COGNITIVE AND BEHAVIOURAL EFFECTS

Effects of Acute Alcohol Consumption on Ratings of Attractiveness of Facial Stimuli: Evidence of Long-Term Encoding

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Abstract — Aim: A strongly held popular belief is that alcohol increases the perceived attractiveness of members of the opposite sex. Despite this, there are no experimental data that investigate this possibility. We therefore explored the relationship between acute alcohol consumption and ratings of attractiveness of facial stimuli. Methods: We investigated male and female participants (n = 84), using male and female facial stimuli, in order to investigate possible sex differences, and whether any effects of alcohol are selective for opposite-sex facial stimuli. We tested participants immediately following consumption of alcohol or placebo and one day later, in order to investigate whether any effects of alcohol persist beyond acute effects. Results: Attractiveness ratings were higher in the alcohol compared to the placebo group (F[1, 80] = 4.35, P = 0.040), but there was no evidence that this differed between males and females or was selective for opposite-sex faces. We did not observe marked effects of alcohol on self-reported measures of mood, suggesting that the effects on ratings of attractiveness were not due simply to global hedonic effects or reporting biases. Conclusions: Alcohol consumption increases ratings of attractiveness of facial stimuli, and this effect is not selective for opposite-sex faces. In addition, the effects of alcohol consumption on ratings of attractiveness persist for up to 24 h after consumption, but only in male participants when rating female (i.e. opposite-sex) faces.

INTRODUCTION

A strongly held popular belief is that alcohol consumption increases the perceived attractiveness of members of the opposite sex. This has been suggested as one mechanism by which individuals may facilitate engagement in risky sexual behaviours, given that these frequently occur in the context of social interactions where alcohol is readily available (Jones et al., 2003). It is well supported that alcohol consumption leads to increased feelings of self-confidence, sexual arousal and sex expectancy (George and Stoner, 2000), as well as more broadly influencing social behaviours through cognitive (Mulvihill et al., 1997) and social (Leeman et al., 2007) disinhibition. It is therefore possible that alcohol consumption does indeed result in increased ratings of attractiveness of potential sexual partners.

Despite this, there are, remarkably, no experimental data to investigate this possibility. One study (Gladue and Delaney, 1990) was unable to show a correlation between blood alcohol concentrations among bar patrons and ratings of attractiveness, although this study did not include a zero alcohol control condition. A more recent study (Jones et al., 2003) investigated ratings of attractiveness, using quasi-experimental methods (i.e. without random assignment to an alcohol or placebo condition), in undergraduate students who had either consumed a moderate amount of alcohol within the last 3 h or had not consumed alcohol during that day. This suggested that the alcohol consumers rated facial stimuli as more attractive than non-consumers, and that this effect was specific to opposite-sex facial stimuli. The authors suggest that this effect may have implications for the likelihood of risky sex occurring with a potential sexual partner.

However, this more recent study (Jones et al., 2003) was limited because it relied on self-reported recent alcohol consumption, rather than the experimental manipulation of acute alcohol consumption. It is possible, therefore, that the higher ratings of attractiveness may be confounded with an increased likelihood of voluntary alcohol consumption. Moreover, these data were collected in a naturalistic setting which, despite having excellent ecological validity, may have primed particular responses, such as the specificity of the effects of alcohol consumption to opposite-sex stimuli. The authors therefore note that further research is necessary to identify the mechanisms that may be based on the pharmacological actions of alcohol, from those that may be based on the psychological effects.

It is also relevant to explore whether any effects of alcohol consumption on ratings of attractiveness of facial stimuli extend beyond the period of acute intoxication. The importance of ‘first impressions’ is well known in social psychology, and such impressions are heavily influenced by attractiveness (Zebrowitz, 1998). There has been little investigation, however, of the durability of first impressions gleaned under conditions of intoxication. If acute alcohol consumption influences ratings of attractiveness, this modified encoding of the corresponding facial stimuli may result in correspondingly higher ratings of attractiveness at a later time. It is also possible that the rewarding effects of alcohol, when paired with the presentation of facial stimuli, may result in a conditioned preference for those stimuli at a later time.

We therefore explored the relationship between acute alcohol consumption and ratings of attractiveness of facial stimuli in order to test the hypothesis that alcohol consumption is associated with increased ratings of attractiveness relative to placebo. We included male and female participants, and male and female facial stimuli, in order to investigate possible sex differences and in particular whether any effects of alcohol are selective for opposite-sex facial stimuli. Finally, we tested participants immediately following alcohol consumption and ~1 day later in order to investigate whether any effects of alcohol consumption on ratings of facial attractiveness result in differences in the encoding of these stimuli beyond the acute effects of alcohol.
METHODS

Design and overview

Male and female heterosexual participants attended two testing sessions. At the first session, participants were randomized to consume either an alcoholic or non-alcoholic drink, after which they completed ratings of attractiveness of 20 male and 20 female faces. At the second session, 1 day later, participants completed ratings of attractiveness of the same faces for a second time. The experimental design therefore consisted of two between-subjects factors of drink (alcohol, placebo) and participant sex (male, female) and one within-subjects factor of target sex (male, female). The alcohol manipulation was conducted double-blind.

Participants

Male and female (n = 84; 50% male) heterosexual social alcohol consumers (defined as ≥10 and ≤50 units/week for males and ≥5 and ≤35 units/week for females, confirmed by self-report) were recruited from students at the University of Bristol. Participants received £10 each for participation. The study was approved by the Faculty of Science Research Ethics Committee.

After providing informed consent, participants completed a screening process, consisting of an interview conducted by a trained researcher, to ensure good physical and psychiatric health and to confirm self-reported sexuality. Exclusion criteria included homosexuality (given our interest in the possible specificity of any effects for opposite-sex faces), drug dependence (excluding caffeine and nicotine) and significant current or past medical or psychotic illness. Participants were also required to be free from medication and illicit substances, verified by self-report, and were required to abstain from alcohol for 24 h prior to the study, with recent abstinence confirmed by the breath test.

Materials

Cues for the attractiveness task comprised 40 photographic facial stimuli (20 males and 20 females, mean age 21 years). The facial photographic images were collected using a Canon EOS300D at a focal length of 50 mm under standardized lighting conditions provided by two lateral diffuse portaflash DL1000 studio lights. Images were captured at a resolution of 2048 by 3072 pixels, in full colour. There was a constant background for all images. The photographic subjects wore no overt facial jewellery and cues to clothing were masked with a neutral smock. Participants were asked to pose, standing, with a neutral expression and photographed at a distance of ~150 cm. The camera lens was at the same horizontal plane as the eyes for each photograph. This procedure provides replicable images of the same individual and provides images that are equivalent to experience of faces in day-to-day interaction (Stephan et al., 2004). All the photographic subjects were undergraduate students at University of Bristol, and each individual was the current heterosexual partner of one other individual in the opposite-sex face set, thus providing a likely match between the mean attractiveness of male and female face sets, as humans tend to mate assortatively for attractiveness (i.e. there are strong correlations between the attractiveness of romantic partners) (Berscheid et al., 1971; Feingold, 1988).

The questionnaire measures used included the Alcohol Use Disorders Identification Test (AUDIT) (Bohn et al., 1995), the Eysenck Personality Questionnaire—Revised (EPQ-R) (Eysenck and Eysenck, 1991), the Spielberger State–Trait Anxiety Inventory (STAI State and STAI Trait) (Spielberger et al., 1983) and visual analogue scales (VAS) of mood, anxiety and craving, comprising the items ‘happy’, ‘drowsy’, ‘depressed’, ‘anxious’, ‘energetic’, ‘irritable’ and ‘craving a drink’ rated on a 100-mm scale from ‘Not At All’ to ‘Extremely’.

Procedure

On the first test day, participants were randomized to receive either 0.4 g/kg of alcohol using vodka at 37.5% alcohol, with one part of vodka to three parts of tonic water, or a placebo consisting of an equal total volume of tonic water. This equates to 28 g of alcohol in a 70 kg individual, equivalent to 3.5 units (roughly 250 ml of wine at 14% alcohol by volume, or 700 ml of beer at 5% alcohol by volume). All drinks were chilled and flavoured with lime cordial. Previous studies in our laboratory have demonstrated that this is an effective placebo-controlled design, with participants identifying the drink they are administered at chance level at the time of consumption. All drinks were prepared by a third party so that the experimenter administering the drinks was blind to their true alcohol content.

Baseline ratings included self-reported measures of personality, mood and craving (AUDIT, EPQ-R, STAI State, STAI Trait, VAS). Participants were then given their drink to be consumed in a 15-min period. Following consumption of the drink at the end of the 15-min period, participants completed self-reported measures of mood and craving (STAI State, VAS).

Participants then completed the ratings of facial attractiveness. Facial stimuli were presented in a blocked format (male and female), with both the order of blocks, and the order of faces within blocks, randomized across participants. The testing was self-paced, and participants were required to rate each face for attractiveness, using a 7-point Likert scale anchored at ‘very unattractive’ and ‘very attractive’. Responses were entered using numeric keys on the testing computer. The presentation of facial stimuli was controlled by E-Prime v.1.2 (Psychology Software Tools Inc., Pittsburgh, PA, USA).

On the second test day, conducted 24 h after the first test day, participants completed the ratings of facial attractiveness a second time, followed by an awareness check to test whether they were aware of whether their drink contained alcohol. Participants were then debriefed as to the purpose of the study.

Statistical analysis

Data were analysed in two stages. The first stage was intended to test the effects of acute alcohol consumption on immediate ratings of facial attractiveness and subjective mood (i.e. do immediate ratings of attractiveness differ among individuals randomized to consume alcohol versus placebo drinks?). The second stage was intended to test the effects of prior alcohol consumption on later ratings of facial attractiveness (i.e. does previous alcohol consumption predict ratings of facial attractiveness and, if so, are these effects due to differences in ratings of attractiveness at the time of alcohol consumption?).

In the first stage, data were analysed within a 2 × 2 × 2 mixed-model-repeated measures ANOVA framework, with drink (alcohol, placebo) and participant sex (male, female) as
between-subjects factors. For the analysis of attractiveness rating data on the first day, average attractiveness responses to male and female faces were calculated separately and target sex (male, female) was included as a within-subjects factor, while for the analyses of questionnaire data, time (pre-drink, post-drink) was included as a within-subjects factor.

In the second stage, data were analysed separately for ratings of male and female faces within a linear regression framework, with drink, sex, and a drink × sex interaction term entered in the first step. In the presence of a significant drink × sex interaction, subsequent analyses were stratified by sex, while in the absence of such an effect this term was removed. Ratings of facial attractiveness collected on the first test day were then entered in the second step of the regression, in order to test whether any effects of alcohol were due to effects on ratings during the first test day.

An alpha level of 0.05 was maintained throughout, except in the case of VAS measures where an alpha level of 0.007 was employed, corrected for seven independent tests using Bonferroni’s method. All analyses were performed using SPSS v.12.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Characteristics of participants

Participants were aged on average 20 years (SD = 1 years, range 18–22 years), began testing at 17:00 (SD = 3 min, range 14:00–21:30) and had an average AUDIT score of 16 (SD = 6, range 5–32).

A series of 2 × 2 ANOVAs, with drink (alcohol, placebo) and sex (male, female) as between-subjects factors, were conducted to assess the matching of participants in the four cells of the experimental design on a number of variables. These indicated that participants did not differ in age, start time, AUDIT, EPQ-R Extraversion, EPQ-R Neuroticism or STAI Trait Anxiety (Ps > 0.17).

Questionnaire measures

A series of 2 × 2 × 2 mixed model repeated measures ANOVAs, with drink (alcohol, placebo) and participant sex (male, female) as between-subjects factors and time (pre-drink, post-drink) as a within-subjects factor, were used to examine STAI State, AUQ and VAS data.

State anxiety. For STAI State data, there was a significant main effect of participant sex (F[1, 80] = 9.79, P = 0.002), reflecting higher scores among females than males. No other main effects or interactions were significant (Ps > 0.24).

Visual analogue scales. For VAS data, there were main effects of time for ratings of ‘happy’ (F[1, 80] = 4.07, P = 0.047), reflecting an increase from pre-drink to post-drink, and ‘anxious’ (F[1, 80] = 9.36, P = 0.003), reflecting a decrease from pre-drink to post-drink, although the former was not significant at the corrected alpha level of 0.007. There was also a significant main effect of participant sex for ‘anxious’ (F[1, 80] = 7.96, P = 0.006), reflecting higher scores among females than males. Finally, there was a significant time × participant sex × drink interaction for ‘craving a drink’ (F[1, 80] = 7.66, P = 0.007), which post hoc tests indicated reflected a decrease in ratings in the alcohol condition compared with the placebo condition among males, but not among females. No other main effects or interactions were significant (Ps > 0.06).

Attractiveness-rating task

Effects of acute alcohol consumption. A 2 × 2 × 2 mixed model repeated measures ANOVA, with drink (alcohol, placebo) and participant sex (male, female) as between-subjects factors, and target sex (male, female) as a within-subjects factor, was used to examine attractiveness rating data on the first test day (i.e. immediately following alcohol consumption). This indicated a significant main effect of drink (F[1, 80] = 4.35, P = 0.040), reflecting higher overall attractiveness ratings (irrespective of target sex) in the alcohol condition compared with the placebo condition, a significant effect of participant sex (F[1, 80] = 5.69, P = 0.019), reflecting higher attractiveness ratings among female participants compared with the male participants, and a significant main effect of target sex (F[1, 80] = 14.45, P < 0.001), reflecting higher attractiveness ratings for female faces compared with male faces, as typically observed in studies of facial attractiveness (Bashour, 2006). No other main effects or interactions were significant (Ps > 0.24).

Effects of prior alcohol consumption. A linear regression model was used to examine predictors of attractiveness rating data on the second test day (i.e. 24 h following alcohol consumption), separately for male and female faces. This indicated no evidence of a significant drink × participant sex interaction for ratings of male faces (P = 0.34), and this interaction term was removed from subsequent analyses of male faces. However, the drink × sex interaction term was significant for rating of female faces on the second test day (P = 0.036), and subsequent analyses of female faces were stratified by sex.

For ratings of male faces, there was a significant effect of participant sex on attractiveness ratings on the second test day in the first step of the model (B = +0.22, t = 2.02, P = 0.047), but this was no longer significant when ratings of attractiveness on the first test day were included (B = +0.08, t = 0.94, P = 0.35). The addition of ratings of attractiveness on the first test day in the second step significantly improved the model fit (F[1, 80] = 48.19, P < 0.001), and overall the model accounted for 42% of the variance in ratings of attractiveness on the second test day (F[3, 80] = 19.41, P < 0.001), with ratings of attractiveness on the first test day the only individually significant predictor (B = +0.62, t = 6.94, P < 0.001). The effect of drink was non-significant at both steps (Ps > 0.13).

For ratings of female faces on the second test day, analyses were stratified by participant sex, as described above. Among male participants, there was a significant effect of drink on attractiveness ratings on the second test day in the first step of the model (B = +0.33, t = 2.19, P = 0.034), but this was no longer significant when ratings of attractiveness on the first test day were included (B = +0.16, t = 1.25, P = 0.22). The addition of ratings of attractiveness on the first test day in the second step significantly improved the model fit (F[1, 39] = 23.66, P < 0.001), and overall the model accounted for 44% of the variance in ratings of attractiveness on the second test day (F[2, 39] = 15.60, P < 0.001), with ratings of attractiveness on the first test day the only individually significant predictor (B = +0.61, t = 4.86, P < 0.001).

Among female participants, the effect of drink was not significant in the first step of the model (P = 0.43). The addition...
of ratings of attractiveness on the first test day in the second step significantly improved the model fit \( (F[1, 39] = 13.35, P = 0.001) \), and overall the model accounted for 27% of the variance in ratings of attractiveness on the second test day \( (F[2, 39] = 7.09, P = 0.002) \), with ratings of attractiveness on the first test day the only individually significant predictor \( (B = +0.50, t = 3.65, P = 0.001) \).

**DISCUSSION**

Our results indicate that alcohol consumption increases ratings of attractiveness of facial stimuli, and that this effect is not selective for opposite-sex faces. Perhaps surprisingly, this represents the first demonstration of this effect conducted within a laboratory environment where the alcohol challenge was administered under controlled conditions and double-blind. We did not observe marked effects of alcohol consumption on other self-reported measures of mood, suggesting that the effects on ratings of attractiveness were not due simply to global hedonic effects or reporting biases.

Our findings are broadly consistent with the one previous study to have investigated the effects of alcohol consumption on ratings of attractiveness (Jones et al., 2003); in particular, this previous study also did not find evidence that these effects were due to global hedonic effects or reporting biases. However, our finding that the immediate effects of alcohol consumption do not appear to be specific to opposite-sex facial stimuli differs from this earlier study, which did observe an effect of acute alcohol consumption that was selective for opposite-sex faces, in contrast to the present results. In our view, the most likely explanation stems from the social context within which the experiment took place—in the present study, participants rated faces in a controlled, laboratory environment that was relatively free from extraneous cues, while in the previous study, participants rated faces in bars, an ecological setting that may have contained numerous cues priming mate-seeking behaviour. That is, there may be two mechanisms operating, one principally pharmacological that serves to globally enhance ratings of attractiveness and another principally social that serves to modulate this effect and target it at opposite-sex faces (at least among heterosexual individuals). Another possible explanation is that, in the previous studies, allocation to alcohol consumption groups was based on self-reported recent consumption, which may have either primed participants as to the purpose of the study or introduced other reporting biases. Clearly the data do not currently exist to test these alternative explanations directly, and future studies should seek to introduce social priming cues in combination with an alcohol challenge in order to investigate their interactive effect on ratings of attractiveness in same-sex and opposite-sex faces. It would also be of interest to explicitly investigate these effects in both heterosexual and homosexual participants.

Our results do suggest, however, some that the effects of alcohol consumption on ratings of attractiveness persist for up to 24 h after consumption, but only in male participants when rating female (i.e. opposite-sex) faces. This effect appears to be due to the effects on ratings of unfamiliar opposite-sex faces completed during the period of acute intoxication, suggesting an effect of encoding state on later ratings of facial stimuli. This effect was not observed among females; the reasons for this sex difference are unclear. Speculatively, this may reflect a general sex difference in male and female mating-relevant behaviours, rather than a sex-specific effect of alcohol consumption. For reasons that may have an evolutionary basis (Trivers, 1972), women report higher levels of selectivity in mate choice (Clark and Hatfield, 1989), and a sex-specific mechanism allowing constant re-evaluation of potential mates on successive encounters may offer more benefits to females than males, as differences in minimal parental investment make the potential costs of ‘bad’ matings more substantial for females (due to gestation and lactation) than males. Such an explanation could plausibly explain our reported sex difference, but clearly more research is needed.

These findings are important because they reinforce recent evidence that may have implications for the likelihood of risky sex occurring with a potential sexual partner following alcohol consumption (Jones et al., 2003) and suggest that these effects are due at least in part to the direct effects of alcohol. They may also have broader implications for the mechanisms that contribute to the addiction potential of alcohol. For example, there is evidence to suggest that facial attractiveness is correlated with activity in the reward pathways such as the orbitofrontal cortex and striatum (Aharon et al., 2001; Kampe et al., 2001; O’Doherty et al., 2003). Our results are therefore consistent with evidence that acute alcohol administration stimulates activity in the striatum (Schreckenberger et al., 2004) and suggest that the effects that we observed may generalize to other stimuli associated with striatal activation.

There are a number of limitations that should be considered when interpreting the results of the present study. First, the sample we recruited was drawn from a young, student population. While this was in part intentional, given that the facial stimuli were drawn from a similar population, it would be informative to investigate these effects in a more representative sample. Second, the alcohol dose we administered was relatively low, certainly in the context of the levels of alcohol consumption typical for the population from which our sample was drawn. In particular, it is by no means clear that any effects of alcohol on ratings of attractiveness will be linear, given the biphasic nature of the pharmacological effects of alcohol (Earleywine and Martin, 1993). Future studies should therefore include a range of alcohol doses, including those that more closely mimic the levels of intoxication typically experienced by social drinkers. Third, participants were able to identify whether or not their drink contained alcohol at above chance levels, suggesting that our study was not truly conducted double-blind. This is most likely because the awareness check was conducted at the end of testing, when the subjective effects of alcohol would be close to their maximum, rather than prior to testing in order to avoid priming participants unnecessarily as to the purpose of the study. Nevertheless, this means that we cannot be certain that the effects we observed are due to the pharmacological effects of alcohol, as opposed...
to the psychological effects of knowing that one has consumed alcohol. Fourth, and relatedly, we did not explicitly include a manipulation of alcohol expectancies. It would be valuable to replicate our findings within a balanced-placebo design, manipulating both alcohol exposure and alcohol expectancy, in order to better ascertain whether the effects we observed are due to the pharmacological effects of alcohol or the expectation of having consumed alcohol. This is particularly important given the high levels of accuracy among participants when identifying whether the drink they had consumed contained alcohol. Fifth, although we interpret the effects of prior alcohol consumption on ratings of attractiveness completed 24 h later as potentially reflecting an encoding effect in males, our data do not allow us to test this possibility directly. Future studies should include, in addition, novel facial stimuli to which participants have not been exposed in order to test this possibility directly.

In conclusion, our data appear to confirm that alcohol consumption increases ratings of attractiveness of facial stimuli but suggest that the direct effects of alcohol are global and not selective for opposite-sex faces among heterosexual individuals. Moreover, among males only, these effects appear to persist for 24 h beyond the acute administration of alcohol, but only for female (i.e., opposite-sex) faces. Future research is necessary to distinguish between the pharmacological effects of alcohol and the expectation of having consumed alcohol, and to explore the modifying effects of social and contextual cues on the effects of alcohol on face perception, in particular given the potential role of these mechanisms in social behaviours.

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REFERENCES


