BRIEF REPORT

PSYCHOPHYSIOLOGICAL REACTIVITY TO ALCOHOL ADVERTISING IN LIGHT AND MODERATE SOCIAL DRINKERS

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Abstract — Psychophysiological responses to alcohol and nonalcohol advertising slides were compared in light and moderate social drinkers. Each slide presentation was interspersed with a rest period. Before viewing the slides, participants completed a questionnaire to estimate their quantity and frequency of alcohol consumption. Participants were divided into two groups using a median split of alcohol consumption scores. Light social drinkers showed a significant decrease in heart rate response to both alcohol-related and nonalcohol advertisements. Moderate social drinkers showed a significant increase in skin conductance to both alcohol-related and nonalcohol advertisements. The findings of this study have implications for understanding both the influence of alcohol advertisements on behavior and the psychophysiological correlates of cue reactivity. © 1998 Elsevier Science Ltd

The effect of alcohol advertising on drinking patterns has been a highly debated issue. Atkin, Neuendorf, and McDermott (1983) completed a nationwide survey of 1,200 respondents between the ages of 12 and 22 years. They found a moderate positive correlation among the amount of daily exposure to alcohol advertising, alcohol consumption, and drinking in hazardous situations (e.g., while driving a car). These findings remained after controlling for demographic and interpersonal variables. Atkin et al. (1983) concluded that alcohol advertising appears to contribute to certain forms of problem drinking (also see Aldaf & Kohn, 1989).

Kohn and Smart (1984) examined the impact of television advertising on alcohol consumption in alcoholics and normal controls. Participants viewed a videotape of a soccer game interspersed with zero, six, or nine commercials. Results showed that exposure to the first few commercials increased alcohol consumption, but total alcohol consumption was unaffected by continued exposure to advertising.

McCarty and Ewing (1983) examined alcohol consumption among participants while viewing alcohol advertisements. Specifically, they investigated whether alcohol advertising cues drinking, prompts faster drinking, or prolongs drinking episodes. Although the authors found that alcohol advertisements did not affect the quantity of liquor poured in the mixed drinks, or the rate of drinking, they did conclude that alcoholics who were viewing the advertisements drank for a longer duration than those who did not.

Taken together, these studies suggest that alcohol advertising has a significant but not well-understood influence over drinking patterns. Furthermore, the question remains as to how this influence is exerted. One possible mechanism of action may be alcohol cue reactivity.

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Research investigating cue reactivity suggests that alcoholics develop classically conditioned responses to drinking-related stimuli as a consequence of their long and varied drinking histories (Mackay, Donovan, & Marlatt, 1991; Niaura et al., 1988). These responses include increased urges to drink, craving, and preparatory approach responses (Rohsenow et al., 1994).

If this model is valid, psychophysiological measures should provide potential indices for these cued emotional responses. Pomerleau, Fertig, Baker, and Cooney (1983) compared the psychophysiological responses of 8 alcoholics in treatment with 10 alcoholics not in treatment using cues of smelling their favorite alcoholic beverage and cedar chips. Indeed, results suggested that swallowing and salivation were significantly elevated in alcohol-sniffing trials for alcoholics in treatment. Later studies using similar procedures have consistently found increases in salivation and skin conductance in response to the sight and smell of alcohol in alcoholics (Glautier & Drummond, 1994; Payne et al., 1992; Staiger & White, 1991).

To date, alcohol cues have sometimes elicited increases and sometimes elicited decreases in heart rate (Staiger & White, 1991). Rohsenow, Niaura, Childress, Abrams, and Monti (1990–1991) borrowed from a broader appetitive model and predicted that increases in heart rate should be obtained if a cue reactivity model were applicable to alcoholics. Nonetheless, the empirical findings of cue reactivity and heart rate have not been as consistent as with salivation and skin conductance.

Most studies have examined cue reactivity using the actual sight and smell of alcohol. However, several studies have examined psychophysiological responding to pictures of alcohol beverages to determine whether the cue reactivity model generalizes to these stimuli as well (Eriksen & Gotesom, 1984; Laberg et al., 1992; Stormark, Laberg, Bjerland, & Hugdahl, 1993). In one study, Laberg et al. (1992) found that 83 alcohol-dependent subjects demonstrated significantly greater skin conductance responses to alcohol-related slides than to control slides. In a second study using a control group design, however, Stormark et al. (1993) did not find a cue-specific response to alcohol slides. In this latter study, 20 alcohol-dependent subjects responded with increased skin conductance levels to both alcohol-related and neutral slides relative to the 20 control subjects. They concluded that the alcohol-dependent subjects demonstrated a nonspecific pattern of hyperreactivity rather than a cue-specific one. Therefore, the previous findings are inconclusive as to whether visual stimuli such as pictures serve as a cue for urges to drink and craving. Clearly, additional research is needed.

Specifically, we examined whether a distinct pattern of psychophysiological responding emerges when individuals are exposed to the visual cues of alcohol-related advertising. Most studies in this area have used a clinical sample. The participants used in this experiment were college students divided into light and moderate social drinking groups based on a median split of their scores on a questionnaire of alcohol consumption. This is a reasonable population to use, because alcohol consumption is frequent among college students, and a large percentage can be classified as moderate or heavy drinkers (Carey & Correia, 1997; O’Hare & Tran, 1997).

Specific hypotheses were developed from the recent reviews of the literature on alcohol cue reactivity (Rohsenow et al., 1994; Rohsenow et al., 1990–1991):

1. Moderate social drinkers will exhibit higher skin conductance levels in response to alcohol advertisements relative to nonalcohol beverage advertisements.
2. Moderate social drinkers will exhibit greater heart rate increases in response to alcohol advertisements relative to nonalcohol beverage advertisements.
3. Light social drinkers will not exhibit this pattern of skin conductance and heart rate reactivity to alcohol and nonalcohol advertisements.

METHOD

Participants
Participants were 46 undergraduate psychology students (38 male, 8 female) who were informed that the study was about advertising and beverage preferences. The light social drinkers’ average age was 20.5 years, and the moderate social drinkers’ average age was 22.7 years. Thirty percent of the light social drinkers were White, and 43% of the moderate social drinkers were White. There were no significant differences between the groups in their demographic characteristics. The students received extra course credit for participating in this study.

Self-report measure
The Khavari Alcohol Test (KAT). Participants completed the KAT (Khavari & Farber, 1978) to measure their alcohol consumption patterns. The KAT is a 24-item questionnaire consisting of 12 items that provide demographic information and 12 items relating to rates of beer, wine, and distilled spirits consumption. Each respondent is asked his or her usual frequency of drinking, the usual amount consumed per occasion, the maximum amount consumed on any one occasion, and the frequency of this maximum. The questions are identical for the three alcoholic beverages. These amounts are converted to total ounces of alcohol consumed annually by assuming that the average can or glass of beer contains 12 oz, the average glass of wine contains 4 oz, and the average drink of distilled spirits contains 1.5 oz.

Khavari and Farber (1978) found that their measure significantly differentiated alcoholics from nonalcoholics. An estimate of test–retest reliability produced coefficients ranging from $r = .78$ for the wine-maximum frequency variable to $r = .98$ for the wine-maximum volume variable. The mean correlation across the 12 variables was $r = .92$.

Psychophysiological measures
Skin conductance and heart rate measures were collected continuously during the experiment. Both heart rate and skin conductance signals were sampled at 2 Hz relayed through a Coulbourn 8-bit analog-to-digital convertor (L25-08) to Labtech Notebook software on an AT-compatible personal computer.

Heart Rate. Heart rate was measured with a photoplethysmographic sensor placed on the center of the distal phalanx of the left index finger. The heart rate signal was processed through a Coulbourn Pulse Monitor Optical Densitometer (S71-40) and a Coulbourn Tachometer (S77-26).

Skin conductance. Skin conductance was measured with 10-mm Beckman electrodes attached to the thenar and hypothenar eminences of the left palmar surface (Venables & Christie, 1975). A water soluble transmission gel was applied to the electrodes, and both the contact medium and electrode sites were prepared with distilled water. The skin conductance signal was processed through a Coulbourn Skin Conductance Coupler (S71-22).
Slides

One hundred alcohol and 100 nonalcohol beverage advertisements were collected from popular magazines. Each advertisement was mounted in a plastic ring binder. As part of a class assignment, 25 clinical psychology PhD candidates rated each advertisement on a 10-point Likert-type scale on two dimensions: (a) How much does this advertisement make me desire the product I am viewing? (b) How complex is the advertisement I am viewing? The highest ranking alcohol advertisements were selected. There were four beer, one wine, five mixed alcohol drinks, and nine straight alcoholic beverages. The nonalcoholic slides were matched with the alcoholic slides for equivalent desirability and stimulus complexity. The nonalcoholic beverages chosen included colas, lemon-lime sodas, chocolate and vanilla milk shakes, juices, sports drinks, and teas. Following this process, the selected advertisements were made into slides.

PROCEDURE

Participants completed the KAT after informed consent was obtained. Once the electrodes were attached, the participants were seated in a reclining chair in a dark room. A 10-min habituation period followed. Slides were projected onto a 32 cm × 48 cm area on the wall in front of the participant with a hidden Kodak 4200 Carousel Slide Projector. Participants were seated 140 cm from the projection area as measured from the nose tip. Participants were then shown a series of 38 slides: 19 nonalcohol and 19 alcohol beverage advertisements. Each slide was presented for 30 sec with a 20-sec rest interval. Alcohol and nonalcohol slides were presented in counterbalanced order. At the end of the session, each student was debriefed. Participants who scored in the clinically significant range on the KAT were referred to the Campus Counseling Center for further evaluation and possible treatment.

RESULTS

Participants were divided into light and moderate social drinking groups based on a median split of their annual absolute alcohol intake scores on the KAT. Review of the participants’ KAT profiles revealed that the preferred alcoholic beverage for both groups was beer. Light social drinkers consumed an average of 55 oz annually, and moderate social drinkers consumed an average of 2,693.4 oz annually.

The physiological data were collected continuously during three stimulus conditions: baseline, viewing alcohol slides, and viewing nonalcohol slides. Each stimulus condition was divided to produce means for three 10-sec time blocks. The three 10-sec time blocks for the baseline stimulus condition were calculated from the last 30 sec of the habituation period. The first block represented the mean from the last 30 to 20 sec remaining in the habituation period, the second block represented the mean from the last 20 to 10 sec remaining in the habituation period, and the third block represented the mean of the last 10 sec of the habituation period. Each 30-sec slide presentation was divided into three 10-sec averages. The three 10-sec averages for each of the 19 alcohol slides were averaged together to produce three separate time blocks for the alcohol stimulus condition. The three 10-sec blocks from the 19 nonalcohol slides were averaged together in the same manner to produce three separate time blocks for the nonalcohol stimulus condition. The means and standard deviations for heart rate and skin conductance data by group and stimulus condition are displayed in Table 1.
A 2 (Group) × 3 (Stimulus Condition) × 3 (Time Block) analysis of variance (ANOVA) with repeated measures over the last two factors was conducted on the heart rate averages. No significant main effect for group was found. A significant main effect for stimulus condition, \( F(2, 76) = 5.09, p = .008 \), and a significant Group × Stimulus Condition interaction, \( F(2, 76) = 7.93, p < .001 \), were found. Subsequent testing was conducted with Tukey’s honestly significant difference (HSD) procedure to interpret the significant interaction. The light social drinkers demonstrated a significant deceleration in heart rate from baseline upon viewing both the alcohol slides and the nonalcohol slides \( (p < .05) \), but the moderate social drinkers did not.

A 2 (Group) × 3 (Stimulus Condition) × 3 (Time Block) ANOVA with repeated measures over the last factor was conducted on the skin conductance averages. No significant main effect for group was found, although a suggestive Group × Stimulus Condition interaction, \( F(2, 82) = 2.77, p = .06 \) was obtained. The a priori hypotheses concerning skin conductance justified continued subsequent testing. Tukey’s HSD procedure revealed that the moderate social drinkers demonstrated a significant increase in skin conductance from baseline upon viewing both the alcohol and nonalcohol slides \( (p < .05) \), but the light social drinkers did not.

**CONCLUSIONS**

One purpose of this study was to determine if moderate social drinkers would exhibit the psychophysiological correlates of cue reactivity in response to alcohol advertisements. Alcohol-specific cue reactivity has been reported in response to the sight and smell of alcoholic beverages in alcoholics (Glahtier & Drummond, 1994; Payne et al., 1992; Staiger & White, 1991). Another purpose of this study was to determine if a cue reactivity model is applicable to a nonclinical sample. Light social drinkers demonstrated significant reductions in heart rate from baseline to the alcohol and nonalcohol slides. The moderate social drinkers failed to display this pattern. Heart rate deceleration in response to visual stimuli, such as slides, has been interpreted as an orienting response (see Andreassi, 1995, pp. 235–237). Lacey (1959) and Lacey, Kagan, Lacey, and Moss (1963) associated this pattern of psycho-

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Social drinking group</th>
<th>Light</th>
<th>Moderate</th>
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<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
<td>( M )</td>
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<tr>
<td>Heart rate (beats/min)</td>
<td></td>
<td></td>
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<tr>
<td>Baseline</td>
<td>72.6( _a )</td>
<td>10.2</td>
<td>72.3</td>
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<tr>
<td>Nonalcohol slides</td>
<td>70.4( _b )</td>
<td>8.7</td>
<td>72.1</td>
</tr>
<tr>
<td>Alcohol slides</td>
<td>69.7( _b )</td>
<td>8.7</td>
<td>72.2</td>
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<tr>
<td>Skin conductance (( \mu )Mhos)</td>
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<tr>
<td>Baseline</td>
<td>3.6</td>
<td>3.2</td>
<td>3.9( _a )</td>
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<td>Nonalcohol slides</td>
<td>3.4</td>
<td>2.9</td>
<td>4.4( _b )</td>
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<tr>
<td>Alcohol slides</td>
<td>3.4</td>
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Note. Means in the same column that do not share subscripts differ at \( p < .05 \) using the Tukey honestly significant difference procedure.
physiological responding with the “intake” of information. Following this logic, the light social drinkers were attending to and processing the visual information irrespective of content.

Moderate social drinkers demonstrated significant increases in skin conductance from baseline to the alcohol and nonalcohol slides. The light social drinkers failed to display this pattern. Stormark et al. (1993) found the same pattern of responses in skin conductance. They found that alcohol-dependent participants demonstrated increased skin conductance irrespective of the test stimuli compared to control subjects. Therefore, the skin conductance results obtained in the present study replicate and extend the findings of Stormark et al. (1993) to alcohol advertisements and to a nonclinical population.

Stormark et al. (1993) concluded that a cue reactivity model did not explain their findings. Rather, they argued that because the increase in skin conductance was not specific to alcohol-related stimuli, a nonspecific tendency of psychophysiological hyperreactivity was operating in alcohol-dependent individuals. Although the results of the current study replicate the findings of Stormark et al. (1993), it may be premature to conclude that the cue reactivity model is not applicable. In both studies, alcohol and nonalcohol cues were presented in a counterbalanced sequence during one session; it is possible that moderate social drinkers displayed a response pattern in anticipation of alcohol stimuli. Stormark et al. (1993) alluded to this possibility when they suggested that the neutral cue may acquire a signal value regarding the alcohol slide (p. 442). Thus, the cravings for alcohol may not be reversible within a 20-sec rest period; these emotions may not be easily “turned on,” and “turned off.” Once the urge to drink is elicited, the craving may not rapidly dissipate within a single session. Therefore, within-subject comparisons made within a given session may not be the most sensitive methodological design to detect autonomic responding to specific alcohol cues like advertisements.

Alternatively, a cue reactivity model may not be applicable to alcohol advertising, as Stormark et al. (1993) concluded. However, situational factors, not trait factors, may explain this pattern of results. Participants may have suspected that the study was alcohol related, because of the questionnaire they completed before the slide presentation. Generally, increases in skin conductance in response to discrete visual stimuli have been interpreted as a defensive reaction (Andreassi, 1995, pp. 235–237). According to this explanation, the moderate social drinkers may have responded with increases in skin conductance to both alcohol and nonalcohol slides because they were reacting “defensively” to being evaluated about their alcohol use. This may have occurred even though the pretense for the study given to all participants did not mention alcohol. This line of reasoning suggests that moderate social drinkers became aroused in a context of having their drinking habits evaluated, whereas light social drinkers did not feel threatened by this situation.

Future directions include taking methodological steps to rule out alternative explanations for the findings of this study. One recommendation is to include longer intertrial recovery periods to ensure that a return to baseline has been achieved after the stimulus presentation. Another recommendation is to include direct comparisons between olfactory cues and various visual stimuli, such as actual bottles of alcohol and pictures of alcohol such as those found in advertisements. Different patterns of cue reactivity may emerge with variations in the salience of the stimuli. An important replication of this study is to counterbalance the administration of the alcohol use questionnaire before and after the slide presentation. That way, the impact of such
instruments on the participants’ reactions to the situation may be determined. Future replications may benefit by recording a desirability rating after each slide. This may also shed light on the issue of whether psychophysiological responses are cue specific or situationally specific.

Although the sample studied here was diverse, no subgroup was large enough to break out for intragroup comparison. Recent research has suggested that there are significant differences in gender and race in patterns of drinking (Herd, 1997). Additionally, a recent review suggested that there may be significant differences in race and gender in patterns of psychophysiological reactivity (Anderson & McNeilly, 1991). Therefore, another area ripe for investigation is whether differences in psychophysiological responding to alcohol-related stimuli occur by race or gender.

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