Published in final edited form as:

J Consult Clin Psychol. 2011 June ; 79(3): 319–329. doi:10.1037/a0023065.

Does Distraction Reduce the Alcohol-Aggression Relation?: A Cognitive and Behavioral Test of the Attention-Allocation Model

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Abstract

Objective—This study provided the first direct test of the cognitive underpinnings of the attention-allocation model and attempted to replicate and extend past behavioral findings for this model as an explanation for alcohol-related aggression.

Method—A diverse community sample (55% African-American) of males ($N = 159$) between 21 and 35 years of age ($M = 25.80$) were randomly assigned to one of two beverage conditions (i.e., alcohol, no-alcohol control) and one of two distraction conditions (i.e., distraction, no-distraction). Following beverage consumption, participants were provoked via reception of electric shocks and a verbal insult from a fictitious male opponent. Participants' attention-allocation to aggression words (i.e., aggression bias) and physical aggression were measured using a dot probe task and a shock-based aggression task, respectively.

Results—Intoxicated men whose attention was distracted displayed significantly lower levels of aggression bias and enacted significantly less physical aggression than intoxicated men whose attention was not distracted. However, aggression bias did not account for the lower levels of alcohol-related aggression in the distraction, relative to the no-distraction, condition.

Conclusions—These results replicated and extended past evidence that cognitive distraction is associated with lower levels of alcohol-related aggression in highly provoked males and provide the first known cognitive data to support the attentional processes posited by the attention-allocation model. Discussion focused on how these data inform intervention programming for alcohol-related aggression.

Keywords

Alcohol Consumption; Alcohol Myopia Theory; Attention-Allocation Model; Physical Aggression

The past several decades have witnessed substantial advancements in the scientific understanding of alcohol's facilitative effect on aggression. Cumulatively, research has identified numerous situational and trait-based risk factors associated with this aggression (e.g., Chermack & Giancola, 1997; Parrott & Giancola, 2006). In addition, researchers have found strong evidence to support a pharmacological explanation for alcohol's facilitative role in aggressive behavior. In addition to reducing fear and anxiety (e.g., Ito, Miller, & Pollock, 1996) and increasing arousal (e.g., Giancola & Zeichner, 1997), the

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pharmacological effects of alcohol have been shown to disrupt executive cognitive functioning that is central to maintaining inhibitory control over behavior (e.g., Giancola, 2004).

Despite these advancements, little research has investigated methods to reduce alcohol's effect on aggression. To help guide the field in a more applied direction, recent empirical (Giancola & Corman, 2007; McMurrin, 2007) and theoretical work (Giancola, Josephs, DeWall, & Gunn, 2009; Giancola, Josephs, Parrott, & Duke, 2010) has considered potential methods to reduce or prevent alcohol-related aggression. The majority of this work has invoked the attention-allocation model of alcohol myopia theory (Pernanen, 1976; Steele & Josephs, 1990; Taylor & Leonard, 1983). According to the attention-allocation model, alcohol intoxication impairs attentional capacity, which then restricts the inebriate's attentional focus to the most salient cues in the environment. Because in most real-world situations cues that instigate behavior (e.g., provocation) are more salient and easier to process than cues that inhibit behavior (e.g., negative consequences of aggression), intoxication is likely to facilitate attention toward cues that instigate behavior (Steele & Josephs, 1990). As a consequence of this attentional focus, aggression is more likely to occur.

Although a wealth of research has utilized the attention-allocation model to explain alcohol-related aggression and numerous other behaviors of public concern (e.g., unprotected sex: MacDonald, Zanna, & Fong, 1996; drinking and driving: MacDonald, Zanna, & Fong, 1995; suicide: Hufford, 2001; disinhibited eating: Ward & Mann, 2000), the attentional processes proposed to underlie this effect have yet to be directly subjected to empirical scrutiny. Before researchers can begin to utilize this model in intervention programming for alcohol-facilitated aggression, it is first necessary to examine whether acute alcohol intoxication facilitates attention toward provoking cues and whether disruption in attentional focus can redirect attention away from these cues. As such, the chief purpose of the present study was to directly test the effects of alcohol and an established method for reducing alcohol-related aggression on attention-allocation to cues of aggression among provoked men.

How Does Alcohol Intoxication Decrease Aggressive Behavior?

The attention-allocation model has largely been utilized to explain why alcohol increases aggressive behavior. However, this model also makes the counterintuitive prediction that alcohol may *decrease* aggressive behavior, even below that of *sober* individuals. In a situation where non-provocative cues are most salient, alcohol myopia theory states that the narrowed attentional capacity of the inebriate will be focused on those cues leaving little space in working memory to focus on less salient provocative cues. In contrast, sober individuals faced with the same situation will still possess sufficient working memory to allocate attention to both sets of cues, thus increasing their likelihood of aggressive action above that of intoxicated individuals.

Recent empirical work supports this theoretical prediction. In a recent study (Giancola & Corman, 2007), participants were administered either an alcohol or placebo beverage and participated in a laboratory aggression paradigm without distraction or while presented with a moderate-load distraction task designed to disrupt working memory. In accordance with the attention-allocation model, the moderate-load distraction task was successful in attenuating alcohol-related aggression for inebriated individuals below that of sober individuals. Results further confirmed moderate-load distraction (i.e., holding four memory sequences in working memory) to be optimal for reducing aggression, relative to higher or lower levels (e.g., holding eight or two sequences in working memory) of distraction (Giancola & Corman, 2007). Furthermore, laboratory research has found that interventions designed to increase self-awareness (e.g., the addition of mirrors) reduces alcohol-related

aggressive behavior toward oneself (Berman, Bradley, Fanning, & McCloskey, 2009) and others (Bailey, Leonard, Cranston, & Taylor, 1983). Thus, by increasing self-awareness, the inebriate is distracted from provocation and able to process cues of inhibition.

Together, this theoretical and empirical work has begun to establish a foundation for intervention research in the field of alcohol-related aggression. In fact, several ecologically-valid interventions have recently been proposed that are based on the attention-allocation model. These include individual interventions that increase or decrease cognitive states associated with aggressive behavior (e.g., self-awareness, mindfulness, rumination), as well as public interventions designed to manipulate the attentional focus of inebriates, such as flashing signs in bars that proscribe violence (Gallagher, Hudepohl, & Parrott, 2010; Giancola et al., 2009, 2010). However, before such work can progress further, it is critical to demonstrate how these theoretically-based interventions might actually affect attention-allocation. Indeed, the focus of attentional resources on instigatory or inhibitory cues is the fundamental tenant of the attention-allocation model, yet extant research has not directly tested this attentional mechanism.

Attention-Allocation and Alcohol-Related Aggression

The reviewed literature indicates that research is needed to examine alcohol-facilitated attentional biases toward instigatory or inhibitory cues among provoked individuals. Pertinently, the idea that attention is allocated to mood-congruent stimuli is a well-accepted phenomenon in the psychological literature. Numerous studies have demonstrated mood-congruent attention-allocation to a number of stimuli, such as alcohol and drug cues, affect-related cues (e.g., threatening or sad faces), and aggression-themed words (e.g., Cohen, Eckhardt, & Schagat, 1998; Duka & Townshend, 2004; MacLeod, Mathews, & Tata, 1986; Smith & Waterman, 2003, 2004). Attention-allocation is commonly measured using the dot probe task. This task assesses reaction times to semantic or pictorial stimuli presented on a computer screen, with the dependent variable representing reaction times to the stimuli of interest. Particularly, the dot probe task can be modified to facilitate research with populations that are more difficult to test such as children and intoxicated individuals (reviewed in Mogg & Bradley, 1999).

In a typical version of the task with semantic stimuli, a fixation marker (e.g., an “X”) is presented on a computer screen for a set period of time and is followed by two words, one above the other. On critical trials, one word represents the stimulus of interest (e.g., fear) and is paired with a matched neutral word (e.g., fork). Immediately following the disappearance of each word pair, a small probe (e.g., dot, arrow) randomly appears in the location of one of the words. Participants press the button that corresponds to the probe location as quickly as possible. Attention allocation to the stimulus category is reflected by faster reaction times when the probe replaces stimulus, relative to the neutral, words. Extant research suggests that this effect reflects an attentional shift to the stimulus theme of interest (e.g., Mogg & Bradley, 1998).

Past research using variations of the dot probe task have evidenced attention-allocation toward aggression-themed stimuli among individuals prone to aggressive behavior (Cohen, Eckhardt, & Schagat, 1998; Smith & Waterman, 2003, 2004). However, participants in these studies did not consume alcohol and, thus, these data did not provide the direct evidence needed to support the attention-allocation model. Given that it is feasible to test directly the attention-allocation of intoxicated participants using methods such as the dot probe task, it is surprising that alcohol-aggression research has not yet examined the effect of alcohol on attention-allocation toward provocative and non-provocative cues. As such, a primary aim of the present study was to address this gap in the literature with the end goal of facilitating more informed intervention research to reduce alcohol-related aggression.

The Present Study

The purpose of the present study was threefold. The first goal was to examine the effects of alcohol and a cognitive distraction task on attention to aggression-themed stimuli among provoked men using a modified version of the dot probe task (e.g., Mogg & Bradley, 1999). The second goal was to replicate the findings of Giancola and Corman (2007) by examining behaviorally the effects of alcohol and distraction on physical aggression among provoked men using a modified version of the Taylor Aggression Paradigm (Giancola & Zeichner, 1995). Finally, the third goal was to examine whether hypothesized biases in attention-allocation to aggression-themed stimuli were associated with concomitant decreases in physical aggression.

To address these goals, we randomly assigned social drinking men to beverage (Alcohol, No-Alcohol Control) and distraction (Moderate Distraction, No Distraction) conditions. All men in this study were verbally and physically provoked by a fictitious male adversary following beverage consumption. In accordance with the reviewed literature, the overarching hypothesis of this study contended that, relative to all other groups, intoxicated-distracted participants would display the lowest levels of aggressive behavior and the least attention to aggression-themed words. A mediated moderation hypothesis was also advanced, such that alcohol-facilitated suppression of aggression was expected to be mediated by less attention-allocation toward aggression-related stimuli. In other words, it was expected that alcohol would narrow attentional capacity and thus restrict processing of instigatory cues (i.e., aggression-themed words) in distracted, relative to non-distracted, men. This reduced attentional focus and processing of instigatory cues was expected to directly account for lower levels of physical aggression in intoxicated-distracted, but not intoxicated-non distracted, men.

Method

Participants and Recruitment

Male social drinkers ($n = 170$) between 21 and 35 years of age ($M = 25.82$; $SD = 4.24$) were recruited from the metro-Atlanta community through advertisements posted on internet classifieds and placed in local-area newspapers. While studies have shown that women can be aggressive under certain circumstances (Bettencourt & Miller, 1996), most laboratory research has demonstrated that the effect size of alcohol on direct physical aggression is larger in men than in women (Giancola et al., 2009; Gussler-Burkhardt & Giancola, 2005). Moreover, crime statistics indicate that compared with women, men are disproportionately more aggressive (Bureau of Justice Statistics, 2001) and more likely to inflict physical injury during violent encounters (Archer, 2000). Thus, because this study sought to test hypotheses amongst persons deemed most susceptible to the aggression-facilitating effects of alcohol, only men were examined. Social drinking was defined as consuming at least three drinks per occasion at least twice per month. Respondents telephoned the laboratory and completed a telephone interview in which they were screened for alcohol dependence using the Brief Michigan Alcoholism Screening Test (Pokorny, Miller, & Kaplan, 1972). Pertinent research indicates that a cutoff score of six or above maximizes identification of alcohol dependent persons with minimal likelihood of false positives (Chan, Pristach, & Welte, 1994; Pokorny et al., 1972). Thus, any person scoring at or above this cutoff was excluded from participation. Those who reported past or present drug or alcohol-related problems, acute psychiatric symptomatology as defined by a score above 65 on the Global Severity Index of the Symptom Checklist-90-Revised (Derogotis, 1983), serious head injuries, or a condition in which alcohol is medically contraindicated were also excluded. Within one week of completing the telephone screening interview, eligible participants were contacted by phone and scheduled for an appointment. Participants were told to refrain from drinking alcohol or

using recreational drugs 24 hours prior to testing and to refrain from eating four hours prior to testing. Ineligible participants were also contacted by phone, informed that they would not be eligible to participate, and thanked.

The racial composition of this sample consisted of 94 African-Americans, 58 Caucasians, and 18 men who identified with another racial description. The sample had an average of 14.5 years of education, earned \$27,338 per year, and 89% had never been married. This study was approved by the university's Institutional Review Board.

Experimental Design

Participants were randomly assigned to one of four experimental groups: (1) Alcohol, Distraction, (2) Alcohol, No Distraction, (3) No-Alcohol Control, Distraction, and (4) No-Alcohol Control, No Distraction. While placebo groups may sometimes produce compensatory responses that could reduce aggression relative to no-alcohol control groups (Bushman & Cooper, 1990), meta-analytic studies demonstrate that placebo and no-alcohol control groups do not significantly differ in aggression (Bushman, 1993). Thus, a placebo group was not utilized.

Materials

Prior to experimental procedures, participants completed the *Buss-Perry Aggression Questionnaire* (BAQ; Buss & Perry, 1992). The BAQ is a 29-item self-report measure used to assess one's disposition toward physical aggression, verbal aggression, anger, and hostility. In the present study, only the Physical Aggression subscale was analyzed to identify group differences that could potentially confound laboratory-based physical aggression. On this measure, participants rate how each item describes them on a scale of 1 (*extremely uncharacteristic of me*) to 5 (*extremely characteristic of me*). The BAQ has been shown to have high validity and reliability ($\alpha = .80$). A Cronbach alpha coefficient of .78 was obtained for the Physical Aggression subscale in the present sample.

Beverage Administration

Men who received alcohol were administered a dose of 1g/kg of 95% alcohol USP mixed at a 1:5 ratio with Tropicana orange juice. Beverages were poured into two glasses in equal quantities. The dosing procedure was also calculated for participants in the no-alcohol control group, however, they received an isovolemic beverage consisting of only orange juice (i.e., the missing alcohol portion was replaced with orange juice). Participants in the alcohol group were not given information regarding what to expect from their beverages other than they would receive the equivalent of "about three or four mixed drinks in a bar." Participants in the no-alcohol control group were explicitly told that their beverage did not contain alcohol.

Dot Probe Task

A modified dot probe task was used to assess attention-allocation to aggression-themed, relative to neutral-themed, words. The task was created with Direct RT software (Empirisoft Research Software, Philadelphia, PA) and was presented on a personal desktop computer. Previous work with this task and its various modifications (reviewed in Mogg & Bradley, 1999) has established its reliability and validity as a measure of attention biases in clinical versus non-clinical samples (e.g., MacLeod et al., 1986), as well as in experimentally primed versus control samples (reviewed in Matthews & MacLeod, 2002). Importantly, past research has also found that the dot probe task is not a reliable measure of attentional biases of unprimed non-clinical samples (Schmukle, 2005). From these data, it is clear that non-clinical samples must undergo experimental state activation (e.g., priming via provocation)

in order to evidence significant attention allocation biases. Thus, in the present study, all participants were primed for aggression-themed stimuli using both physical and verbal provocation (see the Procedure section for more detail). Furthermore, the validity of a dot probe task as a measure of attention-allocation to aggression-themed stimuli has also been demonstrated. Specifically, studies using this task indicate that violent offenders and individuals high in trait aggressivity evidence significant response biases to aggression-themed words (Smith & Waterman, 2003, 2004).

In this task, participants were seated approximately three feet in front of a computer screen and faced the screen at approximately a 90 degree angle. Participants were instructed to “hover” the index finger of their dominant hand over the down arrow key in a “ready” position throughout the task. After reading a set of directions and indicating that they were ready to begin, a fixation “x” was presented in the center of the computer screen for 500 ms. After this brief period of time, the “x” disappeared and two words appeared on the screen, one above the other. The words remained on the screen for 500 ms and then disappeared. Immediately following presentation of the words, a probe (either a left-facing arrow or right-facing arrow) replaced one of the words. Participants were asked to press the left arrow key if a left-facing arrow replaced the word or to press the right arrow key if a right-facing arrow replaced the word. Participants were directed to respond as quickly and as accurately as possible. The present study used arrow probes instead of dot probes to simplify the task for our population of intoxicated individuals (reviewed in Mogg & Bradley, 1999).

There were 49 aggression-neutral word pairings (see Appendix) and 40 neutral-neutral word pairings to mask the theme of the study. The aggression words were obtained from three sources that aggregated emotionally salient words from the English language (Bradley & Lang, 1999; Clore, Ortony, & Foss, 1987; Smith & Waterman, 2003). Aggression words were selected only if they reflected themes of behavioral aggression, as opposed to reflecting themes of emotion (e.g., anger) or cognition (e.g., hostility). A neutral word was matched to each aggression word in terms of word frequency (Kucera & Francis, 1967), first letter, and syllabic length in order to control for these potential confounds; neutral words paired with the aggression words were different from the 40 neutral-neutral word pairings. Because past research has shown that response latency decreases and accuracy increases when words are repeated within the same task (Grant & Logan, 1993), each word pairing was only presented once. The task was configured to ensure that the probes appeared an equal number of times in both the upper and lower word locations and replaced the aggression and neutral words an equal number of times. The direction of the arrow (i.e., left-facing, right-facing) appeared an equal number of times and appeared equally within the aggression-neutral and neutral-neutral word pairings.

Attention-allocation to aggression stimuli was measured by the reaction time to the arrow probe, with faster reaction times occurring when the arrow probe replaced aggression words and slower reaction times occurring when the probe replaced neutral words. Extant research suggests that this effect reflects an attentional shift or “attention-allocation” to the stimulus theme of interest (e.g., Mogg & Bradley, 1998). In the present study, attention-allocation to aggression-themed, relative to neutral-themed, words was termed aggression bias and calculated by subtracting the mean reaction time (RT) to probes that replace aggression words from the mean RT to probes that replace neutral words. Separate calculations were conducted for words that appear above and below the fixation point. More positive scores indicate faster responses (i.e., an attentional bias) to probes replacing aggression words.

Aggression Task

A modified version (Giancola & Zeichner, 1995) of the Taylor Aggression Paradigm (TAP; Taylor, 1967) was used to assess direct physical aggression. The hardware for the task was

developed by Coulbourn Instruments (Allentown, PA) and the computer software was developed by Vibranz Creative Group (Lexington, KY). The TAP is presented as a reaction time competition in which electrical shocks are administered to and received from a “fictitious” opponent. Participants are seated at a table in a small room. On the table facing participants is a computer screen and keyboard. The numbers “1” through “10” on the computer keyboard are labeled from “low” to “high” to allow participants to determine varying levels of shock to administer. Participants receive visual feedback on the computer monitor indicating whether they “won” or “lost” the trial as well as the shock level selected and received. The keyboard and monitor are connected to a computer located in an adjacent room out of the participant’s view. Physical aggression was defined as the summation of standardized scores for the average intensity and duration of shocks selected. This was done because previous research has demonstrated that shock intensity and shock duration are highly correlated and part of a more general construct of direct, physical aggression (Carlson, Marcus-Newhall, & Miller, 1989). The Taylor task and other similar shock-based laboratory paradigms have been repeatedly shown to be safe and valid measures of aggressive behavior (e.g., Anderson & Bushman, 1997).

Distraction Task

While engaged in the dot probe task and the TAP, participants in the distraction condition also attended to a computerized memory sequencing task on a laptop computer located to the left of their desktop computer. Participants were able to see the laptop screen with the distraction task trials in their periphery, while attending to the dot probe task and TAP on the desktop computer. In the distraction task, a 3×3 matrix of 2-cm light-gray squares were presented on a white computer screen. On each trial, four squares illuminated (in black) in a random sequencing order. Participants were asked to attend to, memorize, and click (using the laptop keypad) the sequencing order of each trial. The distraction trials proceeded throughout the duration of the dot probe task and the TAP, and these trials proceeded continuously regardless of whether the participant responded to the sequence. In order to prevent confounding emotional responses, performance feedback was not provided. To ensure participants engaged in the task, distraction condition participants were told that they would receive an extra \$30 if they performed better than 80% of subjects who have already been tested. In reality, all subjects were remunerated an extra \$30. Previous research using similar methodology has confirmed the validity of this task as a moderate-level distracter (Giancola & Corman, 2007).

Although the distraction task continued to proceed throughout the dot probe task, participants attended solely to the dot probe task trials until the computer program instructed participants to stop the task (at intermittent intervals) by displaying a black screen that stated “Play the Tile Game” (i.e., the distraction task). During these intermittent breaks, participants completed trials of the distraction task; to control for the passage of time, participants in the no-distraction condition were instructed to stare at a black screen on the computer monitor during the intermittent breaks. After a pre-determined period of time, the experimenter instructed participants via the intercom to press the spacebar to resume the dot probe task. Participants then attended to the dot probe task trials until the computer program instructed them to stop the task and play the “Tile Game” again. The experimenter monitored participant’s adherence to this sequence via the control room.

During the TAP, the program did not stop to allow participants to attend solely to the distraction task at intermittent intervals; rather, it was left up to individual participants to decide how they wished to allocate their time between the two tasks. As such, participants were allowed to shift their focus back and forth between the TAP and the distraction task.

Procedure

The sequence of experimental procedures is summarized in Figure 1. Upon arrival to the laboratory, participants were asked to present a picture ID and informed consent was obtained. Participants were weighed and their breath alcohol concentration (BrAC) was assessed to confirm sobriety. Participants with a BrAC above 0% were prohibited from completing the study on that day and asked to reschedule. Participants then completed a written version of the telephone screening measures to re-establish eligibility and the BAQ. Eligible participants were randomly assigned to one of the four conditions and were informed of their beverage condition.

Participants were allotted twenty minutes for beverage consumption. During the first ten minutes of beverage consumption, all participants engaged in 20 practice trials for the dot probe task with neutral word pairings (not utilized in the experimental trials) to account for decreases in response latencies during initial trials (Forbach, Stanners, & Hochhaus, 1974). During the second ten minutes of beverage consumption, distraction condition participants practiced the distraction task. Following beverage consumption, the experimenter conducted the pain threshold assessment to determine the intensity parameters for the shocks they would receive. Assessment of participants' pain thresholds was accomplished via the administration of short-duration shocks (1 sec) presented in an incremental stepwise intensity method from the lowest available shock setting, which is imperceptible, until the shocks reached a reportedly painful level. All shocks were administered through two electrodes that were attached to the index and middle fingers of the non-dominant hand. Participants were asked to inform the experimenter when the shocks were "first detectable" and then when they reached a "painful" level. This procedure was conducted while participants were seated in the testing room and the experimenter was in an adjacent control room. They communicated through the use of an intercom.

Following the pain threshold assessment (and upon reaching a BrAC of .08% for alcohol participants), participants were shown a 20 second video of their same-race "opponent" answering several demographic questions (see Deception Manipulation below). Next, participants were informed that they would complete several "practice" competitive reaction time trials against their opponent so that they could become familiar with the procedure. In actuality, the "practice" trials were rigged so that all participants received physical and verbal provocations from their opponent in order to create the impression of an adversarial interpersonal interaction and engender state-activation for the dot probe task (see Dot Probe Task). Specifically, participants "lost" a disproportionate number of trials (i.e., four out of six) and the "opponent" delivered the highest possible shock intensity (i.e., 10's) to participants on each of these four trials. At the end of the trials, participants were instructed to provide verbal feedback to their opponent via a closed circuit intercom system and received a pre-recorded derogating message from their opponent stating "Well, he was really slow, I mean mentally slow. This guy must be a real idiot or something. I mean, I messed up on some of those trials and still won! Now that I've got the hang of it, I think I can pretty much beat him every time, which will be great because I want to keep nailing him with tens!"

Immediately after receipt of the opponent's feedback, participants completed the dot probe task and the TAP in their respective distraction conditions (see Distraction Task for more detail). The aggression task commenced immediately after participants completed the dot probe task. This task consisted of 20 reaction time trials (10 wins and 10 losses). For each trial, participants were informed that shortly after the words "Get Ready" appeared on the 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 their opponent. 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. Participants could not elect to not shock their opponent. However, participants were told that shock button “1” would deliver a low intensity shock that is best characterized as “very mild” and “definitely not painful.” On losing trials, participants received shocks from their “opponent” that were one second in duration and ranged from 90% (an “8”) to 100% (a “10”) of the highest tolerated shock intensity. These high intensity shocks were administered to remain consistent with participants’ prior receipt of high intensity shocks and verbal provocation. Following each trial, a specially designed “volt meter” and the illumination of one of the 10 “shock lights” [ranging from 1 (low) to 10 (high)] on the computer screen signaled to the participant the shock that he or the opponent selected. In actuality, the competitive task was used to lead participants to believe that they were engaging in an adversarial interaction with another individual. A randomly generated win/loss sequence was predetermined and incorporated into the computer program that executed the task. All participants received the same sequence. A computer controlled the initiation of trials, administration of shocks to participants, and recording of their responses.

Upon completion of the aggression task, BrACs were measured for all participants. They were also asked a variety of questions to indirectly assess the credibility of the experimental manipulation (see below). Participants were then debriefed and compensated. All individuals who received alcohol remained in the laboratory until their BrAC fell to .03% and escorted to pre-arranged transportation (e.g., public transportation, friend) by laboratory staff.

Deception Manipulation

To disguise the true aims of the study, participants were told that the purpose of the study was to examine alcohol’s effects on motor attention. In order to convince participants that they were competing against another person, they completed a demographic interview (prior to beverage consumption) in which they answered several basic questions about themselves (e.g., first name, favorite food). This interview was ostensibly videotaped by the experimenter for the purpose of informing the participants’ opponent about who they would be competing against. Participants were told that they would receive similar information about their opponent. Immediately prior to the reaction time task, participants viewed a 20-sec video that portrayed a male opponent (a confederate) of the same race answering these same questions. Additionally, prior to assessment of participants’ pain threshold, they heard their “opponent’s” pre-recorded pain threshold assessment responses over the intercom system.

Results

Manipulation Check

To verify task deception, participants were asked to verbally discuss with the experimenter whether or not they thought the tasks were good measures of reaction time. In addition, participants were asked to describe their overall “impression” of their opponent during the tasks and to comment on whether they thought their opponent was “reasonable.” Overall, the deception manipulation appeared successful. Ten participants (five no-alcohol/no-distraction and five alcohol/no-distraction) reported that they did not believe they were competing against another person and were removed from analyses. This left a sample of 160 men.

Participants typically stated that they thought their opponent was “overconfident” or “a jerk” and most stated that they believed the tasks were good measures of reaction time.

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 .091% ($SD = .012$) just before the experimental procedures commenced and a mean BrAC of .113% ($SD = .016$) immediately following the experimental procedures. Inspection of these data at the individual level confirmed that all intoxicated participants were on the ascending limb of the BrAC curve during the experimental procedures. Participants in the no-alcohol control condition had a mean BrAC of 0% before and after the experimental procedures.

Data Preparation

Preliminary analyses—Random group assignment was expected to produce, on average, an equal distribution of pertinent demographic and dispositional variables across experimental groups (Whitley, 2002). To confirm this assumption, a series of 2 (Beverage) X 2 (Distraction) between-groups analysis of variances (ANOVAs) were conducted with pertinent demographic characteristics (e.g., age, years of education, yearly income) and dispositional physical aggression. No significant group differences emerged for years of education, yearly income, or dispositional physical aggression. However, a significant main effect of distraction was detected for age $F(1,158) = 3.99, p < .05^1$. Chi-square analysis did not detect a significant difference in the racial composition or marital status of the experimental groups. Finally, inspection of the distribution of aggression scores revealed one extreme outlier (i.e., beyond 3 SDs). This case was removed prior to hypothesis testing and resulted in the following sample size in each experimental group (total $N = 159$): Alcohol, No Distraction ($n = 41$); Alcohol, Distraction ($n = 36$); No-Alcohol Control, No Distraction ($n = 40$); No-Alcohol Control, Distraction ($n = 42$).

Bias scores—Data from trials with errors were excluded from analysis (.02% of the data points). Reaction times (RTs) less than 200 ms and greater than three standard deviations above the mean were defined as outliers and were discarded. As noted previously, the mean RT was computed separately for each probe location (i.e., top probe, bottom probe) in order to allow analyses to examine the effect of this nuisance variable on attention-allocation.

Regression Analyses

The overarching hypothesis of mediated moderation was tested by computing three regression models as described by Muller, Judd, and Yzerbyt (2005). Dummy coding and effects coding were employed to standardize the categorical variables (i.e., beverage condition, distraction condition). Effects coding was utilized in regression models with interactions composed of two categorical variables and dummy coding was utilized in regression models with interactions composed of one categorical variable and one continuous variable (Cohen, Cohen, West, & Aiken, 2003). Furthermore, when aggression bias scores were entered as the predictor variable, they were mean centered by subtracting the mean score of the variable from the raw score of the variable. Interaction terms were calculated by obtaining cross-products of pertinent first-order variables.

¹There is no theoretical evidence to suggest that age should significantly influence the effects of distraction on alcohol-related attentional biases or physical aggression within our sampled age-range of 21–35 year-old participants. Nonetheless, separate analyses were computed with age as a covariate in the first step of the hierarchical regression models. Results did not significantly differ after accounting for this variable.

Due to the fact that probe location was a repeated-measure variable (bottom probe and top probe), the sum/difference regression method was employed (Judd, Kenny, & McClelland, 2001). Two new dependent variables were created. The first variable (DV1) represented the sum of the response times to bottom and top probe locations (DV1 = Bottom Probe Location + Top Probe Location). The second variable (DV2) represented the difference between the two responses (DV2 = Bottom Probe Location - Top Probe Location). The regression models were computed separately with DV1 and DV2 as criterion variables. The coefficients for the DV1 model represented the “between” effects and the coefficients for the DV2 model represented the “within” effects. Given that independent or interactive effects of probe location were not anticipated, regression models that examined within subjects effects (i.e., DV2 as criterion variable) were not expected to be significant.

Effects of Distraction on Alcohol-Facilitated Physical Aggression

The full model was not significant, $F(3, 155) = 1.72, p = .17, R^2 = .013$. Beverage ($\beta = .06, p = .48$) and distraction ($\beta = -.10, p = .23$) were not significantly related to physical aggression. However, the Beverage X Distraction interaction was significant ($b = -.223, p < .05$) and thus met the first criterion for mediated moderation. Examination of this interaction indicated that intoxicated, distracted participants ($M = -.29, SD = 1.47$) were significantly less aggressive than intoxicated, non-distracted participants ($M = .45, SD = 1.74$), $t(75) = -2.01, p < .05, d = -.46, 95\% \text{ CI } [-0.91, 0.00]$. Significant differences in aggression were not observed between any other groups, although intoxicated, distracted participants displayed the lowest levels of aggression overall (see Figure 2, top panel). Overall, these findings evidenced that participants in the alcohol, distraction group displayed significantly lower levels of aggression than participants in the alcohol, no-distraction group.

Effects of Distraction on Alcohol-Facilitated Aggression Bias

With the between effects variable (i.e., DV1) as the criterion variable, the model was significant, $F(3, 155) = 3.506, p < .05, R^2 = .064$. The effects of beverage ($\beta = -.107, p = .172$) and distraction ($\beta = -.117, p = .136$) were not significant. However, the Beverage X Distraction interaction was significant ($b = -12.51, p < .01$) and thus met the second criterion for mediated moderation. Examination of this interaction indicated that intoxicated, distracted participants ($M = -15.87, SD = 41.40$) evidenced less attentional bias toward aggression words than intoxicated, non-distracted participants ($M = 3.76, SD = 28.15$), $t(75) = -2.46, p < .05, d = -.57, 95\% \text{ CI } [-1.02, -0.10]$, sober, distracted participants ($M = 3.16, SD = 25.95$), $t(76) = -2.47, p < .05, d = -.56, 95\% \text{ CI } [-1.01, -0.11]$, and sober, non-distracted participants ($M = -2.23, SD = 22.10$), $t(74) = -1.82, p < .10, d = -.41, 95\% \text{ CI } [-0.87, 0.04]$. No other group differences in aggression bias were detected. Overall, these findings indicated that participants in the alcohol, distraction group displayed less attentional bias toward aggression words than participants in all other conditions (see Figure 2, bottom panel).

With the within effects variable (i.e., DV2) as the criterion variable, the model was not significant, $F(3, 155) = 2.084, p = .105, R^2 = .039$. The effects of beverage, distraction, and their interaction were not significant. As expected, probe location did not significantly affect participants' aggression bias.

Effects of Alcohol, Distraction, and Aggression Bias on Physical Aggression

Because prior analyses determined that distraction resulted in lower levels of alcohol-related aggression and attentional bias toward aggression words, the final criterion for mediated moderation was tested with aggression bias as the mediator variable. The model was not significant, $F(5, 153) = 1.10, p = .36, R^2 = .003$. The effect of aggression bias was not

significant ($\beta = .054, p = .694$). Thus, the final criterion for mediated moderation was not met².

Discussion

The present study provides the first known cognitive data to support directly a primary hypothesis of the attention-allocation model, which posits that distraction will shift the inebriate's attention away from aggressive cues. Results of this investigation also support this model as an explanation for alcohol-related aggression (Giancola & Corman, 2007) and extend this finding to a sample of men who experienced an extremely provoking interpersonal interaction. These data provide preliminary support for the development of interventions that aim to redirect intoxicated men's attention toward stimuli that is non-aggressive, non-provocative, and/or prohibitive of aggressive behavior.

Effect of Distraction on Alcohol-Facilitated Physical Aggression

In line with past findings (Giancola & Corman, 2007), results indicate that intoxicated men whose attention was distracted during the aggression task evidenced less aggression than intoxicated men whose attention was not distracted during the aggression task. In other words, these data show that during a hostile situation, distraction from salient cues of instigation (i.e., threat from an opponent) can decrease alcohol-related aggression in highly provoked men. Although the present study did not replicate findings by Giancola and Corman (2007) that distraction can reduce intoxicated men's aggression below that of sober men, it is worth noting that while Giancola & Corman (2007) utilized high physical provocation, the present study incorporated both high *verbal* and high *physical* provocation. In fact, the verbal provocation included the opponent's explicit intent to aggress toward the participant. Thus, even within this extremely provoking interpersonal interaction, our data suggest that cognitive distraction resulted in significantly less alcohol-related aggression in men.

Effect of Distraction on Alcohol-Facilitated Aggression Bias

While it was important to replicate Giancola and Corman's (2007) findings and extend these results to a sample of highly provoked men, the next step in this line of research was to test the cognitive underpinnings of the attention-allocation model in relation to alcohol-related aggression. Indeed, previous studies in this area have provided only indirect evidence that intoxicated participants' attention is focused more so on cues related to the instigation, rather than the inhibition, of aggression. However, no study has directly tested this assumption or whether cognitive distraction facilitates a shift in attention away from salient aggression-related cues. As such, the second goal of the present study was to examine the effect of cognitive distraction on sober and intoxicated men's attention-allocation toward aggression-themed words. In accordance with predictions, results evidenced that intoxicated men whose attention was distracted evidenced the lowest attentional bias toward aggression-themed words compared to non-distracted intoxicated men and all sober men.

As such, this work not only informs the alcohol-aggression literature but also advances understanding of other alcohol-facilitated public health behaviors. For example, the attention-allocation model contends that alcohol-related sexual aggression is a result of myopia toward cues that instigate sexually aggressive behavior (e.g., desire to have sex) to

²Because many studies using the TAP utilize mean shock intensity, rather than a combined score of mean shock intensity and mean shock duration, as the outcome variable, analyses were re-run using mean shock intensity as the outcome variable. No significant effects emerged. This suggests that, in the present study, mean shock intensity alone did not capture the aggression construct as well as the combined index.

the exclusion of cues that inhibit this behavior (e.g., negative consequences). Likewise, cognitive distraction may also decrease myriad other negative behaviors – such as unprotected sex, drinking and driving, suicide, and disinhibited eating – that have previously been conceptualized within the framework of the attention-allocation model (see Giancola et al., 2010). It will be important for future experimental research to test these hypotheses.

Effects of Alcohol, Distraction, and Attentional Bias on Physical Aggression

Support for the first two aims of the present study advances scientific understanding of the cognitive and behavioral effects of acute alcohol intoxication and cognitive distraction on aggression. The final aim was to test the hypothesis that lower levels of aggression in intoxicated distracted, relative to intoxicated non-distracted, men is mediated by a shift in attention away from aggression-related cues. Results did not support this hypothesis. One explanation for this outcome is that the present study only measured attention-allocation to aggression-themed words; attention-allocation to the actual instigatory cues in participants' environment (e.g., opponent threat to administer high shock levels) was not measured. As a consequence, attentional biases toward semantic stimuli were likely one step removed from the hypothesized attentional biases toward the environmental cues purported to mediate alcohol-related aggression. Thus, future research may benefit from an assessment of participants' attention-allocation to actual cues of instigation during an adversarial interaction. Alternatively, research may benefit from utilizing assessment measures that are better able to capture the intervening cognitive mechanisms for this aggression. Cognitive-behavioral theory and research suggest a strong correlation between affect and thought, which is posited to comprise an overall state of cognition (Wright, Basco, & Thase, 2006). As such, research could simultaneously employ real-time measures of state affect and cognition during the aggression task. Past research has successfully utilized facial coding (e.g., Parrott, Zeichner, & Stephens, 2003) to assess state affect and the articulated thoughts paradigm (e.g., Eckhardt, Barbour, & Davison, 1998) to assess "in-the-moment" cognitions. Employing these methodologies during the aggression task may provide an assessment of attention-allocation that more readily maps onto participants' behavior.

Study Limitations

Several limitations of the present study merit discussion. First, acknowledging an extensive literature on mood congruent biases in information processing, the present study cannot rule out the possibility that alcohol narrowed attention to provocative cues in a mood congruent fashion (i.e., greater alcohol myopia to provocative cues among men with higher anger arousal). Accordingly, cognitive distraction may reduce alcohol-related aggression most effectively for individuals who were experiencing high anger arousal. An alternative conceptual model advanced by Giancola and colleagues (2010) posits that alcohol narrows attention onto negative affect and/or anger, which then serves to exacerbate those affective states. This short term increase in negative affect then facilitates mood congruent cognitive (e.g., hostile attributions) and behavioral responses (e.g., aggression). Thus, it is also plausible that cognitive distraction reduces alcohol-related aggression by facilitating a shift in attention away from negative mood states. Future research is needed to evaluate simultaneously these hypotheses.

Second, a placebo group was not incorporated, which would have allowed for the examination of expectancy effects on alcohol-related aggression. However, while important for measuring the effects of alcohol expectancies on a variety of other behaviors, several meta-analytic studies have demonstrated that placebo groups do not differ from no-alcohol control groups in the expression of aggression (Bushman, 1993). Thus, it is unlikely that addition of a placebo group would have changed the present findings. Third, evidence indicates that alcohol-related aggression is most likely among heavy drinkers (e.g., Parrott &

Giancola, 2006). However, like most studies in this area, the present sample was comprised entirely of social drinkers who did not evidence an alcohol use disorder on screening measures. Thus, studies of the alcohol-aggression link that recruit samples of heavy and/or problematic drinkers (inclusive of persons with an alcohol use disorder) are sorely needed. Fourth, although the distraction task resulted in significantly less attentional bias toward aggression-themed stimuli and physical aggression in intoxicated men, the ecological validity of this task is limited and cannot be specifically applied to interventions to reduce alcohol-related aggression. However, this limitation is tempered by the fact that it is the theoretical mechanism, and not the specific intervention, that may be generalized to naturalistic settings. Put another way, the intention of this study was not to predict whether our specific distraction task would reduce alcohol-related aggression and attention toward aggression-themed stimuli in the “real world.” Rather, this study sought to test the theoretical assumptions of the attention-allocation model. Indeed, it has been argued that external validity is not the same thing as generalizability (Mook, 1983). As Anderson and Bushman (1997) astutely noted “the primary goal of most laboratory research is the development of theories designed to explain underlying processes and mechanisms..., it is these theoretical principles that one wishes to generalize, not the specific characteristics of the sample, setting, manipulation, or measure” (p. 22).

Clinical Implications

Findings from the present study provide *preliminary* support for the development of interventions proposed by Giancola and colleagues (2009, 2010) that aim to redirect intoxicated men’s attention toward stimuli that is non-aggressive, non-provocative, and/or prohibitive of aggressive behavior. For example, results support the strategic placement of large mirrors painted with jail bars, anti-violence slogans, and visible cameras in high-risk environments (e.g., bars). Indeed, as demonstrated by a simple distraction task in the present study, these environmental cues are posited to shift myopia toward inhibitory cues and away from instigatory cues such as provocation. The present results also support the use of techniques that set to re-focus or “cool down” intoxicated individuals before aggression can escalate.

Alcohol-related violence in the home, particularly toward intimate partners, is one of the most common settings for aggression outside of public establishments (Leonard, Quigley, & Collins, 2002). As such, it is important for interventions to be geared toward both the general public (e.g., bar settings) and the individual (e.g., persons who perpetrate alcohol-facilitated intimate partner violence). In addition to informing interventions delivered to the general public, the present study also provides useful insight into interventions that may be delivered directly to the individual. For example, enhancing dispositional mindfulness via mindfulness training has been proposed as one avenue to decrease alcohol-related aggression (Giancola et al., 2009, 2010). Researchers hypothesize that mindfulness engenders healthier cognitions and behaviors by increasing cognitive flexibility and facilitating self-awareness. Within the framework of the attention-allocation model, this heightened self-awareness is posited to “free up” attention and allow for the more flexible distribution of limited cognitive resources to respond and, when needed, to regulate emotional and behavioral reactions (Brown & Ryan, 2003). It is these effects of mindfulness that are hypothesized to account for decreases in aggressive action (Gallagher et al., 2010; Heppner et al., 2008). Indeed, several recent laboratory studies have demonstrated an inverse relation between mindfulness and aggression (e.g., Heppner et al., 2008). Additionally, one cross-sectional study found that heavy episodic drinking increased perpetration of sexual aggression toward one’s partner among men with lower, but not higher, levels of dispositional mindfulness (Gallagher et al., 2010).

Concluding Summary

Results of this study provide direct empirical support for the attention-allocation model in a diverse community sample of men. This work demonstrates that intoxicated and highly provoked men are significantly less aggressive and allocate less attention toward aggression-themed stimuli when exposed to a cognitive distraction, relative to a no distraction, condition. However, results did not indicate that attention-allocation toward semantic aggression stimuli accounted for the relation between alcohol intoxication and aggression. Nonetheless, this study provides the first known cognitive data to support the attentional processes posited by the attention-allocation model and replicates and extends past behavioral findings (Giancola & Corman, 2007) for this model as an explanation for alcohol-facilitated aggression. If research continues to support the theoretical tenants of the attention-allocation model, public health programming and treatment-outcome studies can then be utilized to test and further refine interventions for the reduction of alcohol-related aggression.

Acknowledgments

This research was supported by grant R01-AA-015445 from the National Institute of Alcohol Abuse and Alcoholism. Portions of these data were presented at National Summit on Interpersonal Violence and Abuse Across the Lifespan, Dallas, TX.

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Appendix. Aggression and Neutral Word Pairs

Abuse/alike	Fight/film	Rifle/rising
Annihilate/accordion	Gouge/geese	Riot/rabbit
Argue/actor	Horror/hotels	Ripped/ramp
Assault/assert	Humiliate/hyperbole	Scratch/shelf

Attack/account	Hurt/height	Scream/stove
Batter/banjo	Injure/import	Shoot/scope
Bloody/brazil	Insult/inform	Slash/sage
Break/bank	Intimidate/informative	Slaughter/sculpture
Brutal/bucket	Kick/kent	Smash/scan
Burn/bush	Knife/key	Stab/sash
Capture/classroom	Massacre/mackerel	Strike/sake
Cruel/cone	Menace/marrow	Threaten/timing
Crush/chrome	Mutilate/maverick	Torture/tablet
Crushed/danced	Punch/paved	Violent/vehicle
Cut/cent	Punish/picnics	Wound/wood
Damage/decades	Quarrel/quoted	
Destroy/decide	Rape/raft

Figure 1.
Sequence of procedures for experimental session. DPT = Dot Probe Task; TAP = Taylor Aggression Paradigm.

Figure 2.
Top panel: Effect of distraction on the relation between beverage consumption and aggression. Bottom panel: Effect of distraction on the relation between beverage consumption and aggression bias.