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Men and Women, Alcohol and Aggression

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The purpose of this study was to examine the acute effects of alcohol on aggressive behavior in men and women in a laboratory setting. Participants were 526 (261 men and 265 women) healthy social drinkers between 21 and 35 years of age. They were randomly assigned to either an alcohol or a placebo group. Aggression was measured using a modified version of the *Taylor Aggression Paradigm* in which electric shocks are received from, and delivered to, a same gender fictitious opponent during a supposed competitive interpersonal task. Aggression was operationalized as the intensity and duration of shocks that participants administered to their "opponent." Overall, men were more aggressive than women. Alcohol increased aggression for both men and women but this effect was stronger for men. This is one of the first laboratory studies to demonstrate that alcohol increases aggression in women.

Keywords: alcohol, aggression, women, gender differences

The fact that there is an association between acute alcohol consumption and aggressive behavior is no longer in dispute. A Canadian general population study found that alcohol was present in roughly 38% of incidents involving serious arguments, 57% of incidents involving threats, and 68% of incidents involving physical aggression. This study also demonstrated that acute alcohol intoxication, and not chronic alcohol consumption, was more chiefly related to aggressive behavior (Wells, Graham, & West, 2000). A British study of heavy drinkers reported that 76% of serious arguments and 94% of physical fights occurred on days in which high levels of alcohol (10–12 drinks) were consumed (Rolfe et al., 2006). A Russian investigation found a high correlation ($r = .75$) between daily distributions of homicides because of alcohol. In other words, homicides were lowest on weekdays, when alcohol consumption was at its nadir, and highest on weekends, when consumption reached its apogee (Pridemore, 2004). Finally, a Swedish study determined that violent offenders were 13 times more likely to commit a violent act within 24 hours of consuming alcohol (Haggård-Grann, Hallqvist, Långström, & Möller, 2006).

Gender Differences in Aggression

Crime statistics indicate that men are disproportionately more violent than women (U.S. Department of Justice, 2008). Whereas a large body of empirical literature does not dispute this claim, it does suggest that gender differences in aggression might be smaller than expected and not always consistent across studies (for reviews see Archer, 2004; Bettencourt & Miller, 1996; Eagly & Steffen, 1986; Frodi, Macaulay, & Thome, 1977; Harris, 1996; Hyde, 1984; Richardson & Hammock, 2007; Verona & Vitale, 2006). Recent research with adolescents shows rising rates of violence among girls (Odgers et al., 2007) and that gender differences in serious violent behavior are diminishing over time (Graves, 2007). A meta-analytic study by Archer (2000) determined that, in the context of intimate partner violence, women are slightly more likely to engage in physical aggression than men and tend to exhibit such behavior more frequently. However, male perpetrated violence is more likely to cause physical injury and have other negative consequences. In a narrative review of her research program, Richardson (2005) echoed these findings in her conclusions that "*females are not passive creatures but that they are perpetrators as well as victims of aggression*" (p. 238) and that male-female differences in physical aggression have been overestimated, possibly even outside of the realm of intimate partner violence. However, she also stated that men do engage in more aggression than women and that such aggression has more serious repercussions (i.e., injury, financial costs, etc.).

Although the literature may be unclear about gender differences in overall aggression, marked male-female distinctions have been identified with regard to different types of aggression. Men appear to exhibit greater levels of "direct" physical aggression compared with women whereas there appear to be no gender differences with respect to "indirect" aggression (reviewed in Richardson & Hammock, 2007). Direct aggression encompasses any direct route of aggression that results in the victim's ability to

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identify the perpetrator (e.g., punching someone, making verbal threats), whereas indirect aggression is typified by harm resulting from circuitous actions (e.g., gossip, spreading rumors, ordering a shooting) where the perpetrator is known or unknown to the victim (Parrott & Giancola, 2007). Similarly, others have found that females are more likely than males to engage in relational aggression, whereby a person attacks another via damaging their peer relationships (Crick & Grotpeter, 1995; Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007).

Alcohol-Related Aggression: Survey and Field Research

Survey and field research suggest that alcohol-related aggression might be more prevalent in men; nevertheless, the association is also clearly evident in women. A large British study of heavy drinkers found that men tend to become more physically aggressive after alcohol consumption whereas women become more verbally aggressive (Rolfe et al., 2006). Data from the *National Longitudinal Survey of Youth* determined that the relation between heavy episodic drinking and fighting after drinking was stronger for women than for men (Wells, Speechley, Koval, & Graham, 2007), but that drinking frequency was an equally significant predictor of fighting after drinking for both men and women (Wells, Graham, Speechley, & Koval, 2005). However, a random digit dialing study by this same research group found that overall incidents of alcohol-related aggression were more likely to involve men than women (Wells & Graham, 2003). Furthermore, an epidemiological study of persons arrested for a violent crime reported that 57% of men and 44% of women were intoxicated at the time of their arrest and that the rates of intoxicated violence were relatively the same for both genders. This study also demonstrated that being intoxicated had a greater effect on being arrested for a violent crime for women than for men (Martin & Bryant, 2001).

Interestingly, research conducted in a barroom setting showed that women consumed greater amounts of alcohol when initiating a fight than when someone else initiated the fight and that women reported drinking more alcohol when initiating a fight than on a typical nonviolent visit to a bar (Collins, Quigley, & Leonard, 2007). Other studies have found that alcohol-related aggression is more common in men than in women in bar settings (Graham, West, & Wells, 2000; Quigley, Corbett, & Tedeschi, 2002) and that men tend to exhibit more severe physical aggression that results in more harm compared with women (Graham et al., 2006). Finally, in a sample of women arrested for domestic violence incidents, heavy or hazardous drinkers exhibited significantly higher levels of physical, psychological, and sexual abuse as well as injury to their partner compared with women without such drinking problems (Stuart, Moore, Ramsey, & Kahler, 2004).

Research on alcoholic couples has demonstrated that women commit more frequent and more serious acts of violence than their male partners (Chase, O'Farrell, Murphy, Fals-Stewart, & Murphy, 2003; Drapkin, McCrady, Swingle, & Epstein, 2005). Such research has also documented a positive correlation between alcohol consumption and degree of physical violence in women; yet, the opposite correlation was observed in men (Drapkin et al., 2005). Others have shown that heavy alcohol consumption (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005; Lipsky, Caetano, Field, & Larkin, 2005) and alcohol use problems (Stuart et al., 2006, 2008) were a factor in both male and female perpetrated intimate partner violence. Finally, whereas men and women in treatment for substance use disorders reported high rates of aggression, few gender differences in such behavior were observed (Chermack et al., 2008; Chermack, Walton, Fuller, & Blow, 2001), particularly before beginning treatment (O'Farrell, Murphy, Stephan, Fals-Stewart, & Murphy, 2004).

In summary, research indicates that men are significantly more violent than women, but that this gender gap appears to be closing, particularly in the context of intimate partner relationships. With regard to different types of aggression, men appear to exhibit more direct aggression than women whereas there appear to be no gender differences in indirect aggression. On the more specific topic of alcohol-related aggression, the findings reviewed above suggest that there is a clear relation between alcohol consumption and aggressive behavior but that it might be more prevalent in men; nevertheless, the association is also very clearly evident in women; particularly in women who drink heavily.

Alcohol-Related Aggression: Laboratory Research

The survey and field studies reviewed above portray a very compelling association between alcohol use and aggression. However, aspects inherent in their correlational designs preclude the formulation of statements suggesting a causal relation between alcohol use and aggressive behavior. Other difficulties with such designs are that some of their results do not indicate whether alcohol is associated with aggression at a higher rate than would be expected by chance alone, a lack of clarity about the causal direction of the alcohol-aggression relation, limited information regarding whether alcohol was present at the exact time of the transgression, as well as a reliance on self-report methods that are troubled by response biases, problems in recollection, and problems with making inferences about another person's state of intoxication.

Another source of data on gender differences in alcohol-related aggression comes from in vivo experimental studies carried out in laboratory settings. Although such designs also have their own limitations, the high degree of internal validity they provide offers an excellent complement to the important results of survey and field studies. Laboratory studies generally measure aggression using behavioral tasks in which aggression is operationalized as the administration of electric shocks, tone blasts, or the subtraction of points (redeemable for money) to and from a fictitious opponent during a supposed competitive interpersonal task. Bond and Lader (1986) found that alcohol increased aggression (i.e., tone blasts) equally for men and women when they were exposed to low levels of provocation (i.e., low intensity tone

blasts). However, when highly provoked, alcohol only increased aggression for men. In a study using a point subtraction task, Dougherty, Cherek, and Bennett (1996) showed that alcohol increased aggression for women. In a follow-up study with men and women, Dougherty, Bjork, Bennett, and Moeller (1999) reported that alcohol increased aggression equally for both genders. In contrast, however, Gustafson (1991) found that alcohol did not increase aggression in women toward a fictitious male opponent. Gender comparisons were precluded in this latter study inasmuch as men were not included as a comparison group. Finally, other investigators found that alcohol increased aggression for men but not for women (Giancola et al., 2002; Giancola & Zeichner, 1995; Gussler-Burkhardt & Giancola, 2005; Hoaken, Campbell, Stewart, & Pihl, 2003; Hoaken & Pihl, 2000).

The Present Study

The above literature review, as a whole, suggests that men may indeed be more aggressive than women but that this statement should be qualified by the type of aggression expressed (e.g., physical vs. relational, etc.) as well as contextual factors (e.g., intimate partner violence vs. barroom violence, etc.). Clearly, the question of gender differences in aggression is not as simple as once believed. This issue is no less complicated with regard to alcohol-related physical aggression. The laboratory data reviewed above are mixed in that some studies show that alcohol increases aggression for women whereas others do not. Those studies that yielded negative findings for women may be hampered by low statistical power. Given the overall male proclivity for greater, and more severe, physical aggression compared with women, it is likely that more statistical power is needed to detect the effects of alcohol on aggression in women. Given some of the more recent data reviewed above indicating that gender differences in aggression may have been overestimated, the purpose of this investigation was to help elucidate this literature by conducting a laboratory study with sufficient power to examine the effects of acute alcohol consumption on aggressive behavior in men and women.

Method

Participants

Participants were 526 (261 men and 265 women) healthy social drinkers between 21 and 35 years of age ($M = 23.02$; $SD = 2.86$). Previous reports from our laboratory that focused on gender differences in aggression were all conducted on separate datasets (Giancola & Zeichner, 1995; Giancola et al., 2002; Gussler-Burkhardt & Giancola, 2005). The data presented herein are also based on an entirely new sample. As in our previous studies, participants were recruited through advertisements placed in various newspapers in Lexington, Kentucky. Individuals reporting any past or present drug- or alcohol-related problems, serious head injuries, learning disabilities, psychotic symptomatology, or a medical condition contraindicating alcohol consumption were excluded from participation. Respondents were screened for alcohol use problems using the *Short Michigan Alcoholism Screening Test* (SMAST; Selzer, Vinokur, & van Rooijen, 1975). Any person scoring an "8" or more on the SMAST was excluded. Anyone with a positive breath alcohol concentration (BrAC) reading or a positive urine pregnancy or drug test result was also excluded. The ethnic composition of the sample was ≈88% White (men = 232; women = 232), ≈10% African American (men = 29; women = 23), ≈2% Hispanic (men = 4; women = 4), and ≈.004% Indian (men = 2; women = 0). Ninety-two percent of the participants were never married and the sample had an average of 16 years of education. The sample also had a mean yearly household income (including support from parents) of approximately $62,000. This study was approved by the University of Kentucky's Institutional Review Board and complied with the *National Institute on Alcohol Abuse and Alcoholism's* guidelines for alcohol administration with human participants.

Prelaboratory Procedures

Following a telephone screening interview, persons eligible for the study were scheduled for an appointment to come to the laboratory. They were told to not consume any alcohol 24 hours before testing, to refrain from using recreational drugs from the time of the telephone interview, and to avoid eating 4 hours before testing. Because of hormonal variations associated with menstruation that may affect aggressive responding (Volavka, 1995), women were not tested between 1 week before menstruation and the beginning of menstruation. Participants were told that they would receive $75.00 at the completion of the study as compensation.

Experimental Design

This study utilized a 2 (beverage: alcohol, placebo) × 2 (gender: male, female) independent-groups design. Participants were assigned to one of four groups: (1) men who received alcohol ($n = 123$), (2) men who received a placebo ($n = 138$), (3) women who received alcohol ($n = 128$), and (4) women who received a placebo ($n = 137$).

Beverage Administration

Men who received alcohol were administered a dose of 1 g/kg of 95% alcohol USP mixed at a 1:5 ratio with Tropicana orange juice. Women were given a dose of 0.90 g/kg of alcohol to control for gender differences in body fat composition (Watson, Watson, & Batt, 1981). The dosing procedure was also calculated for the placebo group, however, they received an isovolemic beverage consisting of only orange juice (i.e., the missing alcohol portion was replaced with orange juice). Four milliliters of alcohol were added to each placebo beverage and 4 ml were layered onto the juice in each glass for a total of 8 ml of alcohol in each glass. Immediately before serving the placebo beverages, the rims of the glasses were sprayed with alcohol and

participants were given 20 minutes to consume their beverages. Participants were not given any information regarding what to expect from their beverages. However, during the informed consent process, they were told that they would consume the equivalent of about 3 to 4 mixed drinks.

Aggression Task

A modified version of the *Taylor Aggression Paradigm* (TAP; Taylor, 1967) was used to measure aggression. This task places participants in a situation where electric shocks are received from, and administered to, a fictitious opponent during a supposed competitive reaction time task. Physical aggression was operationalized as the shock intensities and durations selected by the participants. Participants were seated at a table in a small room. On the table facing the participant was a computer screen and a keyboard. White adhesive labels marked "1" through "10" were attached to the number keys running across the top of the keyboard. The labels "low," "medium," and "high" were placed above keys "1," "5," and "10," respectively, to indicate the subjective levels of shock corresponding to the number keys. The keyboard and monitor were connected to a computer located in an adjacent control room out of the participant's view. The TAP has been repeatedly shown to be a safe and valid measure of aggressive behavior for men and women (Anderson & Bushman, 1997; Giancola & Chermack, 1998; Hoaken & Pihl, 2000).

There were three dependent variables. The first of these measures, *Unprovoked Aggression*, comprises the average shock intensity selection ("1" through "10") and duration (in milliseconds) administered on the first trial of the task. It represents a measure of unprovoked aggression inasmuch as participants win the first trial and thus have no information about the ostensible aggressive intentions of their opponent. The score was calculated by transforming the first trial shock intensity and duration variables into *z*-scores and then summing them. This was done to increase the reliability of both indices inasmuch as a meta-analytic investigation demonstrated that shock intensity and duration are significantly related to one another and are considered to be part of a more general construct of aggression (Carlson, Marcus-Newhall, & Miller, 1989). For this reason, more recent studies using the TAP, and its modified versions, have adopted, and successfully used, similar combinatory techniques involving shock intensity and duration (Bartholow, Anderson, Carnagey, & Benjamin, 2005; Carnagey & Anderson, 2005; Parrott & Zeichner, 2001; Ward et al., 2008). The second dependent measure, *Overall Aggression*, is represented by the mean responses for shock intensity and duration (in milliseconds) across all trials of the TAP. These scores were also *z*-transformed and then summed. Finally, the third dependent variable, *Extreme Aggression*, is operationalized as the percentage of trials that participants selected the highest shock intensity button (i.e., "10").

Procedure

To disguise the fact that the TAP is a measure of aggression, participants were given a fictitious cover story. They were informed that the study was aimed at understanding the effects of alcohol on reaction time in a competitive situation. Participants were told that they were about to compete against a person of the same gender in an adjacent room on a reaction time task. In actuality, there was no opponent. Instructions for the TAP were given as participants began drinking their beverages. They were informed that shortly after the words "Get Ready" appeared on a computer screen, the words "Press the Spacebar" would appear at which time they had to press, and hold down, the spacebar. Following this, the words "Release the Spacebar" would appear at which time they had to lift their fingers off of the spacebar as quickly as possible. A "win" was signaled by the words "You Won. You Get to Give a Shock" and a "loss" was signaled by the words "You Lost. You Get a Shock." A winning trial allowed participants to deliver a shock to their opponent and a losing trial resulted in receiving a shock from this individual. Participants viewed the shocks they selected and received on a "volt meter" and by the illumination of one of 10 "shock lights" [(ranging from 1 (low) to 10 (high)] on the computer screen.

Before beginning the TAP, participants' pain thresholds and tolerances were assessed to determine the intensity parameters for the shocks they would receive. This was accomplished via the administration of short duration shocks (.5 seconds) that increased in intensity in a stepwise manner from the lowest available shock setting, which was imperceptible, until the shocks reached a subjectively reported "painful" level. All shocks were administered through two finger electrodes attached to the index and middle fingers of the nondominant hand using Velcro straps. Participants were instructed to inform the experimenter when the shocks were "first detectable" and then when they reached a "painful" level. Later, during the actual testing, participants received shocks that ranged from "1" to "10." These shocks were, respectively, set at 55, 60, 65, 70, 75, 80, 85, 90, 95, and 100% of the highest tolerated shock intensity.

Participants in the alcohol group were tested on the TAP as close as possible to a BrAC of .09% whereas those in the placebo group were tested directly after their pain threshold and tolerance assessment. Immediately before beginning the TAP, participants provided subjective ratings of their level of intoxication. This was done using a specially constructed scale ranging from 0 to 11 on which "0" was labeled "not drunk at all," "8" was labeled "drunk as I have ever been," and "11" was labeled "more drunk than I have ever been." Regardless of beverage group assignment, all participants were informed that their opponent was intoxicated. This was done to ensure that the "drinking status" of the opponent would not confound any potential beverage group differences in aggression.

The entire TAP procedure consisted of 34 trials. Participants were told that they had a choice of 10 different shock intensities to administer at the end of each winning trial for a duration of their choosing. After a losing trial, they received 1 of 10 shock intensities that lasted one second. Shock intensities were administered in a pseudorandom pattern that followed a general inclination over the trials.

Taylor and Chermack (1993) argued that using such a shock pattern adds an increased degree of external validity to the task because this ordering best reflects how an escalation in interpersonal provocation leads to increased aggression in "real-life" situations.

Immediately after the TAP, BrACs were measured and participants were again asked to rate their subjective state of intoxication. In addition to this, they were asked whether the alcohol they drank caused them any impairment on a scale ranging from 0 to 10 on which "0" was labeled "no impairment," "5" was labeled "moderate impairment," and "10" was labeled "strong impairment." Participants were then asked a yes or no question regarding whether they believed that they had consumed alcohol.

Deception Manipulation

To convince participants that they actually competed against another person, before beverage consumption, an experimenter informed them that we wished to give them and their opponent "a chance to get to know one another" before proceeding with the "reaction time" task. To do so, participants were told that both they, and their opponent, were going to be video-recorded, in separate rooms, while answering three questions about their personality (i.e., [1] "What is your favorite TV show?," [2] "Do you have a favorite hobby; something you like to do for fun?," and [3] "What is your favorite food?"). The experimenter ostensibly recorded the participant's responses (on a "cam-corder") to the questions while another experimenter supposedly recorded their opponent's responses to the same questions. Following the mock video recordings, participants were escorted into another testing room where they were given their beverages. Just as they began consuming their beverages, participants viewed a prerecorded, gender and race matched, video clip in which their fictitious opponent provided neutral answers to the three questions. Their opponent was ostensibly viewing the participants video clip at the same time in a separate room. It is important to note that the cam-corder was "rigged" to simulate taping the participant; no recordings were actually made. Furthermore, immediately before testing their pain thresholds and tolerances, participants were informed that their opponent would undergo the same threshold/tolerance testing procedure first. To further enhance the believability of the TAP, participants were also informed that they would be able to hear their opponent's responses over an intercom that ostensibly served the two testing rooms and the control room. In actuality, an audio recording was played that simulated the fictitious opponent's answers to the experimenter's questions regarding the testing of his or her pain threshold and tolerance.

Results

Manipulation Checks

TAP checks. To verify the success of the TAP deception, participants were asked about their subjective perceptions of their opponent, whether their opponent tried hard to win, whether they thought the task was a good measure of reaction time, and how well they believed they performed on the task. The deception manipulation appeared successful. Typical descriptions from participants about their opponents included "just an average college student," "performance was as good as mine," and "competitive." Many participants also used very profane abusive and antagonistic remarks and inappropriate hand gestures toward their opponents. Some participants also indicated that they had "no feelings for this person either way," "he or she shocked me a little high," and that "the person played fair." The majority of participants stated that they did equally well on the task as their opponent and thought that their opponent tried hard to win. Seventeen participants (≈3%) were excluded because of positive drug tests and 11 participants (≈2%) were excluded because they did not believe the TAP deception. The remainder all felt that the task was a good measure of reaction time leaving a final sample of 526.

Placebo checks. All participants in the placebo group indicated that they believed that they drank alcohol. With regard to the question regarding how drunk they felt, persons in the alcohol group reported mean pre- and post-TAP ratings of 4.6 and 5.0 (scale range: 0 to 11) and those in the placebo group reported mean pre- and post-TAP ratings of 1.7 and 1.9, respectively [pre-TAP ratings: $t(524) = -19.9$, $p < .05$; post-TAP ratings: $t(524) = -20.1$, $p < .05$]. With regard to the question about whether the alcohol they drank caused any impairment, persons in the alcohol group reported an average rating of 5.5 and those in the placebo group reported an average rating of 2.1, $t(524) = -19.4$, $p < .05$ (scale range: 0 to 10).

BrAC levels. All participants tested in this study had BrACs of 0% upon entering the laboratory. Individuals in the alcohol group had a mean BrAC of 0.095% ($SD = 0.011$) just before beginning the TAP and a mean BrAC of 0.105% ($SD = 0.015$) immediately after the task. Persons given the placebo had a mean BrAC of 0.015% ($SD = 0.011$) just before the TAP and a mean BrAC of 0.007% ($SD = 0.007$) immediately after the task. There were no gender differences in mean BrACs either before (men = .095%; women = .096%) or after (men = .103%; women = .106%) the TAP.

Demographic Data: Gender Differences

To ensure no unexpected beverage group differences or significant beverage X gender interactions, all demographic variables were analyzed using 2 (beverage) × 2 (gender) between-groups design analysis of variance (ANOVA). As expected, there were no such differences. However, consistent with our expectations, compared with women, men had higher SMAST scores, drank alcohol on more occasions per week, consumed more drinks per occasion, and consumed more drinks per week. Men and women did not differ on age, years of education, or yearly household salary (see Table 1).

Table 1
Demographic Data

Measure	Men		Women	
	M	*SD*	*M*	*SD*
Age	22.98	2.54	23.06	3.14
Years of education	16.16	1.92	16.28	1.96
Yearly household salary	$61.40K	$68.83K	$62.63K	$88.61K
SMAST	0.97	1.82	0.43	1.44*
Drinking occasions per week	2.01	1.11	1.61	0.87*
Drinks per occasion	5.93	2.92	3.91	1.45*
Drinks per week	11.88	8.62	6.61	4.96*

Note. SMAST = Short Michigan Alcoholism Screening Test; K = $1,000.
* $p < .05$.

Aggression Data

Unprovoked aggression. A 2 (beverage) × 2 (gender) between-groups design ANOVA detected a marginally significant beverage X gender interaction, $F(1, 522) = 3.60$, $p = .058$. Decomposition of this effect indicated that alcohol significantly increased unprovoked aggression for men, $t(259) = -2.95$, $p = .003$; Cohen's $d = .36$. There was a trend toward significance for women, $t(263) = -1.68$, $p = .09$; $d = .21$ (see Figure 1). Results also revealed significant main effects for beverage, $F(1, 522) = 11.63$, $p = .001$; $d = .27$; and for gender, $F(1, 522) = 64.0$, $p < .001$; $d = .68$.

Overall aggression. A 2 (beverage) × 2 (gender) between-groups design ANOVA detected a significant beverage X gender interaction, $F(1, 522) = 4.03$, $p = .045$. Decomposition of this effect indicated that alcohol significantly increased aggression for men, $t(259) = -4.18$, $p < .001$; $d = .51$ as well as for women, $t(263) = -2.40$, $p = .017$; $d = .29$ (see Figure 2). Results also revealed significant main effects for beverage, $F(1, 522) = 23.08$, $p < .001$; $d = .40$; and for gender, $F(1, 522) = 49.0$, $p < .001$; $d = .58$.

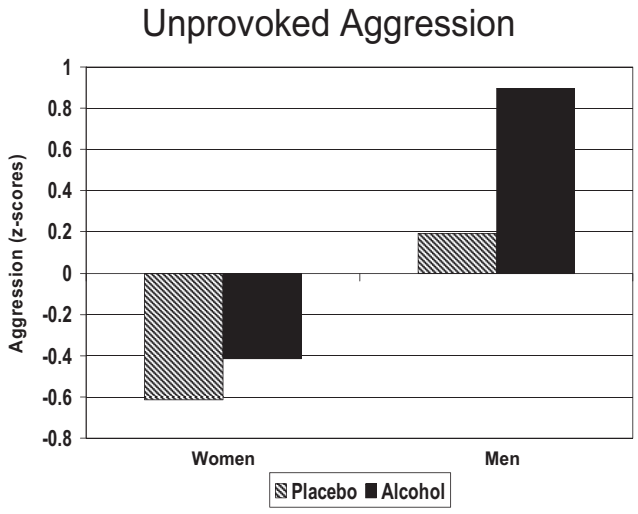

Figure 1. Effects of alcohol and gender on unprovoked aggression.

Extreme aggression. A 2 (beverage) × 2 (gender) between-groups design ANOVA detected a significant beverage X gender interaction, $F(1, 522) = 6.11$, $p = .01$. Decomposition of this effect indicated that alcohol had a significant effect on increasing aggression for men, $t(259) = -3.74$, $p < .001$; $d = .46$; and a marginally significant effect for women, $t(263) = -1.93$, $p = .05$; $d = .24$ (see Figure 3). Results also revealed significant main effects for beverage, $F(1, 522) = 17.90$, $p < .001$; $d = .34$; and for gender, $F(1, 522) = 58.21$, $p < .001$; $d = .64$.[1]

Discussion

Our results showed that alcohol increased overall and extreme aggression for both genders but that its effect was stronger for men than it was for women. Regarding unprovoked aggression, alcohol produced a significant increase for men but only a marginally significant increase for women. A number of previous laboratory studies found that alcohol only increased aggression for men but not for women (Giancola et al., 2002; Gussler-Burkhardt & Giancola, 2005; Hoaken et al., 2003; Hoaken & Pihl, 2000). However, all of these studies had significantly smaller sample sizes than the current investigation. Furthermore, a close examination of their data reveals that intoxicated women almost always exhibited somewhat higher levels of aggression than sober women. As such, it would seem that our results are in keeping with those of previous studies other than the fact that the present investigation had enough power to detect alcohol's effect on aggression for women. In fact, even using conservative effect size estimates for our main effects ($f = .25$) and our interaction terms ($f = .15$), we found that our power to detect such significant effects

[1] It is possible that responses on the TAP might have been influenced by participants' subjective perceptions of the aversiveness/annoyance of the shocks that they received. Thus, we examined gender differences in this regard on a Likert scale ranging from 0 to 10 (0 = *not at all annoying*; 10 = *very much annoying*). Results indicated that women perceived the shocks to be more annoying than men $t(521) = 5.19$, $p < .001$. As such, we recomputed all analyses including this variable as a covariate. Its addition did not affect the results in any way; in fact, it slightly improved significance levels.

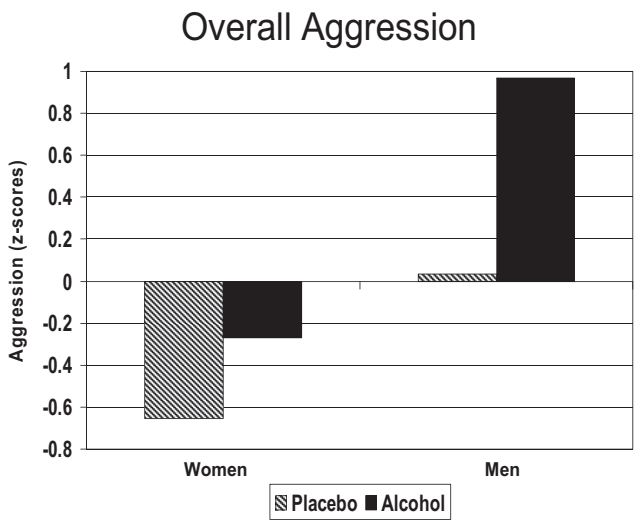

Figure 2. Effects of alcohol and gender on overall aggression.

was 1.0 and .93, respectively (Borenstein et al., 2001). It should be noted that *f* is an extension of Cohen's *d.* Cohen's *d* is used to compare two means whereas *f* is used for ANOVA (*f* values of .10, .25, and .40, respectively represent "small," "medium," and "large" effects) (Cohen, 1992). Given the large sample size used in this study, our effect sizes for two-group comparisons, represented as *d,* should be interpreted in the context of Cohen's criteria (.20 = "small," .50 = "medium," and .80 = "large"). Thus, as can be seen in the Results section, alcohol's effects on unprovoked aggression for men and women were .36 and .21, respectively. Similar respective effects for men and women were .51 and .29 for overall aggression and .46 and .24 for extreme aggression. Overall, these findings suggest "medium" effects of alcohol on aggression for men and generally "small" effects for women.

The previous laboratory studies that demonstrated nonsignificant effects of alcohol on aggression for women used either the TAP or slight modifications of this task to measure aggression. Interestingly, only one study found that alcohol increased aggression equally for men and women with a small sample size (Dougherty et al., 1999). This study used a different laboratory measure of aggression called the *Point Subtraction Aggression Paradigm* (PSAP; Cherek, 1981). The main difference between the TAP and the PSAP is the way in which aggression is operationalized. Whereas the TAP operationalizes aggression as a physical retaliation to provocation in the form of electric shock, the PSAP operationalizes aggression as the removal of points (later redeemable for money) in retaliation to provocation (subtraction of points) from a fictitious opponent. Loosely stated, one can argue that the TAP employs a more "harsh" expression of aggression than the PSAP. Given this, it is reasonable to argue that, at least in a laboratory setting, the threshold for a physical attack is probably higher than that for a monetary one. This of course begs the question of whether women have a higher liability threshold to exhibit violent behavior. Some scientists have indeed put forth this hypothesis (Cloninger, Christiansen, Reich, & Gottesman, 1978; Cloninger, Reich, & Guze, 1975) that would help explain why alcohol had a stronger effect on increasing aggression in women in the PSAP study (Dougherty et al., 1999) than in the TAP studies (Giancola et al., 2002; Hoaken & Pihl, 2000). This explanation is supported by a previous report from our laboratory in which alcohol was equally effective in increasing aggression for men and women on the TAP, but only for persons who reported high levels of trait physical aggressivity which could be an indicator of a lower liability threshold for violence (Giancola, 2002).

It is also important to note that when examining the main effects of gender in the present study, men were significantly more aggressive than women. This finding corroborates crime (U.S. Department of Justice, 2008) as well as other statistics (Archer, 2004; Eron & Huesmann, 1989) indicating that men tend to exhibit more physical aggression than women. However, this statement does seem to exclude the literature on intimate partner violence where such gender differences appear to be attenuated (Archer, 2000). Nevertheless, it is important to note that even Archer's meta-analytic study found that men were more likely than women to inflict physical injury.

The literature as a whole is quite clear that acute alcohol intoxication facilitates aggression in men. However, the data for women on this topic are more complicated. Gender differences in alcohol-related aggression could involve biological as well as a number of psychological and social factors. Specifically, women have been shown to possess better behavioral inhibition under alcohol (Fillmore & Weafer, 2004) and are less likely than men to implicate alcohol as a causal factor for aggressive behavior (Crawford, 1984; Giancola, Godlaski, & Parrott, 2005). Moreover, women have greater societal constraints and expectations associated exhibiting aggression as well as how aggression should be expressed (e.g., physical, verbal, relational, indi-

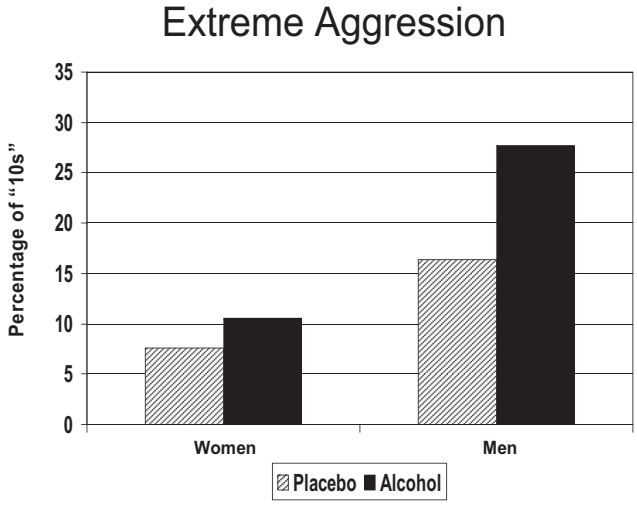

Figure 3. Effects of alcohol and gender on extreme aggression.

rect, etc.). For example, females are more likely to display relational (Crick & Grotpeter, 1995) and psychological aggression (Murray et al., 2008) compared with males. Other research has shown that alcohol is more likely to facilitate verbal aggression in women whereas it is more likely to produce physical aggression in men (Rolfe et al., 2006). Furthermore, when considering aggression in women, there are a number of key factors that must be taken into account such as the type of relationship between the perpetrator and the victim (Chase et al., 2003; Chermack et al., 2001), gender roles (Richardson & Hammock, 2007), contextual factors (Collins et al., 2007; Wells & Graham, 2003), cognitive factors (Bennett, Farrington, & Huesmann, 2005), certain psychiatric syndromes, socialization (Graves, 2007), and the manner in which aggression is measured (Dougherty et al., 1999; Giancola, 2002). Nevertheless, in the context of the above qualifications, the extant literature (laboratory and nonlaboratory), seems to point to the conclusion that alcohol increases aggression for both men and women but that this effect is more pronounced in men (Wells & Graham, 2003) and that women appear to sustain a greater degree of physical injury from alcohol-related violence compared with men (Archer, 2000; Murray et al., 2008).

Limitations, Future Research, and Conclusions

Our study utilized an alcohol and a placebo group. We did not add a knowingly sober control group inasmuch as multiple meta-analytic studies of the alcohol-aggression literature have found that sober and placebo groups do not tend to differ from one another (Bushman, 1993, 1997; Bushman & Cooper, 1990; Hull & Bond, 1986; Ito et al., 1996; Steele & Southwick, 1985). Given this information, in addition to our sample size, we felt that our choice of groups was the most practical for studying the effects of alcohol on aggression while controlling for the belief that alcohol had been consumed. On balance, the absence of a knowingly sober group precluded a direct test of the effect of the belief that alcohol had been consumed.

It is also important to highlight that fact that some laboratory aggression studies have used versions of the TAP that incorporate a nonaggressive response option (Bernat, Calhoun, Adams, & Zeichner, 2001; Bushman, Baumeister, & Phillips, 2001; Gustafson, 1991). The addition of such an option might have the effect of altering responses on the task. Unfortunately, as our paradigm did not have a nonaggressive response option, our data cannot directly speak to this issue. Nevertheless, this question presents opportunities for future research. Specifically, one could make a systematic comparison between responses on the TAP using conditions in which a nonaggressive option is, and is not, offered. This would also apply to versions of the TAP that use the "extreme aggression" option of a "20" button that supposedly has the potential to inflict physical harm (Taylor, Schumtte, Leonard, & Cranston, 1979; McCloskey, Berman, Echevarria, & Coccaro, 2009; Broman-Fulks, McCloskey, & Berman, 2007).

We previously noted that shock intensities on the TAP were administered in a pattern that followed a general pseudorandom inclination over the trials as this best mirrors how an escalation in interpersonal provocation leads to increased aggression in "real-life" situations. Nevertheless, depending on the underlying rationale of one's research questions, future studies might consider testing how different patterns of shock administration (e.g., steady declination, completely random pattern, etc.) might affect responding on the TAP.

Furthermore, as discussed above, a meta-analytic investigation by Carlson et al. (1989) determined that shock intensity and duration are significantly related and considered to be part of a more general construct of aggression. As a result, a number of researchers (Bartholow et al., 2005; Carnagey & Anderson, 2005; Parrott & Zeichner, 2001; Ward et al., 2008), including ourselves (Giancola & Corman, 2007), have combined these two indicators to increase the reliability of these variables. In addition to our large sample size, and thus sufficient power to detect significant effects, we suggest that this increased reliability of our dependent variable played a role in demonstrating that alcohol had an effect on increasing aggression in women (keep in mind that we also found the same effect of alcohol on aggression for women using the "noncombined" variable of extreme aggression). However, one might wonder how the variables performed independently. As such, we recalculated our results using shock intensity and duration as separate dependent variables. The general pattern of the findings remained the same. However, as would be expected, the increased reliability of the combined variable strengthened our data. Although both shock intensity and duration have been shown to be part of a more general construct of aggression (Carlson et al., 1989), a fruitful avenue for future research might be a programmatic psychometric investigation of this issue as it would have significant value for researchers using laboratory-based measures of aggression.

Finally, relative to some of the types of aggression illustrated in the Introduction section, it is clear that the present study measured direct physical aggression. Many studies have focused on this form of aggression given its obvious harmful consequences. However, our understanding of how alcohol differentially affects aggression in men and women would be significantly improved by examining different forms of aggressive behavior in different contexts and when these forms of aggression are moderated by key trait variables. For example, some research has indicated that violence among women may be especially linked to heavy or binge drinking (Stuart et al., 2004; Wells et al., 2007). Unfortunately, a post hoc analysis of our data revealed no significant relations between SMAST scores and number of drinks consumed per week with any of the TAP variables for men or for women.

In summary, our findings indicate that, in general, alcohol increased aggression for men and women; however, an examination of the means and effect sizes showed that this effect was clearly stronger for men. Although a number of previous laboratory studies found that alcohol increased

aggression only for men (Giancola et al., 2002; Gussler-Burkhardt & Giancola, 2005; Hoaken & Pihl, 2000; Hoaken et al., 2003); we reasoned that our findings for women were due to our large sample size as well as more reliable indices of aggression.

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