal drinking age is lower than in the United States (e.g., England) also could help to evaluate the generalizability of the interpretation of SEAS scores proposed within the current study.

Implications and Future Directions

In spite of its limitations, the current study makes a number of notable contributions to the SR field. The current study was the first to ensure that the alcohol effects being assessed were identified as plausible outcomes of consuming alcohol and that the affective characteristics of the effects provided adequate coverage of the quadrants of valence by arousal affective space. Furthermore, by establishing scalar measurement invariance of the proposed SEAS subscale scores for BAC limb and beverage condition, the current study was the first to ensure the ability to make statistical comparisons of SR across the limbs of the BAC as well across placebo and alcohol conditions. Through examining the relationships between the SEAS subscales scores and alternative SR measures, the uniqueness of the HIGH− and LOW+ SEAS subscales was readily apparent. Furthermore, although alcohol expectancies and SR are theorized to be overlapping constructs that likely function in tandem to promote alcohol use, the relationship between the constructs has not been formally evaluated with comparable measures. The relationships identified between the SEAS and its companion measure of alcohol expectancies (the AEAS) provide exciting preliminary evidence that SR and expectancies are overlapping yet distinct constructs.

When relationships between the SEAS subscales and alcohol-related outcomes of interest were evaluated, each of the subscales accounted for significant variance in one or more drinking outcomes. The novel HIGH− subscale accounted for significant variance in alcohol-related problems (as did the LOW+ subscale when incremental utility was examined). The HIGH− and LOW− subscales accounted for significant variance in total monthly alcohol use and binge frequency across the ascending and descending limbs. Interestingly, differences in the direction and magnitude of the effects associated with experiencing stronger HIGH− and LOW− SR highlights the importance of discriminating negative effects based on arousal level. For example, strong HIGH− scores (e.g., rude, aggressive) were positively associated with monthly drinking, and engaging in binge drinking, and while strong LOW− effects (e.g., wobbly, woozy) appeared to protect against heavy drinking. With respect to drinking and driving, experiencing stronger HIGH+ effects on the ascending limb and weaker sedative effects (LOW− and LOW+) was associated with more frequent driving after drinking.

Given the interpersonal nature of the novel HIGH− effects (e.g., aggressive, demanding, rude), future research examining relationships between HIGH− effects and additional negative outcomes of drinking like perpetration of physical or sexual violence or development of AUDs will help to further establish the importance of assessing HIGH− effects. Research may also find that experiencing strong HIGH− effects relates to other well-established risk factors for alcohol-related problems, including antisocial personality characteristics.

The addition of the LOW+ subscale also allows for more comprehensive evaluations of the veracity of the Tension Reduction Model of alcohol use. Although the model has demonstrated staying power over the past 50 years, limitations of extant measures (namely, that LOW+ effects have largely been untapped) have made it difficult to test formally. The findings within the current study were inconsistent with the primary tenet of the tension reduction model: Heavier drinking is motivated by the experience of anxiolytic effects. Where significant effects emerged in the present study, reductions in LOW+ effects (on the ascending limb) were associated with driving after drinking and with alcohol-related problems. Historically, tension reduction has been conceptualized as a sedative response linked to the descending limb of the BAC. One particularly interesting question that future research can address is whether the relationship between the experience of tension reduction and important alcohol-related outcomes is moderated by whether the LOW+ effects are experienced on the ascending or descending limb of the BAC. Future research using the SEAS can evaluate the veracity of the model across a range of different types of participants, including individuals for whom tension reduction may be particularly reinforcing, such as those high in trait anxiety or personality dimensions like neuroticism.

In sum, over the past 30 years, researchers studying subjective response to alcohol have greatly advanced our knowledge of how individual differences in the experience of acute alcohol effects relate to outcomes of paramount interest within our field (e.g., heavy drinking; alcohol use disorders). While the SR field has enjoyed many notable successes, a number of important questions remain unanswered. Collaborative research efforts are needed to evaluate the veracity of some of our most prominent theoretical models, including models that address broad motivations for drinking (e.g., the Tension Reduction Model) as well as theoretical models that relate more specifically to identifying risk associated with SR (e.g., the Low Level of Response and Differentiator Models). Reaching a consensus about the profiles of SR that confer the greatest risk for negative alcohol-related outcomes (e.g., heavy drinking, AUDs) will represent an integral step in developing a richer, more comprehensive model of alcohol use, and ultimately, in designing effective prevention and treatment programs for alcohol-related problems. It is our hope that the SEAS will be a useful tool in addressing these remaining challenges.

References

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107,* 238–246. doi:10.1037/0033-2909.107.2.238

Bradley, M. M., & Lang, P. J. (1999). Fearfulness and affective evaluations of pictures. *Motivation and Emotion, 23,* 1–13. doi:10.1023/A:1021375216854

Browne, M. W., & Cudek, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CT: Sage.

Byrne, B. M., & Watkins, D. (2003). The issue of measurement invariance revisited. *Journal of Cross-Cultural Psychology, 34,* 155–175. doi:10.1177/0022022102250225

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling, 14,* 464–504. doi:10.1080/10705510701301834

Chen, F. F. (2008). What happens if we compare chopsticks with forks? The impact of making inappropriate comparisons in cross-cultural research. *Journal of Personality and Social Psychology, 95,* 1005–1018. doi:10.1037/a0013193

Davidov, E. (2009). Measurement equivalence of nationalism and constructive patriotism in the ISSP: 34 countries in a comparative perspective. *Political Analysis, 17,* 64–82. doi:10.1093/pan/mpn014

Goldman, M. S., & Darkes, J. (2004). Alcohol expectancy multiaxial assessment: A memory network-based approach. *Psychological Assessment, 16,* 4–15. doi:10.1037/1040-3590.16.1.4

Hu, L. T., & Bentler, P. M. (1999). cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. doi:10.1080/10705519909540118

Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7: A guide to the program and applications*. Lincolnwood, IL: Scientific Software International.

King, A. C., de Wit, H., McNamara, P. J., & Cao, D. (2011). Rewarding, stimulant, and sedative alcohol responses and relationship to future binge drinking. *Archives of General Psychiatry, 68,* 389–399. doi:10.1001/archgenpsychiatry.2011.26

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1,* 130–149. doi:10.1037/1082-989X.1.2.130

Martin, C. S., Earleywine, M., Musty, R. E., Perrine, M. W., & Swift, R. M. (1993). Development and validation of the Biphasic Alcohol Effects Scale. *Alcoholism: Clinical & Experimental Research, 17,* 140–146. doi:10.1111/j.1530-0277.1993.tb00739.x

Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation*. Thousand Oaks, CA: Sage.

Morean, M. E., & Corbin, W. R. (2010). Subjective response to alcohol: A critical review of the literature. *Alcoholism: Clinical & Experimental Research, 34,* 385–395. doi:10.1111/j.1530-0277.2009.01103.x

Morean, M. E., Corbin, W. R., & Treat, T. A. (2012). The Anticipated Effects of Alcohol Scale: Development and psychometric evaluation of a novel assessment tool for measuring alcohol expectancies. *Psychological Assessment, 24,* 1008–1023. doi:10.1037/a0028982

Newlin, D. B., & Thomson, J. B. (1990). Alcohol challenge with sons of alcoholics: A critical review and analysis. *Psychological Bulletin, 108,* 383–402. doi:10.1037/0033-2909.108.3.383

Newsome, J. (2012). *Some clarifications and recommendations on fit indices*. Retrieved from http://www.upa.pdx.edu/IOA/newsom/semclass/ho_fit.pdf

Quinn, P. D., & Fromme, K. (2011). Subjective response to alcohol challenge: A quantitative review. *Alcoholism: Clinical & Experimental Research, 35,* 1759–1770. doi:10.1111/j.1530-0277.2011.01521.x

Radlow, R., & Hurst, P. M. (1985). Temporal relations between blood-alcohol concentration and alcohol effect: An experiment with human subjects. *Psychopharmacology, 85,* 260–266. doi:10.1007/BF00428184

Schuckit, M. A. (2009). An overview of genetic influences in alcoholism. *Journal of Substance Abuse Treatment, 36,* S5–S14.

Schuckit, M. A., & Gold, E. O. (1988). A simultaneous evaluation of multiple markers of ethanol/placebo challenges in sons of alcoholics and controls. *Archives of General Psychiatry, 45,* 211–216. doi:10.1001/archpsyc.1988.01800270019002

Schuckit, M. A., Smith, T. L., Danko, G. P., Trim, R., Bucholz, K. K., Edenberg, H. J., . . . Dick, D. M. (2009). An evaluation of the full level of response to alcohol model of heavy drinking and problems in COGA offspring. *Journal of Studies on Alcohol and Drugs, 70,* 436–445.

Schuckit, M. A., Smith, T. L., Kalmijn, J., Tsuang, J., Hesselbrock, V., Bucholz, K., & Alcoholi, C. S. G. (2000). Response to alcohol in daughters of alcoholics: A pilot study and a comparison with sons of alcoholics. *Alcohol and Alcoholism, 35,* 242–248. doi:10.1093/alcalc/35.3.242

Sobell, L. C., & Sobell, M. B. (2003). Alcohol consumption measures. In J. P. Allen & V. B. Wilson (Eds.), *Assessing alcohol problems: A guide for clinicians and researchers* (pp. 78–99). Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism.

Steenkamp, J. B. E. M., & Baumgartner, H. (1998). Assessing measurement invariance in cross-national consumer research. *Journal of Consumer Research, 25,* 78–107. doi:10.1086/209528

Stritzke, W. G., Lang, A. R., & Patrick, C. J. (1996). Beyond stress and arousal: A reconceptualization of alcohol-emotion relations with reference to psychophysiological methods. *Psychological Bulletin, 120,* 376–395. doi:10.1037/0033-2909.120.3.376

Stritzke, W. G., Patrick, C. J., & Lang, A. R. (1995). Alcohol and human emotion: A multidimensional analysis incorporating startle-probe methodology. *Journal of Abnormal Psychology, 104,* 114–122. doi:10.1037/0021-843X.104.1.114

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Boston, MA: Pearson/Allyn & Bacon.

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3,* 4–70. doi:10.1177/109442810031002

White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol, 50,* 30–37.

Widaman, K. F., & Reise, S. P. (1997). Exploring the measurement invariance of psychological instruments: Applications in the substance use domain. In S. G. West (Ed.), *The science of prevention: Methodological advances from alcohol and substance abuse research*. Washington, DC: American Psychological Association. doi:10.1037/10222-009

Wiers, R. W. (2008). Alcohol and drug expectancies as anticipated changes in affect: Negative reinforcement is not sedation. *Substance Use and Misuse, 43,* 429–444. doi:10.1080/10826080701203021

Received August 4, 2012
Revision received February 5, 2013
Accepted February 6, 2013 ■