The Effect of Alcohol Primes on State Aggression Among University Students

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Abstract

The association between alcohol consumption and increased aggression is a consistently documented phenomenon, supported by unequivocal evidence. Two primary theories have been proposed to explain this relationship. The first posits that alcohol induces aggression by pharmacologically impairing cognitive processes related to inhibitory control. The second theory suggests that the link between alcohol and aggression stems from the belief that alcohol consumption leads to increased aggressive behaviour. Notably, research indicates that the effects of expected outcomes may be triggered by mere exposure to alcohol cues.

The present study aimed to test this hypothesis by examining how subliminal alcohol primes influence state aggression in university students. Thirty-one participants engaged in an experiment that investigated lexical decision-making, facial expression recognition, and hostile tendencies. The results largely confirmed the expectations and aligned with findings from previous studies. Participants exposed to alcohol primes exhibited faster reaction times to aggression-related words and showed more hostile tendencies compared to the control group. Contrary to expectations, alcohol cues did not bring about changes in facial expression recognition. These results are discussed in the context of existing theories, and recommendations for future research are presented.

Keywords: alcohol, aggression, automaticity, priming, alcohol outcome expectancies

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"Blaming the bottle" is an expression used to attribute inappropriate behaviour to the consumption of alcohol. From everyday encounters to legal settings, intoxication is used as a 'scapegoat' to explain missteps, such as aggression. In the field of psychology and behavioural science, the interplay between alcohol consumption and aggression has long captured the attention of researchers.

Although aggression is a concept that has found its place in common language, its definition is a subject of debate. The most widely accepted conceptualization in the academic field defines aggression as any behaviour that is intended to cause harm towards a target who is motivated to avoid the behaviour; aggressive behaviour is not characterised by behaviour itself or the consequences of behaviour, but by its underlying motivation (Bushman & Cooper, 1990). Aggression can be manifested in many forms, and there are numerous taxonomies that attempt to categorize behaviours. Typologies focus on different aspects, such as response modality (action/failure to act), type of harm, or duration of effects, to mention a few examples (Krahé, 2013). There are some traditional distinctions that are worth elaborating to understand the broad concept of aggression.

Reactive aggression, also called hostile aggression, is impulsive, unplanned, and occurs as a reaction to perceived provocation. Proactive aggression, also called instrumental aggression, is planned with the motivation of obtaining a goal (Anderson & Bushman, 2002; Kempes et al., 2005). A typical illustration of this is the distinction between voluntary manslaughter, which is committed in "the heat of the moment", and murder, which is premeditated (Kempes et al., 2005). The second central distinction is between direct and indirect aggression. Direct, often also referred to as overt aggression, happens face-to-face between the aggressor and target, whereas indirect or covert aggression happens without the target's knowledge (Allen & Anderson, 2017). To sum up various dichotomies and typologies characterizing aggression, one prominent theoretical model is the general aggression model (GAM) which is a parsimony of existing smaller and domain-specific theories of aggression. GAM characterizes aggression in terms of inputs (person, situation), routes (present internal state), and outcomes (appraisal and decision processes that lead to thoughtful or impulsive action) (Allen & Anderson, 2017).

Explicitly focusing on the inputs in GAM, several factors predispose aggressive tendencies, ranging from dispositional factors to situational factors – and the interaction of the two (Allen & Anderson, 2017). Alcohol is one of the situational factors that is consistently associated with aggression. There are two leading theory categories explaining this connection. The first theory establishes that alcohol pharmacologically impairs cognitive processes, inferring with self-regulation and inhibitory control (Bushman & Cooper, 1990; Subra et al., 2010). The second category of theories, referred to as expectancy-based models, suggest the connection between alcohol and aggression to be an implicit association, meaning that alcohol increases aggression because of the

mere belief that it does so. Placebo studies support expectancy-based models by showing little to no differences between alcohol consumption and placebo consumption (Subra et al., 2010). The connection between alcohol and aggression is theorized to go beyond any consumption; the suggestion being that mere exposure to alcohol cues, such as pictures, activates aggressive thoughts, associations, and behaviour.

Theoretical Framework

Semantic Network Model of Memory

Different explanations for the proposition that aggressive responses can be induced by cues alone have been suggested, but there is no unequivocal agreement on a singular path. A commonly referenced theory is the semantic network model of memory (Collins & Loftus, 1975), which holds that frequently co-occurring concepts, or those sharing a similar meaning, are semantically linked in long-term memory. For instance, a link may connect "cat" and "pet", or "vehicle" and "car". The basis of the theory lies in the idea that this intricate network facilitates efficient storage, retrieval, and processing of information (Collins & Loftus, 1975). Semantic connection of concepts, which are often referred to as nodes, leads to a phenomenon wherein the activation of one concept enhances the accessibility of related concepts (Mayer & Abrams, 2010). This principle, known as spreading activation, establishes a route for automatic processes that run to completion with little, if any, conscious monitoring – and the stronger this connection in one's memory is, the more effortless these processes are (Collins & Loftus, 1975).

Researchers have explored automaticity theories' relevance in the understanding of how aggression can be triggered by mere alcohol cues. A technique that is commonly employed in settings studying implicit and automatic processes is priming. In priming experiments, participants are (often subtly and unobtrusively) exposed to stimuli related to a concept under study (Todorov & Bargh, 2000). The goal is to examine how this exposure influences subsequent cognitive processes or behaviour.

In reference to the theory of spreading activation, Bartholow and Heinz (2006) explored the link between alcohol and aggression in long-term memory using a primed lexical decision task and found that compared to neutral cues, alcohol cues facilitated faster lexical decisions regarding aggression-related words. Similar lexical decision results were produced by Subra et al. (2010). These findings demonstrate that alcohol cues increase the accessibility of aggressive thoughts. Along with sole accessibility, cues have powerful effects on perception and behaviour.

Automatic Effects on Perception and Judgment

Once aggressive thoughts are activated and accessible, individuals are more sensitive to external cues related to aggression. This sensitivity can manifest in altered judgments, attitudes and interpretations. Especially in situations of ambiguity, interpretation of social stimuli is influenced by what is accessible in the moment (Mayer & Abrams, 2010). To illustrate, Carver et al. (1983), found that after watching a video depicting hostile interaction, participants were later more likely to interpret

ambiguous behaviour as hostile; similarly, Bushman and Anderson (2002) found that after playing a violent video game, in a subsequent task, participants were more likely to rate a fictional character's ambiguous behaviour as hostile, than those who played a non-violent video game.

Bartholow and Heinz (2006) studied this concept, described as hostile attribution bias, as an outcome of alcohol cue exposure. They found that after viewing alcohol advertisements, participants were more likely to describe a person's ambiguous behaviour as hostile, than in a neutral priming condition (Bartholow & Heinz, 2006). Stepanova et al. (2012) found a disparate outcome, increased automatic racial bias, as a response to alcohol cue exposure. Like hostile attribution bias, racial bias often occurs in ambiguous situations, when the other's intentions are unclear. They proposed that this effect operates through alcohol cues diminishing perceptual attention, resulting in a narrowed focus on immediate, threat-related cues. Along these lines, this narrowing of attention may influence how individuals perceive and interpret any social stimuli (Stepanova et al., 2012).

Automatic Effects on Behaviour

Previous studies have established that primes not only evoke cognitions, but also elicit behavioural outcomes. The precedents for the theory that activated concepts can carry on to have automatic effect on behaviour come from William James' notion of ideomotor action, which suggests that the mere thought of doing something makes an individual more likely to actually do so (James, 1890, as cited in Subra et al., 2010). Bargh et al. (1996) demonstrated how priming can alter behaviour in their study, in which they primed participants with either the concept of rudeness or politeness. As a dependent measure, they assessed the willingness of participants to interrupt a conversation – their results showed that those who were primed with the concept of rudeness were more likely to interrupt, while those primed with politeness were less likely to do so. In a separate experiment, they found that subliminally priming participants with African-American faces, as opposed to Caucasian faces, increased the likelihood of displaying aggressive behaviour, given that aggressiveness is a component of stereotypes associated with African-Americans (Bargh et al., 1996).

In a similar manner, the presentation of alcohol primes has been demonstrated to elicit aggressive behaviour. In a study by Subra et al. (2010), participants were presented with alcohol primes and after an ambiguous frustration, the participants were asked to evaluate the experimenter. The results showed that compared to neutral prime condition, those in alcohol prime condition were more aggressive towards the experimenter in their evaluation. Likewise, Friedman et al. (2007) investigated alcohol cue provoked behavioural responses and found that alcohol cues facilitated stronger aggressive responses than neutral cues (Friedman et al., 2007).

Alcohol Outcome Expectancies

A central concept in the discussion around the alcohol-aggression link is alcohol (outcome) expectancies, which are beliefs about the outcomes of drinking in terms of behaviour, affect, physiology, and cognition. Alcohol expectancies, which exist in long-term memory, form through an interplay of social transmission and personal experiences (Mayer & Abrams, 2010). Usually,

expectancies are measured by reflective self-report questionnaires that list a number of specific domains, like tension reduction and aggression, that may be associated with alcohol. Alcohol expectancies have been found to predict drinking behaviour, which in turn bidirectionally shapes expectancies (Tuliao & McChargue, 2014).

Previous studies have provided evidence supporting the notion that alcohol expectations play a pivotal role in the cognitive and behavioural effects of alcohol. Friedman et al. (2007) found in their study, that after near-subliminal exposure to alcohol words, individuals with higher aggression-related alcohol expectancies exhibited more aggressive behaviour than those with low aggression expectancies. Similar findings were made by Bartholow and Heinz (2006). Other researchers have investigated alternative behavioural domains associated with alcohol, for example tension reduction (Friedman et al., 2007) and sexual desire (Friedman et al., 2005), and found that the effect sizes were influenced by the strength of expectancies regarding these behaviours.

A more nuanced perspective refines the idea that specific behaviour expectancies are needed for particular effects to occur, the suggestion being that the proxy between alcohol and aggression involves associating it with general disinhibiting effects. In other words, alcohol cues can influence behaviour by activation of cognitive scripts related to impaired control (Mayer & Abrams, 2010). This can be linked back to pharmacological models of the alcohol-aggression association. To support this view, Freeman et al. (2010) investigated the effect of alcohol primes on social inhibition with three studies and revealed that participants exposed to alcohol stimuli were faster to generate free associations to provocative words, which was taken to indicate social disinhibition. Along these lines, Mayer and Abrams (2010) suggested that independent of specific expectations, alcohol cues can foster varied outcomes, depending on which expectancies are activated or relevant in the situation.

The Present Study

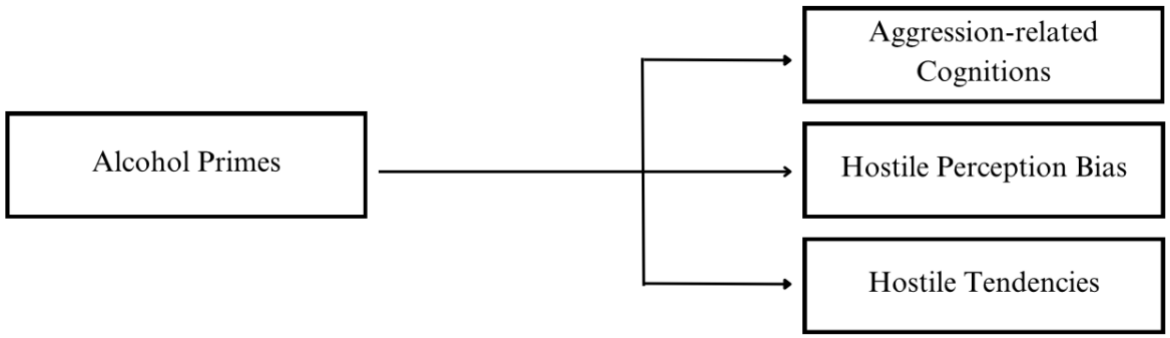
In the context of social cognition research, a commonly used method to assess implicit cognitions is the measurement of reaction times. It has two important advantages: it allows for testing spontaneous reactions in the absence of explicit instructions or informing participants about the underlying variables that are measured (Todorov & Bargh., 2000). Second, it is difficult to systematically manipulate responses, in contrast to structured response formats (Freeman et al., 2010). As it provides a convenient method which minimizes bias arising from demand characteristics, the present study utilizes a lexical decision task to assess aggressive cognitions as a response to presented alcohol primes. Moreover, a measure of hostile tendencies will be integrated into the research framework to offer a more complete viewpoint.

Building on research on racial bias by Stepanova et al. (2012), and findings by Bartholow and Heinz (2006) who showed that alcohol primes increased the likelihood of rating a person's behaviour as aggressive, it can be hypothesized that this impact may extend to other evaluative and perceptual outcomes. This may include heightened sensitivity to cues signalling hostility – referred to as hostile perception bias. Ingestion of alcohol has been associated with hostile perception bias in different

contexts, of which perception of facial expressions is one, but this finding has been mostly explained by impairments in neural processes (Attwood & Munafò, 2014). Research does suggest that increase in aggression can influence facial expression recognition, independent of any neural impairment related to emotion recognition (Wegrzyn et al., 2017) so along these lines, it can be proposed that much like alcohol cues heighten the accessibility of aggressive cognitions, they also contribute to increased perceptual sensitivity toward anger expressions. This suggestion will be explored in the present study. Figure 1 represents a conceptual model illustrating the foundational framework.

Figure 1

A Conceptual Model



Research Question and Hypotheses

The aim of the study is to answer the research question: "Does exposure to alcohol cues increase state aggression, as measured by speed of language processing, sensitivity in recognizing anger expressions and hostile tendencies?" The central hypotheses of the study are as follows:

H1: Alcohol primes, in contrast to neutral primes, will lead to faster reaction times to aggression words than to neutral words.

H2: Sensitivity in recognizing facial expressions displaying anger will be enhanced with exposure to alcohol primes compared to neutral primes.

H3: Participants who receive alcohol primes will be more hostile towards the experimenter than participants receiving neutral primes.

Methods

Study Design

This research employed a between-participants design to investigate the influence of alcohol primes on state aggression. The study assessed the accessibility of aggressive cognitions using a lexical decision task (LDT), which also served as the priming procedure. Additionally, the impact of primes on facial expression recognition and hostile tendencies were analysed. Participants were randomly assigned to one of two groups: one exposed to alcohol primes and the other exposed to neutral primes, which served as the control group. In the sign-up process, participants were informed that the study aimed to investigate the relationship between language processing and facial expression recognition to minimize potential bias arising from experimental demand.

The study was approved by the Ethics Committee from the Faculty of Behavioural, Management, and Social sciences, Domain of Humanities and Social Sciences, of the University of Twente.

Participants

The sample consisted of thirty-one participants (21 F, 10 M, M_{age} = 21.6, *SD* = 2.93, range 17 – 29 y), who all were university students studying communication science or psychology. Participants were recruited using a test subject pool of the University of Twente (SONA). In return for participation, they received partial course credit. As inclusion criteria, the participants were required to be at least 17 years old, have basic English knowledge and not have been diagnosed with dyslexia or prosopagnosia (face blindness). Participants were also requested to abstain from alcohol or other substance use 24 hours prior to the laboratory task. Prior to the study, participants completed a questionnaire measuring their trait aggression and personality. Additionally, the participants were asked to provide demographic data (age, gender, nationality, and their study program).

Measures

Trait Aggression

To control for potential influences that individual differences in trait aggression may have, the Brief Aggression Questionnaire (BAQ) was administered. The BAQ (Webster et al., 2014) is a shortened version of the Buss and Perry Aggression Questionnaire (Buss & Perry, 1992). It consists of 12 items, of which one is reverse-coded. The items fall into four subscales: Physical Aggression (e.g. “Given enough provocation, I may hit another person”), Verbal Aggression (e.g. “I tell my friends openly when I disagree with them”), Anger (e.g. “I have trouble controlling my temper”), and Hostility (e.g. “When people are especially nice, I wonder what they want”). The items are responded to on a Likert scale ranging from 1 (*Extremely uncharacteristic of me*) to 5 (*Extremely characteristic of me*). Responses to the items are summed. The reliability of the hostility subscale was notably low with $\alpha = .09$. Consequently, it was omitted from the analysis, resulting in the BAQ reliability to be $\alpha = .62$.

Personality

BAQ items were included within a personality measure to reduce the possibility of suspecting the aims of the research. Although analysed, no particular expectations were laid on these results. As the personality measure, the Mini-IPIP was administered. The Mini-IPIP (Donnellan et al., 2006), a 20-item short form of the International Personality Item Pool – Five-Factor Model measure (Goldberg, 1999), assesses five factors: Neuroticism, Extraversion, Intellect/Imagination (often labelled as Openness or Openness to Experience), Agreeableness, and Conscientiousness. The questionnaire consists of nine directly scored items, such as "I am the life of the party", and 11 reverse-scored items, such as "I am not interested in other people's problems". The items are rated on a 5-point Likert scale, worded identically to that of the BAQ. For each subscale, responses are summed, with applicable items reversed. The Mini-IPIP demonstrated reliability of $\alpha = .53$.

Procedure

Upon arrival in the laboratory, the participants were reminded of their rights and asked to confirm their understanding. If they agreed and had no further questions, they were given a brief introduction to the study. The laboratory task was run using the E-Prime (version 3.0) application on a computer. The experimenter remained blind to the condition.

Lexical Decision Task

The Lexical Decision Task (LDT) served two functions. The first part of it was used as a priming manipulation, and the second part was used as a measure of alcohol associations. Participants believed they were completing a singular task. LDT began with a page with instructions, after which the participant completed five practice trials. After completing them, the participant continued to the task.

Each trial began with a 1000 ms presentation of a fixation point (+) at the centre of the screen. This fixation point was followed by a forward masking string (########) presented for 500 ms, which was followed by a 35 ms presentation of 1 of 5 words, written in capital letters. These words were alcohol-related (beer, wine, cider, vodka, liquor) in the experiment group, and other beverage words (water, milk, soda, lemonade, juice) in the control condition. Following the word presentation, a backward masking string (XXXXXXXX) was presented for 500 ms. Following the backward masking string, participants were presented with a letter string, and had to indicate whether it was a legitimate English word or not by pressing either 1 (word) or 0 (non-word) on the keyboard. The first 60 trials were part of the priming procedure, and performance in these trials was not analysed. The target words were neutral and varied in their length.

After the priming trials, the task continued, but prime words between the masking strings were removed. In the following trials, legitimate words fell into three categories: aggression words (e.g. attack, violence, harm), sociability/happiness words (e.g. joyful, social, approach), and neutral words (e.g. mouse, beneath, echo). Sociability/happiness words were added to assess alternative alcohol associations. The categories were formulated to match each other in terms of word length,

natural language frequency and previously collected LDT performance data (speed of recognition and average accuracy), as determined in English Lexicon Project (n.d.). Finally, a list of 12 aggression words, 12 sociability words, 12 neutral words and 24 non-words was chosen. Non-word trials were not analysed. Each category of legitimate words was represented in 20 trials, in a randomized order. The central focus was on measuring reaction times to the different word categories.

Facial Expression Recognition Task

The LDT was followed by a facial expression recognition task. Facial expression stimuli were generated using FaceGen Modeller software (Version 3.34) which generates realistic 3D faces that can be modified with various controls. It offers the capability to adjust the intensity of different emotional expressions, allowing for a range from 0% to 100%.

The software was used to generate stimuli representing varying degrees of anger. Avatars displaying 30%, 40%, 50%, 60%, 70% and 80% of anger were generated on seven models, resulting in 42 stimuli. Additionally, 20 filler avatars displaying a neutral expression or other emotion were generated to de-emphasize the quantity of anger expressions. Trials with filler avatars were not analysed. All models were designed to be gender-neutral and had a Caucasian appearance.

On each trial, an expression was randomly presented. Participants were instructed to indicate which of seven emotions (happiness, sadness, surprise, disgust, fear or neutral) they perceived by pressing corresponding keys 1-7 on the keyboard. After indicating one of the seven expressions, a new face appeared.

Hostility Assessment

As a measure of hostile tendencies, the participants were asked to evaluate the experiment following an intentionally induced frustration. Towards the end of the facial recognition task, the computer was programmed to display a false error message that the participant could not skip. The experimenter told them they would go see if they can fix the error or whether the participant should restart the experiment. The purpose of the error message was to function as an ambiguous provocation after participants had already spent time completing the long and repetitive task.

After spending time out of the experiment room "trying to fix the program", the experimenter returned to the room and told them that the data was apparently saved, and they had reached the end of the experiment. After this, the experimenter asked for an anonymous evaluation of the experiment, which was said to be given to the experimenter's supervisor and a laboratory representative. The experimenter provided the participant with a form and was instructed to seal it in an envelope after completing it. After this, participants were debriefed and released.

The form included four questions: "How would you rate your experiment experience?" (1 = *Very bad*, 7 = *Very good*), "How would you rate the laboratory facilities?" (1 = *Very bad*, 7 = *Very good*), "How would you rate the experimenter's overall performance during the study?" (1 = *Very bad*, 7 = *Very good*), "To what extent would you recommend this experiment?" (1 = *Lowest possible recommendation*, 7 = *Highest possible recommendation*). At the end of the form, a non-mandatory

open space was provided for additional comments. The second question had the main purpose to make the form seem more legitimate, and it was excluded from the analyses. The scores of the rest of the questions were summed. Lower scores were taken to indicate higher hostility.

The form provided participants a possibility to aggress against the experimenter. This paradigm is commonly adopted as a measure of hostility, as it measures behaviour that could have harmful implications for the target, while not allowing for actual harm. It also is convenient to administer and is less subject to socialized inhibitions or restraints (Friedman et al., 2007).

Results

Table 1 presents the means, standard deviations, and a correlation matrix for the key variables involved in the study.

Table 1

Means, Standard Deviations and Correlations

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Aggression LDT	550.65	107.84													
2. Sociability LDT	545.95	69.08	.86*												
3. Neutral LDT	575.28	91.78	.81*	.77*											
4. FER	20.29	5.05	.11	.07	.12										
5. Hostility	18.37	2.08	.28	.25	.27	-.17									
6. Neuroticism	11.34	1.88	.21	.11	.03	.14	-.08								
7. Intellect	10.37	1.85	-.05	.01	.22	.32	-.22	.03							
8. Agreeableness	12	1.93	.07	.00	.17	-.12	.22	-.25	.32						
9. Extraversion	11.03	1.38	.34	.30	.42*	.08	.31	-.04	.10	-.12					
10. Cons.	11.77	1.96	.19	.15	.17	.27	-.36*	.34	.34	.04	.03				
11. V. Aggression	9.73	1.93	-.18	-.11	-.30	-.00	.26	-.39*	-.24	.01	.24	-.28			
12. P. Aggression	6.67	2.72	.19	-.05	.19	.15	.14	.17	.07	-.03	.30	.18	.05		
13. Anger	7.23	1.07	-.04	-.07	-.03	.33	.21	.20	.02	-.10	.09	.08	.07	.28	
14. BAQ	23.63	3.83	.03	-.11	-.02	.20	.29	-.02	-.07	-.04	.35	.01	.56*	.81*	.51*

Note. Aggression LDT = reaction time to aggression words in ms; Sociability LDT = reaction time to sociability words in ms; Neutral LDT = reaction time to neutral words in ms; FER = total times participants recognized anger expressions; Hostility = evaluation form score; Cons. = Conscientiousness; V. Aggression = Verbal Aggression; P. Aggression = Physical Aggression; BAQ = the Brief Aggression Questionnaire.

[a] N = 31

* $p < .05$

Lexical Decision Task

Respective to aggression words, the alcohol-prime group obtained a mean reaction time of 521.53 ms (*SD* = 49.65) whereas the control group obtained a mean of 577.96 ms (*SD* = 136.18). Mean reaction times to neutral words for the alcohol-prime group and control group were 562.63 ms (*SD* = 50.49) and 545.34 ms (*SD* = 84.31), respectively.

An analysis of covariance was conducted to assess group differences in reaction times to aggression words. Reaction times to neutral words were treated as a covariant. The main effect of condition was statistically significant, F (1, 28) = 4.51, p = .04. This implies that those receiving alcohol primes displayed faster reaction times to aggression-words than the control group.

As to sociability words, the alcohol-prime group obtained a mean reaction time of 546.60 ms (*SD* = 47.87) whereas the control group obtained a mean of 545.34 (*SD* = 84.31). Analysis of covariance, with neutral word reaction times as a covariant, revealed that the main effect of condition was not statistically significant, F (1, 28) = 0.11, p = .74, suggesting no significant difference between the groups in reaction times to sociability words.

Facial Expression Recognition Task

For each degree of anger (30%, 40%, etc.), a contingency table was created, and the Pearson's Chi-squared test was employed. For 30%, the chi-squared test statistic yielded a non-significant result, X^2 (1) = 1.79, p = .18. Similar non-significant results were observed for 40% (X^2 (3) = 1.44, p = .70), 50% (X^2 (3) = 1.44, p = .70), 60% (X^2 (6) = 4.46, p = .61), 70% (X^2 (4) = 4.31, p = .37), and 80% (X^2 (3) = 1.89, p = .60). Finally, for the total sum, the chi-squared test indicated a non-significant result, X^2 (15) = 9.51, p = .85. Overall, the findings suggest that alcohol primes did not have a significant effect on anger-expression recognition.

Hostility Assessment

The scores in the evaluation forms were summed. Participants in the alcohol-prime group obtained a mean of 17.6 (*SD* = 2.20), with values ranging from 14 to 21. In the control group, participants achieved a mean of 19.06 (*SD* = 1.69), ranging from 15 to 21. A Two Sample t-test was conducted to compare the means between the alcohol-prime and control groups. The results indicated a significant difference between the groups t (24.7) = 2.08, p = .04, suggesting that those who received alcohol-primes, gave lower ratings to the experimenter than those who received neutral primes.

Trait Aggression and Personality

The influence of trait aggression and personality on the outcome measures were investigated by incorporating these variables, along with the variable condition, in a series of ANOVAs. To test the effect of trait aggression on each of the three outcome measures, analyses with total aggression score and condition as independent variables were conducted for LDT (aggression and sociability words respectively), facial expression recognition, and the hostility measure. Across all the measures, no sign main effects nor interactions were found at significance of $p < .05$.

For personality, a series of ANOVAs revealed no main effects nor interactions at significance of $p < .05$, apart from analysis in which the effect of the Intellect-subscale was found to have a significant main effect of F (1, 26) = 4.39, p = .05 on reaction times to aggression words in the LDT; the interaction effect between condition and Intellect was also found to be significant of F (1, 26) = 4.66, p = .04. The main effect of condition remained significant with F (1, 26) = 8.22, p = .01

Discussion

The aim of this research was to assess the effect of alcohol primes on state aggression. Aggression was measured by speed of aggression word recognition, ease of anger-expression recognition, and hostile tendencies. It was predicted that those who receive alcohol primes would exhibit faster reaction times to aggression words, be more sensitive to anger expressions and rate the experiment(er) lower than those who received neutral primes. Additionally, a trait aggression measure and a personality measure were introduced.

The results largely confirmed the expectations. The lexical decision task (LDT) verified that alcohol-cues increased the accessibility of aggressive thoughts. This effect was not apparent in those who received neutral primes. This finding implies that participants associate alcohol with aggression and is in line with automaticity theories, which suggest that commonly co-occurring and associated concepts become accessible when primed with related terms. The outcome also corroborates previous research. For instance, Subra et al. (2010) utilized a LDT in their study and found that alcohol primes provoked faster reaction times to aggression words. Similarly, Bartholow and Heinz (2006) found that alcohol primes led to decreased reaction times to aggression words. Curiously, sociability words did not produce decreased reaction times, suggesting no association between alcohol and sociability concepts.

The hostility measure produced complementary findings. Participants who received alcohol primes, as compared to neutral primes, tended to give lower ratings in the evaluation form. This also confirmed previous findings by Subra et al. (2010) and Friedman et al. (2007) who introduced a similar paradigm in their study and demonstrated more negative ratings in response to alcohol primes. These findings can also be traced back to theories of automaticity and spreading activation. Research indicates that mental representations are related not only to semantic constructs, but also to behavioural scripts. In this context, whereas alcohol cues may activate mental representations associated with aggressive words, concepts, or ideas, they also may activate hostile scripts (Friedman et al., 2007). Another plausible suggestion is that alcohol primes may activate mental representations related to social disinhibition. This potential mechanism might have served as an intermediary step, suggesting that the influence of alcohol-related cues on aggression could be mediated by the activation of mental constructs related to reduced social inhibitions, consistent with research by Freeman et al. (2010).

An alternative, or supplementary, suggestion is that alcohol primes alter a person's self-concept, which in turn affects behaviour. In accordance with this theory, alcohol primes may evoke memories of past instances of alcohol-related aggression, leading individuals to temporarily attribute it to their self-concept (Freeman et al., 2010). Although no interactions featuring trait aggression were found in this study, another presented possibility is that alcohol-primes might activate relevant traits in the person's self-concept, meaning that those high in trait aggression have these traits more accessible (Subra et al., 2010).

Moreover, it has been suggested that alcohol primes could function as cues indicating that certain behaviours, like aggression, will be reinforced, rewarded, or encouraged (Stepanova, 2012). From an attributional perspective, individuals who believe that alcohol promotes aggression might use intoxication to mitigate negative reactions from others; alcohol could offer a self-serving explanation to diminish personal responsibility (Bègue et al., 2008). While the exact path through which alcohol cues generate outcomes suggestive of aggression remains uncertain, the observed patterns support the existence of an association between the two concepts.

The facial expression recognition task that was introduced as an additional measure of the accessibility of aggressive thoughts failed to show significant results. Although not expected, it was not surprising. There are studies about alcohol's effects on facial expression recognition, but these findings have mostly been explained by the influence of intoxication on the brain's information-processing pathways. To corroborate, Attwood et al. (2009) conducted a balanced placebo study investigating facial expression categorization. They found that after alcohol, participants were more likely to categorize male disgusted faces as angry, but no effects were found after placebo. This implies that expectancy alone may not be sufficient to generate effects.

Following findings that suggest that higher aggression affects facial expression recognition/interpretation, there is still some debate about how this effect might manifest, which sheds light on the potential explanations for the unanticipated results. In line with the hypothesis of the present study, for example Teige-Mocigemba et al. (2016), and Wilkowski and Robinson (2012) showed that the more aggressive individuals were, the more sensitive they were to anger expressions. Another perspective suggests a biased perception (i.e., hostile attribution bias), meaning the tendency to interpret ambiguous expressions as hostile, even if they show no anger whatsoever. For instance, Taylor and Jose (2014) showed that those with higher physical aggression showed misattribution errors, but there were no differences in identifying anger expressions between individuals with low and high aggression. Along these lines, Jusyte and Schönenberg (2016) found miscategorization of ambiguous fearful-happy blends, but no increased sensitivity to angry expressions.

Limitations and Future Research

Although the outcomes of the present study were mostly in line with existing theories and previous findings, there are limitations that should be acknowledged when interpreting the results. First, while participants were led to believe the objective of the experiment was to explore the

relationship between language processing and facial expression recognition, there is a possibility that they became aware that the focus of the study was on aggression, because of the frequency of aggression-related words and anger expressions. The programmed error message may have prompted further suspicions. Although participants, when asked during debriefing, did not express any doubts during the task, it remains possible that demand characteristics may have in some way contributed to the findings, given previous research indicating that participants frequently fail to report their suspicions in debriefings (Freeman et al., 2010). However, it is noteworthy that despite these considerations, the study observed significant differences between the groups, thereby affirming the main outcomes.

One aspect that was not addressed by the present research was alcohol outcome expectancies. Based on for example Friedman et al. (2007) and Bartholow and Heinz (2006), expectancies may have a substantial effect in shaping the outcomes of alcohol cue exposure. Friedman et al. (2007) found that alcohol primes did not affect hostile behaviour in those with low aggression expectancies; Bartholow and Heinz (2006) found that alcohol prime condition did increase hostile attribution bias overall, but the effect was largest among those with high aggression expectancies. In contrast, Subra et al. (2010) found no interactions involving alcohol-related aggression expectancies. Although it is still up to question whether expectancies skew the results of the present study, the findings do show that those participants who received alcohol-primes did exhibit outcomes indicative of aggression.

It is crucial to note that the effects that were observed may not stem from explicit alcohol outcome expectancies, but from primed implicit expectancies or associations. Alcohol outcome expectancies refer to conscious beliefs about the effects alcohol might produce, whereas implicit memory associations are not directly accessible to awareness (Freeman et al., 2010). These two concepts should be distinguished, as explicit outcome expectancies are represented in distinct neural circuits and are dependent on deliberative processes (Stepanova et al., 2017). Accordingly, it is plausible to suggest that the effects observed in the present study stem from implicit expectancies, which may make disparate self-report expectancy measures that have been used in previous studies irrelevant. Based on these considerations, future research should integrate both implicit and explicit measures within cohesive frameworks and focus on delineating the precise mechanisms through which these distinct constructs operate.

Furthermore, given that the facial expression recognition task failed to produce significant results, facial expression recognition should be further investigated as an outcome measure of alcohol priming. In the present research, it was investigated how sensitive participants are to different degrees of anger, but future research should implement other types of expression stimuli. Although the sensitivity perspective and bias perspective, which were discussed earlier, may not operate entirely separate, previous research signals that there is a need for adopting stimuli testing the suggestion that aggression manifests as misattribution of ambiguous expressions showing no anger whatsoever.

Implications

This research provides evidence for the theory that in the absence of actual or expected alcohol consumption, mere alcohol cues have the potential to increase aggression. The results also potentially confirm that these results can be obtained, irrespective of explicit aggression-related alcohol outcome expectancies.

A comprehensive understanding of the ease and contexts in which mere alcohol cues impact cognition and behaviour is crucial for informing intervention initiatives targeting adverse effects stemming from alcohol. These findings underscore the importance of strategies that go beyond addressing explicit beliefs about alcohol's effects. Traditional interventions often focus on challenging explicit alcohol outcome expectancies, assuming they are the primary drivers of behaviour, but given the present results, there may be a need for more nuanced and comprehensive intervention approaches.

Conclusion

This study demonstrated that in the absence of any consumption, subliminal exposure to alcohol primes influences state aggression, as evidenced by faster reaction times to aggression words and evaluation outcomes indicative of hostility. The non-significant results in the facial expression recognition task indicates a need to further explore the nature of how alcohol cues may shape perception. This study contributes valuable insights to the alcohol-aggression relationship, urging future research to delve into the specific dynamics of the association.

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