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University-Affiliated Alcohol Marketing Enhances the Incentive Salience of Alcohol Cues

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Abstract

We tested whether affiliating beer brands with universities enhances the incentive salience of those brands for underage drinkers. In Study 1, 128 undergraduates viewed beer cues while event-related potentials (ERPs) were recorded. Results showed that beer cues paired with in-group backgrounds (logos for students' universities) evoked an enhanced P3 ERP component, a neural index of incentive salience. This effect varied according to students' levels of identification with their university, and the amplitude of the P3 response prospectively predicted alcohol use over 1 month. In Study 2 (N = 104), we used a naturalistic advertisement exposure to experimentally create in-group brand associations and found that this manipulation caused an increase in the incentive salience of the beer brand. These data provide the first evidence that marketing beer via affiliating it with students' universities enhances the incentive salience of the brand for underage students and that this effect has implications for their alcohol involvement.

Keywords

event-related potentials, alcohol marketing, incentive salience, in-group affiliation, marketing, open data

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The need to belong to a valued social group is among the most powerful motivating forces in human life (Baumeister & Leary, 1995). Humans have evolved psychological mechanisms that bias feelings toward those with whom they share group memberships (Caporael & Baron, 1997), producing positive in-group evaluations (Maass, Ceccarelli, & Rudin, 1996; Pinter & Greenwald, 2011) and causing the perception of in-group members to shift attitudes (Norton, Monin, Cooper, & Hogg, 2003), behavior (Lakin, Chartrand, & Arkin, 2008), and motivation (Loersch, Aarts, Payne, & Jefferis, 2008) toward in-group norms.

Marketers routinely affiliate their products with social groups (e.g., Bergkvist & Bech-Larsen, 2010; Cornwell & Coote, 2005). People's tendency to confer feelings of trust and safety to their in-groups (Brewer, 2008) provides marketers with the opportunity to implicitly convey that their products are safe, trustworthy, and endorsed by the group. In many cases, this tendency is innocuous, but it can be problematic if the product is potentially dangerous. Alcohol misuse among college students causes nearly 2 million injuries each year (A. White & Hingson, 2013). Hence, marketing efforts that affiliate alcohol brands with students' universities have potentially dangerous consequences.

Alcohol manufacturers use various means to associate themselves with universities, including advertising during college sports broadcasts (Center on Alcohol Marketing and Youth, 2010). Current alcohol-marketing efforts explicitly affiliate brands with universities via licensing agreements that permit corporations to use trademarked

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university symbols (e.g., the University of Missouri's "Power Tiger" athletics logo and official school nickname, "Mizzou") in their advertisements and product displays. Given that students often strongly identify with their institutions (e.g., Cialdini et al., 1976) and seemingly confer feelings of safety to university-themed beer (Loersch & Bartholow, 2011), such efforts have the potential to encourage harmful drinking practices.

Beyond their association with trust and safety, in-group-affiliated stimuli can rapidly capture attention (e.g., Dickter & Bartholow, 2007; Kawakami et al., 2014). In-group cues are inherently motivationally significant, given their ability to signal potential rewards in the form of social cohesion and shared resources (Correll & Park, 2005; Pickett, Gardner, & Knowles, 2004). This property is particularly important in the context of in-group-alcohol affiliations, given that alcohol's motivational significance strongly determines its addictive potential (see Robinson & Berridge, 1993). In other words, the pairing of alcohol with in-group stimuli has the potential to enhance its motivational significance, or *incentive salience*, particularly for individuals who strongly identify with their in-group.

The purpose of the current research was to characterize the effects of in-group (i.e., university-themed) beer marketing on the incentive salience of beer cues for underage drinkers and to investigate the extent to which such effects can predict changes in alcohol involvement. Incentive salience was measured using the amplitude of the P3 (i.e., P300) component of the event-related potential (ERP) elicited by beverage cues. P3 amplitude varies along with the incentive value of eliciting stimuli (Begleiter, Porjesz, Chou, & Aunon, 1983; Nieuwenhuis, Aston-Jones, & Cohen, 2005), and numerous studies have shown that P3 amplitude elicited by images of alcohol signifies risk for heavy drinking (Bartholow, Henry, & Lust, 2007; Littel, Euser, Munafò, & Franken, 2012). Recent evidence links P3 amplitude to ventral striatum activation (Pfabigan et al., 2014), underscoring its significance as an index of motivational salience. Given that cues to in-group membership are also highly salient, we predicted that an in-group context would exaggerate the incentive salience of beer cues, reflected in larger P3 amplitude relative to beer cues presented in a neutral out-group context.

Further, we predicted that this in-group context effect would vary according to individual differences in identification with the in-group. Drinking is a salient part of the self-schemas of many students, for whom college attendance is stereotypically associated with drinking (Ashmore, Del Boca, & Beebe, 2002), and college students drink more than their age-matched peers (Slutske, 2005). Furthermore, the strength of group identification moderates the relationship between perceived norms for that group and its members' drinking (Neighbors et al., 2010). Thus, we reasoned that as in-group identification increases, so too should the incentive salience of alcohol in an in-group context. Finally, we predicted that the P3 elicited by beer cues would uniquely predict future alcohol use and that this effect would be amplified for beer cues presented in an in-group context. (More extensive rationale for this prediction is provided in the Supplemental Material available online.) Importantly, we do not contend that exposure to in-group beer stimuli in the lab causes differences in alcohol use. Rather, we predicted that the incentive salience of in-group beer cues would vary across individuals, which we view as analogous to their susceptibility to this type of alcohol marketing more generally.

Water-related cues were used as comparison stimuli. We also expected water cues to elicit larger P3s in an in-group versus an out-group context because, like beer, water is also a consumable, appetitive commodity with incentive value, which also should be amplified by in-group context. Critically, however, we did not expect the P3 elicited by water cues to be moderated by in-group identification or to predict future alcohol use.

Study 1

The first study consisted of two experiments, run concurrently at the University of Missouri (MU) and University of Colorado (CU), which involved an initial lab session and a 30-day follow-up. Participants at both sites completed versions of the same laboratory task—the tasks differed only in the stimuli used to represent in-group and out-group universities—and completed identical self-report measures. The labs in both locations were identically equipped, which controlled for variability across labs that could affect data quality. Different out-group stimuli were used at the two sites to ensure that effects of interest were not limited to a specific perceptual or group contrast; at the MU site, the out-group (University of Toronto) was represented by different colors than the in-group, whereas at the CU site, the out-group (Appalachian State University) and in-group were represented by a similar color scheme (see Fig. 1). These out-groups were selected because they do not typically compete for students (or in athletics) with the in-group institutions.

Method

Participants. Participants were recruited via introductory-psychology subject pools and with posted flyers and e-mail announcements that advertised the opportunity for currently enrolled, underage undergraduates (age = 18–20 years) to participate in research investigating brain

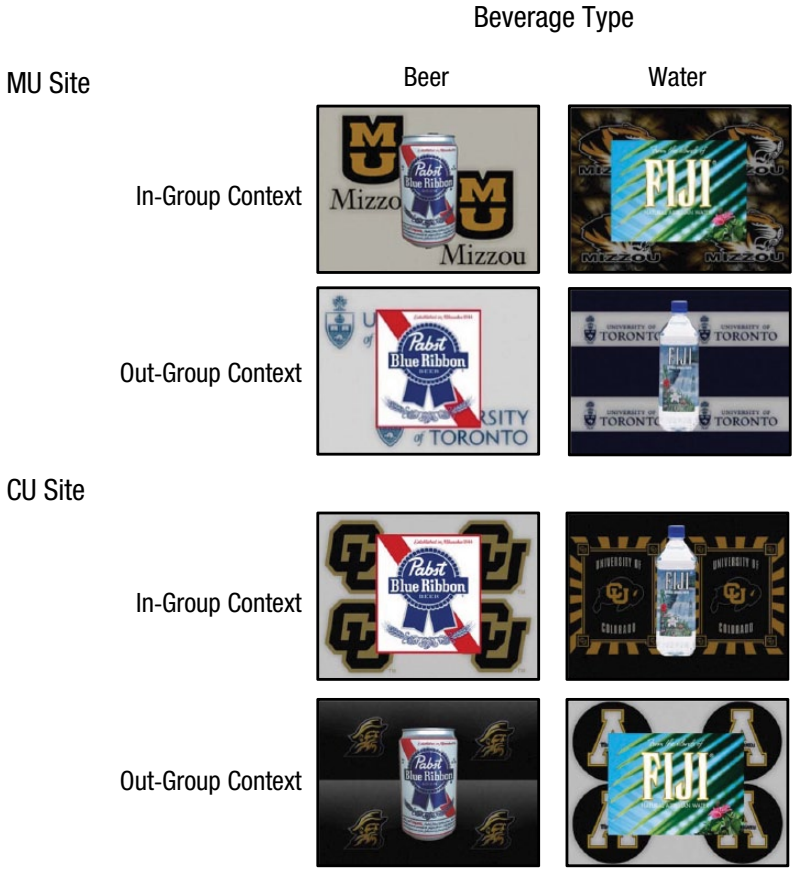

Fig. 1. Example oddball stimuli used in Study 1. Oddball stimuli consisted of images of beer and bottled water, which were presented against background images from either the participant's school (in-group context) or another school (out-group context). Testing occurred at the University of Missouri (MU) and University of Colorado (CU).

responses and health behaviors. Interested students contacted the lab, and a research assistant administered a brief screening interview via telephone. Individuals reporting a history of head trauma (leaving them unconscious for > 2 min), neural surgery, or neurologic disorder or who were taking psychoactive medication were disqualified, as were individuals who wore a hairstyle (e.g., dreadlocks, cornrows) that would prevent electrode placement on the scalp. Students who had not consumed alcohol in the past year or who typically consumed more than 24 drinks per week (indicative of potential alcohol use disorder) were ineligible. The sample included 72 students at MU and 56 students at CU ($N = 128$), all of whom were 18 to 20 years old and roughly half (52%) of whom were women. Self-reported racial category was 82% White (including 4% Hispanic/Latino), 9% Black, 5% multiracial, 3% Asian, and less than 1% other. Participants received either $15 per hour or partial course credit (if enrolled in introductory psychology) for the laboratory session and an additional $20 (or additional credit) for completing the follow-up survey.

No previous studies have reported effects of in-group (vs. out-group) affiliation on P3 responses. Thus, sample size was estimated from power calculations based on effect sizes from prior studies using similar alcohol cue-presentation paradigms and predicting alcohol use prospectively with alcohol-cue-elicited P3 amplitude (e.g., Bartholow et al., 2007; Bartholow, Lust, & Tragesser, 2010). However, because effect sizes in those prior studies (e.g., $d = 0.89$, partial $R^2 = .09$) were likely overestimated because of small sample sizes (Ns = 46), we sought here to more than double the sample size to help ensure more accurate estimates.

Measuring the incentive salience of beverage cues.

P3 responses to beverage cues. Neural responses to beer and water presented in in-group and out-group university contexts were measured during a visual oddball

task (adapted from Bartholow et al., 2007). Participants saw infrequent beer and water logos superimposed on university backgrounds (i.e., the oddballs; see Fig. 1) amid more frequent neutral images (the standards) drawn from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). (Details concerning the specific IAPS images used can be found in the Supplemental Material.) Participants' task was to categorize each image as either pleasant or neutral using one of two buttons. These stimuli were presented in five-image sequences, with the oddball always occurring in the fourth or fifth position. Each image was presented in the center of the display for 1,000 ms, with an interstimulus interval varying randomly (to reduce anticipatory processes) between 1,500 and 2,100 ms.

The oddballs formed a 2 (beverage type: beer vs. water) × 2 (beverage context: in-group vs. out-group) within-participants design.[1] These cells were represented by two images each, and each oddball image appeared on 32 separate trials. (Note that participants saw all possible combinations of logo vs. can/bottle and in-group vs. out-group context images; the specific combinations shown in Fig. 1 are merely examples.) On an additional 32 trials, all five images were neutral (standards), to permit estimation of the oddball effect and further reduce anticipatory responses. Thus, a total of 160 five-picture trials (800 images) were presented. Trials were equally divided into four blocks, and participants were given a brief break between blocks.

Electroencephalogram (EEG) recording. The EEG was recorded continuously from 40 standard scalp locations (American Clinical Neurophysiology Society, 2006) using tin electrodes in an electrode cap (Electro-Cap International, Eaton, OH). Scalp electrodes were referenced online to the right mastoid and re-referenced off-line to an average of the two mastoids. Additional electrodes were placed near the eyes to record vertical and horizontal eye movements. Electrode impedances were kept below 8 KΩ. The EEG signal was amplified by NeuroScan SynAmps[2] amplifiers (Compumedics, Charlotte, NC), digitized at 500 Hz, and filtered on-line using a 0.05 to 40 Hz band-pass. Off-line, blinks were removed from the EEG using a regression-based procedure (Semlitsch, Anderer, Schuster, & Presslich, 1986), after which stimulus-locked epochs of 1,100 ms (including a 100-ms prestimulus baseline) were created. Epochs were baseline-corrected and then visually inspected for remaining artifacts; epochs containing significant drift or artefactual voltage deflections at all electrodes of interest for the current analyses were discarded.

Averages were created for each participant at each electrode according to the stimulus conditions of interest and then low-pass filtered at 12 Hz. Conditions containing fewer than 20 artifact-free trials for a given participant were discarded for that individual (M = 29.9 valid trials per condition). As in prior research using a similar paradigm (e.g., Bartholow et al., 2007), the P3 was most pronounced 400 to 600 ms after stimulus presentation, primarily at parietal and occipital scalp locations. Thus, P3 amplitude was quantified as the average voltage occurring during this epoch at 13 electrodes in this region (P3, P1, Pz, P2, P4, PO5, PO3, POz, PO4, PO6, O1, Oz, and O2).

Questionnaire measures administered in the lab.

University Identification Questionnaire (UIQ). Individual differences in the strength of identification with the university were assessed using the nine-item UIQ (Loersch & Arbuckle, 2013). Modeled after other in-group identification measures (e.g., Tropp & Wright, 2001), the UIQ provides an index of the degree to which students' university affiliation is a salient and meaningful part of their identity. Sample items include, "Knowing that I am a student at my university tells others a lot about me" and "How important is being a student at your university to you?" Responses were made on 7-point Likert-type scales ranging from 0 (*strongly disagree/not at all*) to 6 (*strongly agree/very much*). UIQ scores were calculated as the mean response averaged over all nine items (α = .81). The full UIQ is available in the Supplemental Material (Table S1).

Alcohol-related measures. Past-year quantity and frequency of alcohol consumption were assessed using items recommended by the National Institute on Alcohol Abuse and Alcoholism (2003). An alcohol quantity-frequency score (AlcQF), representing typical alcohol use per week over the past year, was calculated for each participant as the product of two items: (a) "During the last 12 months, how often did you usually have any kind of drink containing alcohol?" and (b) "During the last 12 months, how many alcoholic drinks did you usually have on a typical day when you drank alcohol?"

Alcohol-related expectancies were measured using the brief form of the Comprehensive Effects of Alcohol (CEOA) scale (Fromme, Stroot, & Kaplan, 1993). The brief CEOA comprises 15 items describing commonly experienced effects of alcohol, rated in two ways. First, respondents indicate the extent to which they expect each effect to happen to them ("If I were under the influence of alcohol . . .") using the response options *disagree, slightly disagree, slightly agree*, and *agree* (scored −2, −1, 1, and 2, respectively). Sample items include "I would feel calm," "I would enjoy sex more," and "I would feel courageous." Second, respondents evaluate the extent to which each of these effects is bad or good, using the response options *bad, slightly*

bad, neutral, slightly good, and *good* (scored −2, −1, 0, 1, and 2, respectively). The Expectancy scale (i.e., CEOA-exp) and Evaluation scale (CEOA-eval) both showed acceptable internal consistency in this sample (αs = .67 and .73, respectively).

Adverse consequences from drinking were assessed using the 23-item Rutgers Alcohol Problems Index (RAPI; H. R. White & Labouvie, 1989). Participants were asked to indicate the number of times during the past year they have experienced a number of negative outcomes while drinking or as a result of drinking. Sample items include "Got into fights with people" and "Caused shame or embarrassment to someone." Responses are made using a 4-point scale with the response options 0 (*none*), 1 (*1–2 times*), 2 (*3–5 times*), and 3 (*more than 5 times*). For each participant, a total RAPI score was calculated as the sum of his or her responses to all 23 items (α = .84). The RAPI has good test-retest reliability (Miller et al., 2002).

Follow-up assessment. Approximately 1 month following the lab session (M = 32 days, SD = 5), participants were asked to provide data on their alcohol use and related experiences since the laboratory session. A version of the same alcohol use items given at baseline was administered, modified to refer to the past month (e.g., "Since you participated in the laboratory session about a month ago, how often did you usually have any kind of drink containing alcohol?"). A follow-up AlcQF variable was calculated from these responses.

Procedure. Participants provided informed consent, were fitted with the electrode cap, and then completed the self-report measures. Next, participants completed the visual oddball task while the EEG was recorded. The electrode cap was then removed, and an additional set of tasks and questionnaire measures not of central interest to the hypotheses investigated here were administered (see the Supplemental Material for details). Participants were then debriefed about this portion of the study, thanked, and dismissed. One month later, participants were sent a link to the online survey querying their drinking behavior since the laboratory session. Participants who did not complete the follow-up survey within 3 days of receiving this initial e-mail were sent a reminder. Subsequently, all participants were sent a final e-mail containing a full debriefing and information concerning their compensation.

Analytic approach. Five participants were eliminated from the MU sample because of problems with EEG recording (falling asleep, data recording errors). Two additional MU participants were eliminated because they reported no alcohol use during the past year, and 1 withdrew from the study, leaving a final MU sample of 64 students (19 males, 45 females; mean age = 19.05 years). Six participants were eliminated from the CU sample because of problems with their EEG data, leaving a final CU sample of 50 students (29 males, 21 females; mean age = 19.08 years). Four additional CU and 2 additional MU participants failed to complete the follow-up survey. These individuals did not differ significantly from those who completed the study on any of the other dependent measures or demographic variables (all ts and χ^2s < 1).

To account for the multilevel nature of the ERP data, we analyzed quantified P3 amplitudes using multilevel models with restricted maximum-likelihood estimation (see Kristjansson, Kircher, & Webb, 2007). Electrode locations were nested within participants. Following recent recommendations (see Selya, Rose, Dierker, Hedeker, & Mermelstein, 2012), we computed estimates of local effect size as f^2 (Cohen, 1988). Additional details concerning the multilevel modeling approach are given in the Supplemental Material. Histogram distributions of alcohol use (i.e., AlcQF) measured at both baseline and follow-up indicated that these variables were positively skewed. Thus, both variables were log-transformed for analyses. UIQ scores were mean-centered to zero prior to creation of cross-product terms.

Results

Sample characteristics. We took two steps to determine whether relevant measures were similar across the two research sites. First, mean levels of the measured variables of interest were compared across sites (see Table 1); no significant differences were found. Next, to determine whether effects of in-group context on motivated attention responses to beverage cues represent general phenomena that are not specific to a given set of stimuli or group of participants, a set of ancillary multilevel models including data collection site as a categorical predictor of primary outcomes were tested. As described in the Supplemental Material (and see Fig. S1), responses to the manipulations and their interactions with measured variables of interest were similar across the two sites. Thus, data were collapsed across site in our primary analyses.

P3 amplitude.

Base model. The hypothesis that an in-group context would enhance the motivational significance of beer cues was tested using a 2 (beverage type: water = 0, beer = 1) × 2 (beverage context: out-group = 0, in-group = 1) factorial multilevel model with random intercepts specified for participants and electrodes within participants.

ERP waveforms elicited in these four conditions are given in Figure 2. This model showed a significant main effect of beverage context, $F(1, 4286) = 254.4$, $b = 1.35$,

Table 1. Means of Primary Variables in Study 1 as a Function of Data-Collection Site

Variable	Data-collection site: University of Missouri	Data-collection site: University of Colorado	Comparison of means
AlcQF at baseline	9.37 (8.45)	9.46 (9.64)	$t(112) = 0.05$
AlcQF at follow-up	9.28 (9.22)	9.91 (11.54)	$t(109) = 0.64$
RAPI score	9.30 (6.62)	7.96 (6.52)	$t(112) = 1.08$
UIQ score	4.31 (0.96)	3.98 (0.92)	$t(112) = 1.83^{\dagger}$
P3 amplitude (μV)	9.36 (6.13)	9.51 (5.10)	$t(4289) = 0.07$

Note: Standard deviations for means are given in parentheses. Alcohol quantity-frequency (AlcQF) was measured by the number of drinks per week in the past 12 months (baseline) or past month (follow-up). The Rutgers Alcohol Problems Index (RAPI) assessed alcohol-related negative consequences. UIQ = University Identification Questionnaire.
$^{\dagger}p < .10$.

$SE = 0.10$, $p < .001$, $f^2 = .06$, indicating that beverage cues elicited larger P3 amplitude in an in-group context ($M = 9.92$ μV, $SD = 5.05$) than in an out-group context ($M = 8.83$ μV, $SD = 4.84$). This effect was qualified by a significant Beverage Type × Beverage Context interaction, $F(1, 4286) = 15.2$, $b = -0.53$, $SE = 0.14$, $p < .001$, $R^2 = .003$. Although there were significantly larger P3s in in-group than out-group contexts for both beer stimuli (mean change = 0.82 μV) and water stimuli (mean change = 1.35 μV), ts(4286) = 8.5 and 14.1, ps < .001, respectively, this beverage-context effect was stronger for water stimuli, $t(4286) = -3.81$, $p < .001$, 95% confidence interval for the effect of in-group versus out-group context for water stimuli = [−.55, .35]. The main effect of beverage type was not significant $F(1, 4286) = 2.24$, $p = .134$, $f^2 = .001$.

Moderation by UIQ. To test the prediction that the strength of participants' identification with their universities moderates the extent to which the in-group context enhances the incentive salience of beer cues, UIQ scores (mean-centered) were added as a predictor to the Beverage Type × Beverage Context multilevel model described previously, including all interactions involving UIQ, beverage type, and beverage context. This model showed a number of significant interactions involving UIQ, all of which were qualified by the predicted Beverage Type × Beverage Context × UIQ interaction, $F(1, 4283) = 18.74$, $b = 0.61$, $SE = 0.14$, $p < .001$, $f^2 = .0055$. We probed this interaction by examining the simple slopes of the association between UIQ scores and P3 amplitude in each of the four stimulus conditions. As Figure 3 shows, and as predicted, P3 responses to in-group beer were strongly related to UIQ scores ($b = 1.69$, $SE = 0.47$), $t(4287) = 3.60$, $p < .001$, with P3 responses to beer shown with an in-group background increasing as a function of in-group identity. By contrast, P3 responses to the other stimulus types were only marginally associated with this variable—out-group beer: $b = 0.81$, $SE = 0.47$, $t(4287) = 1.74$, $p = .082$; in-group water: $b = 0.86$, $SE = 0.47$, $t(4287) = 1.84$, $p = .067$; out-group water: $b = 0.58$, $SE = 0.47$, $t(4287) = 1.24$, $p = .214$.

Drinking behavior during the follow-up interval. As with most behaviors (see Aarts, Verplanken, & van Knippenberg, 1998), past drinking is often the best predictor

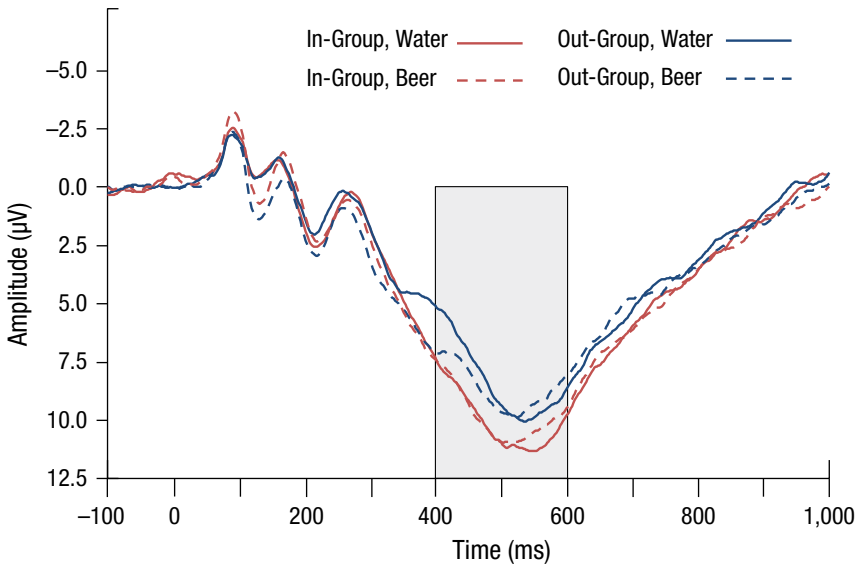

Fig. 2. Stimulus-locked event-related potential (ERP) waveforms from Study 1, shown as a function of beverage type (water vs. beer) and beverage context (in-group vs. out-group). The shaded area indicates the measurement window used for P3 amplitude quantification (400–600 ms). ERPs shown here were measured at electrode Pz (midline parietal location).

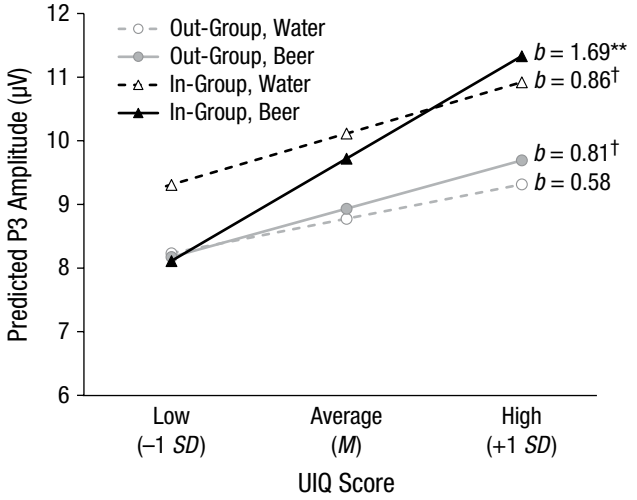

Fig. 3. Mean predicted P3 amplitude in Study 1, shown as a function of University Identification Questionnaire (UIQ) score, beverage type (water vs. beer), and beverage context (in-group vs. out-group). Symbols indicate significant slopes ($^{\dagger}p < .10$, $^{**}p < .01$).

of future drinking. Of greater interest theoretically is whether other variables account for unique variance in drinking behavior when variance associated with past drinking behavior is accounted for, providing some indication of processes that might determine differences over time. Here, we were interested in whether P3 amplitude elicited by in-group beer stimuli might represent such a process, potentially reflecting susceptibility to university-themed marketing approaches.

To address this question, we submitted AlcQF at Time 2 (log-transformed, zero-centered) to a stepwise regression procedure using forward selection and alpha-to-enter set to .15. Predictor variables included sex, baseline AlcQF (zero-centered), CEOA-exp and CEOA-eval scores, RAPI scores, and P3 amplitudes elicited by in-group beer, in-group water, out-group beer, and out-group water.[2] Tolerances for retained predictors were > 0.88, and variance inflation factors were < 1.14, indicating limited collinearity. Three predictors were retained above the threshold of $p = .15$ (see Table 2). Step 1 established, unsurprisingly, that baseline AlcQF was the strongest predictor of AlcQF at Time 2. Step 2 retained the RAPI scores, suggesting that while controlling for prior alcohol use the number of past-year alcohol-related negative consequences also positively predicted Time 2 alcohol use. Finally, Step 3 retained P3 amplitudes elicited by in-group beer cues, which predicted additional variance in follow-up drinking beyond that accounted for in the first two steps. No other predictors accounted for significant additional variance (all ps > .15). To determine the specificity of the prediction by in-group-beer P3, we tested a number of additional models in which all possible combinations of the P3 variables were included. In each model where in-group-beer P3 was included, it emerged as a significant predictor; in every model that did not include in-group-beer P3, no P3 variables emerged as significant predictors.

Discussion

These findings suggest that pairing beverages with university's logos enhances their incentive salience for underage students at those universities. As predicted, the P3 response to beer was larger when paired with symbols of students' (in-group) universities than when paired with other (out-group) universities. Although the in-group context also increased the P3 to water, that pairing has fewer implications for encouraging harmful behavior. Here, for example, variability in the magnitude of the in-group-beer P3 effect—but not the in-group-water P3 effect—predicted future alcohol use, over and above previous drinking. Considered in the context of previous studies showing that alcohol-cue-elicited P3 predicts alcohol involvement (Littel et al., 2012), these results suggest that marketing beer by paring it with universities increases students' risk for heavy drinking.

Further, the salience of in-group beer cues varied according to participants' identification with their university. This effect was specific to in-group beer: UIQ scores correlated with in-group-beer P3 amplitude but not with that elicited by other targets. This finding suggests that

Table 2. Results From the Stepwise Regression Model in Study 1 Showing Unique Predictors of Alcohol Use During the Month Following the Lab Session

Step	Variable	Model R^2	ΔR^2	b (SE)	95% CI	$t(96)$	p
1	Baseline AlcQF	.333	.333	0.539 (0.091)	[0.357, 0.721]	5.95	< .001
2	Baseline RAPI score	.363	.029	0.031 (0.014)	[0.003, 0.059]	2.24	.027
3	In-group-beer P3	.388	.025	0.031 (0.015)	[0.001, 0.061]	1.99	.049

Note: Baseline alcohol quantity-frequency (AlcQF) was measured by the average number of drinks per week in the 12 months prior to the lab session. The Rutgers Alcohol Problems Index (RAPI) indicated the number of alcohol-related negative consequences experienced during the 12 months prior to the lab session. CI = confidence interval.

underage students with the strongest psychological attachment to their universities might be the most susceptible to marketing approaches aimed at associating alcohol brands with universities.

Study 2

Because Study 1 was limited by its correlational nature, we cannot infer from its findings that exposure to in-group, university-embedded alcohol cues causes increased P3 responses to those cues. Study 2 addressed this limitation by experimentally manipulating the context in which beer advertisements were presented and used a more naturalistic means of placing beer ads in a university context. Participants were randomly assigned to watch basketball game footage featuring either their university's team or another university's team, during which ads for either beer or water were shown. They then completed a picture-viewing oddball task in which brand logos for beer and water were infrequent targets. We predicted that P3 responses to beer logos would be largest for participants who had seen beer ads (vs. water ads) in the context of their own university team's game (vs. an out-group team's game).

Method

Participants. One hundred four CU undergraduates (age = 18–20 years; 46% female) participated in exchange for partial credit in an introductory psychology course (if enrolled) or for payment of $15 per hour. The eligibility criteria and methods used to recruit and screen participants were similar to those used for Study 1, with one exception. Given that effects of our manipulations in Study 1 were most evident among students who more strongly identified with their university, for Study 2, we administered the UIQ as part of a pretesting battery early in the semester and recruited only individuals who responded with a 2 or higher on the 0-to-6 response scale for each of the UIQ's items (indicating moderate to high university identification). Individuals not enrolled in introductory psychology completed the UIQ as part of their eligibility screening protocol. Approximately 82% self-identified as White (including 12% as Hispanic or Latino), 9.4% indicated more than one race, 2% were Asian, 1% were Black, and 5.6% did not indicate a racial or ethnic category.

Materials and procedure. Electrophysiological recording parameters were identical to those used in Study 1. However, the primary tasks were different.

Manipulating the incentive salience of beer cues. Following electrode placement, participants were told that the first part of the experiment involved watching television footage from a basketball game. They were told to simply watch the game and that they would be asked to respond to some questions about the video content at the conclusion of the experiment. Participants were randomly assigned to one of four between-participants conditions, which determined the specific combination of game footage and television ads they viewed. During the 2009–2010 National Collegiate Athletic Association (NCAA) men's basketball season, both MU and CU played games against the University of California. Both games were telecast by ESPN. We obtained both telecasts and edited them to show 4 min of first-half game action during which the home team (MU or CU) was leading. These video segments included three transitions to commercial breaks, the first occurring after approximately 2 min of game action and the others after approximately 1 min each, after which we inserted three 30-s video advertisements as they typically appear during sports telecasts. In all four experimental conditions and in each set of commercials, one ad varied according to condition—either one of three ads for Dasani water (water condition) or one of three ads for Pabst Blue Ribbon beer (beer condition). The other two ads featured products not relevant to the manipulation (e.g., pizza, luxury car, tablet). The manipulated ad was presented immediately after the first basketball segment, last after the second basketball segment, and immediately after the final basketball segment. The combination of game (CU [in-group] or MU [out-group]) and ad content (beer or water) constituted our primary experimental manipulations, resulting in a 2 (game: in-group, out-group) × 2 (ad type: beer, water) between-participants design (*n*s ranged from 25 to 27 per condition).

P3 responses to beverage cues. Following the third video ad, participants were informed that the second part of the study would involve a picture-rating task in which pictures would be shown roughly once per second and that they should attend to and categorize each image as pleasant or neutral using one of two response buttons. The task used to elicit P3 responses to beer and water cues was structured exactly like the one used in Experiment 1, except that the oddballs (Pabst Blue Ribbon and Dasani logos) were shown without any background imagery (i.e., not superimposed over in-group and out-group logos).

As in Experiment 1, averages were created for each participant and electrode according to stimulus conditions and then low-pass filtered at 12 Hz. Conditions containing fewer than 20 artifact-free trials for a given participant were discarded for that individual (M = 29.9 valid trials per condition). Visual inspection of the grand-average waveforms indicated that the P3 was

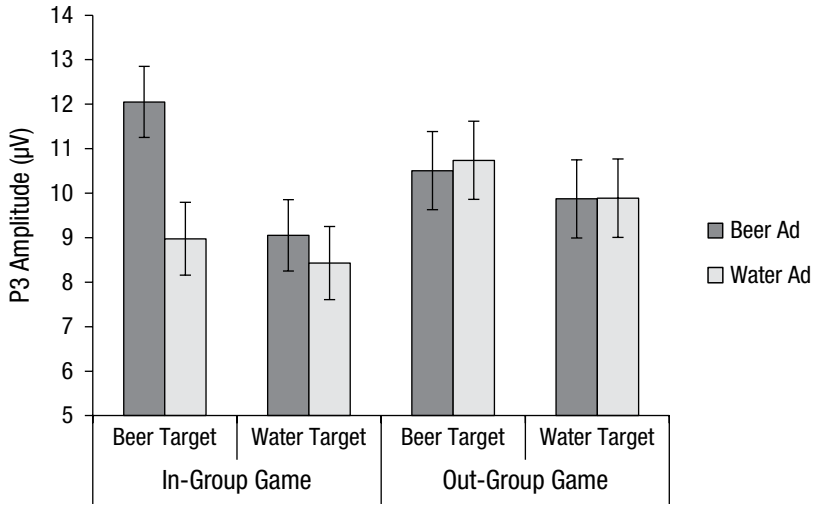

Fig. 4. Mean P3 amplitude in Study 2 as a function of game viewed (in-group vs. out-group), ad viewed (beer vs. water), and oddball target type (beer logo vs. water logo). Error bars represent standard errors of the mean.

most pronounced 400 to 700 ms after stimulus presentation, primarily at parietal and occipital scalp locations. Thus, P3 amplitude was quantified as the average voltage occurring during this epoch at the same set of 13 electrodes used in Experiment 1.

Results

Data from 3 participants were unusable because of a high proportion of EEG artifacts, leaving a final sample of 101 participants. The primary prediction advanced for this study was for a three-way interaction, in which P3 amplitude elicited by beer logos (vs. water logos) would be largest among participants who had seen video ads for beer (vs. water) viewed in the context of their own university team's game (vs. an out-group team's game). This prediction was tested with a 2 (game: in-group, out-group) × 2 (ad type: beer, water) × 2 (target: beer logo, water logo) multilevel model with restricted maximum-likelihood estimation. Electrode locations were nested within participants. The predicted Game × Ad Type × Target interaction was significant, $F(1, 1310) = 40.58$, $p < .0001$, $f^2 = .033$ (see Fig. 4).

To unpack this complex interaction, we computed separate Ad Type × Target interactions for each game condition. Among participants who watched an out-group team game, the Ad × Target Type interaction was not significant, $F(1, 622) = 0.50$, $p = .480$, $f^2 = .001$. For participants who watched an in-group team game, the Ad × Target Type interaction was significant, $F(1, 688) = 73.20$, $p < .0001$, $f^2 = .104$. Follow-up contrasts showed that the P3 elicited by the beer logo was larger among participants who had seen the beer ad ($M = 12.05$ μV) compared with the water ad ($M = 8.98$ μV), $t(134.8) = 2.78$, $p = .006$. In contrast, the P3s elicited by water logos were unaffected by which ad was seen during the game (Ms = 9.05 and 8.43 μV for beer and water ads, respectively), $t(134.8) = 0.57$, $p = .573$. An additional contrast compared the P3 elicited by beer logos among participants who had viewed a beer ad during an in-group team game ($M = 12.05$ μV) versus an out-group team game ($M = 10.51$ μV); this contrast was significant, $t(134.8) = 2.08$, $p = .046$.

Discussion

Through its experimental design, Study 2 showed that exposure to beer ads in an in-group context increases the incentive salience of alcohol cues, providing the first evidence that neural reactivity to alcohol cues can be manipulated via implied associations with a valued in-group. These results provide compelling evidence for the effects of realistic advertising exposure on the incentive salience of a beer brand. To the extent that college students are routinely exposed to ads for particular brands on campus or during university-related telecasts, these findings suggest those brands will be imbued with incentive value, potentially increasing alcohol seeking and consumption.

General Discussion

Universities work hard to reduce alcohol involvement and its related harms among students (see Wolfson et al., 2012); they also strive to increase students' identification with their schools. The current findings suggest that

when university units (e.g., athletics departments) license the use of university-related images to market beer, these efforts might be at cross-purposes. Here, presenting beer in an in-group context—in either an abstract, laboratory-derived way or in a realistic television-advertising setting—enhanced its motivational significance for underage drinkers, and this effect had implications for their alcohol involvement. Moreover, these effects appear largest among the very students universities hope to cultivate—those most strongly identified with their schools—suggesting that these individuals might be more susceptible than their less strongly identified peers to the appeal of university-themed alcohol marketing.

Beyond their implications for understanding this marketing approach, the current findings make a number of other contributions. First, the research deepens understanding of cue reactivity as a marker for addiction risk by highlighting the importance of contextual factors and individual differences. Most cue-reactivity paradigms present cues in isolation from any meaningful context, which fails to represent the ways in which drinking and alcohol marketing actually occur. Using both simple background images implying an association and actual television ads as they typically appear, the current work demonstrated the importance of context for shaping incentive salience. This context-dependent neural response afforded unique prediction of alcohol involvement prospectively. Future research could investigate the extent to which context-dependent P3 reactivity predicts alcohol use in situations specifically related to that context, such as football tailgating.

Previous attempts to identify moderators of substance-cue-elicited P3 response have focused on characteristics of the sample, such as abstinence duration among recovering addicts (Littel et al., 2012). The current research identified characteristics of both the cues (their context) and the participants (in-group identification) that are not directly tied to alcohol use but nonetheless were important moderators, suggesting that broadening the scope of cue-reactivity paradigms can greatly enhance their utility for understanding the neurobiology of risk.

Finally, the present work represents a response to recent calls for understanding problematic drinking by investigating domains of functioning that can be tied to endophenotypes with identifiable neurobiological circuits (see Sher, 2015). A recent review (Litten et al., 2015) listed incentive salience and social processes as two promising candidate domains that should be investigated. The current work addresses this call by testing the importance of social processes on a neurophysiological response linked to incentive salience.

This work also was limited in several respects. Two of the primary hypotheses were correlational in nature, leaving uncertainty as to the existence of causal relationships between in-group identification, cue salience, and changes in drinking. Also, although generally consistent with previous reports (e.g., Bartholow et al., 2007) the prediction of drinking behavior by in-group-beer P3 amplitude was modest; confidence should be tempered until this effect is replicated. We are encouraged by ongoing work in our laboratories (Loersch, Ito, Volpert-Esmond, & Bartholow, 2017) showing a highly similar result using a different cue-exposure paradigm.

In conclusion, this research contributes to the understanding of the neurobiological mechanisms underlying both susceptibility to alcohol marketing and risk for underage alcohol use, and it underscores the importance of social context and social motives in determining the incentive salience of alcohol-related cues. Research of this kind holds promise to translate neurobiologically based theories of motivated behavior to a human laboratory model, ultimately promoting efforts to specify the biological bases of behavior.

Action Editor

Eddie Harmon-Jones served as action editor for this article.

Author Contributions

B. D. Bartholow, C. Loersch, P. Bolls, and T. A. Ito developed the study concept and study design. Data were collected by H. I. Volpert-Esmond, M. P. Levsen, K. A. Fleming, and B. K. Carter. Data were analyzed by C. Loersch, M. P. Levsen, and K. A. Fleming, and findings were interpreted by B. D. Bartholow, T. A. Ito, M. P. Levsen, and C. Loersch. B. D. Bartholow and C. Loersch drafted the manuscript, and T. A. Ito provided critical revisions. All authors approved the final version of the manuscript for submission.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797617731367

Open Practices

All data have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/h67mx/. The complete Open Practices Disclosure for this article can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797617731367. This article has received the badge for Open Data. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

Notes

1. Pretesting data from both research sites indicated that Pabst Blue Ribbon beer and Fuji water were evaluated neutrally by samples drawn from the same populations used here. Also, neither brand had been previously affiliated with either university in marketing campaigns.
2. One hundred participants (38 from CU, 62 from MU) were included in this analysis. Six participants failed to complete the follow-up assessment; 8 others had missing values on one or more predictor variables. Rationale for the stepwise modeling approach is provided in the Supplemental Material.

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