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Trait displaced aggression and psychopathy differentially moderate the effects of acute alcohol intoxication and rumination on triggered displaced aggression

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ABSTRACT

When angered, alcohol and rumination increase aggression toward the source of a subsequent minor annoyance. Little is known about individual differences that moderate this phenomenon. One hundred university students (47 men, 53 women) were provoked and given either alcohol or placebo and subsequently induced to ruminate or engage in distraction. Participants were then given the opportunity to aggress against a somewhat annoying fictitious participant by determining the amount of hot sauce the other participant must consume. Alcohol and rumination independently augmented aggressive behavior, and these effects were moderated by trait displaced aggression and psychopathy, respectively. These findings suggest alcohol use and rumination as targets of intervention, specifically for those high in trait displaced aggression and psychopathy.

1. Introduction

The causes of many acts of aggression are difficult to comprehend. For example, the excessive aggression commonly observed in cases of intimate partner violence and road rage are often instigated by fairly trivial triggering events. Research and theory within the triggered displaced aggression (TDA) paradigm can explain such perplexing instances of aggression that exceed normative tit-for-tat responding (Axelrod, 1984). The classic displaced aggression effect occurs when a person is provoked, is unwilling or unable to retaliate against the original provocateur and subsequently aggresses against a seemingly innocent target (Dollard, Doob, Miller, Mowrer, & Sears, 1939; Hovland & Sears, 1940; Marcus-Newhall, Pedersen, Carlson, & Miller, 2000). In contrast to classic displaced aggression, TDA occurs when the subsequent target is the source of a second, subjectively annoying provocation, (referred to as the trigger), and the aggressor responds with a disproportionate level of aggression (Pedersen, Gonzales, & Miller, 2000; Vasquez, Denson, Pedersen, Stenstrom, & Miller, 2005). To illustrate, a man who is scolded by his superior (e.g., "you really messed up that presentation") and does not retaliate, but then encounters a co-worker who is less than sympathetic (e.g., "well, maybe you should have tried harder") and subsequently shouts insults at the co-worker, has engaged in TDA.

A number of factors increase the severity of TDA. These include alcohol intoxication, rumination, and the stable dispositional tendency to displace aggression (Aviles, Earleywine, Pollock, Stratton, & Miller, 2005; Bushman, Pedersen, Vasquez, Bonacci, & Miller, 2005; Denson, Aviles, et al., 2008; Denson, Pedersen, & Miller, 2006). These effects can be understood within the context of the General Aggression Model (GAM; Anderson & Bushman, 2002). The GAM proposes that personal characteristics interact with situational features such as provocation and alcohol intoxication to activate aggressive cognition, angry affect, and/or physiological arousal. When sufficiently activated, these internal states bias appraisal and decision-making processes, which subsequently increase the likelihood and severity of aggressive behavior.

Recent research suggests that rumination increases all three of the internal antecedents to aggression specified in the GAM: angry affect, aggressive cognition, and physiological arousal (Kross, Ayduk, & Mischel, 2005; Ray, Wilhelm, & Gross, 2008; Rusting & Nolen-Hoeksema, 1998; Wimalaweera & Moulds, 2008). Miller and colleagues (Miller, Pedersen, Earleywine, & Pollock, 2003) theorized that prolonged rumination facilitates TDA because it maintains these routes to aggression over time, which in turn, increase hostile reactions to subsequent triggering events. The findings of recent TDA experiments are consistent with this theorizing.

Specifically, relative to distraction, rumination increases displaced aggression, but only when individuals are provoked and rumination is followed by a triggering event (Bushman et al., 2005; Denson et al., 2006; Denson, Spanovic, et al., 2008).

Only one previous experiment has simultaneously examined the effects of rumination and alcohol in eliciting aggression. Denson, Spanovic, et al. (2008) found that alcohol and self-focused

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rumination independently augmented TDA. *Self-focused rumination* is defined as thoughts and feelings about one's thoughts, behavior, and negative emotions (Rusting & Nolen-Hoeksema, 1998). This is distinct from *provocation-focused rumination*, wherein the individual's thoughts and feelings are primarily externally focused on reliving the provoking incident and planning revenge (Denson et al., 2006). The current study is the first to simultaneously examine the effects of alcohol and provocation-focused rumination on aggression.

Researchers have proposed a number of psychological mechanisms to explain the aggression-augmenting effects of alcohol. One such mechanism, the *attention–allocation model* (also known as *alcohol myopia*), posits that alcohol consumption interferes with cognitive functioning by narrowing one's attention toward the most salient cues in the environment and steering attention away from less salient cues (Giancola & Corman, 2007; Steele & Josephs, 1990). This model is consistent with a recent TDA experiment which found that intoxicated participants were only able to pay attention to highly salient triggering events, whereas sober participants were able to allocate their attention to triggers that were both high and low in salience (Denson, Aviles, et al., 2008).

A second compatible mechanism is that of diminished inhibitory control. Giancola (2000, 2004) suggests that intoxicated aggression occurs as the result of temporary impairment of executive functioning, primarily via a reduction in the ability to control aggressive thoughts and actions. Such theorizing is consistent with neuroimaging research demonstrating that acute alcohol intoxication disrupts activity predominantly in the prefrontal cortex (Volkow, Wang, & Doria, 1995). Similarly, a recent study also reported alcohol dose-related increases in impulsive responses on a measure of inhibitory control (Dougherty, Marsh-Richard, Hatzis, Nouvion, & Mathias, 2008).

2. Trait displaced aggression and psychopathy

Although the consistency of the alcohol–aggression relationship is robust, it is well established that alcohol does not facilitate aggression in everyone. Meta-analyses have shown that the magnitude of the alcohol–aggression link is moderate, supporting the notion that additional situational and dispositional variables are necessary to fully explain for whom and under what conditions alcohol increases aggression (Bushman & Cooper, 1990; Ito, Miller, & Pollock, 1996). Theorists have speculated that alcohol and rumination most likely prompt aggressive behavior only for persons who are already predisposed to behave aggressively (e.g., Caprara, Barbaranelli, & Comrey, 1992; Giancola, 2002b). Personality risk factors that moderate alcohol-induced aggression include low anger control, high trait anger, aggressive traits, low dispositional empathy, and narcissism (e.g., Barnwell, Borders, & Earleywine, 2006; Eckhardt & Crane, 2008; Foran & O'Leary, 2008; Giancola, 2002a, 2002b;). In the present research, we investigated two personality dimensions that have not yet been considered in experimental research on alcohol-induced aggression (viz. trait displaced aggression and psychopathy).

When provoked, individuals high in *trait displaced aggression* tend to respond with angry rumination rather than direct retaliation, and eventually end up 'taking it out' on undeserving others in the laboratory and in the real world (Denson et al., 2006). Interestingly, trait displaced aggression is correlated with behavioral inhibition. This is in contrast to trait general aggression, which is correlated with approach orientation and characterized by intense, immediate anger and direct retaliation following provocation (Buss & Perry, 1992). Because alcohol is associated with disinhibition (Giancola, 2002a), we expected that alcohol would augment TDA among those high in trait displaced aggression by weakening their normally adequate levels of inhibitory control. Thus, trait displaced aggression should moderate the effect of alcohol on TDA. By contrast, experimentally induced rumination might not have an additional effect on those high in trait displaced aggression, because these individuals have a natural tendency to engage in provocation-focused rumination (Denson et al., 2006).

This is the first experiment to examine *psychopathy* within the TDA paradigm (or any other form of acute alcohol-induced aggression). Psychopathy is a robust predictor of aggression and violence in forensic, psychiatric, and youth populations (e.g., Edens, Lilienfeld, Poythress, & Patrick, 2008; Porter & Woodworth, 2005; Skeem & Mulvey, 2001). In community and college samples, psychopathy has been linked with premeditated and reactive forms of aggression under both neutral and provoking conditions (e.g., Nouvion, Cherek, Lane, Tcheremissine, & Lieving, 2007; Reidy, Zeichner, & Martinez, 2008; Reidy, Zeichner, Miller, & Martinez, 2007).

In broad terms, there are two subtypes of psychopathy that are associated with aggression (see Benning, Patrick, Blonigen, Hicks, & Iacono, 2005; Hare, 1991; Harpur, Hakstian, & Hare, 1988; Levenson, Kiehl, & Fitzpatrick, 1995).[1] The first subtype is characterized by fearlessness, callousness, manipulativeness, lack of remorse, and low anxiety. In Lilienfeld and Widow's (2005) Psychopathic Personality Inventory-Revised (PPI-R), this relates to the factor known as Fearless Dominance (FD). The second subtype is characterized by extreme self-centeredness, impulsivity, proneness to boredom, poor behavioral control, poor goal-setting, and aggressive, anti-social behavior. In the PPI-R this relates to the factor known as Self-Centered Impulsivity (SCI). Both subtypes of psychopathy are correlated, with most imprisoned psychopathic individuals scoring high on both dimensions (Levenson et al., 1995). Impulsive behavior, which is most noticeable in SCI-type psychopaths, is considered to be the result of a breakdown in inhibitory control mechanisms. Indeed, studies with clinical samples indicate that adolescent psychopaths exhibit worse performance than normal controls on neuropsychological tests of executive functioning (Roussy & Toupin, 2000).

Because individuals high in psychopathy are dispositionally disinhibited, we expected that alcohol would not increase aggression among such individuals. Indeed, research with forensic and clinical samples has found that psychopaths and those with antisocial personality disorder were most likely to engage in violence when they were sober, despite higher overall levels of alcohol dependence than controls (Holcomb & Adams, 1985; Walsh, 1999). The authors suggested that alcohol lowers inhibition against violence only in non-psychopathic personalities. Thus, whereas alcohol lowers the threshold for aggression in low-psychopathy individuals, high-psychopathy individuals, who are often at or above this aggression threshold, tend to respond aggressively to even mild provocations, and the presence of alcohol should not appreciably alter this tendency. For this reason, alcohol intoxication was expected to interact with psychopathy in the current experiment such that alcohol would increase aggression only for those low in psychopathy. Furthermore, it was expected that provocation-focused rumination, which focuses attention on a highly-salient provocation, would exacerbate psychopathic tendencies toward blame externalization, self-centeredness, and exaggerated entitlement. As a result, rumination should elicit higher levels of TDA in high-psychopathy individuals than low-psychopathy individuals. Thus, we expected that psychopathy would interact with rumination to augment TDA.

[1] A third psychopathy factor, cold-heartedness, was not associated with aggression in prior research or the current study (Barry et al., 2007; Benning et al., 2005; Edens et al., 2008).

3. The present research

The primary aim of the current research was to simultaneously examine the effects of trait displaced aggression and psychopathy on alcohol- and rumination-induced TDA. We expected that alcohol intoxication and rumination would independently and additively augment TDA, and that the effects of the alcohol and rumination manipulations would be moderated by trait displaced aggression and psychopathy. A secondary aim was to test the hypothesis that alcohol would temporarily reduce inhibitory control capacity.

4. Method

4.1. Participants and design

A total of 110 participants volunteered from either the UNSW first year psychology pool ($n = 38$), or through a campus advertisement ($n = 72$), and were at least 18 years old (i.e., of legal drinking age in Australia). To avoid obtaining a biased sample, no mention of alcohol appeared in the advertisement. The research was advertised as a study on '*taste preferences, personality, and cognitive ability*'. Three participants were excluded due to failure to believe that the feedback or fictitious partner was real and 7 due to the presence of an Axis-I disorder (see below). Thus, data from 100 participants were included in the final analyses (53 females, 47 males; $M_{age} = 20.37$; $SD = 2.65$, range 18 to 32 years; 48% Asian, 36% White, 1% Indigenous Australian, 15% other ethnicities; 60% were native English speakers). With the exception of a main effect of gender on psychopathy (see results), there were no main effects or interactions with gender, age, race, recruitment method, or native English speaker status (all $ps > .50$). Because TDA occurs only when previously provoked and subsequently triggered (Bushman et al., 2005; Denson et al., 2006; Pedersen et al., 2000; Vasquez et al., 2005), all participants were exposed to both provocation and trigger. Participants were also randomly assigned to a 2 (alcohol, placebo) × 2 (rumination, distraction) between-participants design.[2] The distribution of men and women was equal among the cells, $\chi^2(3) = 2.34$, $p = .50$, as were the means for participant age, $F < 1$, psychopathy, $ps > .40$, trait displaced aggression, $ps > .19$, and alcohol use, $ps > .15$.

4.2. Procedure and materials

4.2.1. Screening procedure

During an initial telephone interview, all participants were told the study was examining the effects of alcohol on taste preferences and cognitive ability, and participants would therefore be required to consume alcohol. Individuals were excluded if they reported adverse reactions to alcohol, poor health, use of medications for which alcohol is contraindicated, consuming alcohol less than twice per month, prior participation in social psychology experiments, university education in psychology, or a score of 8 or higher on the Michigan Alcoholism Screening Test (Selzer, 1971). Eligible participants were invited to undergo an in-person clinical interview with the Mini International Neuropsychiatric Interview (Sheehan et al., 1997). All participants complied with a request to refrain from drinking alcohol for 24 h and eating 2 h prior to their interview time. Written informed consent was obtained from all participants. Female participants were given pregnancy tests prior to participation, none of which were positive.

4.2.2. Experimental procedure

Two individuals greeted participants as the 'experimenter' and the 'research assistant' (RA). The experimenter explained s/he was in charge of supervision and scoring for the experiment. The experimenter, who was blind to experimental condition, explained to participants that the experiment would consist of (a) demographics questionnaires, (b) consuming four alcoholic beverages while completing a writing task, (c) cognitive tasks, (d) an interactive web-based task with a fellow participant, (e) taste testing, and (f) personality questionnaires. The experimenter then left the room and the RA began the experiment.

Following the demographics questionnaire, participants were weighed with an electronic body fat scale to determine how much alcohol (if any) they would consume. The RA explained as part of the cover story that 'hot and spicy' and 'dry' foods were being examined on that particular day. Hence, participants were asked to fill in a taste preference survey (1 = *no liking at all;* 7 = *extreme liking*) to evaluate their preference for various flavors. Participants sealed their survey in an envelope with their participant number.

In order to obtain a baseline reading, participants then completed the 1st of 5 Breath Alcohol Level (BAL) measurements with an Alco-Sensor IV (Intoximeters, Inc.), all of which were zero. Participants also completed the Biphasic Alcohol Effects Scale (BAES), which measures stimulant (7 items, $\alpha = .90$; e.g., elated) and sedative (7 items, $\alpha = .85$; e.g., sedated) effects of alcohol (Martin, Earleywine, Musty, Perrine, & Swift, 1993). The BAES was included as a subjective measure of intoxication to complement the objective BAL measure. A final item assessed intoxication (i.e., intoxicated). Participants indicated how they felt 'right now' on an 11-point scale (0 = *not at all,* 10 = *extremely*). Participants also indicated their baseline mood using a 28-item Mood Adjective Checklist (MACL; Nowlis, 1965; 1 = *not at all;* 7 = *extremely so*). The MACL formed three subscales: angry affect ($\alpha = .79$; e.g., *angry, hostile*), negative affect ($\alpha = .81$, e.g., *down*, *fearful*), and positive affect ($\alpha = .83$, e.g., *happy, competent*).

4.2.3. Provocation procedure

Participants were given 4 min to complete an anagram task consisting of 11 difficult (e.g., 'nvtnimereon' = 'environment') and four easy anagrams (e.g., 'rsasg' = 'grass') while listening to loud, distracting music (i.e., Stravinsky's '*The Rite of Spring*' at 80db). The RA gave the answer sheet to the experimenter for scoring. As expected, participants performed poorly on the anagram test ($M = 4.83$ correct, $SD = 1.54$). The experimenter then insulted the participant in an irritated and serious tone of voice: "*You really got a lot of these wrong. This data is useless to me. We should probably just start all over, but to be perfectly honest with you, I don't want to waste my time.*" The experimenter then abruptly departed. This provocation manipulation has been successfully shown to elicit anger and aggression (e.g., Aviles et al., 2005; Denson et al., 2006, Denson, Aviles, et al., 2008; Vasquez et al., 2005).

4.2.4. Rumination manipulation

Participants were then asked to write on an ostensibly randomly selected essay topic for 20 min while simultaneously consuming their beverages. Participants in the *rumination condition* wrote a series of short answer responses focusing on their personal experience as a participant in the current study. This included describing their feelings, thoughts, and what had happened during the experiment thus far. They were instructed to spend 1–2 min on each question and ensure they answered all questions. Participants in the *distraction condition* were asked to describe the layout of their university campus. These manipulations have been used

[2] In the present research the full design would entail a 2 (provocation, no provocation) × 2 (rumination, distraction) × 2 (alcohol, placebo) × 2 (trigger, no trigger) between-participants experiment. However, because TDA only occurs in the presence of a provocation and trigger (Pedersen et al., 2000; Vasquez et al., 2005), the smaller 2 (rumination, distraction) × 2 (alcohol, placebo) between-participants design was utilized.

effectively in prior research (e.g. Bushman et al., 2005; Denson, Pedersen, Ronquillo, & Nandy, 2009; Denson et al., 2006).

4.2.5. Alcohol manipulation

Participants in the *alcohol condition* received .77 g alcohol/kg, a dose comparable to that of the low dose groups in a meta-analysis on alcohol-induced aggression (Ito et al., 1996). Four alcoholic drinks were prepared by combining 75 proof vodka with tonic water (1:8 ratio). Beverages for the *placebo condition* were identical except the rims of the cups were rinsed with vodka to provide an odor of alcohol and only tonic water was administered. The participant received one alcoholic drink every 5 min, for the 20 min duration of the rumination manipulation. Participants then rinsed their mouths with water and the experimenter took the 2nd BAL.

4.2.6. Stroop task

Participants then completed the Stroop color-naming task to assess inhibitory control. In the Stroop task, participants were presented with 3 pages of stimuli and asked to respond as quickly as possible. On the 1st page, they were instructed to read a list of words (*red*, *blue*, *green*) printed in black ink. On the 2nd page, they were asked to name the color in which a series of *X*s were printed. On the 3rd page, participants reported the color of the ink in which words were printed; however, the word names were incongruent with the colors in which they were printed. Thus, the task requires inhibition of habitual responses (i.e., to read aloud the word rather than the color). Interference scores were calculated, with higher scores indicative of poorer performance. The Stroop task is one of the oldest and most widely used measures of inhibitory control.

4.2.7. Trigger procedure

The RA explained to the participant that they would be asked to talk for a period of 2 min via a web cam with another (fictitious) participant about their university life, goals, and aspirations. The RA then switched on the computer showing a pre-recorded video of a sex-matched participant sitting in a similar laboratory setting. The RA then repeated the instructions to both participants, emphasizing they were to each speak for 2 min without interruption. They would then be given a chance to give each other some written feedback after the session timed out. The RA then left the room while the video played and the participants completed their speech and written feedback. After participants had provided feedback for their fellow participant, they received some pre-scripted feedback ostensibly from the other participant (e.g., "*Your speech was ok. However I actually found it a bit boring. It wasn't very unique and sounded pretty standard for a uni student.*") Participants received the trigger approximately 50 min after the initiation of beverage consumption. The 3rd BAL was then taken.

4.2.8. Physical TDA

Participants were then told they would do some taste testing with their web cam partner. Using an adaptation of the "hot sauce" procedure, aggression was operationalized as the amount of hot sauce allocated to the fictitious participant (Lieberman, Solomon, Greenberg, & McGregor, 1999; Warburton, Williams, & Cairns, 2006). Participants were told that they, along with their fellow participant, would be simultaneously preparing a food sample for each other because the RA needed to be blind to what foods each participant would taste. A box was then produced, ostensibly for the random selection of food types, but in reality all labels read "*hot and spicy*". Participants were given the bogus participant's taste preference survey, which indicated that their partner strongly disliked hot and spicy foods (a rating of 2 out of 7 on the "hot and spicy" item). Participants were then given an information sheet that asked them to sample the food type (ostensibly to verify its properties), to read their partner's survey, and then to allocate a sample of the hot sauce in the Styrofoam cup, knowing that their partner would be required to consume the allocated sample in its entirety. Participants were then to cover the sample with foil and write their partner's participation number on the cup. After participants undertook this task in private, the experimenter pretended to swap the food samples with the other laboratory and then brought the participant their 'dry' taste sample (three bland saltine crackers), which the participant consumed and rated on the same 7-point scale. Cups were then weighed to an accuracy of one gram with a digital scale. We operationalized TDA as the weight of hot sauce allocated. Participants completed the aggression measure approximately 55 min after the initiation of beverage consumption.

4.2.9. Manipulation checks

Participants then completed the 2nd MACL, which was modified to assess reactions to the trigger (angry affect, $\alpha = .88$; negative affect, $\alpha = .80$, positive affect, $\alpha = .86$), and were asked to specify on the same 7-point scale what their fellow bogus participant had indicated as their preference for hot and spicy foods, to what extent they had used the survey to guide their sample allocation (1 = *not at all;* 7 = *completely*), and how "*hot and spicy*" they had personally found the hot sauce (1 = *not at all;* 7 = *extremely*). Participants then completed the 2nd BAES and 4th BAL approximately 70 min after the initiation of beverage consumption.

4.2.10. Personality measures

Participants completed 2 self-report personality questionnaires.[3] These were the 154-item Psychopathic Personality Inventory – Revised (Lilienfeld & Widows, 2005; e.g., "A lot of people in my life have tried to stab me in the back"; 1 = *false;* 4 = *true*), which assesses psychopathic traits in non-clinical samples, and the 31-item Displaced Aggression Questionnaire (DAQ; Denson et al., 2006; $\alpha = .90$), which assesses trait displaced aggression and consists of three facets: *angry rumination* (e.g., "I keep thinking about events that angered me for a long time"), *revenge planning* (e.g., "When someone makes me angry, I can't stop thinking about how to get back at this person") and *behavioral displaced aggression* (e.g., "I take my anger out on innocent others"). Both questionnaires have good internal consistency, test–retest reliability, and construct validity. The DAQ predicts self-reported domestic abuse, road rage, and displaced aggression in a laboratory paradigm even when controlling for trait direct aggression (Denson et al., 2006). Participants completed the computerized questionnaires approximately 80 min after their first beverage. The RA probed for suspicion, thoroughly debriefed, and thanked participants. Finally, participants completed the 3rd BAES and 5th BAL to ensure those in the alcohol condition had readings less than .045 before leaving the laboratory.

5. Results

5.1. Manipulation checks

5.1.1. BAL assessments

A 2 (rumination, distraction) × 4 (BAL at times 2–5) mixed ANOVA for those in the alcohol condition revealed a main effect for time only, $F(3, 144) = 5.76$, $p = .001$, $\eta^2 = .11$. Thus, among intoxicated participants, the rumination and distraction conditions did not differ in their BALs prior to aggressing against the bogus participant, nor at any point throughout the experiment (see Table 1).

[3] Although the placement of the trait measures near the end of the experiment was not ideal, a preliminary 2 (alcohol, placebo) × 2 (rumination, distraction) between-participants ANOVA revealed no effects of the experimental manipulations on DAQ or PPI-R scores, thus ruling out the possibility that the experimental manipulations might have influenced self-reported trait displaced aggression and psychopathy.

Table 1
Means and standard deviations of BALs for participants in the alcohol condition as a function of time of assessment and rumination and distraction conditions.

Condition	BAL 1 *M* (*SD*)	BAL 2 *M* (*SD*)	BAL 3 *M* (*SD*)	BAL 4 *M* (*SD*)	BAL 5 *M* (*SD*)
Alcohol/ rumination	0.00	0.07 (0.03)	0.05 (0.01)	0.05 (0.01)	0.05 (0.05)
Alcohol/distraction	0.00	0.08 (0.09)	0.05 (0.06)	0.05 (0.01)	0.04 (0.01)

Table 2
Means and standard deviations for subjective stimulation, sedation, and intoxication as a function of time and beverage conditions.

BAES Scale	Time	Placebo *M* (*SD*)	Alcohol *M* (*SD*)
Sedated	Time 1	1.31 (1.27)	1.77 (1.58)
	Time 2	2.24 (1.50)	3.24 (2.37)
	Time 3	2.53 (2.07)	3.66 (2.41)
Stimulated	Time 1	3.94 (1.61)	4.41 (1.67)
	Time 2	3.73 (1.59)	3.97 (2.28)
	Time 3	3.72 (1.74)	4.02 (2.00)
Intoxicated	Time 1	0.20 (1.14)	0.12 (0.59)
	Time 2	1.28 (1.84)	3.56 (2.74)
	Time 3	1.10 (2.13)	1.94 (2.53)

5.1.2. Subjective alcohol assessments

Prior to beverage administration, there were no differences between the alcohol and placebo conditions for the stimulant, sedated, or intoxicated BAES scales (all $ps > .12$; see Table 2). Immediately after the hot sauce allocation, participants in the alcohol condition reported feeling more intoxicated than those in the placebo condition, $F(1, 86) = 23.83$, $p < .001$, $\eta^2 = .20$, $d = 0.98$, and more sedated, $F(1, 97) = 5.18$, $p = .03$, $\eta^2 = .05$, $d = 0.50$. No differences emerged for the stimulant descriptors ($p > .50$). The final BAES, which was completed at the end of the experiment, showed that those in the alcohol conditions endorsed more sedative descriptors, $F(1, 98) = 6.42$, $p = .01$, $\eta^2 = .06$, $d = 0.50$, and reported feeling more intoxicated than those in the placebo conditions, $F(1, 94) = 12.32$, $p = .001$, $\eta^2 = 0.11$, $d = 0.36$. Again there was no difference between the alcohol and placebo conditions for the stimulant descriptors ($p > .10$). Taken together, the results for the BALs and the BAES are consistent with a successful implementation of the alcohol manipulation.

5.1.3. Mood

A repeated measures ANOVA examined the effects of the experimental procedures on self-reported mood change from baseline. Participants reported increased angry affect, $F(1, 99) = 64.37$, $p < .001$, $\eta^2 = .39$, $d = .94$, and negative affect, $F(1, 99) = 29.13$, $p < .001$, $\eta^2 = .23$, $d = .58$, and decreased positive affect, $F(1, 99) = 69.24$, $p < .001$, $\eta^2 = .41$, $d = -.83$.

5.2. Physical TDA (hot sauce)

Following prior research utilizing the hot sauce measure, the amount of hot sauce was log-transformed (Warburton et al., 2006).[4] In order for the hot sauce measure to be considered valid, participants needed to understand that the fictitious recipient did *not* like hot and spicy foods. Participants reported an average rating of 2.02 ($SD = 1.99$) for the target's hot and spicy food preference. This was not significantly different from the true answer of 2.00, $t(99) = .10$, $p = .92$, $d = .02$. By contrast, participants reported the hot sauce as quite "hot and spicy" ($M = 6.11$ on a 7-point scale, $SD = 2.20$). There were no differences between the groups on these measures. Thus participants clearly knew that the target did not like hot and spicy foods and found the sample to be quite hot and spicy. Therefore hot sauce allocation was considered a valid measure of TDA.

A 2 (alcohol, placebo) × 2 (rumination, distraction) between-participants ANOVA on the amount of hot sauce allocated to the fictitious participant revealed main effects of alcohol, $F(1, 96) = 7.79$, $p = .006$, $\eta^2 = .08$, $d = .55$, and rumination, $F(1, 96) = 6.16$, $p = .01$, $\eta^2 = .06$, $d = .48$. Specifically, participants in the alcohol condition ($M = 2.52$, $SD = 1.39$) were more aggressive than participants in the placebo condition ($M = 1.78$, $SD = 1.31$). Moreover, those in the rumination condition ($M = 2.47$, $SD = 1.25$) were more aggressive than those in the distraction condition ($M = 1.82$, $SD = 1.47$).

5.3. Trait displaced aggression[5]

There were no sex differences on the DAQ. To investigate the extent that alcohol, rumination, and individual differences in trait displaced aggression influenced the laboratory measure of physical TDA, a hierarchical multiple regression analysis was used with the amount of hot sauce as the dependent variable. For the hierarchical regression analyses, the DAQ was mean-centered when testing the interaction effects; however, uncentered means are presented for ease of interpretation.

The 1st step of the model contained the two manipulated variables: alcohol and rumination. The DAQ was entered into the 2nd step and the 3rd step contained the two-way interactions of these three predictor variables. As in the ANOVA, there were main effects at the 1st step for both alcohol and rumination (reported above), which accounted for 12.5% of the variance in TDA. The 2nd step accounted for an additional 3.8% of the variance, with a significant main effect for the DAQ, $\beta = .20$, $t(96) = 2.08$, $p = .04$. This was qualified by a significant DAQ × alcohol interaction in the 3rd step, $\beta = .31$, $t(93) = 2.27$, $p = .03$. R^2 increased from .16 to .22. No other interactions, including the 3-way, were significant. As expected, *post-hoc* tests of the simple slopes revealed that the DAQ predicted aggression for individuals in the alcohol condition, $\beta = .41$, $t(48) = 3.15$, $p = .003$, $R^2 = .17$, but not for individuals in the placebo condition, $\beta = .03$, $t(48) = .19$, $p = .85$, $R^2 = .00$, (see Fig. 1). There was no DAQ × rumination interaction.

5.4. Psychopathy

Preliminary analyses revealed a significant difference for gender, with females ($M = 61.93$, $SD = 8.75$) scoring higher on the PPI-R than males ($M = 55.98$, $SD = 8.75$), $t(80) = 3.23$, $p = .002$, $\eta^2 = .12$, $d = .71$. This was unexpected, as previous research typically shows that males score higher than females in forensic, clinical, and general population samples (Benning, Patrick, Hicks, Blonigen, & Krueger, 2003; Lilienfeld & Widows, 2005). The men in our sample were not particularly low in psychopathy; however, the women in our sample scored approximately one *SD* above the population mean (Lilienfeld & Widows, 2005). We therefore controlled for sex in the analyses involving the PPI-R.[6]

[4] Prior to log transformations, skewness and kurtosis in the current study for the physical aggression variable were 3.19 and 11.71 respectively and .038 and −.511 after transformations. Values closer to zero reflect increasing normality.

[5] The DAQ and PPI-R were moderately correlated, $r = .45$, $p < .001$.

[6] In order to determine whether this unexpected result was due to systematic error resulting from our sampling method or simply sampling error, we conducted several additional analyses. First, we examined whether scores on the PPI-R differed as a function of whether participants were recruited via campus advertisement or the introductory psychology pool. There were no differences in PPI-R scores for these two groups, $M_{advertisment} = 58.54$, $SD = 7.59$, $M_{participant\ pool} = 59.54$, $SD = 10.91$, $t(80) = 0.49$, $p = .63$. There were also no differences in the number of men and women in each recruitment group, $\chi^2(3) = 2.81$, $p = .42$, and recruitment group and gender did not interact with any of the experimental manipulations in determining PPI-R scores. Thus, sampling error is likely responsible for this finding.

Participants who scored ⩾15 on the Inconsistent Responding 15 scale of the PPI-R were excluded ($n = 18$) from these analyses because such scores are considered unlikely to reflect accurate reporting. The Inconsistent Responding scale is used to reduce error variance by identifying individuals who respond randomly, have poor English reading ability, or attempt to invalidate the PPI-R by intentionally providing unusual answers. Hence, Lilienfeld and Widows (2005) suggest an Inconsistent Responding score ⩾15 are of questionable validity and scores ⩾17 should definitely be inconsistent and invalid.[7]

Hierarchical multiple regression analyses, similar to those used for the trait displaced aggression measure, were conducted with amount of hot sauce as the dependent variable. The 1st step showed the main effects of alcohol and rumination. The 2nd step accounted for an additional 3.9% of the model, with a main effect for the PPI-R, $\beta = .21$, $t(77) = 1.97$, $p = .05$, which was qualified by a significant PPI-R × rumination interaction at the 3rd step, $\beta = .48$, $t(73) = 2.87$, $p = .005$. This increased R^2 from .22 to .33. As expected, *post-hoc* tests of the simple slopes revealed that the PPI-R predicted TDA for individuals in the rumination condition, $\beta = .51$, $t(40) = 3.75$, $p = .001$, $R^2 = .26$, but not for individuals in the distraction condition, $\beta = -.16$, $t(38) = -.98$, $p = .33$, $R^2 = .03$ (see Fig. 2). Contrary to expectations, there was no PPI-R × alcohol interaction.

Because psychopathic personality is a broad personality dimension, the PPI-R factor scales were also analyzed separately. As expected, these analyses showed that the SCI, $\beta = .51$, $t(75) = 3.01$, $p = .004$, $R^2 = .35$, and FD factors, $\beta = .42$, $t(74) = 2.67$, $p = .009$, $R^2 = .29$, both interacted with rumination. *Post-hoc* analyses revealed that the effects were only significant when individuals ruminated (see Table 3).

5.5. Inhibitory control

A 2 (alcohol, placebo) × 2 (rumination, distraction) between-participants ANOVA was conducted to examine the effects of the independent variables on Stroop interference scores. Although participants in the alcohol condition ($M = 53.63$, $SD = 6.58$) tended to perform more poorly than participants in the placebo condition ($M = 56.24$, $SD = 8.18$), this effect was only marginally significant $F(1, 95) = 3.10$, $p = .08$, $\eta^2 = .03$, $d = -.35$. There were no interactions or main effects for rumination, psychopathy, and trait displaced aggression on interference scores. Interference scores were unrelated to TDA.

6. Discussion

This was the first experiment to examine the moderating effects of trait displaced aggression and psychopathy on alcohol- and rumination-induced TDA. Both experimental manipulations reliably augmented TDA. In addition to replicating prior research showing that provocation-focused rumination and alcohol augment TDA (Aviles et al., 2005; Bushman et al., 2005), the current research is also consistent with a previous study demonstrating the TDA-augmenting effects of alcohol and self-focused rumination (Denson, Spanovic, et al., 2008). Thus, when previously angered and intoxicated, both internally and externally focused rumination increase aggression when subsequently annoyed. Furthermore, alcohol marginally reduced inhibitory control as assessed by the Stroop color-naming task.

Of most interest were the novel findings showing the moderating effects of trait displaced aggression and psychopathy. The effect of alcohol intoxication on TDA became stronger with higher levels of trait displaced aggression. This disposition is associated with behavioral inhibition (Denson et al., 2006). When provoked, individuals high in trait displaced aggression display increased activity in the medial prefrontal cortex, a brain region associated with the regulation and awareness of one's negative mood (Denson et al., 2009; Lane, Fink, Chau, & Dolan, 1997; Ochsner, Bunge, Gross, & Gabrieli, 2002). Perhaps alcohol disrupts functioning in this region, which leads to disinhibited aggression. Additional research will likely increase our understanding of the underlying neural and cognitive mechanisms.

The effect of provocation-focused rumination on TDA became stronger with higher levels of overall psychopathy, and with higher levels of both psychopathy subtypes (i.e., the callous, fearless, low anxiety subtype, and the self-centered, impulsive subtype). Psychopathy broadly encompasses poor impulse control, ruthlessness, aggressiveness, and a disregard for social norms and the consequences of anti-social behavior (Benning et al., 2005; Levenson et al., 1995; Lilienfeld & Widows, 2005). For individuals high in psychopathy, rumination likely serves as a means of focusing these dispositional tendencies and thereby exacerbating TDA.

Contrary to our hypothesis, alcohol did not interact with psychopathy. Specifically, alcohol intoxication failed to augment aggression among those low in psychopathy. Although our focus is on the role of the disinhibition seen in psychopathy and alcohol intoxication, there are a number of attributes by which those low and high in psychopathy differ that might account for the lack of a significant interaction. For example, compared to high-psychopathy individuals, low-psychopathy individuals are more empathic, more remorseful, less self-centered, less manipulative, and better able to control themselves (Hare, 1991): all of which might exert a powerful counterforce to the disinhibiting effects of alcohol. Indeed, individuals high in psychopathy demonstrate functional abnormalities in limbic and paralimbic brain regions, which Kiehl (2006) has suggested accounts for their difficulty experiencing empathy, guilt, and remorse. Individuals low in psychopathy suffer no such dysfunction, and therefore in the present experiment were likely better able to empathize with their victim as well as anticipate feelings of guilt and remorse that might follow an act of aggression. The role of empathy within the context of alcohol-induced aggression is highlighted by Giancola (2003) who found that relative to placebo, alcohol failed to increase aggression among those high in dispositional empathy. Thus, these prosocial emotions and associated motivations inherent in low-psychopathy individuals but not high-psychopathy individuals might have caused our lack of an interaction between alcohol intoxication and psychopathy. Future research can further explore the roles of empathy, guilt, and remorse in reducing alcohol-induced aggression.

[7] A cut-off of 15 on the validity scale is conservative in the sense this criterion errs on the side of excluding more potentially error-prone data rather than less; however, a more liberal cut-off of 17 ($n = 9$ excluded) provided the same pattern of results, albeit with slightly differing significance levels. For instance, the main effect of psychopathy remained nearly identical, $\beta = .20$, $t(86) = 1.95$, $p = .056$, and the PPI-R × rumination interaction remained marginally significant, $\beta = .31$, $t(83) = 1.81$, $p = .074$. When all participants were included in the analyses, the main effect of psychopathy remained significant, $\beta = .25$, $t(95) = 2.47$, $p = .015$; however, the PPI-R × rumination interaction failed to reach statistical significance, $\beta = .17$, $t(92) = 1.08$, $p = .28$. These results highlight the importance of considering inconsistent responding when studying psychopathy. It is possible that the relatively high number of inconsistent responders resulted from our late placement of the trait measures. Specifically, individuals might have concluded that their personality data would be matched with their behavioral data and attempted to randomly alter their responses. However, a comparison of the 18 inconsistent responders with the remaining sample revealed no differences in hot sauce allocation or PPI-R means ($ps > .20$). Furthermore, the number of inconsistent responders did not differ as a function of experimental condition, $\chi^2(3) = 5.15$, $p = .16$. Thus, a more likely explanation for this relatively high rate of inconsistent responding is fatigue from participating in a quite lengthy experiment or English difficulty (40% of our sample were non-native English speakers, see participants section). Indeed, aside from intentional sabotage, the Inconsistent Responding scale is sensitive to these latter two phenomena as well.

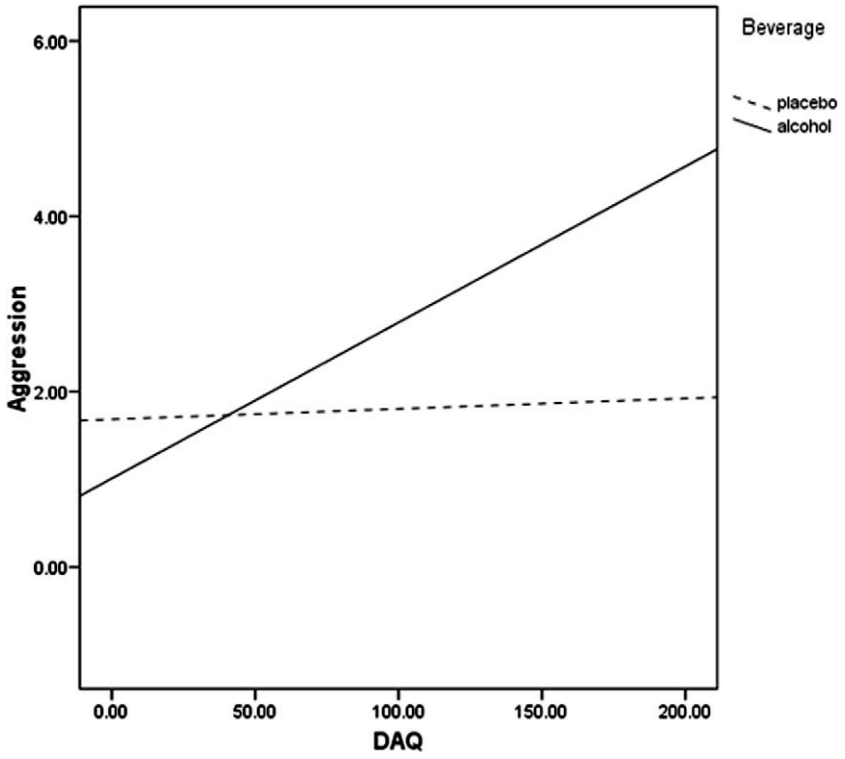

Fig. 1. Triggered displaced aggression as a function of alcohol and trait displaced aggression. The dependent measure is the log transformation of the amount of hot sauce in grams allocated to the fictitious participant.

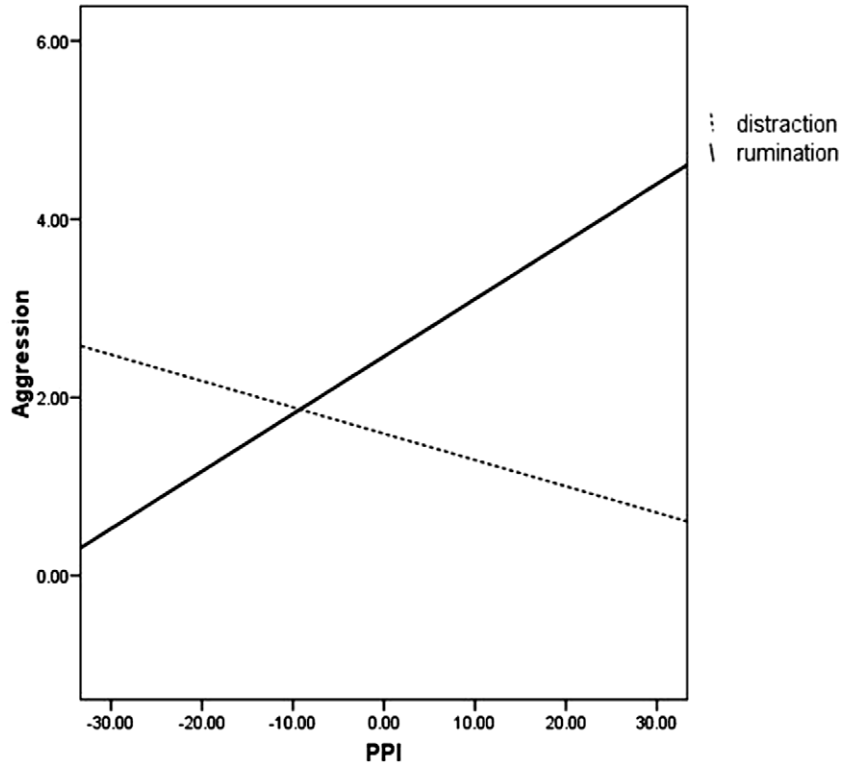

Fig. 2. Triggered displaced aggression as a function of rumination and psychopathy. The dependent measure is the log transformation of the amount of hot sauce in grams allocated to the fictitious participant.

Table 3
Post-hoc simple effects analyses of the PPI-R factor scales for the rumination and distraction conditions. Regression coefficients are standardized.

	Self-centered impulsivity				Fearless dominance			
	ΔR^2	T	β	p	ΔR^2	T	β	p
Distraction	0.03	−0.98	−0.16	.33	0.02	−0.86	−0.14	.39
Rumination	0.34	4.55	0.58	<.001	0.20	3.13	0.44	.003

6.1. Implications

The present research suggests that when angered, rumination and alcohol use should be targets of interventions for those high in psychopathy and trait displaced aggression, respectively. For those high in psychopathy, interventions may be enhanced by a reduction in opportunities for rumination and by the use of distracting tasks to attenuate attentional focus on provoking thoughts. Indeed, the null relationship between psychopathy and TDA in the distraction condition suggests that training in distraction techniques might prove beneficial for these individuals. Similarly, refraining from alcohol use when angered for those high in trait displaced aggression should reduce the excessive levels of aggression observed among these at-risk individuals toward undeserving others. Indeed, alcohol is involved in a large proportion of cases of intimate partner violence, which we believe are often cases of TDA (Boles & Miotto, 2003; Hoaken & Stewart, 2003) and those high in trait displaced aggression report increased intimate partner abuse (Denson, Pedersen, Ronquillo, & Miller, 2008; Denson et al., 2006). Interestingly, Nolen-Hoeksema and Harrell (2002) found that depressive ruminators were more likely to turn to alcohol abuse as a coping mechanism. Similarly, we have found that those high in trait displaced aggression prefer to engage in avoidant coping strategies rather than problem-solving strategies (Denson, Pedersen, et al., 2008). Consistent with this notion, there is a weak relationship between trait displaced aggression and symptoms of alcohol dependence (Denson, Pedersen, et al., 2008). Thus, for those high in trait displaced aggression, alcohol abstention should be considered a key strategy in any anger/aggression management plan.

6.2. Limitations

There are several limitations of the current research. Our exclusion criteria limit the generalizability of our results. Specifically, we intentionally excluded problem drinkers and participants with clinical psychological disorders. Furthermore, the sample was comprised of young adult university students. Thus, the results may not be readily generalized to problem drinkers, clinical populations and older participants. In addition, because the alcohol dose administered was relatively low, more sensitive neuropsychological measures and the inclusion of a pre-test might be necessary to document a mediating role of executive control on aggression. Indeed, Dougherty et al. (2008) found that the effects of alcohol varied across three reliable and valid measures of impulsivity. Examination of the self-reported intoxication revealed that those in the placebo condition did indeed report very low levels of perceived intoxication, suggesting that these participants may have correctly concluded that they did not receive alcohol. We also did not include a no-beverage control condition in addition to the placebo condition to examine alcohol expectancy effects. However, meta-analysis suggests that such effects are typically quite small (Hull & Bond, 1986).

7. Conclusions

Despite these limitations, our findings confirm the importance of both situational and personality factors as predictors of TDA. It is hoped that by identifying the moderating variables and understanding the cognitive processes involved, we may eventually reduce the harm associated with common, yet seemingly inexplicable displays of TDA, such as many acts of intimate partner violence.

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