



Reports

A message in a bottle: Extrapharmacological effects of alcohol on aggression

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ABSTRACT

The physiological and expectancy effects of alcohol consumption on the aggressive behavior of 116 general-population males aged 18–45 years were analyzed separately in a naturalistic field experiment using a 3 × 3 Balanced Placebo Design (BPD). Participants were given a non-alcoholic drink, a drink targeting a Blood Alcohol Concentration (BAC) of .05%, or a drink targeting a BAC of .1%. Within these three groups, three expectancy levels were induced regarding the quantity of alcohol ingested. Aggressive behavior was measured as retaliation against an aggressive confederate, in the form of amounts of hot sauce and salt administered in a taste test. Expectancies significantly increased aggressive behavior, whereas actual quantity of alcohol ingested was unrelated to aggression. Aggressive dispositions also predicted aggressive behavior.

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Introduction

Alcohol is the substance most frequently cited for aggressive and violent behavior (Boles & Miotto, 2003; Gmel & Rehm, 2003; Parker & Rebhun, 1995; Pernanen, 1991), with an average of 40–50% of violent crimes involving a person who has consumed alcohol (Murdoch, Pihl, & Ross, 1990; see also Bègue & Subra, 2008). Pharmacologically-based models purport that aggression following the consumption of alcohol is due to the pharmacological properties of alcohol itself, whereas expectancy models have proposed that the behavior following the ingestion of alcohol is a function of the drinker's implicit or explicit beliefs regarding the effects of alcohol. For example, according to the attributional perspective, since alcohol is believed by layperson to facilitate aggression, transgressing individuals should use intoxication to decrease negative reactions of others by the use of self-serving explanations aimed at reducing personal responsibility (Snyder, Higgins, & Stucky, 1983).

In a recent synthesis, Exum (2006) concluded that “expectancy has a negligible effect on aggression” (p.141). This conclusion closely reflects the statistical trends reported in published studies and meta-analyses (e.g., Bushman, 1997; Bushman & Cooper, 1990). However, while quantitative meta-analysis represents the best way of evaluating existing knowledge on a topic, its results also primarily depend on the quality of the studies on which meta-anal-

ysis is based (Johnson & Eagly, 2000). We believe that the Exum (2006) synthesis may not provide a definitive answer concerning the issue of the extrapharmacological effects of alcohol because it is mainly based on studies that may not have successfully implemented the methodology of the balanced placebo design (BPD) necessary to disentangle pharmacological and expectancy effects (Hull & Bond, 1986).

Another reason that should prevent a definitive conclusion on the in-existent contribution of extrapharmacological factors of alcohol on human aggression lies in research on automatic activation of aggression (Todorov & Bargh, 2002). In a recent study, Bartholow and Heinz (2006) showed that participants made faster lexical decisions concerning aggression-related words following alcohol-related primes compared with neutral primes. In a subsequent experiment, individuals who were first exposed to alcohol advertisements then rated the behavior of a target person as more hostile than participants who initially viewed control advertisements. These results suggest that the mere expectancies of alcohol consumption may activate aggressive thoughts and behavior (see Friedman, Mc Carthy, Bartholow, and Hicks, 2007). In the following section, we suggest that because of the well known practical difficulty linked to experimental research on intoxicated aggression, most studies may have led to a systematic underestimation of alcohol expectancy effects. Consequently, we will present a new BPD experiment carried out in a realistic setting and involving an alternative measure of aggression to differentiate the pharmacological and extrapharmacological effects of alcohol on aggressive behavior.

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The balanced placebo methodology

The classic balanced placebo design (BPD) is a 2×2 factorial design crossing non-alcohol/alcohol received and non-alcohol/alcohol expected. The use of a BPD thus relies on a manipulation of the taste and smell of beverages such that participants cannot reliably distinguish alcoholic from non-alcoholic beverages on the basis of sensory cues (Marlatt, Demming, & Reid, 1973; Mendelson, McGuire, & Mello, 1984), while non-alcoholic beverages may deliver the sensory cues of alcoholic beverages (Glautier, Taylor, & Remington, 1992). Unfortunately, suspicion in the placebo condition and especially in the anti-placebo condition (when alcohol is ingested but is not expected) is often rampant, with rates of suspicion reaching 60% or even 90% in some studies based on BPD (Bradlyn, Strickler, & Maxwell, 1981; Keane, Lisman, & Kreutzer, 1980; Lyvers & Maltzman, 1991; Martin & Sayette, 1993). Moreover, manipulation checks may themselves induce experimental demand (Collins & Searles, 1988; Knight, Barbaree, & Boland, 1986; Knight, Barbaree, & Boland, 1988).

In order to avoid a minimization of the extrapharmacological effects of alcohol owing to participants' suspicion, we paid attention to three kinds of cues potentially leading to participants' suspicion and unreliable results: *internal cues* (interoceptive events attributed to the effects of alcohol), *gustative cues* (taste of alcohol) and *instructional cues* (experimental instructions and manipulations, cover story) to judgments of intoxication (see below). We predicted two additive effects of alcohol ingested and alcohol expected. Therefore, we expected a linear increase in aggression as a function of the expectancies, and a linear increase in aggression as a function of the quantity of alcohol ingested. We also anticipated that aggressive dispositions would increase aggressive response.

Method

Participants

The participants were 117 males between the ages of 18 and 44 ($M = 29.31$, $SD = 6.6$) from the mid-size city of Grenoble (pop. 340,000) and the surrounding communities with various occupational and educational levels. Females were excluded in order to prevent risks related to potential pregnancy.

Measures

Aggressive dispositions

During a preliminary phone interview, participants completed the Physical Aggression Subscale of the Buss–Perry Aggression Questionnaire (BPAQ, Buss & Perry, 1992). The scale Cronbach's alpha was .60.

Measure of aggressive behavior

Our aggression measure consisted of an adaptation of the Hot Sauce Paradigm (HSP, Lieberman, Solomon, & Greenberg, 1999). The participants were given a large quantity of small doses of Tabasco in plastic capsules. We also gave them the same quantity of salt doses so as to provide them with a more covert way of aggressing (Ritter & Eslea, 2005). Information regarding the correspondence between amount of salt and of hot sauce doses and their gustative effects were given from 1 to 6 (examples: 1 salt dose = *salted*; 6 salt doses and more = *excessive burning sensation*; 1 Tabasco dose = *spicy*; 6 Tabasco doses = *risks of temporary extinction of the sense of taste, risks of vomiting*). Although the correspondences stopped at 6, the possibility of putting more salt or Tabasco was fully possible, because there were 50 doses of Tabasco and 80

doses of salt in front of the participant. The quantity of Tabasco and salt administered were aggregated (Cronbach's alpha = .53).

Post-debriefing evaluation

Participants gave their evaluation of the study on five Likert-type items such as "I consider that the incomplete and inaccurate quality of the information that has been conveyed to me at the moment of the inclusion in the study was completely justified" (Cronbach's alpha = .58).

Procedure

Screening procedure and final sample

The participants were recruited through a two-step selection process. An advertisement was published eight times in the main regional newspaper and 35,000 flyers were disseminated. The advertisement indicated that a session was being organized by Stat-Food in order to taste energy food with 18–45-year-old males and that the length of the tasting session varied from 2 to 7 hours. Each hour was paid 14 euros (approximately 19 USD). A preliminary phone interview lasting about 30 minutes was performed with 358 interested participants, supposedly aimed to "identify participants' eating habits and consumption profile". It included various filler questions about alimentary habits and personality items in order to deemphasize target questions concerning physical aggression as well as alcohol consumption (see below). Drinkers at risk were identified by the CAGE (Beresford, Blow, Hill, Singer, & Lucey, 1990) and eliminated. In order to collect participants' agreement to consume alcohol indirectly, they were informed that so as to limit biases in their taste evaluations, they would not know in advance exactly what they would have to taste. We therefore proceeded to ask them whether they were willing to consume certain foods, supposedly to "avoid any risk of allergic reactions". A list of 30 food components was named on the phone. Participants who did not wish to consume a food listed were asked to indicate their disagreement. One question tapped alcohol and participants who disagreed with the possibility of consuming alcohol were excluded from the sample. One hundred eighty-eight participants were excluded because of their inadequacy in terms of the expected profile for sociodemographic motives, 14 for medical reasons not including alcohol problems, 11 for alcohol problems, 23 for refusal of alcohol consumption, 7 for technical reasons and 10 for miscellaneous reasons. Among the scheduled participants, 63 did not show up without forewarning and 25 cancelled. Among the participants who came, 17 were included in a pretesting session –not reported here– and were not included in the final sample. Among the remaining participants, 3 were excluded for medical reasons that were not detected previously, 3 because of their inadequacy to the expected sociodemographic profile, 6 for misunderstanding instructions unrelated to the beverage composition, 4 because of the refusal of drinking during the tasting session, 1 for having vomited, and 4 for procedure error. Finally, 11 were excluded because of suspicion concerning the role of the confederate playing the role of the provocator.

Experimental procedure

We primarily handled the issue of internal cues indirectly by trying to divert participants' attention from bodily sensations indicative of beverage content. By using distracter tasks and a loud musical background, we expected to decrease the salience of the interoceptive cues and facilitate a misattribution process (Rohsenow & Marlatt, 1981). The issue of gustative cues was handled by a major change compared to previous studies. In the three anti-placebo groups, we added that in fact, there was no alcohol, but that this new beverage was currently under development phase and targeted persons who appreciated the taste of alcohol

		Alcohol expected		
		None	Low dose	High dose
Alcohol ingested	None	Control 1	Placebo 1	Placebo 2
	Low dose	Antiplacebo 1	Control 2	Placebo 3
	High dose	Antiplacebo 2	Anti-placebo 3	Control 3

Fig. 1. The 3 × 3 BPD design.

but wished to avoid drinking alcohol. Therefore, the beverage was supposed to have the taste of alcohol without containing any drop of alcohol. In the three placebo groups, we simply told the participants that the beverage contained a specified quantity of alcohol. Lastly, in the three control groups, the participants were told the exact quantity of alcohol that had been poured in their glasses. Other more usual ways of masking gustative cues were also carried out besides masking substance in the beverage (low temperature of the drink, and alcohol sprayed onto the sides and the bottom of the glass in the placebo conditions). Regarding instructional cues, we improved the global credibility of the experimental setting and avoiding any reference to a psychopharmacological study on alcohol. We therefore designed a bogus food-tasting company called Stat-Food, allegedly investigating people's preferences for energy food, to recruit the participants from the general population.

Following the eligibility phase, the participants involved in a so-called tasting session were randomly assigned to one of the nine experimental conditions—crossing three levels of alcohol ingested (none, medium, high) with three levels of alcohol expected (none, medium, high; see Fig. 1)—and then aggressively provoked by a confederate who pretended to be a tasting volunteer. Two important situational factors increasing intoxicated aggression were held constant: provocation (Ito, Miller, & Pollock, 1994; Lipsey, Wilson, Cohen, & Derzon, 1997) and social pressure to vengeance (Taylor & Sears, 1988; Tedeschi & Felson, 1994). We studied participants' aggressive reaction by measuring the quantity of aversive substance (salt and hot sauce) they put in the food that the person who had provoked them earlier would eat later, (Lieberman et al., 1999). Important precautions in the manipulation checks and the debriefing phase were also taken in order to avoid experimental demand. It was therefore not the same experimenter who conducted both the study and the manipulation checks concerning the content of the served beverage. The experimenter in charge of the debriefing pretended not to know what was in the participants' glasses in order to avoid any experimental demand associated to the potential fear of contradicting the experimenter (Knight et al., 1986). Its function was supposedly to ask questions and have a feedback about the session in order to improve the quality of the future tasting sessions.

Pre-experimental phase

The experiment was run daily except on Sundays from 9 AM to 8 PM for two months, at a community health center. Individuals eligible were scheduled for an appointment at a fictitious food-tasting firm called Stat-Food.¹ The participants who were assigned to a non-alcohol condition were previously informed by phone that they would have to stay 2 h, whereas we asked the participants in the moderate and high alcohol condition to stay, respectively, 3 and 7 h. We told participants that the length of the tasting session

depended on the number of foodstuff to be tasted. Participants were asked to abstain from food and drink (except water) for a period of 3 h prior to their scheduled appointment (Millar, Hammersley, & Finnigan, 1992). They were greeted at a front desk by a 25-year-old hostess dressed in a professional way and wearing a label of Stat-Food drawn by a design graphic artist. Advertising posters of Stat-Food made by professionals were disposed on the walls. After an identity check, a physician verified that the state of health of the participant enabled his inclusion and measured participant body size and weight. The participant was then escorted into a waiting room, where he was led to exchange a few words with a confederate for about 5 min. Then the hostess escorted him to the tasting room, where he was received by another hostess. A second confederate, playing the role of a provoking and offensive participant, was already seated in the room, apparently ready to start the tasting, and was made to give his turn to the participant by the hostess. He asked with an irritated voice, "What? Will I still have to hang around?" As he left, the confederate looked at the participant with extreme dislike and uttered a swear word indicating aggressive discontent (in French "putain"). Then, the participant signed a form committing him to consume the entire food sample that was to be presented to him. Participants were informed that if food samples were not consumed entirely, the promised amount of money would be reduced and they would lose 15 euros (approximately 20 USD) out of their expected remuneration. Then, the participant was seated in front of a table, and told to wait for the first tasting product.

Experimental manipulation

A third female hostess came in and asked him to begin the first stage of the tasting session. In front of him she put three cold iso-volemic glasses each containing a cocktail with grapefruit and grenadine cordial, mint, and lemon concentrate. One-third of the participants were given a non-alcoholic cocktail, another third a moderately alcoholic cocktail (containing 0.95 OZ of pure alcohol to target a peak BAC of 0.05%), and the last third a strongly alcoholic cocktail (containing 2.01 OZ of pure alcohol to target a peak BAC of 0.1%). The dose was not adjusted, except when the participant's weight was more than 20 kg under or over the median weight (75 kg). Within each of these three groups of participants, three levels of expectancy were introduced. Some participants were told that the cocktails tasted of alcohol but did not contain any drop of alcohol. Others were told that the cocktails contained moderate amounts of alcohol, the equivalent of two to three glasses of vodka (an example was shown). Finally, other participants were told that the cocktails were highly alcoholic, roughly five to six glasses of vodka. There were therefore 9 experimental groups. Immediately prior to serving the beverage, the rims of the glasses were sprayed with alcohol in the placebo conditions. Ten minutes were allotted for beverage consumption, which was followed by a 20 min absorption period during which participants performed various filler tasks. In the tasting room where the bulk of the experiment was carried out, the experimenters and the confederate were not aware of the quantity of alcohol contained in the glasses. This double-blind procedure was employed because experimenter knowledge of drink content is related to increased intoxicated aggression (Ito, Miller, & Pollock, 1994).

Provocation and incitation to revenge

Twenty minutes later, while the participant was finishing filler questionnaires, the offensive confederate came back into the tasting room. The female hostess then loudly told the confederate—in order to make the participant hear the content of her speech—that he had to taste 80 g of mashed potatoes after seasoning them with salt and hot sauce presented in small doses, and that he would then have to season the dish of the participant, who was still in the process of filling out a questionnaire. Once he had finished,

¹ Note 1: Eating the spicy mash was unrelated to aggression.

5 min later, the offensive confederate turned to leave the room; as he passed behind the participant, he violently kicked one of the legs of the chair the participant was sitting in, and yelled, “Just wait ‘til you taste your mash, it’ll blow your head off !”. He then loudly slammed the door and left the room.

Two minutes later, the participant was then invited to sit at another table in the same room for the tasting of the mashed potatoes. In order to season properly his own mash properly, the participant was asked to read a correspondence scale that was placed in front of him. It indicated the following information: “Gustative scale. These correspondences are based on several hundred previous observations. They may help you in the seasoning of your dish. You can use the doses in front of you as you wish”. A large screen was put in front of the table so that nobody could see the participant while he sat at the table. Two plates containing doses of salt and hot sauce were presented to him. He was asked to consume 80 g of mashed potatoes and his desired amount of salt and hot sauce. Then he had to consume the excessively spiced and salted mashed potato dish that the confederate had prepared for him. He finally had to season the confederate’s dish. The participant was made to believe that he would not meet the provocator again. At that moment, the first confederate whom the participant had met in the waiting room after his arrival, and who had entered the room several minutes ago in order to carry out a tasting, and had visibly witnessed the whole scene, incited him to take revenge. He said: “You saw how he loaded your mash with hot sauce; the food’s gone completely red! If I were in your place I would take my revenge”. Next, the participant was left alone in the room for 5 min. While he had the opportunity of putting salt and hot sauce in the puree that was to be eaten by the confederate, no hostess was present in the room. Between the end of the beverage consumption and the moment when participants could express an aggressive response, 30 to 40 min had passed.

A two-step debriefing phase

Participants then left the main room, were offered some food and drink and were kept busy with various tasks. After 2 to 6 h, when their BAC was theoretically near to 0, an experimenter posing as the person in charge of the food evaluation agency took them to another room and asked various questions about the agency’s hostess and the tasting experience. By that pre-debriefing procedure, we expected to hinder the participants’ propensity to answer consistently with what another experimenter had previously told them. The experimenter doing the debriefing pretended not to be informed of what they had drunk or eaten and the participants had simply to inform him at the beginning of the interview (see Knight et al., 1986). The pre-debriefing was also the opportunity for the participants to tell the supposed manager of the tasting company that an incident occurred. Most of the time, they expressed anger and said the tasting session was vitiated by this aggressive altercation, adding that they had had to consume the spicy mash or that they had lost 15 euros because they had refused to eat it. When the participants had finished the narration of the incident, the experimenter asked them uncritically if they had also put salt or hot sauce in the provocators dish, and if that was the case, how many doses they had added.

When the manipulation verification phase was complete, a careful postexperimental individual treatment was administered and each participant was genuinely debriefed. Participants then filled out a consent form and gave their evaluation of the study. All participants agreed that the collected data could be used for research purposes. We then estimated BAC with a breath alcohol testing device (Dräger 5100S). Participants whose BAC was equal to 0.00 were then paid and thanked for their participation.

Results

Manipulation checks

Four participants in placebo conditions and two participants in anti-placebo conditions suspected a discrepancy between what they were told concerning their beverage and what they were actually given. We therefore excluded them from the sample.

Hypothesis testing

Two outliers were detected in the raw data; however, a log transformation brought the participants back into the distribution. All analysis of the behavioral measures of aggression was therefore on log-transformed data. In order to investigate the independent effects of absorbed alcohol and expectancy on aggression (i.e., amount of hot sauce and salt put on the mashed potatoes that was to be consumed by the hostile confederate), we ran a regression analysis with these two principal variables and two covariates. Given that the amount of alcohol expected to be absorbed had three levels, we computed two orthogonal contrasts, the first testing the predicted linear increase in aggression as a function of expectancy, and the second testing a quadratic trend. The level of alcohol actually consumed, which was initially a discrete predictor, was entered in continuous form. This transformation from a discrete into a continuous predictor took into account the variability of the participant’s weight. Indeed, for technical reasons linked to the double-blind procedure, it was not possible to adjust the quantity of alcohol at a finer level than 20 kg below or above the median weight (75 kg). Post-hoc, we calculated the theoretical BAC for each participant depending on his exact weight (which was measured by a medical doctor during the short visit) in order to obtain a more precise measurement, which therefore became continuous. Note that for the regression analysis this variable has also been mean centered.

We also computed interactions between the amount of consumed alcohol and the two contrasts coding the expected level of alcohol. Finally, participants’ weight, and trait aggressiveness were entered as covariates. This analysis first revealed a trait aggressiveness effect on behavioral aggressiveness, $B = 0.05$, $t(109) = 2.10$, $p < .04$. Hence, the higher the level of trait aggressiveness, the more aggressively participants reacted.

More interestingly, we found a significant linear relationship between the level of alcohol that participants thought they had consumed and their aggressive behavior, the linear contrast being significant, $B = 0.13$, $t(109) = 1.99$, $p < .05$, while the quadratic contrast was not, $B = -0.01$, $t(109) = 0.08$, $p < .95$. Hence, at a mean level of consumed alcohol and after controlling for the two covariates, the more participants thought they had drunk, the more

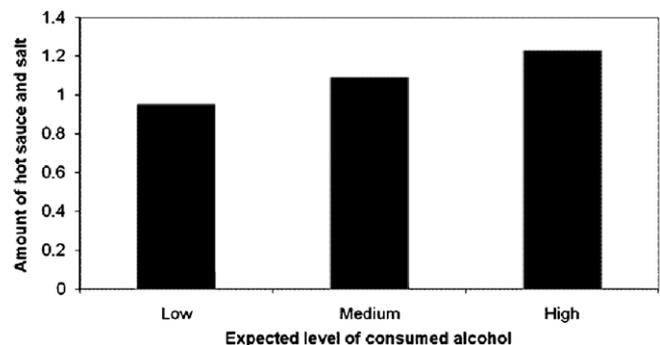


Fig. 2. Adjusted means for the amount of hot sauce and salt as a function of the expected level of consumed alcohol (the quantity of hot sauce and salt were logged before aggregation).

aggressive they were toward the previously hostile confederate (see Fig. 2). There was no effect of consumed alcohol, $B = 0.01$, $t(109) = 0.08$, $p < .94$, and no interaction between this variable and expectancy about level of consumed alcohol, $ps > .64$. These results support the view that, more than alcohol intake, the mere belief of having consumed alcohol is causally linked to reactive aggressiveness.

The same analysis was carried out after removing the two outliers previously detected in the raw data. It turned out that the linear relationship between the expected level of alcohol and the aggressive behavior became stronger (going from a .04 value to a .03), whereas the effect of trait aggressiveness became marginally significant.

Ancillary analyses

Assessment of the anti-normative meaning of aggression

The observed quantity of Tabasco administered to the provocator ranged from 0 to 47 ($M = 5.87$, $SD = 7.44$), whereas the quantity that participant indicated they administered during the pre-debriefing ranged from 0 to 30 ($M = 3.67$, $SD = 4.43$). A paired t -test for dependant sample (on log-transformed data) indicated that the observed quantity of Tabasco administered was significantly higher than the quantity indicated by the participants in the fake debriefing ($M = 0.59$, $SD = 0.40$ vs $M = 0.49$, $SD = 0.37$, $t(112) = 6.27$, $p < .001$). A similar discrepancy was observed regarding salt. The observed quantity of salt administered to the provocator ranged from 0 to 78 ($M = 4.50$, $SD = 9.28$), whereas the quantity indicated by the participants ranged from 0 to 30 ($M = 2.81$, $SD = 3.66$). A paired t -test for dependant sample (on log transformed data) indicated that the observed quantity of salt administered was significantly higher than the quantity indicated by the participants in the fake debriefing ($M = 0.53$, $SD = 0.34$ vs $M = 0.45$, $SD = 0.29$, $t(107) = 4.59$, $p < .001$).

Non-experimental correlates of aggression

Aggressive behavior was positively related to participants body height ($r = .23$, $p < .01$), and negatively correlated with participants age ($r = -.26$; $p < .005$). The amount of time spent by the participant in the experiment (which was linked to the participant's expected remuneration after the tasting session) was unrelated to aggression ($r = .00$, ns). Eating the spicy mash was unrelated to aggression.

Evaluation of the experiment

After the final debriefing, the participants' evaluations of the experiment were unanimously positive and unrelated to the quantity of alcohol ingested. Interestingly, the participants who ate the very spicy mash (and therefore later realized that they might have avoided it without losing any money) evaluated the experiment more positively than those who refused it, ($M = 4.74$, $SD = 0.38$, vs $M = 4.47$, $SD = 0.59$, $t(83.79) = 2.78$, $p < .007$), which is consistent with a self-affirmation (Steele, 1988) or self-consistency (Aronson & Carlsmith, 1962) interpretation.¹

Discussion

The most important result of this experiment is that differences in the level of aggression observed were determined by participants' expectations about the content of the beverage they consumed. Our study has also indicated that the quantity of alcohol ingested was not related to aggression, which is an unexpected result. Three interpretations might be proposed. First, it may be that at the time they had the opportunity to aggress, some participants were already in the decreasing phase of alcoholization. Alcohol

studies show that peak BAC is attained in 45 to 60 min after the end of beverage consumption, and indicate that pharmacological effect of alcohol is limited to the upward slope of the blood alcohol curve (Giancola & Zeichner, 1997). In our study, the aggression measure was taken on average 37 min after the consumption. It may be that because of differences in individual metabolism or drinking history, some of the participants were already in an alcohol descending limb, which may explain why no alcohol effect was observed. Second, this non-effect might be the consequence of the measure of aggression itself. Whereas the quasi-totality of previous studies was based on electric shocks, we relied on the HSP. While this paradigm is considered as a valid way of measuring physical aggression and correlates with dispositional aggressivity (as in Lieberman et al., 1999), it is nonetheless the first time that it is used in a study on intoxicated aggression. Such a measure might be less sensitive than other measures (e.g., electric shocks) to participants' inebriation. Third, the likelihood of an aggressive response was maximized due to situational features such as the confederate's highly provocative behavior and strengthened by the encouragement of retaliation expressed by the witness of the provocation (Borden & Taylor, 1973; Taylor & Sears, 1988). According to studies reviewed by Hull and Van Treuren (1986), when the cues to behave in a certain way are very explicit, sober and intoxicated individuals tend to act similarly (see also Steele & Southwick, 1985). This might explain the absence of difference in aggression between sober and intoxicated participants in our study.

The observed expectancy effect is consistent with recent studies on automatic activation of aggressive thoughts following an alcohol priming (Bartholow & Heinz, 2006) as well as with earlier investigations relying on a BPD methodology (Marlatt et al., 1973; Rohsenow & Bachowski, 1984). At a methodological level, our results suggest that when adequate precautions are taken, an expectancy effect of alcohol on aggression can be found. This is consistent with the situation-specificity hypothesis (Wall, Hinson, & McKee, 2001; Wall, McKee, & Hinson, 2000).

Experimental studies on aggression are sometimes disparaged because of possible limitations regarding their validity (see Anderson & Bushman, 1997; Anderson, Lindsay, & Bushman, 1999; for an invalidation of the critics). One may then wonder what the degree of generalization of our results is. On the one hand, internal and external validity seemed quite satisfactory because of the concomitant use of an experimental design, the sampling of a general population, and the use of a dependant variable (HSP) that was probably more familiar to the participants than many other current available operationalizations in intoxicated aggression research (see Giancola & Chermack, 1998; Tedeschi & Quigley, 1996; Tedeschi & Quigley, 2000). In addition, our 3×3 experimental design was more comprehensive than previous studies, offering the possibility of observing the potential occurrence of non-linear effects of our manipulated factors. Furthermore, as was demonstrated by the discrepancy between the observed aggression and the participant's self-reported aggression in the pre-debriefing session, the aggressive behavior was clearly perceived as an undesirable response which was not sanctioned by a legitimate third party authority (Gottfredson & Hirschi, 1993).

In accordance with most social psychologists (e.g., Anderson & Bushman, 1997), we believe that the experimental method is the gold standard for hypothesis testing and that the manipulation of social stimuli is possible and relevant for societal issues. In the field of intoxicated aggression, as in any other domain, the validity of experimental demonstration requires that the target variables be manipulated without the awareness of the participants. To clarify the complex relationship between alcohol and aggression, a theoretical inclusion—and a satisfactory technical operationalization—of social-cognitive factors in experimental research is necessary.

Research should give a real opportunity for extrapharmacological factors to be observed by improving the credibility of the experimental setting and increasing the impact of the extrapharmacological variables. As our study shows, alcohol effects on aggression cannot be only understood as a pharmacological processes because the mere belief of having consumed alcohol is causally linked to aggression.

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