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RESEARCH REPORT

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Behavioral economic analysis of cue-elicited craving for alcohol

James MacKillop[1,2], Sean O'Hagen[3], Stephen A. Lisman[3], James G. Murphy[4], Lara A. Ray[5], Jennifer W. Tidey[2], John E. McGeary[2] & Peter M. Monti[2,6]

Department of Psychology, University of Georgia, Athens, GA, USA,[1] Center for Alcohol and Addiction Studies, Brown University, Providence, RI, USA,[2] Department of Psychology, State University of New York at Binghamton, Binghamton, NY, USA,[3] Department of Psychology, University of Memphis, Memphis, TN, USA,[4] Department of Psychology, University of California, Los Angeles, Los Angeles, CA, USA[5] and Providence Veterans Affairs Medical Center, Providence, RI, USA[6]

ABSTRACT

Aims Craving as a motivational determinant of drug use remains controversial because of ambiguous empirical findings. A behavioral economic approach may clarify the nature of craving, theorizing that subjective craving functionally reflects an acute increase in a drug's value. The current study tested this hypothesis via a multidimensional assessment of alcohol demand over the course of an alcohol cue reactivity procedure. **Design** One-way within-subjects design. **Setting** Human laboratory environment. **Participants** Heavy drinkers (n = 92) underwent exposures to neutral (water) cues followed by personalized alcohol cues. **Assessments** Participants were assessed for craving, alcohol demand, affect, and salivation following each exposure. **Findings** Alcohol versus neutral cues significantly increased craving and multiple behavioral economic measures of the relative value of alcohol, including alcohol consumption under conditions of zero cost (intensity), maximum expenditure on alcohol (O_{max}), persistence in drinking to higher prices (breakpoint) and proportionate price insensitivity (normalized P_{max}). Craving was significantly correlated with demand measures at levels ranging from 0.21–0.43. **Conclusions** These findings support the potential utility of a behavioral economic approach to understanding the role of environmental stimuli in alcohol-related decision making. Specifically, they suggest that the behavioral economic indices of demand may provide complementary motivational information that is related to though not entirely redundant with measures of subjective craving.

Keywords Alcohol, behavioral economics, craving, cue reactivity, demand curve, relative value.

Correspondence to: James MacKillop, Experimental and Clinical Psychopharmacology Laboratory, Department of Psychology, University of Georgia, Athens, GA 30602, USA. E-mail: jmackill@uga.edu

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INTRODUCTION

The role of craving in alcoholism and drug addiction has been debated vigorously in the scientific literature for more than 50 years [1], and it remains controversial [2–6]. The classical notion of craving is that over time excessive alcohol or drug use leads to increasingly persistent subjective desires or urges for the drug (i.e. cravings), which motivate further consumption reciprocally [1,7]. However, studies connecting craving to drug use are ambiguous and, although substance-dependent individuals readily report experiencing cravings [8–10], the associations between self-reported craving and actual drug consumption in human laboratory studies have been equivocal [4,5,11]. Similarly, the evidence for craving as a predictor of post-treatment relapse is mixed [5,12–17].

One reason for the ambiguity in the empirical literature may be related to measurement problems [18,19]. For example, individuals may vary in their semantic construal of the terms 'craving' or 'urge' and, given considerable variability in the elicitation and magnitude of craving across individuals [20–22], similar levels of self-reported craving may actually reflect different personal meanings, and vice versa. Furthermore, reports of experiential craving may be limited by the general limitations of memory and subjective introspection [23,24].

The field of behavioral economics is a hybrid of psychology and microeconomics [25] and has the potential to address a number of these limitations. Behavioral economics has been applied extensively to the understanding of both typical decision-making (e.g. [26]) and dysregulated decision-making in the form of addictive behavior (e.g. [27]). With regard to craving, behavioral economics theorizes that experiential craving increases the relative value of the drug (i.e. drug demand [28,29]). More specifically, in economic terms, craving is believed to increase the drug's marginal utility (i.e. perceived benefit of consuming a unit of a commodity) for the individual, serving as an economic complement (i.e. the presence of craving increases the utility of the drug) [28]. The change in value is theorized to shift the individual's preferences among the various behavioral options available, increasing probabilistically the choice of drinking over other alternatives.

To date, there has been relatively little empirical research directly testing the hypothesis that craving reflects an increase in the relative value of alcohol and other drugs, although considerable oblique evidence suggests that this is the case. A number of studies have demonstrated the importance of experiential factors in altering attributions of value via affective states [30] and other physiological states, such as hunger [31] and sexual arousal [32]. Most relevant, several studies have reported significant positive associations between both trait-level and experiential craving and the relative value of alcohol [33–36], as well as other drugs [37]. These studies have typically used forced-choice self-administration tasks that permitted participants to 'buy' alcohol or cigarettes by choosing between the substance and an alternative monetary reward. For example, O'Malley *et al*. [33] and McKee *et al*. [34] used a laboratory paradigm in which alcohol was available for $3 per drink, with all unspent money retained by the participant, and found that craving was correlated significantly with money allocated to alcohol consumption (and consumption itself) in both alcoholics and heavy drinkers.

Although generally supportive, the existing literature has a number of limitations. Chief among these is that the designs used have yielded correlational findings and none have used within-subjects designs to test directly whether the relative value of alcohol changes dynamically. In addition, the behavioral economic measures used in previous studies have typically generated only a single index of relative value in the form of the number of choices for alcohol over an alternative monetary reward. In reality, relative value is multi-dimensional [38], reflecting facets of consumption (e.g. how much alcohol would be consumed), expenditure (e.g. how much money would be spent) and the intersection of the two (e.g. price sensitivity). To date, no studies have addressed which specific facets of the relative value of alcohol are related to cue-elicited craving.

In this study, based upon behavioral economic theory [28,29], we directly tested the hypothesis that alcohol cues, which reliably elicit an increase in alcohol craving, would be associated with a concomitant increase the relative value of alcohol. Unlike previous studies, the current study used a within-subjects design and a multi-dimensional assessment of the relative value of alcohol. Heavy drinkers underwent controlled exposures to neutral cues (a control condition) and to alcohol cues, and were assessed for craving, affect, salivation and the relative value of alcohol after each exposure. A multi-dimensional assessment of relative value was achieved using state-oriented alcohol purchase tasks (APTs) to generate alcohol demand curves. The resulting demand curves were analyzed for multiple indices of demand, comprising intensity (i.e. consumption at minimal cost), breakpoint (i.e. price at which consumption is reduced to zero), O_{max} (i.e. maximum expenditure across prices) and P_{max} (i.e. the price at which demand becomes elastic, which is also the price at which O_{max} is reached). We hypothesized that alcohol cues would increase demand for alcohol significantly and explored the inter-relationships between subjective craving and demand indices, predicting that the behavioral economic indices would provide unique motivational information.

METHOD

Participants

Participants were 92 heavy drinkers recruited from the Human Subjects Research Pool at the State University of New York at Binghamton. Participants were required to be at least 18 years old (mean = 18.9) and heavy drinkers (21+/14+ standard drinks/week for males/females), as measured using the Alcohol Use Disorders Identification Test (AUDIT [39]). Mean drinking levels were relatively high [drinks/week: males = 25.18, standard deviation (SD) = 6.87; females = 21.52, SD = 4.42]. Mean AUDIT score was 14.49 (SD = 4.47). Because the alcohol cues were oriented around beer, participants were required to report to open-ended questions that beer was among their three favorite and most commonly consumed alcoholic beverages, and that they enjoyed drinking beer 7 or greater on a 1–10 Likert scale (mean = 8.45, SD = 1.17). For personalization of the alcohol cue exposure, participants were asked their preferred beer and primary reason for drinking from seven choices: relaxation, feeling happy, for the taste, out of habit, feeling depressed, feeling bored or feeling anxious; the majority reported drinking because they felt happy (91%) and small proportions reported drinking to relax (4%), for the taste (3%) and because they felt depressed (1%). The sample was primarily male (71%) and Caucasian (84%; Asian, 11%; African American, 1%; Latino, 1%; biracial, 2%; 'other', 1%. Participants reported a median household income of $100 000 [interquartile range (IQR) = $73 750–150 000], although 15% of the sample did not provide income.

Laboratory assessment

Subjective craving was assessed using the Alcohol Urge Questionnaire (AUQ [8,40]), which had good internal reliability at each time-point, $\alpha s \geq 0.94$. Affect was assessed using the Positive and Negative Affect Schedule (PANAS; [41]), which had good internal reliability at each time-point, $\alpha s \geq 0.78$. Salivation was assessed using established methods [42], with participants inserting three cotton dental rolls between their lower teeth and cheeks prior to each set of cues.

The relative value of alcohol was assessed using a state-oriented alcohol purchase task (APT [43]). The APT was paper-based and used the following instructional set: 'Please respond to these questions honestly. Imagine that you could drink RIGHT NOW. The following questions ask how many drinks you would consume if they cost various amounts of money. The available drinks are standard size domestic beer (12 oz.), wine (5 oz.), shots of hard liquor (1.5 oz.), or mixed drinks containing one shot of liquor. Assume that you would consume every drink you request; that is, you cannot stockpile drinks for a later date or bring drinks home with you.' Participants then entered their estimated consumption at the following 19 price intervals: zero cost (free), 1¢, 5¢, 13¢, 25¢, 50¢, \$1, \$2, \$3, \$4, \$5, \$6, \$11, \$35, \$70, \$140, \$280, \$560 and \$1120. The intervals used were based upon a previous study of tobacco and opiate demand [44]. Purchase tasks are based on progressive-ratio operant schedules [44], hence the approximately doubling response requirements. The APT was administered in a questionnaire packet with the AUQ and PANAS.

Procedure

All procedures were approved by the Institutional Review Board. Participants provided written informed consent followed by an assessment of demographics and other individual difference variables before proceeding to the cue exposures. The consent form informed participants they would be participating in a study of the effects of exposure to stimuli associated with drinking and alcohol. Participants underwent one exposure to neutral cues and one exposure to alcohol cues. The neutral cue exposure used stimuli related to water, including a glass of spring water, and the alcohol cue exposure used stimuli related to beer, including a glass of the participant's preferred beer. All participants received water cues followed by alcohol cues based on previous evidence of carryover effects from alcohol cues [42]. The procedure involved controlled exposure to visual, olfactory, tactile, imaginal and proprioceptive cues in individual laboratory rooms ($8' \times 6' \times 8'$). In each room, the cue exposure comprised 1 minute of observing the array of cues (alcohol-related or water-related) and 4 minutes of listening to a tape-recorded imaginal scene relating to the alcohol or neutral cues. During the tape, participants were asked to raise the beverage and inhale its smell for 5 seconds on five occasions. Thus, the cues comprised a room decorated with beverage-related paraphernalia (pictures, bottles), an empty glass and the beverage itself. The acute exposure involved observing the beverage, inhaling the smell of its aroma and feeling the tactile and proprioceptive sensations of lifting the beverage to their nose, which is similar to lifting the glass to drink. Following each cue exposure, the cotton rolls were removed and participants completed the AUQ, PANAS and APT, which lasted approximately 3 minutes. Finally, participants were escorted to another neutral laboratory room with no stimuli where they were debriefed. Participants were not permitted to drink the alcohol presented. All sessions took place in the afternoon or early evening.

Data analysis

Indices of demand were calculated using both observed values and normalized demand curve modeling. Intensity of demand was defined as the value of consumption at zero cost; breakpoint was defined as the price that first suppressed consumption to zero; O_{max} was defined as the highest observed level of expenditure on alcohol across prices; observed P_{max} was defined as the price associated with the O_{max}, reflecting the point after which decreases in consumption are proportionately greater than increases in price (elastic demand). Normalized demand curve modeling was conducted by applying Hursh & Winger's [45] demand curve normalization equations to generate a normalized estimate of P_{max}. Normalization permits examination of proportionate changes in consumption as price escalates independent of other aspects of the demand curve [45]. The following equations were used to calculate normalized P_{max} for each participant's individual performance. Normalized dose (q) was calculated as $q = 100/B$, where B = consumption at the lowest price. Normalized dose was then used to generate values for normalized price (P) as $P = FR/q$, where FR is the response requirement, in this case the price increment; and to generate values for normalized consumption (Q) as $Q = Rq$, where R refers to reported consumption. These variables were then applied to the normalized demand equation: $\text{Ln}Q = \text{Ln}\,[100] + b\,(\text{Ln}P) - aP$, where a and b are derived parameters reflecting the initial slope and acceleration of the demand curve, respectively. Finally, normalized P_{max} was calculated as $P_{max} = (1 - b)/a$. To permit the use of logarithmic transformations in the normalized demand equation, zero values for price without cost (free consumption) and breakpoint were replaced with arbitrarily low non-zero values [44]. Zero price was replaced with \$0.001 (one-tenth of 1 cent) and breakpoint consumption was replaced with 0.01; these differed because in the case of zero price, 0.01 overlapped with an actual price.

Prior to testing the hypotheses, Pearson's product–moment correlations (*r*) were examined between income and the indices of relative value to evaluate the need to covary income. In addition, correlations among the indices of demand were also examined for descriptive purposes. The principal analyses used within-subjects analyses of variance (ANOVAs), comparing reactions to neutral cues in relation to reactions to alcohol cues, and using partial eta-squared (η_p^2) as a measure of effect size. Follow-up continuous analyses were conducted to clarify further the inter-relationships among variables. All analyses were conducted using SPSS version 16.0.

Preliminary analyses

All data were examined for outliers using standard scores, with a criterion of $Z = 4$ to retain maximum data. A very small number of outliers were detected (<1%), and one participant was determined to account for almost half of the outliers and was excluded from subsequent analyses. The remaining outliers were determined to be legitimate high-magnitude values and were recoded one unit higher than the next lowest value [46]. Two participants reported fewer consumption responses than demand equation parameters, rendering the demand indices uninterpretable, and were excluded from all analyses. All data were examined for distribution normality using histograms. Variable distributions were skewed positively for O_{max}, breakpoint, and the indices of P_{max}, which were transformed logarithmically, improving the distributions substantially.

Derivation of alcohol demand curves generated prototypic consumption and expenditure data. Topographically, demand for alcohol decreased as a function of increasing price (Fig. 1), with full suppression of consumption observed for all participants following both exposures. In parallel, expenditure initially exhibited dramatic increases as price increased, but peaked and then decreased to zero, generating the characteristic inverted U-shaped curve (Fig. 1). The normalized demand equation provided an excellent fit to the demand data (neutral median $R^2 = 0.94$, IQR = 0.88–0.98; alcohol median $R^2 = 0.93$, IQR = 0.88–0.98). The indices of demand were related to each other heterogeneously, with associations ranging from negligible to high-magnitude (Table 1). Income was associated significantly only with observed P_{max} and was included as a covariate in subsequent analyses of that variable.

RESULTS

Effects of alcohol cues on motivation for alcohol

The neutral cues and alcohol cues demand and expenditure curves are presented in Fig. 1 and cue exposure effects (neutral versus alcohol cues) are presented in Table 2. One-way within-subjects ANOVAs revealed significantly greater craving following exposure to alcohol cues compared to neutral cues, a near significant effect on positive affect, and no effect on negative affect and salivation. In terms of demand for alcohol, compared to neutral cues, exposure to alcohol cues resulted in significantly greater intensity, greater O_{max}, higher breakpoint and higher normalized P_{max}. However, analysis of covariance indicated no effect of cue type (alcohol versus water) on observed P_{max}.

Relationship between subjective craving and alcohol demand

Because the alcohol stimuli elicited significant increases in craving and the indices of demand, cross-sectional correlations and correlations between changes were conducted between those variables (Table 3). The associations were of similar magnitude following both cue types and had variable levels of overlap, sharing ~4–19% of variance. With regard to the cue-elicited changes, only changes in intensity and O_{max} correlated significantly with changes in craving, sharing ~4% of variance. Changes in the other demand indices were not associated with craving.

DISCUSSION

The objective of this study was to test the hypothesis that exposure to alcohol cues, eliciting an increase in craving for alcohol, would increase the relative value of alcohol concomitantly as measured by several behavioral economic indices of alcohol demand. This hypothesis was largely supported. Compared to neutral cues, alcohol cues provoked a potent increase in experiential craving and increases in demand at four key topographical aspects of the demand curve. Participants reported that they would drink more under conditions of no cost (intensity of demand), they would spend more money in total on alcohol (O_{max}) and they would persist in drinking to higher prices (breakpoint). In addition, alcohol cues shifted the price at which demand became elastic to higher levels, as measured by normalized P_{max}. This evidence of a state-dependent increase in the relative value of alcohol is consistent with a behavioral economic theoretical approach to craving [28,29] and extends previous correlational studies in this area [33,36]. It was also of interest that alcohol cues had limited effects on affect and

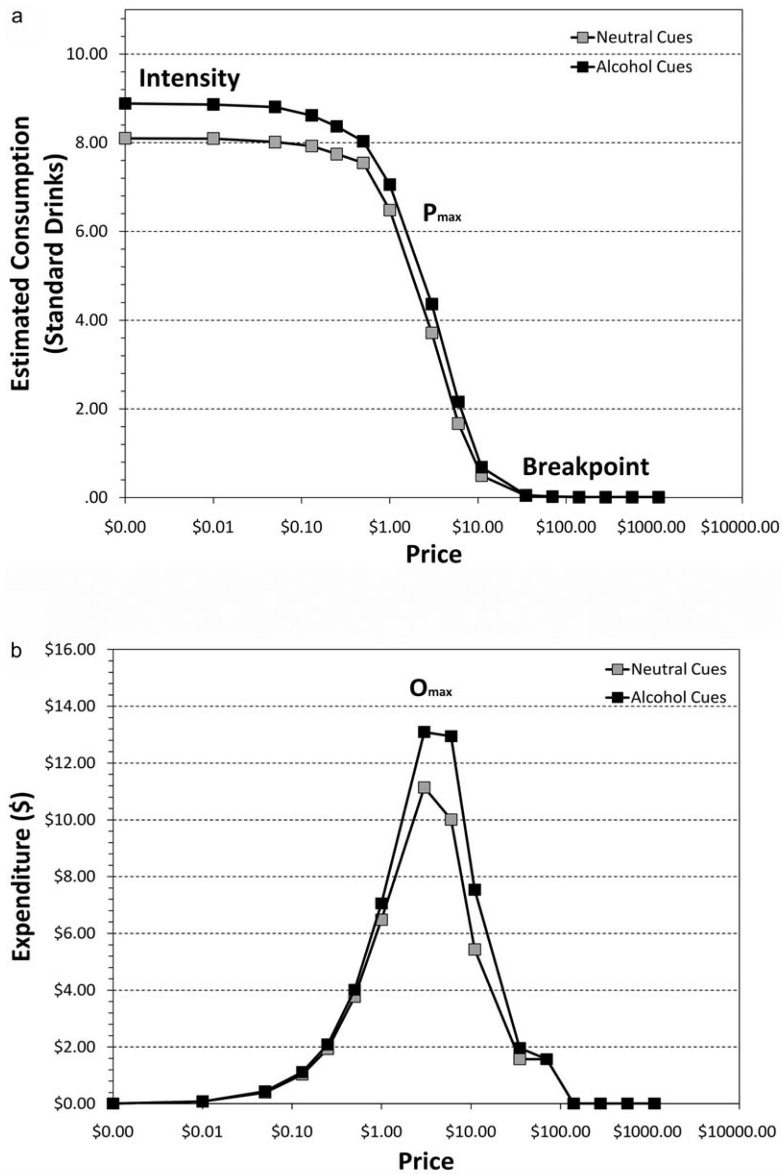

Figure 1 Alcohol demand curves following controlled exposure to neutral (water) and alcohol cues. Intensity refers consumption under zero or minimal cost; P_{max} refers to the price at which demand becomes elastic (the rate of consumption decreases is greater than the rate of price increases); breakpoint refers to the price at which consumption is suppressed to zero; O_{max} refers to maximum expenditure in dollars and corresponds with the P_{max} price. (a, b) The alcohol demand and expenditure curves, respectively. Note that the logarithmic coordinates obscure the effect of cues on breakpoint

Table 1 Correlations among indices of demand, alcohol-related variables, and income following exposure to neutral cues and alcohol cues.

	Neutral cues							*Alcohol cues*						
	1	*2*	*3*	*4*	*5*	*6*	*7*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Intensity	1							1						
O_{max}	0.59**	1						0.60**	1					
P_{max}-O	0.31**	0.81**	1					0.13	0.64**	1				
P_{max}-N	0.69**	0.92**	0.83**	1				0.53**	0.73**	0.62**	1			
Breakpoint	0.50**	0.87**	0.87**	0.96**	1			0.49**	0.81**	0.72**	0.80**	1		
Income	−0.13	0.14	0.24*	0.06	0.10	1		−0.13	0.19	0.34**	0.12	0.10	1	
AUDIT	0.09	−0.09	−0.04	0.01	0.05	0.08	1	0.12	−0.05	0.01	0.11	−0.02	0.08	1
D/W	0.38**	0.16	0.02	0.16	0.05	−0.05	0.41**	0.44**	0.18	−0.08	0.22*	0.10	−0.05	0.41**

O_{max}: output maximum; P_{max}-O: observed price maximum; P_{max}-N: normalized price maximum; AUDIT: Alcohol Use Disorders Identification Test; D/W: drinks/week. *$P < 0.05$; **$P < 0.01$. Base-10 logarithmic transformations were conducted with O_{max}, the P_{max} indices and breakpoint.

Table 2 Comparisons of craving, affect, salivation and behavioral economic measures of demand following exposure to neutral cues and personally-relevant alcohol cues.

	Neutral cues		*Alcohol cues*				
	M	*SEM*	*M*	*SEM*	*F*	*P*	η_p^2
AUQ	26.02	1.23	34.01	1.37	90.83	<0.0001	0.51
PANAS-positive	28.11	0.85	28.83	0.91	3.09	0.08	0.03
PANAS-negative	13.74	0.37	13.69	0.45	0.03	0.87	0.00
Salivation	4.82	0.19	4.63	0.20	2.24	0.14	0.03
Intensity	8.10	0.475	8.89	0.51	21.98	<0.0001	0.20
O_{max}	13.32	1.09	15.85	1.25	28.02	<0.0001	0.24
P_{max}-N	0.30	0.04	1.00	0.32	21.49	<0.0001	0.20
P_{max}-O	4.86	0.74	5.65	0.83	0.60	0.44	0.01
Breakpoint	17.99	1.73	20.17	1.78	16.50	<0.001	0.16

AUQ: Alcohol Urge Questionnaire; PANAS: Positive and Negative Affect Schedule; O_{max}: output maximum; P_{max}-O: observed price maximum; P_{max}-N: normalized price maximum. Non-transformed values are presented for interpretational clarity. Degrees of freedom (df) were 1, 88 for all variables with the exception of P_{max}-O (df = 1, 75) due to some participants not reporting income. SEM: standard error of the mean.

Table 3 Correlations between facets of demand and craving after exposure to neutral cues and exposure to alcohol cues.

	Experiential craving		
Demand index	*Neutral cues*	*Alcohol cues*	*Δ Craving*
Intensity	0.40***	0.43***	0.23*
O_{max}	0.26**	0.32**	0.24*
P_{max}-O	0.22*	0.21*	0.17
P_{max}-N	0.34***	0.28**	0.04
Breakpoint	0.27**	0.29**	0.16

O_{max}: output maximum; P_{max}-O: observed price maximum; P_{max}-N: normalized price maximum; *$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$. In addition, correlations between change in demand measures and change in craving scores are presented.

anticipatory salivation. This is somewhat surprising, but is consistent with the larger literature, in which cue-elicited effects other than craving vary considerably by sample [47]. Furthermore, in this case, the absence of collateral effects actually indicates that indices of alcohol demand were evidently more sensitive to the effect of alcohol cues than affect or salivation and the observed changes were clearly not dependent upon those variables.

The continuous analyses revealed that subjective craving and the indices of demand were correlated moderately positively, which is consistent with the notion that experiential urge to drink is reflected in the relative value of alcohol. These relationships were also consistent within the study, with highly similar levels of association during the assessments following the neutral cues and alcohol cues. However, there are two important nuances to these findings. First, the observed cross-sectional correlations were statistically significant but of moderate magnitude, reflecting on average only ~10% of shared variance. Secondly, the changes in craving and alcohol demand were not correlated highly within individuals. Indeed, significant correlations between changes in craving and changes in demand were evident for only two of the four indices of demand that increased significantly, and those correlations were of modest magnitude. Together, these findings suggest that the experience of craving and attributions of the value of alcohol are related to each other but not redundant with one another. More broadly, these findings support the hypothesis that phasic changes in subjective value along with changes in cravings may underlie the preference reversals that are common to addictive behavior [28]. That is, the results support the notion that an individual's preference for sobriety under neutral conditions may be undermined by drug-related cues that dynamically increase cravings as well as the value of the drug relative to other behavioral options.

Perhaps the most important implication of these findings is that these demand curve indices may complement subjective craving in future laboratory and clinical studies, where craving alone has been associated with inconsistent findings [4,5]. Historically, behavioral economics has applied a molar behavioral analytical framework, emphasizing addictive behavior within a domain of alternative behaviors [48–50], whereas craving has been been studied primarily as an internal (molecular) determinant of addictive behavior. As such, the current methods provide multiple indices of value that may both improve incrementally upon measuring craving alone and contribute to bridging the gap between molar and molecular accounts of motivation. However, this possibility should be tempered by a number of considerations. In the first place, the current study did not have an alcohol consumption period, meaning that the incremental predictive utility of demand indices remains an empirical question. The current findings reflect proof of concept that alcohol cues increase the value of alcohol, but are by no means definitive of the incremental utility or superiority of these indices. In addition, it was notable that the magnitudes of effects for all the behavioral economic indices were smaller than for subjective craving, indicating that incremental utility in future studies will require smaller differences having greater meaningfulness. Finally, alcohol demand was assessed based on estimated APT consumption as opposed to actual consumption. A relatively large literature has demonstrated close correspondence between performance on behavioral economic tasks for hypothetical and actual outcomes [51–55]; however, whether the same results would be present for a paradigm using alcohol itself could not be addressed in the current study. These issues should be addressed in future studies.

In terms of applying these findings, discerning which of the indices are likely to be most complementary is an important question and one that can be addressed to an extent in the current data. The effects of alcohol cues were of largest magnitude for O_{max}, intensity and normalized P_{max}. This provides initial evidence that these three variables may be the most promising, but they are also correlated significantly, making specificity among them hard to address. One possibility is that normalized P_{max} may provide a unique perspective on motivation because it is a derived index of price sensitivity that is a more implicit dimension of participant performance and, in contrast to intensity and O_{max}, it was not correlated significantly with changes in craving. At this point, however, that possibility must remain speculation. In addition, an issue that cannot be addressed, but is certainly of interest, is whether a systematic demand curve analysis procedure is necessary experimentally. Intensity, O_{max}, and breakpoint could all, conceivably, be assessed in single-item measures and it is possible that a shorter behavioral economic assessment might be sufficient and more efficient. This prospect must also remain speculative at this point.

Another important consideration is that although the findings are consistent with the theoretical approach applied, there are ambiguities and alternative explanations. It is recognized increasingly that decision-making involves elements of both value and probability of access [56]. As such, it is possible that, rather than being related directly to value, the cues effects were a function of their historical association with increased probability of access to alcohol, even though participants could not drink in the current study. A related consideration is that the perceived unavailability of alcohol may have affected cue-reactivity. Several recent studies have suggested that availability may be encoded with more explicit drug cues, diminishing cue-reactivity in its absence [57–59], or may result in frustration, reflecting prediction error, potentially augmenting reactivity [60–63]. These different accounts reflect the fact that the role of availability in cue-reactivity has not been characterized definitively. None the less, in both cases, because participants were not permitted to drink the alcohol presented, availability cannot be ruled out as exerting an influence in this study. A final consideration is that the sample was comprised of heavy collegiate drinkers who were not assessed explicitly for alcohol use disorders, limiting the generalizability to an extent. A similar pattern of findings would be predicted in diagnosed individuals, but it is also possible that meaningful differences might also be observed. With regard to each of these issues, the charge for future studies is to disentangle more explicitly the operative underlying mechanisms and to examine more directly the role of alcohol use disorder status.

Taken together, the current study found evidence that alcohol-related cues concomitantly increased craving and demand for alcohol according to a number of indices. Although a number of considerations apply, these findings reveal a potentially important and useful economic dimension to cue-elicited craving for alcohol.

Declarations of interest

None.

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