Alcohol and Aggression: A Meta-Analysis on the Moderating Effects of Inhibitory Cues, Triggering Events, and Self-Focused Attention

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The authors conducted a meta-analysis of 49 studies to investigate 2 explanations of how alcohol increases aggression by decreasing sensitivity to cues that inhibit it. Both the level of anxiety and inhibition conflict moderated the difference between the aggressive behavior of sober and intoxicated participants, but neither level adequately accounted for variation in effect sizes. Additional analyses of 3 social psychological moderating variables—provocation, frustration, and self-focused attention—showed that the aggressiveness of intoxicated participants relative to sober ones increased as a function of frustration but decreased as a function of provocation and self-focused attention. The authors also examined the moderating effects of dose.

Statistics on the co-occurrence of alcohol and violent crimes suggest a troubling link between alcohol and aggression. Perpetrators of violent crimes are more likely intoxicated during the commission of their crime than are perpetrators of nonviolent crimes (Murdoch, Pihl, & Ross, 1990). Such findings have fueled a large body of research addressing the relationship between intoxication and aggression. Both qualitative (e.g., Gustafson, 1993; Moss & Tartar, 1993; Pihl, 1983; Pihl, Peterson, & Lau, 1993; Taylor, 1983; Taylor & Chermack, 1993; Taylor & Leonard, 1983) and quantitative (Bushman & Cooper, 1990; Steele & Southwick, 1985) reviews have quite clearly shown that intoxication can increase aggression. A theoretical understanding of this relationship, however, remains unresolved.

In this article, we use meta-analytic procedures to explore the role of situational factors in moderating the relation between alcohol and aggression. Theories emphasizing the way in which attention is allocated to various situational cues are important in this context (e.g., Taylor & Chermack, 1993; Taylor & Leonard, 1983; Zeichner & Pihl, 1979). Two specific variants are a model based on alcohol's anxiolytic effect and Steele and Southwick's (1985) inhibition conflict model. Other situationally determined variables that may vary within the context of an aggression-eliciting situation are provocation, frustration, and self-focused attention. For decades, researchers have examined the relation between alcohol and aggression using paradigms that contain either a provoking or frustrating event. Although the roles of provocation and frustration have figured prominently in experimental research on aggression per se, interestingly, there has been little explicit theoretical concern about their effects on aggression by intoxicated individuals. Similarly, focus of attention historically has been an important variable in the social psychological literature on aggression, but very little attention has been paid to understanding how it may affect the aggressive behavior of intoxicated participants. Consequently, in this meta-analysis, we also assess the moderating role of provocation, frustration, and self-focused attention in alcohol-induced aggression.

Why Does Alcohol Sometimes Increase Aggression?

The literature on the effects of alcohol on aggression is extremely large, and an examination of all the facets of it is beyond the scope of a single article. For instance, behavioral changes following alcohol consumption may be directly attributable to its pharmacological effects, but at this time there is no clear understanding of the specific mechanism that causes alcohol to increase aggression. Among the effects of acute and chronic alcohol administration are altered permeability of cell membranes, as well as disruptions of voltage-gated ion channels (Hunt, 1985) and secondary messengers (Hoffman & Tabakoff, 1990). Whereas some research has emphasized the roles of tetrahydroisoquinolines (e.g., Myers, Melchior, & Swartzwelder, 1980) and endorphins (e.g., Gianoulakis & Gupta, 1986) as biological mediators of alcohol effects, other research has focused on alcohol-induced changes in the neurotransmitters dopamine and serotonin as mechanisms that underlie behavioral reinforcement resulting from alcohol intake (Koob & Bloom, 1988). Despite this extensive animal and human research, how-
ever, there is no known direct causal link between specific biological and behavioral changes induced by alcohol.

In human behavioral research, a large body of survey data indicates that social drinkers expect alcohol to increase aggression (Lindman & Lang, 1994; Rohsenow, 1983; Roizen, 1983; Southwick, Steele, Marlatt, & Lindell, 1981). It is, therefore, likely that people possess the expectation not only that alcohol will facilitate aggression but also that such antinormative behavior will be met with greater tolerance if it is displayed by an intoxicated rather than a sober person (Critchlow, 1986; Lang & Sibrel, 1989; Sobell & Sobell, 1973; but see Gustafson, 1991b, for an alternative outcome). It has, therefore, been suggested that the increased aggression in intoxicated participants reflects, at least to some degree, their attempt to fulfill this expectation or role-play the part of the "aggressive drunk." (Brown, Goldman, Inn, & Anderson, 1980; Lang, 1983; MacAndrew & Edgerton, 1969; Marlatt & Rohsenow, 1980). Moreover, the appropriateness of this social role may be especially salient to participants in the experiments reviewed in this meta-analysis because their procedures are likely to prime the alcohol-aggression expectation through the display of aggression-related cues (e.g., shock apparatus and competitive games). Finally, the very fact that a scientist studies both alcohol-facilitated aggression and intoxication may reinforce these expectations in participants. Thus, under an expectancy-driven conceptualization of alcohol-facilitated aggression, it is assumed that people possess the expectation that alcohol can increase aggression and that such beliefs facilitate aggression following alcohol consumption.

Despite the expectation people possess for alcohol to increase aggression, substantial unexplained variability characterizes the relation between alcohol and aggression. For example, although survey data show that people expect alcohol to increase aggression, this same data show that aggression is not always expected to follow intoxication. When respondents were asked to indicate whether alcohol always, usually, or sometimes makes them aggressive, only 1% reported that they always expected aggression (Roizen, 1983). In addition, a meta-analytic assessment of the independent contributions of pharmacological and expectancy effects on intoxicated aggression revealed significant heterogeneity among both sets of effect sizes (Hull & Bond, 1986). These findings suggest that situational factors play an important role in determining whether and to what degree aggression increases following alcohol consumption. Consequently, we discuss five situational factors that we examined in our meta-analysis. For this purpose, we group them under the next two main headings.

Cognitive Theories of Intoxicated Aggression

Alcohol has been observed to cause many forms of cognitive impairments. Intoxication appears to narrow attention (Huntley, 1973; Moskowitz & DePry, 1968), interfere with memory processes (Birnbaum, Johnson, Hartley, & Taylor, 1980; Birnbaum & Parker, 1977; Craik, 1977; Jones & Jones, 1977; Rosen & Lee, 1976), and diminish the ability to engage in abstract thinking (Tartar, Jones, Simpson, & Vega, 1971). Applying this array of consequences to the explanation of aggressive behavior, several researchers have proposed what we refer to as cognitive theories of alcohol-induced aggression. These cognitive theories have also been referred to as attentional hypotheses (Gustafson, 1993) and cognitive theoretical perspectives (Taylor & Chermark, 1993). For example, Pernanen (1976) argued that intoxication decreases the number of cues to which a person can attend. An intoxicated person may not correctly perceive the reasons for other people's behavior, making the actions of others appear more arbitrary and provocative than they would to a sober perceiver. As a consequence, Pernanen believed intoxicated individuals are more likely to respond with aggression. Taylor and colleagues (Taylor & Chermark, 1993; Taylor & Leonard, 1983) argued that alcohol-induced impairments render intoxicated individuals able to attend to only the most salient and dominant cues, which are typically those that instigate an aggressive response. According to this view, the propensity for aggression is increased when alcohol is consumed because inhibitory cues are less salient to intoxicated persons. In addition, Zeichner and Pihl (1979) showed that when an experimental procedure directly manipulated the correlation between the amount of aversive stimulation participants received with the amount of aggression they had displayed, sober participants decreased their aggressive behavior relative to a condition in which aggression and aversive stimulation were experimentally controlled to be uncorrelated. By contrast, intoxicated participants appeared unaffected by the contingency between own aggression and amount of aversive stimulation received, displaying equally high levels of aggression in both conditions. This led Zeichner and Pihl to suggest that alcohol increases aggression by affecting the ability to correctly perceive the negative consequences of one's aggression.

The assumption that alcohol impairs a person's ability to perceive and respond to aggression inhibiting cues but has less effect on one's ability to perceive and respond to instigating stimuli is common to these cognitive theories. However, alcohol does not uniformly increase aggression. All people do not become aggressive every time they have a drink. Thus, a crucial question that these theories leave unanswered is when intoxication increases aggression.

Anxiolysis: Disinhibition Theories Revisited

Arousal of anxiety is an inherent feature of situations in which aggression is elicited; therefore, to understand how and when alcohol increases aggression, it is necessary to understand the role of anxiety. Specifically, anxiety can be conceptualized as a warning signal indicating the potential for aversive consequences (Spielberger, 1972). Aggression-eliciting situations are typically fraught with such potential. For example, social disapproval may ensue if others perceive aggression as unreasonable. In addition, an aggressive action may elicit fear of retaliation. Functionally, the experience of anxiety serves to suppress behaviors that are associated with its arousal, and this could account for why aggression is not overtly displayed every time it is instigated.

There has been debate as to whether alcohol reliably decreases anxiety-stress. Sayette's (1993) appraisal-disruption model proposes that the temporal ordering between alcohol consumption and exposure to anxiety-eliciting cues determines whether intoxication is anxiolytic. Specifically, Sayette argued that alcohol produces anxiolysis by disrupting appraisal of the
situation as anxiolytic. Therefore, anxiolysis most likely occurs when alcohol consumption precedes exposure to the anxiety-elicting cues. For studies in this dataset, the source of anxiety-provoking cues is the experimental task itself (e.g., cues indicating social disapproval of aggression or possible retaliation), to which participants are not exposed until after they have consumed alcohol. Studies in this review, therefore, meet the condition set by Sayette for anxiolysis with respect to the temporal ordering of alcohol consumption and exposure to anxiety-provoking cues, suggesting that intoxicated participants in these studies should experience relatively less anxiety than sober ones. In summary, we believe that intoxication dampens the arousal of anxiety in the studies in the present dataset and that this, in turn, weakens the suppression of aggression (Gray, 1987; Pihl et al., 1993; Taylor & Chermack, 1993; Washburne, 1956). It is, therefore, predicted that alcohol may increase aggression in situations in which anxiety would normally both be aroused and act to inhibit it. We refer to this model as the anxiolysis-disinhibition model.

The anxiolysis-disinhibition model leads to the hypothesis that the greatest difference in aggression between sober and intoxicated individuals occurs when anxiogenic cues are greatest. If anxiogenic cues are weak, then little suppression of aggression would be expected in either sober or intoxicated persons. However, as the intensity of anxiogenic cues increases, sober persons should be more likely to experience anxiety than those who are intoxicated and, hence, be more inclined to suppress aggression. By contrast, intoxicated persons would be expected to behave in a fashion relatively free from the effects of such suppression. Therefore, a crucial test of this model is whether the difference between the aggressive behavior of intoxicated and sober persons increases as a function of the degree to which situational factors induce anxiety.

Inhibition Conflict

Alternatively, Steele and colleagues (Steele & Josephs, 1990; Steele & Southwick, 1985) have suggested inhibition conflict as the mechanism by which alcohol increases the likelihood of aggressive behavior. Inhibition conflict refers to a type of response conflict that occurs when a behavior is instigated by one set of strong cues and, simultaneously, is inhibited by another set of strong cues. The two primary tenets of the theory are that (a) alcohol impairs cognitive processing and, in particular, narrows the range of cues to which a person can attend; and (b) as a consequence of this narrowed attentional range, an intoxicated person who is confronted with a situation that elicits high-inhibition conflict is able to process and respond only to the most salient behavioral cues. Consider, for example, an individual who experiences a strong provocation to assault another person at work. If sober, this person should be able to process not only the instigating cue of provocation but also other cues that signal the normative constraints that make physical aggression inappropriate in the workplace. By contrast, an intoxicated person whose attentional focus has been narrowed by alcohol may lack the cognitive resources to attend adequately to both sets of cues. Steele and colleagues argued that because instigating cues are usually more salient and immediate, whereas inhibiting cues often require the retrieval of personal standards of behavior and cognitively demanding estimations of future consequences, the intoxicated person typically will be influenced more by the instigating cue. Thus, an intoxicated person is more likely to aggress than a sober one.

The experience of inhibition conflict is one manifestation of what Steele has referred to as alcohol myopia—the general narrowing of attention following alcohol consumption (Steele & Josephs, 1990). Alcohol myopia may be responsible for a wide range of behaviors, such as drunken self-inflation and decreases in psychological stress when intoxicated. We focus only on the more specific concept of inhibition conflict because it is thought to moderate alcohol’s aggression facilitating effects (Steele & Josephs, 1990).

More important, Steele and colleagues (Steele & Josephs, 1990; Steele & Southwick, 1985) argued that only an interaction between alcohol’s pharmacological effects and features of the situation that affect inhibition conflict alter the balance of cues bearing on a response. Hence, not all situations necessarily increase aggression among intoxicated individuals. If a situation is low in inhibition conflict—because the instigating cues are weak, the inhibiting cues are weak, or both sets of cues are weak—then intoxicated and sober persons process cues similarly and, therefore, behave similarly. According to Steele and Josephs, in a situation low in inhibition conflict, intoxication “would only block inhibiting cues that are already weak or weaken inhibiting cues against a response tendency that was weak to begin with” (p. 923). That is, the combination of high-inhibition conflict and intoxication is expected to increase aggression (p. 925).

Steele and Southwick (1985) meta-analytically assessed the predictive utility of the inhibition conflict model. They confirmed that situations likely to elicit high, as compared with low, levels of inhibition conflict were associated with a larger difference in the degree to which the extremity of the behavior of intoxicated participants exceeded that of controls. Because Steele and Southwick were interested in the effect of alcohol on social behaviors in general, the researchers of the 34 studies in their dataset investigated a wide range of behaviors (e.g., gambling and eating) not solely aggression. In the present analysis, we specifically assessed the effects of inhibition conflict on aggression. Whereas our sample of studies was culled from 49 reports that assessed aggressive behaviors under intoxication, fewer than half of the 34 studies reviewed by Steele and Southwick were concerned with aggression.

Both the anxiolysis-disinhibition and inhibition conflict models assume that responsiveness to inhibiting cues is affected by intoxication, but the explanations they offer for this differ somewhat. The anxiolysis-disinhibition model is concerned with the specific inhibiting cue of anxiety, whereas the inhibition conflict model does not specify any one source of inhibiting cues. Moreover, the inhibition conflict model focuses on the relative strength between inhibiting and instigating cues. Therefore, each model may provide specific insight into how aggression is increased when alcohol is consumed.

Social Psychological Moderators of Aggressive Behavior

We next address whether other social psychological variables—namely, provocation, frustration, and self-focused at-
tention—which have been previously shown to moderate aggressive behavior in sober individuals, similarly affect intoxicated participants.

Provocation

A provoking stimulus can be very effective in increasing aggression for several reasons. By thwarting or angering a person, it may directly elicit negative affect and angry or emotional aggression (Averill, 1982; Berkowitz, 1989; Feshbach, 1964). Alternatively, or in parallel with this emotional responding, cognitive factors such as the belief in “an eye for an eye” may lead people to respond in a tit-for-tat fashion to provocation (Axelrod, 1984; Gouldner, 1960). In fact, actually experiencing physical discomfort as a result of an attack may not even be required. Merely knowing that someone intended to attack can be sufficient to induce aggression (Greenwell & Dengerink, 1973).

Another way in which provocation can increase aggression is by serving as a suitable external justification for a behavior that normally is considered inappropriate. Concern about violating such normative prescriptions may be associated with anxiety, the awareness of which serves to inhibit aggressive behavior. Consequently, people usually behave in a nonaggressive manner, unless a suitable external justification for aggression can be found. Thus, attack or provocation by another person can serve as a triggering event that provides justification for aggressive retaliation. Because the norm of reciprocity sanctions aggression in retaliation to another’s attack, provocation frees the individual to aggress. Provocation can, therefore, serve the dual roles of instigation and excuse for aggression.

The effect of provocation on aggression has long been investigated in sober participants; although it also frequently appears as a central feature of experimental paradigms in research on aggression and alcohol (e.g., Kelly, Cherek, Steinberg, & Robinson, 1988; Richardson, 1981; Shuntich & Taylor, 1972), relatively little attention has been paid to its theoretical importance in this latter literature. Permanen (1976) and Gustafson (1993) have both emphasized that level of provocation should be considered in interpreting findings in the alcohol and aggression literature. In fact, in his analysis of the role of provocation, Gustafson suggested that alcohol facilitates aggression only when provocation is present and that, in the absence of provocation, sober and intoxicated persons will behave similarly. According to Gustafson, then, absence of provoking stimuli may serve as a boundary condition on alcohol’s aggression facilitating effects.

Inherent in Gustafson’s (1993) view on the importance of provocation in alcohol-related aggression is the assumption that intoxicated individuals inhibit their aggression in the absence of provocation in the same manner as sober participants. Specifically, it is assumed that intoxicated individuals will aggress only if a triggering provocation is experienced. Gustafson based this conclusion on a somewhat informal review of results and, unfortunately, provides no theoretical explanation for his conclusion. Moreover, this prediction is not consistent with evidence showing that alcohol increases aggression among intoxicated participants, even in low-provocation conditions (e.g., Gustafson, 1985a, 1986a; Taylor & Gammon, 1976; Taylor & Sears, 1988).

Extant research, therefore, supports a prediction quite different from that of Gustafson (1993). Moreover, theoretical analyses suggest instead that the difference between the aggressive behavior of intoxicated and sober persons should be greatest when provocations are absent. Under conditions of low provocation, sober participants are likely to observe normative constraints and behave relatively nonaggressively. By contrast, intoxicated participants seem less responsive to these normative constraints (perhaps because violating these norms is not associated with anxiety) and instead tend to display more aggression than sober participants, even in circumstances under which controls do not experience provocation.

A similar theoretical argument was used by Bettencourt and Miller (1996) to account for the decrease in gender differences in aggression under provocation. Their meta-analysis shows that men are consistently more aggressive than women when provocation is absent, but this gender difference diminishes when provocation is introduced. At only moderate levels of provocation, the strong gender difference found in its absence is no longer seen. Although social roles dictate that aggression by women is more unacceptable than that by men, provocation apparently frees women from this social role prescription by providing an external justification, thereby enabling them to display levels of aggression more comparable with that of men. Consequently, we hypothesize that the aggressive behavior of intoxicated individuals will exceed that of sober ones under conditions of low provocation. When provoked, sober participants will behave more aggressively than when unprovoked. Intoxicated participants may also respond to provocation with increased aggression; but, because they are already inclined to behave in a relatively aggressive manner, the additional instigation and justification provided by provocation should not increase their aggression as much as it does for sober participants (i.e., a type of ceiling effect). Thus, the difference between the aggressive behavior of intoxicated and sober individuals seems likely to diminish as provocation increases.

Frustration

Just as provoking events are a frequent feature of paradigms investigating the effects of intoxication on aggression, these paradigms also frequently include frustrating events. The role of frustration in aggression also has a long history in the social psychological literature, stimulated by the publication of the frustration-aggression hypothesis (Dollard, Doob, Miller, Mowrer, & Sears, 1939). Although much of this research has been dedicated to refuting the assertion that aggression is an invariant consequence of frustration, this body of evidence, nevertheless, persuasively indicates that frustration can instigate aggression (for a review, see Berkowitz, 1989). Frustration, defined as blocking an ongoing goal-directed behavior, may operate in a manner similar to provocation and serve both as an instigator and an external justification for violating normative constraints against aggression. Consequently, we predict that frustration will be related to alcohol-potentiated aggression in the same manner as provocation. Specifically, we expect that the aggressive behavior of intoxicated participants will exceed that of sober ones when frustrations are minimal, but as frustration increases and the aggressive behavior of sober participants in-
crease correspondingly, intoxicated and sober participants will behave more similarly.

In his statement on the role of provocation in alcohol-facilitated aggression, Gustafson (1993) did not distinguish between provocation and frustration. Rather, he considered frustration to be a form of provocation (p. 23). Even though we predict that provocation and frustration will have similar directions of influence on the difference in aggression between sober and intoxicated participants, we nevertheless believe that it is theoretically important to distinguish between them and to assess their influences separately. Hence, we constrain the use of the term provocation to a negative affect that arises as a direct result of being attacked, or perceiving attack, by another person. In keeping with most prior discussion, we use the term frustration to refer to the blocking of ongoing goal-directed behaviors. In the research on aggression, frustration is often situationally or task induced (Carlson & Miller, 1988).

Self-Focused Attention

Whatever their differences, the anxiolysis–disinhibition and inhibition conflict models both predict that intoxication typically is associated with decreased responsiveness to inhibiting cues and subsequent increases in aggression. Inducing self-focused attention, however, may increase attention to inhibiting cues. Self-focus refers to a state in which a self-regulatory process is initiated, personal standards of appropriate behavior become salient, and attempts are made to comply with these standards (Carver, 1979; Carver & Scheier, 1981, 1990; Duval & Wicklund, 1972). When salient, these standards inhibit impulsive, self-indulgent behavior. Self-focused attention in sober participants is associated with increased prosocial behavior (Duval, Duval, & Neely, 1979; Gibbons & Wicklund, 1982; M. Rogers, Miller, Mayer, & Duval, 1982; also shown meta-analytically by Carlson, Charlin, & Miller, 1988; and Carlson & Miller, 1987) and less antisocial behavior such as aggression (Carver, 1975; Scheier, Fenigstein, & Buss, 1974) and cheating (Diener & Wallbom, 1976). Similarly, deindividuation, which is characterized by a loss of individual identity and a subsequent lack of concern with personal standards of behavior (Diener, 1980), has been associated with increased aggression (Lightdale & Prentice, 1994; Prentice-Dunn & Rogers, 1980; R. W. Rogers & Prentice-Dunn, 1981). It is unclear, however, whether the self-regulatory processes associated with self-focused attention operate in the same manner in intoxicated as in sober individuals. In particular, Hull (1981; Hull, Levenson, Young, & Sher, 1983; see also Washburne, 1956) argued that alcohol interferes with the likelihood of focusing attention on self by inhibiting the encoding of self-relevant information. In support of this view, when asked to make a speech about what they like and dislike about their bodies, intoxicated participants used fewer self-relevant pronouns than those sober (Hull et al., 1983). Hull argued that a desire to decrease self-focused attention, and thereby avoid both assessments of how well one is meeting behavioral standards and the ensuing guilt associated with failure to meet them, may motivate people to drink (Hull & Young, 1983a, 1983b; Hull, Young, & Jouriles, 1986). Heatherton and Baumeister (1991) advocated a similar position.

Despite these findings, Hull and Reilly (1983) suggested that self-focusing manipulations can counteract the intoxication-induced tendency to avoid the focus on self. This position is consistent with data obtained by Bailey, Leonard, Cranston, and Taylor (1983), who increased self-focus in half of their participants by placing a mirror and video camera in the experimental room (common manipulations used to induce self-focus), telling them their session would be videotaped and making a point of calling them by their names. Self-focused participants, both in the placebo (nonalcoholic beverage) and alcohol conditions, chose to administer a lower intensity of shocks to their competitive opponent than non-self-focused participants. The effects of self-focusing manipulations were also investigated by Ross and Pihl (1988), who assessed the performance of intoxicated and sober participants on a complex reaction time task in which behavioral regulation presumably would lead participants to strive for better performance. Both sober and intoxicated participants who performed the task in front of mirrors and a video camera responded faster and made fewer errors than those who did not receive the self-focusing manipulation. Self-focus also appeared to interact with alcohol ingestion such that performance was most improved for intoxicated self-focused participants.

Ross and Pihl (1988) speculated that their self-focused intoxicated participants, who knew they had received alcohol, were attempting to compensate for its deleterious effects. Self-focus presumably made salient to them the behavioral standard of not appearing drunk and impaired and, thereby, motivated them to exhibit superior performance. If this explanation is correct, then it suggests that the intoxicated participants overcompensated for the effects of intoxication in that their absolute performance levels exceeded that of sober participants. An alternative interpretation is that the narrowed attentional focus accompanying intoxication served to intensify their self-focused state by decreasing sensitivity to other stimuli that had the potential to distract attention from self. Sober participants may be relatively less affected by self-focusing cues because their wider range of attentional focus allows them to attend to other stimuli that ordinarily compete with self for attention.

These prior outcomes suggest alternative hypotheses about the relationship of self-focus and aggressive behavior after alcohol consumption. According to Hull (1981), intoxicated participants are less likely to be affected by situational factors that ordinarily encourage self-focused attention in sober participants because alcohol interferes with the encoding of self-rele-

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1 We note that the dimension of human agency may also be an important factor in aggression-inducing events. Meta-analytic evidence suggests that interpersonal sources of instigating events induced twice the magnitude of aggression (relative to control conditions) as that produced by nonpersonal sources, even when intensity of the negative event was controlled (Carlson & Miller, 1988). We note also that the definition of aggression-eliciting events excludes a class of negative events, namely, nonhuman provocations that do not necessarily interfere with a goal-directed activity (e.g., extremes in temperature). Although this category logically exists, and is represented in the larger literature on aggression, it was not present among the studies in this dataset. We, therefore, do not consider them in our analysis.

2 We thank Blair Johnson for suggesting this line of thought.
and cross-referenced with Literature Searches

is focused on self, it may be even more unlikely among intoxicated participants. Moreover, in Ross and Pihl, the performance of intoxicated participants was more strongly affected by self-focusing cues than that of sober participants, suggesting that although aggression behavior may be less likely when attention is focused on self, it may be even more unlikely among intoxicated self-focused persons.

Method

Literature Searches

We used three methods to locate studies for the meta-analysis. First, PsychInfo (1967–1994), Medline (1966–1994), and Current Contents (1989–1994) databases were searched through May 1994 using the keywords alcohol, intoxication, and ethanol, cross-referenced with aggression, antisocial behavior, anger, and attack. Second, we reviewed the reference lists of three previous meta-analyses on the effects of alcohol on aggression, antisocial behavior, anger, and conflict (e.g., by correlating judges’ ratings with manipulation check effect sizes) to assess the contextual level of each moderator variable within each study. We made ratings of the five theoretical variables—anxiety, inhibition conflict, provocation, frustration, and self-focused attention—for all studies by two judges (Tiffany Ito and a graduate student in psychology) on 9-point scales possessing no descriptive adjectives other than that a value of 9 indicated a high level of the variable in question. We present the operational definitions used by the judges in Appendix A. In addition, Appendix B includes examples (not given to the judges before the ratings) of a study that received the most extreme rating for each endpoint of the rated variables. Judges first independently rated a subset of eight studies and discussed discrepancies with the other authors of this article. To avoid systematic bias, we made ratings for each of the five variables across studies before proceeding to the next variable. We randomly determined the order in which each judge made his or her ratings for the five variables, and the order was different for each judge. Additionally, the studies were in a different random order for each judge. These procedures correspond to those discussed and recommended in Miller and Carlson (1990) and Miller, Lee, and Carlson (1991).

The judges also rated a sixth variable, task complexity—defined as the degree to which response measures and features of the experimental task require habitual, routine, low level, familiar, easy mental activity as opposed to effortful, complex, novel, mentally difficult activity. Analyses revealed no significant effects of degree of task complexity on effect size. We did not, therefore, give it further consideration.

We instructed the judges to take within- and between-subject experimental manipulations into account when making their ratings. Therefore, it was possible for a single study to contribute more than one rating per variable if the judges determined that the level of that variable was manipulated within the study. For example, the judges made 50 ratings of self-focused attention. For 48 of the studies, the judges agreed that the level of self-focus did not vary across conditions within the same study; therefore, they assigned a single rating of self-focused attention to each study. However, self-focused attention was manipulated in one study, so they assigned two ratings on the self-focus variable. They used similar procedures to rate within-study differences for the other theoretical variables. In total, the judges made 77 ratings of anxiety, 54 ratings of inhibition conflict, 91 ratings of provocation, and 74 ratings of frustration.

Descriptive statistics and reliabilities of the judges’ ratings are shown in Table 1. Although the validity of these ratings could not be assessed (e.g., by correlating judges’ ratings with manipulation check effect sizes) because the data necessary for such an assessment were not included in the primary sources, these rating procedures have been shown to have convergent and construct validity in other research (e.g., Carlson et al., 1988; Carlson & Miller, 1987; Eagly & Steffen, 1986; Miller & Carlson, 1990; Miller et al., 1991). Moreover, the reliabilities of the judges’ ratings, as defined by the Pearson product–moment correlation coefficient, were generally high in magnitude, and all exceeded .75 (see Table 1). In view of this, we performed moderator analyses on the average of the ratings made by the two judges.

Coding of Study Characteristics

We coded information on 10 characteristics of each study. We coded three of these originally as continuous variables but later made them

vanent information. This view leads to the prediction that when compared with the aggressive behavior of sober participants, intoxicated ones will be relatively unaffected by level of self-focus. The difference between the aggressive behavior of intoxicated and sober participants should, therefore, increase as situational factors encouraging self-focused attention increase. This may be especially likely when subtle self-focusing cues are present. Alternatively, the data collected by Bailey et al. (1983) and Ross and Pihl (1988) suggest that self-focused attention decreases aggression in intoxicated participants as well as sober ones. Moreover, in Ross and Pihl, the performance of intoxicated participants was more strongly affected by self-focusing manipulations than that of sober participants, suggesting that although aggressive behavior may be less likely when attention is focused on self, it may be even more unlikely among intoxicated self-focused persons.
categorical because of the characteristics of their respective distributions. These variables are (a) dose of alcohol (two categories), (b) time allowed for absorption (two categories), and (c) time allowed for ingestion (three categories). We coded the remaining seven study characteristics into either dichotomous or trichotomous categories. The dichotomous variables are (a) presence of nonaggressive response alternatives, (b) possibility of retaliation, and (c) gender. The trichotomous variables are (a) experimenter knowledge of drink content, (b) distraction of participants during beverage consumption, (c) participants’ drinking history, and (d) type of response measure. Two coders independently extracted the information from a subset of 26 studies. Agreement between them was 97%, by assessing the number of agreements divided by the total number of characteristics extracted. Disagreement between the coders typically occurred over whether a certain piece of information could be reliably determined. For example, many studies did not clearly state how long the alcohol absorption period was, but it might have been possible to estimate this value. Disagreement occurred when one coder estimated the value but the other coded the study as missing this information. Ultimately, we adopted the conservative strategy of coding a study as missing the information, unless the relevant information was clearly and unambiguously stated in the method section. Given the high agreement between coders and our decision to adopt a conservative strategy in cases of ambiguous information, only one coder extracted study characteristics from the remaining studies.

Computation of Effect Sizes

Following Hedges (1981) and Hedges and Olkin (1985), we used \( d \) as the effect size index, representing the difference between the experimental and control group means and divided by the pooled standard deviation (SD). We corrected these \( d \) values for bias resulting from small sample size (Hedges & Olkin, 1985). In this meta-analysis, a positive effect size indicates that more aggressive behavior was displayed by participants who were administered alcohol relative to those in the control condition. The pooled SD was based on individual cell SDs whenever possible, but when not reported, we obtained estimates of pooled SDs from analysis of variance results. We performed computations with the meta-analytic program DSTAT (Johnson, 1993).

Frequently, studies reported enough data to compute multiple effect sizes. There were three different sources of multiple effect sizes: (a) comparison of more than one dose of alcohol with a control group (e.g., a low-dose and a high-dose group), (b) data on more than one dependent measure (e.g., number of shocks administered and intensity of shocks), and (c) manipulation of other independent variables in addition to the alcohol-no alcohol variable. Indiscriminantly including multiple within-study effect sizes in the meta-analysis would violate assumptions about their independence and could, thereby, bias outcomes. We adopted the following strategies, therefore, for all datasets used in the analyses reported herein. If a study’s researchers administered more than one alcohol dose (as was the case for seven studies), we randomly selected one of the doses and included in the analysis only those effect sizes that reflected the comparison of the selected dose with the control condition. If a study reported data on multiple dependent measures, we calculated effect sizes for all possible measures, then averaged them together into a single index.

For the last source of multiple effect sizes, manipulation of other independent variables besides dose of alcohol, we considered the random selection and averaging strategies inadequate because the different conditions within a study often had bearing on the theoretical questions addressed in this analysis. For example, a study might cross a manipulation of alcohol dose with a manipulation of provocation. Because we hypothesize that provocation will moderate effect size, it would be inappropriate to average effect sizes that represent different levels of provocation. Similarly, important information on the effects of different levels of provocation would be lost if we only randomly selected one effect size from such studies.

As a result, we used a shifting unit of analysis approach (Bushman & Cooper, 1990, Cooper, 1989), which represents a compromise between the independence assumption and the desire to retain as much information as possible. More specifically, use of the shifting unit of analysis means that, for each of the five variables of theoretical interest, we included all of the effect sizes relevant to that analysis. As previously indicated, judges were instructed to take within-study conditions into account when making their ratings, resulting in 77, 54, 91, 74, and 50 separate ratings of anxiety, inhibition conflict, provocation, frustration, and self-focused attention, respectively. We created five separate datasets, one for each variable with effect sizes that corresponded to the conditions rated for that particular variable. For example, in the self-focused attention dataset, where 48 of the 49 studies were judged to lack within-study variation in level of self-focused attention, the 48 studies contributed one effect size each. For the remaining study, which contained within-study variation in self-focused attention, we entered two effect sizes into the dataset. One represented the difference between sober and intoxicated participants in a condition low in self-focus, and the other represented the difference between participants sober and intoxicated in a condition high in self-focus. We used similar procedures for the other four datasets.

We created a sixth dataset in which each study was allowed to contribute only one effect size by averaging together all effect sizes from the

---

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>All studies</th>
<th>Excluding the two most extreme outliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Anxiety</td>
<td>6.43</td>
<td>2.38</td>
</tr>
<tr>
<td>Inhibition conflict</td>
<td>5.71</td>
<td>3.16</td>
</tr>
<tr>
<td>Provocation</td>
<td>3.95</td>
<td>2.73</td>
</tr>
<tr>
<td>Frustration</td>
<td>3.88</td>
<td>2.67</td>
</tr>
<tr>
<td>Self-focused attention</td>
<td>3.41</td>
<td>1.81</td>
</tr>
</tbody>
</table>

Note. Ratings were made of 49 separate studies. Multiple ratings per study were possible, with the total number shown as \( k \). Reliability is shown as the Pearson product-moment correlation coefficient of the two judges' ratings. All variables were rated on 9-point scales, with a value of 9 indicating the highest levels of anxiety, inhibition conflict, provocation, frustration, and self-focused attention. *** \( p < .001 \).
same study. We used this dataset to obtain the mean effect size across all studies, irrespective of potential variation in any of the five variables of theoretical interest. We also used this dataset for the categorical analyses of study characteristics (e.g., whether participants were distracted during the beverage consumption period) because these characteristics displayed no within-study variation. The only exception was the analysis on participant gender. It was possible in three studies to compute separate effect sizes for male and female participants, and a fourth study included only female participants. The analysis on gender was, therefore, based on 50 effect sizes.

Distributions of Variables

The distribution of ratings of anxiety was negatively skewed and that of self-focused attention was positively skewed. We used logarithmic transformations to normalize these variables. Provocation, frustration, and inhibition conflict were each bimodally distributed, and consequently were dichotomized. Low values ranged from 1 to 4, 1.5 to 4.5, and 1 to 4; high values ranged from 5 to 9, 6 to 9, and 6 to 9 for provocation, frustration, and inhibition conflict, respectively. The dichotomization of inhibition conflict is consistent with results from Steele and Southwick (1985), who reported that a 2-point scale for inhibition conflict yielded the most reliable judgments. Also, as suggested earlier, the distribution of alcohol dose was bimodal. Dose was, therefore, dichotomized, with low doses ranging from 0.23 to 1.00 ml of alcohol/kg of body weight and high doses ranging from 1.20 to 1.30 ml/kg. We used these transformed variables in all subsequent analyses.

Data Analysis Strategy

We used regression analyses to assess the effect of the continuously distributed moderator variables (anxiety and self-focused attention) on effect size. The specific regression analyses used were designed for meta-analytic data (Hedges & Olkin, 1985) and provide a test of model specification, Qm, in which a significant value indicates that the model is not sufficient to account for heterogeneity among the effect sizes. For inhibition conflict, provocation, and frustration, we performed categorical analyses. We first categorized effect sizes as a function of the moderator variable, then we assessed the degree of within- and between-category homogeneity. A well-specified model in which variability in the effect sizes is explained by the category distinctions would result in homogeneity within each category but heterogeneity between the categories. Between-category homogeneity is assessed by Qm, which has an approximate chi-squared distribution with degrees of freedom (df) equal to p - 1, where p is the number of categories in the model. When there are only two categories in the model, Qm is analogous to a pairwise comparison. Within-category homogeneity is assessed by Qn, which has an approximate chi-squared distribution with m - 1 df, where m is the number of effect sizes in each category (Hedges & Olkin, 1985). Both statistics test the assumption of homogeneity; significant values are indicative of heterogeneity in the effect sizes.

Regardless of whether we used regression or categorical models, we performed all analyses on effect sizes that were weighted by the inverse of their variance (Hedges & Olkin, 1985). In addition, we included dose of alcohol administered to participants in the experimental condition as a factor in each analysis. All significance tests are two-tailed, unless stated otherwise.

Results

Overall Effect of Alcohol on Aggressive Behavior

The mean effect size of 0.54 across the 49 studies had a 95% confidence interval (CI) that excluded 0, CI = 0.45–0.63, indicating that intoxication increased aggression. By Cohen's (1988) standards, this is considered a medium effect size. (Effect sizes of d = 0.20, 0.50, and 0.80 are considered small, medium, and large in magnitude, respectively.) In addition, there was significant heterogeneity among these effect sizes, $Q = 285.19, p < .0001$. Most effect sizes ranged from −1.0 to 1.0, but two substantially exceeded this range, d = 7.81 and 5.99, respectively. When we removed these two extreme values, the difference in aggressive behavior between intoxicated and sober participants remained significant: The mean effect size was 0.47, and the 95% CI again excluded 0, CI = 0.38–0.56. Removing these extreme values did not result in homogeneity among effect sizes, $Q(48) = 78.92, p < .005$. Although the general pattern of results did not change when we removed the two most extreme outliers, the possibility that their large magnitude was due to unique features of the original experiments led us to exclude them from subsequent analyses. Despite the substantial independence of our dataset from that of Bushman and Cooper (1990), our mean effect size is similar to the mean of 0.43 obtained in their analysis.

As indicated in the criteria for study inclusion, we extracted all effect sizes in this analysis from published reports. Rosenthal (1979) and Wachter (1988) have argued that because studies obtaining null results are less likely to be published, analyzing data from only published reports biases results in favor of obtaining a mean effect size that differs significantly from 0. This has been labeled the 'file drawer problem.' A fail-safe n, which represents the number of studies obtaining null results that would be needed to render the obtained mean effect size non-significant, was calculated to assess threat of the file drawer problem in this analysis. Rosenthal (1991) suggested that a conservative tolerance level for the fail-safe n is $5k + 10$, where k is the number of effect sizes. Thus, for 49 effect sizes, it should exceed 255. The obtained fail-safe n of 2,826 based on the mean effect size of the 49 studies (or 1,863 when the two most extreme effect sizes are removed) suggests that a file drawer problem is unlikely. In other words, there would need to be 2,826 unpublished studies with null results to render the overall mean effect size obtained in this meta-analysis equal to 0.

Given the significant mean effect size indicating that alcohol increases aggression, it is reasonable to expect that dose of alcohol consumed is related to effect size, with larger effect sizes associated with higher doses. To test this, we compared the effect sizes of studies that administered low as opposed to high doses. We omitted from this analysis the two most extreme outliers and one additional study (Boyatzis, 1974) that did not specify dose. As expected, higher alcohol doses were associated with larger effect sizes, $M = 0.53, CI = 0.41–0.65$, than lower doses, $M = 0.35, CI = 0.21–0.50, Q_4 = 3.43, p < .03$, one-tailed.3 As

---

3 We performed comparable analyses on the five other datasets as well. With the exception of anxiety, all analyses were consistent with the conclusion that alcohol-induced aggression increases when larger alcohol doses are consumed. That is, in the inhibition conflict, provocation, frustration, and self-focused attention datasets, higher doses were associated with significantly larger mean effect sizes than lower alcohol doses. The only exception was the anxiety dataset, in which we entered anxiety and dose into a regression equation. Dose was not a significant predictor of effect size in this analysis, $B = -0.11, p < .20.$ It
Mechanisms of Increased Aggression in Intoxicated Individuals

Role of anxiety. We have suggested that the increased aggression of intoxicated participants might be due to their decreased sensitivity to anxiety-provoking situational cues, which in a sober participant would serve to inhibit aggression. Specifically, the aggressive behavior of intoxicated participants is expected to most greatly exceed that of sober ones as the intensity of anxiety-provoking cues increases. We tested this with a regression analysis. To account for the effects of alcohol dose, we entered dose into the analysis with the anxiety ratings. The regression coefficients and test of model specification are shown in Table 2. As expected, level of anxiety was a significant predictor of effect size, such that the difference between intoxicated and sober participants increased as level of anxiety increased, \( B = 0.58, p < .001 \). Nonetheless, the test of specification for this model was significant, indicating that heterogeneity among the effect sizes was present, \( Q_e = 141.07, p < .001 \).

To explicitly assess whether the influence of anxiety-provoking cues differs as a function of dose, we regressed anxiety onto effect size separately for studies in the high- and low-dose subsets. Regression coefficients and test of model specification for these analyses are also shown in Table 2. In both subsets, the regression coefficient for anxiety was positive. In the high-dose subset, the coefficient was significant, \( B = 0.70, p < .001 \), but the coefficient in the low-dose subset reached only marginal significance, \( B = 0.43, p < .05 \), two-tailed. Despite the absolute difference between these coefficients, they did not differ significantly from each other, \( t = 0.49 \). Also, in the high-dose subset, no significant heterogeneity was present in the model, \( Q_e = 23.17, p < .001 \), but heterogeneity remained in the low-dose subset, \( Q_e = 117.22, p < .001 \).

Inhibition conflict. Table 3 shows the mean effect size and CIs as a function of both levels of inhibition conflict and alcohol dose. The difference in mean effect size between studies with high and low levels of inhibition conflict was significant, \( Q_e = 17.46, p < .001 \), such that larger effect sizes were associated with higher levels of inhibition conflict. It should be noted, however, that the CIs for both means excluded 0. Thus, even when inhibition conflict was low, intoxicated participants exhibited more aggression than sober ones. Significant heterogeneity was present among only the low-inhibition conflict effect sizes, \( Q_e = 52.98, p < .001 \).

To assess potential moderating effects of dose, we separated the dataset into low- and high-dose subsets and examined the means as a function of inhibition conflict (see Table 3, lower panel). Dose did not moderate the tendency for effect size to increase with higher levels of inhibition conflict. High-inhibition conflict was associated with larger effect sizes than low-inhibition conflict within both the high-dose, \( Q_e = 7.52, p < .001 \), and low-dose subsets, \( Q_e = 5.67, p < .02 \).

Other Social Psychological Moderators

The analyses of anxiety and inhibition conflict suggest that both factors may have predictive utility in explaining how alcohol increases aggression. However, neither accounted for all of the variation in effect sizes. We obtained significant heterogeneity in the overall regression analysis of anxiety. According to Steele and Josephs (1990), intoxication should increase aggression only when higher doses of alcohol have been administered and when inhibition conflict is high. In our analyses, however, intoxication increased aggression even at low doses and low levels of inhibition conflict. Moreover, as mentioned, dose did not moderate the effect of inhibition conflict, and there was significant heterogeneity among the low-inhibition conflict studies. These outcomes suggest that the relationship between alcohol and aggression may depend on other factors. We examine next the role of three such factors: provocation, frustration, and self-focused attention.

Provocation. We predicted that the difference in aggression between sober and intoxicated participants would decrease as intensity of provocation increased. As shown by the means and CIs in Table 4, this was the pattern we obtained. Lower levels of provocation were associated with larger effect sizes than higher levels of provocation, \( Q_e = 4.10, p < .05 \). Note, however, that both CIs exclude 0. Hence, under low as well as high provocation, intoxicated participants behaved more aggressively than did those who were sober.

To assess whether the effect of provocation was moderated by alcohol dose, we divided the dataset as a function of dose, and analyses on provocation were repeated. The lower panel of Table 4 shows that, in the low-dose subset, lower levels of provocation were associated with larger effect sizes, \( Q_e = 6.23, p < .01 \). For the high-dose subset, the means were in the same direction, but the difference was not significant, \( Q_e = 0.63 \). Even though the aggressive behavior of intoxicated and sober participants be-

Table 2

<table>
<thead>
<tr>
<th>Dataset and predictor</th>
<th>( B )</th>
<th>( \beta )</th>
<th>( Q_e )</th>
<th>( k )</th>
</tr>
</thead>
<tbody>
<tr>
<td>All studies</td>
<td></td>
<td></td>
<td>141.07***</td>
<td>74</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.58***</td>
<td>0.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dose</td>
<td>-0.11</td>
<td>-0.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-dose subset</td>
<td></td>
<td></td>
<td>117.22***</td>
<td>39</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.43</td>
<td>0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-dose subset</td>
<td></td>
<td></td>
<td>23.17</td>
<td>35</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.70***</td>
<td>0.56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Dose was dichotomized, with low values ranging from 0.23 to 1.00 ml/kg and high values ranging from 1.20 to 1.30 ml/kg. \( B \) denotes unstandardized regression coefficient. \( \beta \) denotes standardized regression coefficient. \( Q_e \) denotes test of model specification. Significant \( Q_e \) values indicate that the model is inadequate to account for heterogeneity among effect sizes. In addition, the two studies contributing the most extreme outliers were excluded. In the low-dose subset, the regression coefficient for anxiety was marginally significant, \( p < .08 \), two-tailed.

***p < .001.

should also be noted that the effect of dose in the self-focus dataset reached only marginal significance with a two-tailed test, \( p < .10 \). (The regression coefficients for dose when entered into the anxiety and self-focus regression equations are shown in Tables 2 and 6, respectively.)
ALCOHOL AND AGGRESSION

Table 3
Categorical Analysis of Inhibition Conflict and Alcohol Dose

<table>
<thead>
<tr>
<th>Dataset and variable class</th>
<th>k</th>
<th>Md,</th>
<th>95% CI for d,</th>
<th>Qw</th>
<th>Qb</th>
</tr>
</thead>
<tbody>
<tr>
<td>All studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-inhibition conflict</td>
<td>22</td>
<td>0.27</td>
<td>0.14 - 0.40</td>
<td>52.98***</td>
<td></td>
</tr>
<tr>
<td>High-inhibition conflict</td>
<td>29</td>
<td>0.65</td>
<td>0.53 - 0.78</td>
<td>17.61</td>
<td></td>
</tr>
<tr>
<td>Low-dose studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-inhibition conflict</td>
<td>16</td>
<td>0.24</td>
<td>0.08 - 0.39</td>
<td>46.71***</td>
<td></td>
</tr>
<tr>
<td>High-inhibition conflict</td>
<td>8</td>
<td>0.64</td>
<td>0.35 - 0.93</td>
<td>6.34</td>
<td></td>
</tr>
<tr>
<td>High-dose studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-inhibition conflict</td>
<td>5</td>
<td>0.22</td>
<td>-0.05 - 0.50</td>
<td>2.84</td>
<td></td>
</tr>
<tr>
<td>High-inhibition conflict</td>
<td>21</td>
<td>0.65</td>
<td>0.52 - 0.79</td>
<td>11.26</td>
<td></td>
</tr>
</tbody>
</table>

Note. d, denotes effect sizes weighted by the reciprocal of their variances. CI denotes confidence interval. Qw tests within-category homogeneity; Qb tests between-category homogeneity. Significant values indicate rejection of the hypothesis of homogeneity. One study (Boyatzis, 1974) lacked dose information, so it was excluded from all analyses involving dose. In addition, the two studies contributing the most extreme outliers were excluded. Significance tests are two-tailed.

*p < .05.  **p < .01.  ***p < .001.

Table 4
Categorical Analysis of Provocation and Alcohol Dose

<table>
<thead>
<tr>
<th>Dataset and variable class</th>
<th>k</th>
<th>Md,</th>
<th>95% CI for d,</th>
<th>Qw</th>
<th>Qb</th>
</tr>
</thead>
<tbody>
<tr>
<td>All studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low provoked</td>
<td>55</td>
<td>0.65</td>
<td>0.56 - 0.74</td>
<td>77.75*</td>
<td></td>
</tr>
<tr>
<td>High provoked</td>
<td>33</td>
<td>0.30</td>
<td>0.40 - 0.61</td>
<td>59.44**</td>
<td></td>
</tr>
<tr>
<td>Low-dose studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low provoked</td>
<td>24</td>
<td>0.54</td>
<td>0.39 - 0.70</td>
<td>52.32***</td>
<td></td>
</tr>
<tr>
<td>High provoked</td>
<td>12</td>
<td>0.23</td>
<td>0.04 - 0.42</td>
<td>33.28***</td>
<td></td>
</tr>
<tr>
<td>High-dose studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low provoked</td>
<td>30</td>
<td>0.70</td>
<td>0.59 - 0.82</td>
<td>22.64</td>
<td></td>
</tr>
<tr>
<td>High provoked</td>
<td>21</td>
<td>0.63</td>
<td>0.50 - 0.76</td>
<td>14.32</td>
<td></td>
</tr>
</tbody>
</table>

Note. d, denotes effect sizes weighted by the reciprocal of their variances. CI denotes confidence interval. Qw tests within-category homogeneity; Qb tests between-category homogeneity. Significant values indicate rejection of the hypothesis of homogeneity. One study (Boyatzis, 1974) lacked dose information, so it was excluded from all analyses involving dose. In addition, the two studies contributing the most extreme outliers were excluded.

*p < .05.  **p < .01.  ***p < .001.

came more similar as the intensity of provocation increased (viz., smaller mean effect sizes), intoxicated participants consistently remained more aggressive than sober ones. This latter effect is revealed by the exclusion of 0 from all CIs, even those in which intensity of provocation was high.

Frustration. Table 5 shows that both low and high levels of frustration were associated with mean effect sizes that differed from 0 (i.e., the 95% CIs excluded 0). However, contrary to our expectation that sober and intoxicated participants would behave more similarly when frustration was high, the results show that higher levels of frustration were associated with larger, not smaller, mean effect sizes, Q, = 6.69, p < .01. We observed this same pattern in the low-dose subset, Q, = 16.48, p < .001. Such a comparison could not be made within the high-dose subset, however, because there was only one effect size in the high-frustration-high-dose cell.

Self-focused attention. The results of the regression analysis on self-focused attention are shown in Table 6. Following the same strategy as with the analysis of anxiety, we included dose as a predictor in the equation with self-focused attention. The results indicate that self-focused attention was a significant predictor of effect size, B = -0.42, p < .05. The negative sign of the regression coefficient indicates that as self-focused attention increased, sober and intoxicated participants behaved more similarly.

To assess whether the effect of self-focused attention was moderated by dose, we conducted separate regression analyses on the low- and high-dose subsets of the studies. The results from the low-dose subset replicate those in the overall sample (see Table 6); higher levels of self-focused attention were associated with smaller effect sizes, B = -0.77, p < .001. By contrast, we observed the opposite relationship within the high-
Table 5

*Categorical Analysis of Frustration and Alcohol Dose*

<table>
<thead>
<tr>
<th>Dataset and variable class</th>
<th>$k$</th>
<th>$M_d$</th>
<th>Lower</th>
<th>Upper</th>
<th>$Q_w$</th>
<th>$Q_h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>All studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low frustration</td>
<td>52</td>
<td>0.42</td>
<td>0.33</td>
<td>0.51</td>
<td>86.38***</td>
<td></td>
</tr>
<tr>
<td>High frustration</td>
<td>20</td>
<td>0.66</td>
<td>0.50</td>
<td>0.82</td>
<td>54.17***</td>
<td></td>
</tr>
<tr>
<td>Low-dose studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low frustration</td>
<td>28</td>
<td>0.23</td>
<td>0.11</td>
<td>0.36</td>
<td>55.33**</td>
<td></td>
</tr>
<tr>
<td>High frustration</td>
<td>19</td>
<td>0.67</td>
<td>0.50</td>
<td>0.83</td>
<td>54.10***</td>
<td></td>
</tr>
<tr>
<td>High-dose studies</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low frustration</td>
<td>23</td>
<td>0.58</td>
<td>0.45</td>
<td>0.70</td>
<td>15.38</td>
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<tr>
<td>High frustration</td>
<td>1</td>
<td>0.54</td>
<td>-0.35</td>
<td>1.43</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

Note. $d_+$ denotes effect sizes weighted by the reciprocal of their variances. CI denotes confidence interval. $Q_w$ tests within-category homogeneity; $Q_h$ tests between-category homogeneity. Significant values indicate rejection of the hypothesis of homogeneity. One study (Boyatzis, 1974) lacked dose information, so it was excluded from all analyses involving dose. The two studies contributing the most extreme outliers were excluded.

Study Characteristics

Categorical moderator analyses of study characteristics are shown in Table 7. Although ancillary to the major theoretical questions, we summarize these results for descriptive purposes.

Presence of nonaggressive-response alternatives. Many studies used paradigms that forced participants to engage in some type of aggression. For example, participants could choose how intense a shock to deliver but lacked the option of not delivering a shock. Gustafson (1993) suggested that increased aggression following intoxication may be restricted to situations in which aggression is the only response alternative available. As shown in Table 7, studies lacking a nonaggressive-response alternative yielded a significantly larger mean effect size than those in which a nonaggressive-response alternative was available, $Q_w = 10.70, p < .001$. However, intoxicated participants behaved more aggressively than sober ones, even when a nonaggressive-response alternative was available (i.e., the CI excluded 0). Caution should be used when interpreting these results because subsequent follow-up analyses revealed that studies in which aggression was the only response alternative also tended to administer higher alcohol doses than studies in which nonaggressive alternatives were available, $t(31) = 5.65, p < .0001$.

Possibility of retaliation. Studies in which it was possible for the target of the participant's aggression to retaliate were associated with a larger mean effect size than those in which retaliation was not possible. This finding is somewhat difficult to interpret, however, because possibility of retaliation tended to covary with other theoretically important variables. For example, a concern about retaliation was the source of inhibiting cues in many studies that received high ratings of inhibition conflict. Similarly, fear of retaliation often contributed to ratings of high anxiety.

Experimenter knowledge of drink content. To examine the consequence of the experimenter's knowledge of drink content, we classified studies into one of three categories: experimenter blind to drink content, experimenter not blind, and not enough information reported to determine the experimenter's knowledge. Although all three categories were associated with positive mean effect sizes and CIs that excluded 0, the mean effect size was smaller in the experimenter blind category, compared with categories in which the experimenter was not blind or not enough information was provided, $\chi^2(2) = 10.41, p < .005$, and $\chi^2(2) = 16.88, p < .0001$, respectively. This outcome, also
obtained by Bushman and Cooper (1990), is consistent with the literature on experimenter expectancy effects (e.g., Rosenthal, 1976).

**Distraction during consumption of alcohol.** There were three categories of studies in this analysis: participants definitely distracted, participants definitely not distracted, and not clearly stated. The two most extreme outliers were excluded from all analyses. Therefore, $k = 47$. Within each category dimension, means with different subscripts differ at $p < .05$.

Separate effect sizes for men and women were calculated from three separate studies. As a result, $k = 50$ for the analysis of gender.

**Time allowed for ingestion and for absorption.** $Q_4$ values for both analyses of time allowed for ingestion and for absorption were significant, indicating that these variables moderate the degree to which alcohol augments aggression. In the case of ingestion time, this effect seems to be primarily due to the difference between studies allowing 5 to 17 min for ingestion and those in which no accurate information on time allowed for ingestion could be obtained, $\chi^2(2) = 9.08$, $p < .01$. Larger effect sizes were associated with studies that did not clearly report the time for ingestion. The effect of time allowed for absorption seems most attributable to the difference between studies allowing 5 to 17 min for absorption and those allowing 30 to 45 min, $\chi^2(2) = 15.71$, $p < .0005$.

**Tests of Categorical Models of Study Characteristics**

<table>
<thead>
<tr>
<th>Variable and class</th>
<th>$k$</th>
<th>$d$, $c$, $b$, $a$</th>
<th>Lower</th>
<th>Upper</th>
<th>$Q_w$</th>
<th>$Q_B$</th>
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<tr>
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<tr>
<td>Available</td>
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<td>0.37</td>
<td>42.17***</td>
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<tr>
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<td>0.24, 0.06</td>
<td>0.36</td>
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<td>5–17</td>
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<td>Time allowed for absorption (in min)</td>
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<td>Direct behavior</td>
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<tr>
<td>Men</td>
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<td>0.60</td>
<td>7.69</td>
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Note. $d$, $c$, $b$, $a$ denotes effect sizes weighted by reciprocal of their variances. CI denotes confidence interval. $Q_w$ tests within-category homogeneity; $Q_B$ tests between-category homogeneity. Significant values indicate rejection of the hypothesis of homogeneity. $Q_B$ is not reported for those categories consisting of only one case. The two most extreme outliers were excluded from all analyses. Therefore, $k = 47$. Within each category dimension, means with different subscripts differ at $p < .05$.

* Separate effect sizes for men and women were calculated from three separate studies. In addition, one study included only female participants. As a result, $k = 50$ for the analysis of gender.

**p < .05. ***p < .01. ****p < .001.
Drinking history, type of response measure, and gender. Although the significant $Q$ values for drinking history and type of response measure suggest that these variables also moderate effect size, we refrain from conclusions concerning them because of their substantial covariation, as well as the small number of studies within some of the variable classes. In addition, both variables tended to covary with participant gender, such that a history of heavy social drinking among the participants and use of verbal measures were associated with the inclusion of female participants. Thus, we were unable to make an assessment of the individual moderating effects of each variable.

Discussion

Anxiety and Inhibition Conflict

Many formulations take the view that increased aggression following alcohol consumption is a consequence of decreased sensitivity to cues that inhibit aggression (e.g., Taylor & Cher-mack, 1993; Taylor & Leonard, 1983; Zeichner & Pihl, 1979). One model focuses on the role of anxiety in inhibiting aggression. It argues that to the extent that intoxication is associated with anxiolysis, intoxication blocks responsivity to this behavioral inhibition system. Similarly, the inhibition conflict model proposed by Steele and colleagues (Steele & Josephs, 1990; Steele & Southwick, 1985) describes how decreased sensitivity to inhibiting cues, in conjunction with intoxication, facilitates aggression.

Our results provide some support for both models. Considering the anxiolysis-disinhibition model first, this model argues that when anxiety arousing cues are very low in intensity, they have little inhibiting effect on either sober or intoxicated participants, thus yielding small effect sizes. When instead such cues are stronger in intensity, their effects in sober participants is to strongly inhibit their aggression. Therefore, if intoxicated participants ignore these latter cues, there is a large difference in the aggressiveness of the two groups, reflected by large effect sizes. As predicted, effect size (reflecting the greater aggression of intoxicated participants relative to that of sober controls) increased as intensity of anxiety-provoking cues increased. There was also a tendency for the effect of anxiety to be strongest in those studies administering relatively high-alcohol doses. This is consistent with the interpretation that at lower alcohol doses, and presumably lower levels of alcohol-related cognitive impairments, both intoxicated and sober participants are relatively responsive to anxiety-provoking cues that serve to inhibit aggression. As alcohol dose increases and various aspects of cognitive functioning are correspondingly impaired, intoxicated participants may experience anxiolysis. Their behavior would, therefore, be relatively free from anxiety-related inhibition, leading to increased aggression in intoxicated relative to sober persons.

The analysis of inhibition conflict revealed that increased levels of inhibition conflict were associated with larger effect sizes. However, our results do not completely support the inhibition conflict model because Steele (Steele & Josephs, 1990; Steele & Southwick, 1985) argued that the aggressive behavior of intoxicated persons should exceed that of sober ones only when both inhibition conflict and alcohol dose are high. Our results show that the combination of high-inhibition conflict and high dose is associated with increased aggression. In conflict to other predictions of this model, however, intoxicated participants were also significantly more aggressive than sober ones when inhibition conflict was high but alcohol dose was low and when both inhibition conflict and dose were low. Indeed, as seen by inspection of Table 3 and contrary to the inhibition conflict model, there is no hint that dose moderates the effect of inhibition conflict.

The conceptual independence of these two models also warrants consideration. Some of the study characteristics judged to be anxiolytic were also judged as contributing to high levels of inhibition conflict. One such example, as mentioned earlier, is the degree to which the experimental paradigm suggests the possibility of retaliation. It could be argued that the specification of anxiolysis is simply one way in which the potency of aggression inhibiting cues is decreased in situations of high-inhibition conflict. However, the anxiolysis-disinhibition model is distinct from, and perhaps preferable to, the inhibition conflict model because it allows for the possibility that inhibiting cues are attended to as fully as instigating cues but that aggression nevertheless increases in intoxicated people. In other words, in contrast to inhibition conflict, the anxiolysis-disinhibition model is more parsimonious because it only requires the assumption that the psychological effect of the inhibiting cues differs depending on whether one is sober or intoxicated.

Zeichner, Pihl, Niaura, and Zacchia (1982) illustrated this difference between the anxiolysis-disinhibition and inhibition conflict models. In their study, intoxicated and sober participants were given the opportunity to shock a "bogus" partner, and the participant was said to have the ability to deliver aversive stimulation to the participants in the form of irritating noise. No partner in fact existed. One third of both groups of participants were given attentional instructions that required them to write down after each trial the level of shock they selected for their partner and the level of noise they received back from their partner. Because the level of noise that participants received was programmed to correlate perfectly with the intensity of shock they chose to deliver to their partners, the attentional instructions should have forced these participants to attend to the consequences of their aggressive behavior. This, in turn, should have inhibited aggression. Instead, intoxicated participants in this condition were more aggressive than their sober counterparts. As Pihl et al. (1993) summarized,

the acutely intoxicated participants were not more aggressive because they were unaware, verbally or cognitively, of what they were doing and of the consequences of their behavior but because that knowledge no longer served an inhibitory function, perhaps because it no longer produced fear (p. 132)

The inhibition conflict model seemingly predicts the opposite pattern of results. Forcing participants to attend to the negative consequences of their aggressive behavior should make the inhibiting cues relatively more salient than instigating cues. Consequently, with a narrowed range of attentional focus, intoxicated participants would be expected to attend more exclusively to these salient inhibiting cues (Steele & Josephs, 1990, Footnote 1). The inhibition conflict model would, therefore, predict that intoxicated participants in the forced attention condition
would behave less aggressively than those in the other two conditions, which clearly was not the case. Alternatively, even if forcing them to attend to the negative consequences of their aggressive behavior only made the salience of the inhibiting cues more similar to that of the provoking cues, these participants should have behaved less aggressively or should not have differed from sober controls, leaving the outcome still contrary to the inhibition conflict model.

Although intensity of anxiety-provoking cues and level of inhibition conflict did moderate effect size, neither completely accounted for the relation between aggression and intoxication. Significant heterogeneity among effect sizes remained in the analyses of anxiety and inhibition conflict. Consequently, we conclude that although knowledge of the intensity of anxiety-provoking cues and level of inhibition conflict provides some predictive utility the effect of alcohol on aggression is a complex process with multiple determinants. A full understanding of the relation between alcohol and aggression, therefore, requires attention to other moderating variables.

Provocation and Frustration

The presence and intensity of provocation is one additional factor that can moderate the tendency for intoxicated people to behave more aggressively than sober ones. Gustafson (1993) has argued that provocation moderates the effect of alcohol on aggression, such that alcohol increases aggression only in situations in which provocation is present. Two aspects of our analysis challenge that conclusion. First, the obtained direction of effect is opposite to that predicted by Gustafson and is in accord with our theoretically derived prediction. That is, the difference in aggression between intoxicated and sober participants actually decreased rather than increased as intensity of provocation increased.

Second, it appears that Gustafson's (1993) conclusion was based on the assumption that provocation affects the difference in behavior between intoxicated and sober participants through its effects on the behavior of those intoxicated. By contrast, we suspect that provocations have their strongest effect on sober people because intoxicated people display relatively greater levels of aggression, even in the absence of provocation. As evidence of this, we calculated the mean effect size of those studies that received a provocation rating of 1 (the lowest possible rating). The mean of these 26 effect sizes was 0.56, CI = 0.43–0.69, indicating that even among studies with the lowest level of provocation, the aggressive behavior of intoxicated participants reliably exceeded that of sober ones. Hence, it is likely that the smaller effect size associated with higher levels of provocation is largely the result of an increased display of aggression by sober participants in response to provocation.

When we examined this difference in effect size as a function of provocation separately within the low- and high-dose studies, the same direction of effect was obtained in both subsets. In the low-dose studies, the greater aggressiveness of intoxicated participants relative to that of sober ones was reliably reduced under higher levels of provocation. In the high-dose studies, however, although provocation produced a similar direction of effect, it did not evidence reliability. In summary then, provocation reduces the difference in aggression between intoxicated and sober participants, although the source of these effects remains unspecified. They may be due to the provocation's instigating or angering effects or because it provides a suitable rationale for aggression, which might otherwise be considered an inappropriate behavior.

Originally, we expected provocation and frustration to have similar directions of influence on effect size, but this was not the case. Whereas higher levels of provocation were associated with smaller effect sizes, higher levels of frustration were associated with larger effect sizes. In retrospect, we believe that these opposing effects become theoretically understandable when they are linked to paradigm characteristics associated with the high-frustration as compared with high-provocation studies in this dataset. Aggressive behaviors can be categorized into two types: (a) instrumental and affective or (b) hostile (e.g., Baron, 1977; Feshbach, 1964; Geen, 1990). The main goal of affective aggression is to inflict harm, whereas instrumental aggression is enacted in the service of attaining some other goal, such as money or status. Of course, any aggressive act may contain elements of both intent to harm and instrumentality. Nevertheless, one motive can dominate.

In this dataset, many studies in which high levels of provocation were induced used the reaction time–competition paradigm. The male participant in this paradigm believed that he was competing with another participant who was said to be located in a separate room (e.g., Jeavons & Taylor, 1985). The loser of each competitive trial received a shock, the intensity of which was determined by his opponent. For trials on which the participant won, he received no shock but was given feedback about the intensity he would have received had he lost. No opponent in fact existed, and the shock intensity feedback was preprogrammed by the experimenter. This feedback was manipulated to indicate that the opponent sometimes selected relatively high-intensity shocks for the participant. We believe that experiencing such provocative behavior from a stranger with whom no prior interaction has occurred, and in particular no prior negative interaction has occurred, would serve to anger and irritate the participant. Aggression displayed by the participant against the opponent is, therefore, likely motivated by a desire to harm the opponent and retaliate against him for the pain he has actually or intended to inflict.

By contrast, the studies judged as high in frustration tended to be teacher–learner studies, or modifications of the paradigm, which we believe are more likely to elicit instrumental aggression. The participant, in the role of teacher (or supervisor, in the modified paradigm), was thought to experience frustration to the extent that a partner performed poorly and jeopardized the participant's likelihood of obtaining a monetary incentive.

The only difference between a teacher–learner study and what we refer to as the "modified version" is that in the latter, participants are explicitly told that the task performed by their bogus partner requires concentration but no learning (e.g., Gustafson, 1986a). We retain the term teacher–learner to refer to both versions of this paradigm, regardless of whether learning is involved, for two reasons: (a) to link the modified paradigm with the larger body of work that is descended from Buss's (1961) original development of the paradigm and (b) the two versions of the paradigm do not differ in the feature that is of theoretical interest, namely, the extent to which a participant's valued goal is blocked.
In many cases, this monetary incentive was quite sizable (e.g., approximately $80 in Gustafson, 1986a), so the motivation to obtain it should be substantial. In addition, participants were sometimes explicitly informed that their aggression could be instrumental in obtaining their monetary reward (e.g., Gustafson, 1985b).

The increased aggression among intoxicated participants under conditions of high frustration may, therefore, be attributable to differences in perceived instrumental value between sober and intoxicated participants. After all, there is the potential that even low-intensity shocks could be effective in improving the learner's performance. Sober and less impaired participants may be more likely to consider this. Moreover, sober participants who do use higher intensity shocks may be more likely than intoxicated ones to notice that their relatively aggressive behavior is not having the intended effect (i.e., is not improving the learner's performance). As a consequence, their aggressive behavior may become less responsive to increases in frustration (i.e., continued poor performance by the learner). By contrast, intoxicated participants may be less likely to realize that their continued and escalating use of aggression is relatively ineffective. If so, the difference in aggression between intoxicated and sober participants should increase as a function of frustration. The likelihood that aggression would begin to lose its instrumental value for sober participants is particularly high in this dataset, given the fact that participants' goal-directed behavior was always completely thwarted. That is, no matter how much aggression participants displayed, they were never able to reach their desired goal.

Additionally, in a teacher-learner study, the participant is charged with the task of teaching or supervising another person. To some extent then, poor performance by the partner reflects poorly on the participant's ability as a teacher-supervisor (Rule & Percival, 1971). Sober participants, as relatively less impaired, are likely to be more sensitive to this contingency than their intoxicated counterparts. They may appear to be less responsive to increases in frustration because they do not want to be seen as severely punishing another person for something for which they themselves are partly responsible.

Finally, the different effects we obtained for frustration and provocation may be attributable to differences in the perceived appropriateness of aggression in response to these two events. As we have already argued, the belief in an eye-for-an-eye may make aggression in retaliation to a provocation acceptable. However, there may be greater ambiguity as to whether it is appropriate to take one's frustrations out on another person. Frustrated individuals may, therefore, be more likely to wrestle with their conscience than those provoked. The greater aggression displayed by intoxicated, frustrated participants may reflect their decreased sensitivity to these concerns.

Paradigm differences between high-frustration and high-provocation studies may, therefore, explain the different effects obtained as a function of provocation and frustration. In particular, paradigm characteristics that elicit angry as compared with instrumental aggression appear important. It should be noted that, whereas high frustration appeared to be associated with instrumental aggression in the current dataset, this covariation does not necessarily appear in the larger literature on aggression. Inductions of task frustration may typically lack the interpersonal aspects that elicit instrumental aggression and instead evoke affective aggression. For example, frustration elicited by one's inability to complete an ostensibly easy task increases aggression relative to individuals who experience task success (Geen, 1968). This aggression could in no way facilitate completion of the task, rendering an instrumental motivation for it unlikely. Thus, it may be that had the research paradigms of the studies in our meta-analysis invoked noninterpersonal, task frustration, our parallel predictions for frustration and provocation would have been upheld.

We conducted an internal analysis to test the hypothesis that provocation and frustration would have similar directions of effect when frustration was likely to elicit affective aggression. We divided studies on the basis of the predominant type of aggression likely instigated (affective or instrumental), then compared effect sizes as a function of level of provocation and frustration. The determining characteristics of aggression type were whether (a) features of the experimental paradigm provided participants with a desirable goal and (b) aggression could be perceived as useful in achieving the goal. We coded the aggression as instrumental in nature if both conditions were met. Otherwise, we considered the aggression primarily affective in nature. The mean effect sizes as a function of level of frustration in Table 8 show that the unexpected reverse outcome obtained in the main analysis—namely, smaller, rather than larger, effect sizes under low levels of frustration—was substantially attenuated when the frustrating event elicited affective aggression. Moreover, the absolute magnitude of the reverse frustration effect obtained in the main analysis (as compared with Table 5) is even larger among the subset of studies limited to include only those in which frustration elicited instrumental aggression.

To provide a conceptual comparison, we conducted this same analysis as a function of level of provocation (see Table 8). When we only considered those studies that elicited affective aggression, as expected, the effect of provocation replicates that obtained in the main analysis: Low provocation was associated with larger effect sizes than high provocation. By contrast, when we examined the subset of studies that elicited instrumental aggression, the absolute magnitude of the difference between low and high provocation was smaller and nonsignificant. Although these outcomes do not completely confirm our hypotheses about the role of type of aggression, they are consistent with it. We are cautious in our interpretation, however, due to the fact that there were only two effect sizes in the high-provocation, instrumental aggression cell (Lang, Goeckner, Adesso, & Marlett, 1975; Zeichner, Allen, Giancola, & Lating, 1994) and only three in the high-frustration, affective aggression cell (Cherek, Steinberg, & Manno, 1985; Kelly, Cherek, Steinberg, & Robinson, 1988; Taylor, Schmutte, & I Leonard, 1977).

These opposing directions of effect for provocation and frustration were interesting although unexpected. In the larger experimental literature on aggression per se (wherein only the behavior of sober participants is considered), the magnitude of the effects may differ, but provocation and frustration typically operate in a similar direction (meta-analysis; Carlson & Miller, 1988; Geen, 1990). Their opposite effects on the difference be-

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2 We thank a reviewer for this suggestion.
between sober and intoxicated aggression in the current dataset suggest that greater attention needs to be paid to the unique aspects of the paradigms in which they are induced. We, therefore, echo a concern—first voiced by Pernanen (1976) and later by Gustafson (1993)—that features of the paradigms that affect frustration and provocation need to be considered when interpreting results of studies on the alcohol-aggression relation. We also think that it may be useful to attend to the motives for aggression that are aroused in different situations (i.e., instrumental as compared with affective aggression).

Self-Focused Attention

The negative relationship between effect size and self-focus in the overall dataset and in the subset of low-dose studies indicates that the tendency for intoxicated participants to behave more aggressively than sober ones is reduced when attention is focused on self. In other words, intoxicated participants behave more similarly to those sober as self-focus increases. Because intoxication generally increases aggression, this finding suggests that self-focus differentially exerts greater inhibitory effects on intoxicated participants. That is, self-focused participants are seemingly able to overcome the aggression-inducing consequences of alcohol ingestion. There are at least two possible explanations for such a pattern. First, intoxicated participants have been shown to overcome alcohol-induced impairments when motivated to concentrate on their performance. For example, intoxicated participants who were told to "try to stay sober" showed better motor and cognitive performance than those not given this instruction (Young & Pihl, 1980; see also Gustafson & Kallmen, 1990a, 1990b, 1990c; Myrsten, Lambie, Frankenhaeuser, & Lundberg, 1979; Ross & Pihl, 1988; Williams, Goldman, & Williams, 1981). Ross and Pihl argued that focusing attention on self can induce such a compensatory process. To the extent that intoxicated participants are more influenced by self-focusing cues than sober participants, as our results indicate, it appears that they actually overcompensate and regulate their behavior even more stringently than sober participants. Alternatively, the narrowed attentional focus accompanying intoxication may intensify a self-focused state by decreasing sensitivity to other, potentially distracting stimuli. Sober participants may be relatively less affected by self-focusing cues because their wider range of attentional focus exposes them to cues that compete with self for attention. These explanations are not incompatible; both processes may occur.

The fact that effect size and self-focus were positively related in the high-dose subset of studies may be a function of the relatively weak strength of the self-focusing cues in this dataset. Explicit manipulations of self-focus were rare in the dataset, and we made ratings of self-focus on the basis of subtle variations in situational cues. Not surprisingly, on average, self-focus was low (viz., below the scale midpoint in 70% of the studies). In this dataset, it is therefore reasonable to expect that as alcohol dose and the cognitive impairment associated with it increased, intoxicated participants would be less affected by the relatively weak self-focusing cues. The unimpaired sober participants may still be influenced by the self-focusing cues, leading them to behave less aggressively than those intoxicated who had been given higher doses.

The different effect of self-focus as a function of dose may also be explained by the finding that intoxication typically decreases the likelihood of focusing attention on self (Hull et al., 1983). The self-focusing cues in this dataset may have been sufficient to overcome this general tendency in those intoxicated participants who had consumed lower doses. Because they may have started out at a lower level of self-focus than sober ones, the aggressive behavior of intoxicated participants may have been more greatly affected than that of sober ones. This would account for the negative relation between effect size and self-focus when lower doses had been consumed. As dose increased, the likelihood of focusing on self may correspondingly decrease, such that stronger self-focusing cues are required if attention is to be redirected to self. The relatively weak self-focusing cues in this dataset may, therefore, have had little effect on the intoxicated participants who had received higher doses. These same cues should still have affected sober ones, resulting in a positive relation between effect size and self-focus when higher doses are involved. It should be noted that the mean judges' ratings of self-focus did not differ as a function of dose ($p > .05$), indicat-

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Table 8

<table>
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<tr>
<th>Variable and class</th>
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<th>Instrumental aggression</th>
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<td>$Q_w$</td>
<td>$k$</td>
</tr>
<tr>
<td>Frustration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>20</td>
<td>0.23</td>
<td>0.08</td>
<td>0.38</td>
<td>35.75**</td>
<td>31</td>
</tr>
<tr>
<td>High</td>
<td>17</td>
<td>0.66</td>
<td>0.50</td>
<td>0.83</td>
<td>54.04***</td>
<td>3</td>
</tr>
<tr>
<td>Provocation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>15</td>
<td>0.37</td>
<td>0.19</td>
<td>0.54</td>
<td>35.12***</td>
<td>39</td>
</tr>
<tr>
<td>High</td>
<td>2</td>
<td>0.26</td>
<td>-0.18</td>
<td>0.70</td>
<td>2.18</td>
<td>31</td>
</tr>
</tbody>
</table>

Note. $d_s$ denotes effect sizes weighted by reciprocal of their variances. CI denotes confidence interval. $Q_w$ tests within-category homogeneity; $Q_b$ tests between-category homogeneity. Significant values indicate rejection of the hypothesis of homogeneity.

* $p < .05$. ** $p < .001$. **

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6 We thank a reviewer for this suggestion.
ing that the different relation observed between self-focus and effect size as a function of dose is not attributable to differences in the intensity of self-focusing cues between high- and low-dose studies.

Study Characteristics

This review has focused on a number of potentially important moderators of the relation between alcohol and aggression. One issue that needs to be stressed is that it is often not possible in the existing literature to assess separately the effect of other theoretically relevant factors because the variables of interest tend to covary within studies. Our analyses has revealed many instances of this. For example, the display of aggression differs as a function of gender (Eagly & Steffen, 1986); but, in the alcohol and aggression literature, inclusion of female participants has tended to covary with a history of heavier social drinking among the participants and use of verbal measures of aggression—both of which could influence effect size. We, therefore, found it impossible to assess the independent influences of these three variables. Because each of these variables is of potential theoretical and practical importance, systematic investigation of their independent effects would be welcomed.

Similarly, we were unable to reach a strong conclusion about certain paradigmatic features, such as the influence of the availability of nonaggressive-response alternatives. Gustafson (1993) argued that alcohol increases aggression only in situations in which participants are forced to make an aggressive response. We attempted to test this hypothesis by dividing studies as a function of whether nonaggressive-response alternatives were present in an experiment. Unfortunately, these two categories differed significantly in mean dose of alcohol given to the participants, thereby precluding assessment of whether observed differences in effect size were due to dose effects or to the type of response alternatives.

Implications for Future Research

The analyses on the moderator variables in this meta-analysis produced a number of interesting results. However, like any meta-analytic research whose researchers examine the effects of moderator variables by comparing subsets of studies or ordering studies in terms of their judged or coded level on the moderator of interest, the obtained relation between the moderator (e.g., anxiety) and effect size (e.g., the difference in aggression between sober and intoxicated participants) is correlational in nature. Hence, it needs to be followed up by experimental research. In this section, we briefly suggest future experimental research linked to the specific effects we have obtained.

Anxiety and inhibition conflict. Although not strongly emphasized in our report, our judges’ ratings of anxiety and inhibition conflict showed strong covariation. Indeed, in an analysis in which each study was allowed to contribute one rating per variable, the correlation between ratings of anxiety and inhibition conflict was so high as to suggest singularity of the two concepts ($r = .91, p < .001$, when corrected for reliability of the judgments). Despite this, we have tried to outline differential predictions made by the anxiolyosis–disinhibition and inhibition conflict models. Before such predictions can be adequately tested, however, independent manipulations of the two models are required, assuming that they do indeed possess discriminative construct validity. Frankly, we are at a loss to generate independent manipulations. Operationalizations of anxiety (e.g., presence of a high-status observer who has control over the participant with respect to an important outcome) that come to mind would also serve as inhibiting cues that increase inhibition conflict, and vice versa. The conceptual independence of anxiety and inhibition conflict and their relation in moderating alcohol-induced aggression, therefore, requires greater attention. As previously discussed, the possibility of retaliation often contributed to ratings of both high-anxiety and high-inhibition conflict in this dataset. A wider range of operationalizations of anxiety and inhibition conflict should be explored to eliminate the possibility that the obtained effects are unique to threat of retaliation. In summary, at the very least, a wider variety of manipulations of anxiety and inhibition conflict and an elaborated conceptual analysis of their potential discriminative construct validity is warranted.

Provocation and frustration. In our analysis of provocation and frustration, it was apparent that the distinction between these concepts was confounded with other variables. In particular, our discussion suggests the need to separately manipulate the type of aggressive responses elicited by provocation and frustration manipulations. Specifically, it calls for experimental researchers to examine separately the effects of alcohol for provocations experimentally designed to elicit instrumental versus affective aggression and, in parallel, for inductions of frustration designed to elicit instrumental versus affective aggression. Perhaps also important is the need for experiments whose researchers orthogonally examine these effects when the instigatory source is human versus environmental. With respect to this latter call, it is worth noting that in our dataset, many of the frustration inductions depended on human agency (a “stupid” partner in the teacher–learner paradigm), as opposed to environmental circumstances (e.g., extreme temperatures or task failure). Provocation may also be induced either by human agency or environmental circumstances. It may be important that the definition of provocation given to our judges constrained it to instances of human agency.

We also note that many of the paradigms used to study alcohol and aggression are fairly provoking (e.g., a shock machine is present, a participant is involved in competition). As a result, studies that received the lowest rating on the provocation dimension most likely reflected a condition of low, as opposed to no, provocation. It would be of interest to compare the aggression of intoxicated and sober participants under conditions in which provocation was judged below threshold, so as to determine whether the relation between provocation and effect size holds in the absence of provocation. Similarly, some amount of anxiety and inhibition conflict likely existed even in those studies that received the lowest ratings on these variables. Hence, our results do not specifically address the relationship between alcohol and aggression under situations of no anxiety or no inhibition conflict.

Self-focus. The concept of self-focus contains two components: One refers to personal standards for ideal behavior, whereas the other represents impulsive inclination. It would be useful to develop separate measures of each component, so as...
to determine whether they are effected equally as a consequence of alcohol ingestion and its dose. It is possible that the attentional deficits induced by intoxication primarily interfere with the encoding of one, the other, or both of these components. Alternatively, or in addition, intoxication may interfere with the high order cognitive process of comparing an adequate cognitive representation of each.

Other issues. It would also be useful to determine whether changes in motivation or ability are responsible for the results obtained herein. On the one hand, proscriptions against drinking and driving imply that alcohol has inevitable capacity reduction consequences. On the other hand, Ross and Pihl (1988) have concluded that the pharmacological action of alcohol may be counteracted when subjects are motivated to "act sober," either by experimenters setting a behavioral standard of sober performance, or by manipulations aimed at forcing the subjects to take personal responsibility for their performance. (p. 116)

The influence of self-focused attention at lower doses is consistent with this conclusion. Clearly, however, at high enough doses, alcohol exerts behavioral effects that cannot be overcome by increased motivation. The data that we reviewed are not sufficient to address this issue, but determination of the relative contributions of changes in ability and motivation could help clarify the effects of alcohol on behavior in general, and on aggressive behavior in particular.

Conclusion

In closing, we emphasize that although this meta-analysis confirms the causal role of alcohol in increasing aggression (see also Bushman & Cooper, 1990; and Steele & Southwick, 1985), we do not view aggression as an inevitable consequence of intoxication. Laboratory studies such as those in this analysis are specifically designed to facilitate aggression by creating situations in which participants feel comfortable displaying it should they desire to do so. By contrast, most real-world settings contain many fewer aggression-instigating cues and many more inhibiting ones.

References

References marked with an asterisk indicate studies included in the meta-analysis.


on physical aggression. *Journal of Experimental Research in Personality*, 5, 111–118.


Appendix A

Overlap of Studies With Other Meta-Analyses

The following studies from the present dataset were also included in the following prior meta-analyses on the relation of alcohol and social behavior:

**Hull & Bond (1986) Meta-Analysis**
- Lang et al. (1975)
- Pihl et al. (1981)
- Rohsenow & Bachorowski (1984)

**Steele & Southwick (1985) Meta-Analysis**
- Bennett et al. (1969)
- Boyatzis (1974)
- Lang et al. (1975)
- Pihl et al. (1981)
- Schmutte & Taylor (1980)
- Shuntich & Taylor (1972)
- Taylor & Gammon (1976)
- Taylor et al. (1976)
- Taylor et al. (1977)
- Taylor et al. (1979)
- Zeichner & Pihl (1979)
- Zeichner & Pihl (1980)
- Zeichner et al. (1982)

**Bushman & Cooper (1990) Meta-Analysis**
- Bailey et al. (1983)
- Gustafson (1985b)
- Gustafson (1985c)
- Gustafson (1986a)
- Gustafson (1986b)
- Gustafson (1987)
- Gustafson (1988)
- Gustafson (1989)
- Gustafson (1991c)
- Jeavons & Taylor (1985)
- Pihl et al. (1984)
- Pihl & Zacchia (1986)
- Pihl et al. (1981)
- Schmutte et al. (1979)
- Schmutte & Taylor (1980)
- Shuntich & Taylor (1972)
- Taylor & Gammon (1976)
- Taylor et al. (1976)
- Taylor et al. (1977)
- Taylor & Sears (1988)
- Zeichner et al. (1982)

**Steele & Southwick (1985) Meta-Analysis**
- Bennett et al. (1969)
- Boyatzis (1974)
- Lang et al. (1975)
- Pihl et al. (1981)
- Schmutte & Taylor (1980)
- Shuntich & Taylor (1972)
- Taylor & Gammon (1976)
- Taylor et al. (1976)
- Taylor et al. (1977)
- Taylor et al. (1979)
- Zeichner & Pihl (1979)
- Zeichner & Pihl (1980)
- Zeichner et al. (1982)

**Steele & Southwick (1985) Meta-Analysis**
- Bennett et al. (1969)
- Boyatzis (1974)
- Lang et al. (1975)
- Pihl et al. (1981)
- Schmutte & Taylor (1980)
- Shuntich & Taylor (1972)
- Taylor & Gammon (1976)
- Taylor et al. (1976)
- Taylor et al. (1977)
- Taylor et al. (1979)
- Zeichner & Pihl (1979)
- Zeichner & Pihl (1980)
- Zeichner et al. (1982)

**Bushman & Cooper's (1990) Descriptive Summary**
- Bennett et al. (1969)
- Boyatzis (1974)
- Gustafson (1984)
- Lang et al. (1975)
- Rohsenow & Bachorowski (1984)

Appendix B

Attention and Cue Salience Variables Extracted From Each Study

These are the definitions judges used to rate the levels of anxiety, inhibition conflict, provocation, frustration, and self-focused attention of each study. All variables were rated on 9-point scales; examples are provided of studies which, according to the ratings obtained from the judges, represented the endpoints of each scale.

**Anxiety**

This criteria is the extent to which the overall experimental circumstances effected the participants by increasing their anxiety, making them excited, worried, highly alert, or attentive. Such a state is usually aroused by the perception of threat to self (either physical or psychological) or worry over potential or actual negative consequences for the self. Endpoints are

- 2 = participating in a reaction time-competition study in which the fear of receiving shocks has been removed (e.g., Ganter & Taylor, 1992)
- 9 = participating in a reaction time-competition study in which there is concern about beating an opponent on a reaction time task and receiving shocks for losing.

**Inhibition Conflict**

This criteria is the degree to which participant’s response is simultaneously pressured by instigating and inhibiting cues (Steele & Southwick, 1985). High-inhibition conflict is assigned when conflicting pressures are strong and relatively equal. If inhibiting cues involve the possibility for negative consequences, these consequences should be directly linked to the participant’s behavior. Endpoints are

- 1 = ability to negatively evaluate another person without fear of retaliation (e.g., Rohsenow & Bachorowski, 1984)
- 9 = participating in a reaction time-competition paradigm (e.g., Taylor et al., 1977) where there are cues instigating the delivery of high-intensity shocks to an opponent, while fear of receiving high-shock levels from that opponent simultaneously inhibits aggression.

**Provocation**

This criteria is the extent to which negative affect would arise as a direct result of being attacked or provoked by another person. It de-
pends on the extent to which the participant perceives malicious or aggressive intent (i.e., how the participant perceives the situation, irrespective of the actual intentions of the actor). Endpoints are

1 = Trial 1 in a reaction time-competition study before any high-intensity provoking shocks have been received from an opponent (e.g., Jeavons & Taylor, 1985)
9 = learning that an opponent planned to deliver a shock that was twice as high as one’s pain threshold in a reaction time-competition study (e.g., Taylor et al., 1979).

Frustration
This criteria is the extent to which an ongoing, goal-directed behavior is blocked or thwarted. The source of frustration could be another person or an event. Endpoints are

1 = participating in a reaction time-pain perception study in which the participant’s task is to respond as quickly as possible to a tone and in so doing, deliver a shock to one’s partner (e.g., Pihl et al., 1984)
9 = the crucial trials where the teacher-supervisor in a teacher-learner study sees that he or she will not win an amount ($80) because the learner-partner has made too many mistakes on a simple task (e.g., Gustafson, 1986a).

Self-Focused Attention
This is the degree to which the participant’s attention is focused on self because of circumstances in the experimental setting that cause the participant to be the object of his or her attention and the degree to which experimental situation induces self-evaluation for internal concerns or standards (but not self-presentational concerns). Endpoints are

1–2 = participating in a teacher-learner study (e.g., Gustafson, 1986a) where attention is directed toward supervising another person
9 = performing a task in front of a mirror and video camera (Bailey et al., 1983).